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IT Infrastructure for Strategic Agility

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CISR has recently embarked upon a new phase of industry-sponsored research, under the leadership of Peter Weill. Peter comes to CISR from Melbourne Business School and brings a strong practical research background in IT portfolio and IT infrastructure management.

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Title: **IT Infrastructure for Strategic Agility**

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Abstract: Investing in IT infrastructure is one of the most challenging tasks facing senior managers who often feel ill equipped to make these decisions. Investing in the right infrastructure at the right time enables rapid implementation of future electronically based business initiatives and cost reduction of current business processes. This paper presents a framework for senior executives to view IT infrastructure in business terms and to lead in making investment decisions. By studying 180 electronically based business initiatives in 89 top performing enterprises we identified the specific infrastructure capabilities needed for different types of business initiatives and how this capability is provided as an integrated IT infrastructure. An integrated IT infrastructure has ten clusters of IT infrastructure services fine tuned to the enterprise's set of electronically based business initiatives. Using the frameworks for describing IT based business initiatives, executives can identify the future family of initiatives (i.e., their desired strategic agility) the enterprise desires to lead their industry with. This is a process of strategic choice and balancing investing in longer-term agility with shorter-term cost minimization. Successful enterprises get this infrastructure balance right more often than not because they make regular, systematic modular and targeted investments while having a clear picture of their own overall infrastructure capability and how each incremental investment adds value. To lead on multiple dimensions in strategic agility required an integrated infrastructure with high capabilities in all infrastructure clusters and a deliberate approach to data management to manage conflicts. The paper concludes with a set of suggested steps to link an enterprise's desired strategic agility with the above average infrastructure capability needed.

30 Pages

IT INFRASTRUCTURE FOR STRATEGIC AGILITY[1]

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Investing in infrastructure for the future is a senior management responsibility. Current and future electronically based business processes and transactions—now the heart of almost every enterprise—need robust IT infrastructure capabilities. IT-enabled processes, transactions and services require substantial infrastructure capabilities to operate effectively and efficiently. Business drivers, such as presenting a unified face to the customer or knowing the customer's entire relationship with the enterprise at any service point, rely on bringing IT assets together from across the enterprise.

Investing in IT infrastructure is one of the most challenging tasks facing senior management. Multiple new business initiatives often emerge unpredictably, making long-term IT infrastructure investments difficult and short-term catch-up investment common. Foresight in establishing the right infrastructure at the right time enables rapid implementation of future electronically based business initiatives as well consolidation and cost reduction of current business processes. Over investing in infrastructure, or worse, implementing the wrong infrastructure, results in wasted resources, delays and system incompatibilities with business partners. Under investing in infrastructure results in rushed implementations to meet business deadlines, islands of automation meeting local needs without integration across the enterprise and limited sharing of resources, information and expertise. Getting the IT infrastructure balance right is a senior management decision requiring the joint expertise of the heads of businesses and IT professionals. Infrastructure capability is difficult to create because it is a complex fusion of technology and human assets. These capabilities require long lead times to emulate and can therefore can be a source of competitive advantage. Enterprises with greater infrastructure capability have faster times to market, higher growth rates, and more sales from new products, but lower short term profitability. [i]

Infrastructure investments require decisions about what and where to invest today resulting from strategic choices about the future. Infrastructure investments are often shared across many applications, multiple business initiatives and often several business units. This sharing requires negotiation about how much is needed, who pays for it, where it should be placed and who owns it. IT infrastructure decisions are often perplexing, facing managers with questions like: "should IT infrastructures be shared and standard and made available enterprise-wide or more tailored and made available at the business unit levels?" and in "what areas of infrastructure capability should we have industry lead?" These are business, not technical, decisions and executives often lack a business-oriented framework to assist in these choices.

This paper presents a framework for senior executives to make informed investment decisions about IT infrastructure capabilities. We studied 180 electronically based business initiatives in leading enterprises in the top three in their industry. We identified the specific infrastructure capabilities

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needed for different types of business initiatives and how these capabilities are provided as an integrated IT infrastructure.

The key finding is that in leading enterprises, each type of strategic agility requires different patterns of IT infrastructure capability. Thus, leading enterprises should think through the types of strategic agility they desire in the next year or two to inform infrastructure investments today for tomorrow's strategic initiatives. We provide guidance for executives on communicating and assessing investment options and addressing these trade-offs as the enterprise looks ahead.

Research Methodology

The key research questions addressed in this paper are:

1. What is IT infrastructure and what services are involved? How do these services fit together in an integrated infrastructure?
2. What are the different types of electronically based business initiatives.
3. What IT infrastructure capabilities are required for different types of electronically based business initiatives?
4. How can enterprises make infrastructure investments today to enable the desired strategic agility in the future?

The observations and insights in this paper are based on an analysis of data collected in four studies of the infrastructure needs of leading enterprises implementing different types of electronically-based business initiatives. All the enterprises were among the top three in their industry by market share and were usually top performers measured by several financial performance measures (ROA, revenue growth, margin, etc.). Thus the findings linking infrastructure capability to different types of business initiatives are based on the top performing enterprises rather than all players in an industry. The data set was rich both in terms breadth and depth—the four studies had details gathered from 180 business initiatives in 118 businesses in 89 enterprises over the period from 1990 to 2001.[2] In all four studies, researchers conducted detailed interviews and collected questionnaire data visiting over 90% of the enterprises. The remaining data collection was by phone and email. The data was analyzed using a combination of quantitative and qualitative techniques (see Appendix 4 for more details). The quantitative techniques were applied to the extensive questionnaire and financial information collected and all relationships described in this paper from the quantitative analysis are statistically significant (i.e., are very unlikely to occur by chance). The qualitative techniques were applied to the interview transcript data and included detailed pattern analysis using a text analysis tool.

[2] The data comes from the following four studies:

a. *Leveraging the New Infrastructure: How Market Leaders Capitalize on IT* by Peter Weill and Marianne Broadbent, Harvard Business School Press, 1998.

b. "Client Infrastructure Services: A Study of the Management and Value of PC and LAN Infrastructure" by Peter Weill, Marianne Broadbent and Adrian Goh, Melbourne Business School, University of Melbourne, October 1997.

c. *Place to Space: Migrating to eBusiness Models* by Peter Weill and Michael Vitale, Harvard Business School Press, 2001.

d. "Justifying and Funding IT Infrastructure," Research Project ITI, The Concours Group, conducted by Eileen Birge, Nancy Wendt, Peter Weill, M. Lynne Markus and others, February 2001.

What is IT infrastructure and how can it be deployed?

IT is a large investment with the average enterprise spending more than 4.2%[3] of revenues annually on IT. Overall, IT investments now account for more than 50% of an enterprise's total capital budget.[ii] Typically about 55% of the enterprise IT budget is infrastructure.[4] Infrastructure capability is difficult to create because it is a complex fusion of technology, processes and human assets.[iii] Once in place, competitors need long lead times to emulate it, so IT infrastructure can be a source of competitive advantage. As is the case with other infrastructure investments in an enterprise (e.g., people, buildings, plant, etc.) the IT infrastructure investment decision involves a tradeoff between profit levels now, with minimal future-oriented investment, and investing now, enabling benefits later from growth and flexibility.

The demands of new business initiatives are immediate but building a tailored strategy-enabling infrastructure often takes considerable time and expertise. Identifying these needs is not easy. While the components of infrastructure are commodities and are commonly available, the management processes used to implement the best mix of infrastructure capabilities to meet specific business strategy needs are a scarce resource. Even more desirable and scarce is a modular, service-based infrastructure tailored to an enterprise's strategy that is created via a series of incremental investments rather than a lump sum up front.

Think of IT infrastructure as services

IT infrastructure is the base foundation of budgeted-for IT capability (both technical and human) shared throughout the business in the form of reliable services that are centrally coordinated.[iv] Infrastructure links IT-based capabilities in the enterprise to business partners, external infrastructures such as bank payment systems, and to public infrastructures such as the Internet. The concept of information technology infrastructure as services is very powerful. The concept emerged from our discussions with business managers grappling with what they were actually getting for their information technology investments. Business managers told us they had great difficulty determining the value of technology and human components of the infrastructure such as a server, database package, or a network architect. However, business managers can more readily value a service, such as the provision of a fully maintained laptop computer with access to all of the enterprise's systems and the Internet. Such services can be specified, measured and controlled in a service level agreement. Perhaps most importantly, managers can price services in the market place for comparison. Thinking of infrastructure as services places the internal consumer, the business manager, in more familiar territory.

On the supplier's side, such as the IS group or an outsourcer, the services concept also has several advantages. Infrastructure services remain relatively stable over time even when their technical

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[3] Source: "2001 IT Spending and Staffing Survey results," Gartner: B Gormoloski, T Grigg and K. Potter, 19 September 2001 R-14-4158. The figure of 4.2% includes both the IT budget and "hidden" IT spending outside the IT budget.

[4] P. Weill and M. Broadbent, Leveraging the New Infrastructure: How market leaders capitalize on information technology, Boston, MA: Harvard Business School Press, 1998, p. 38

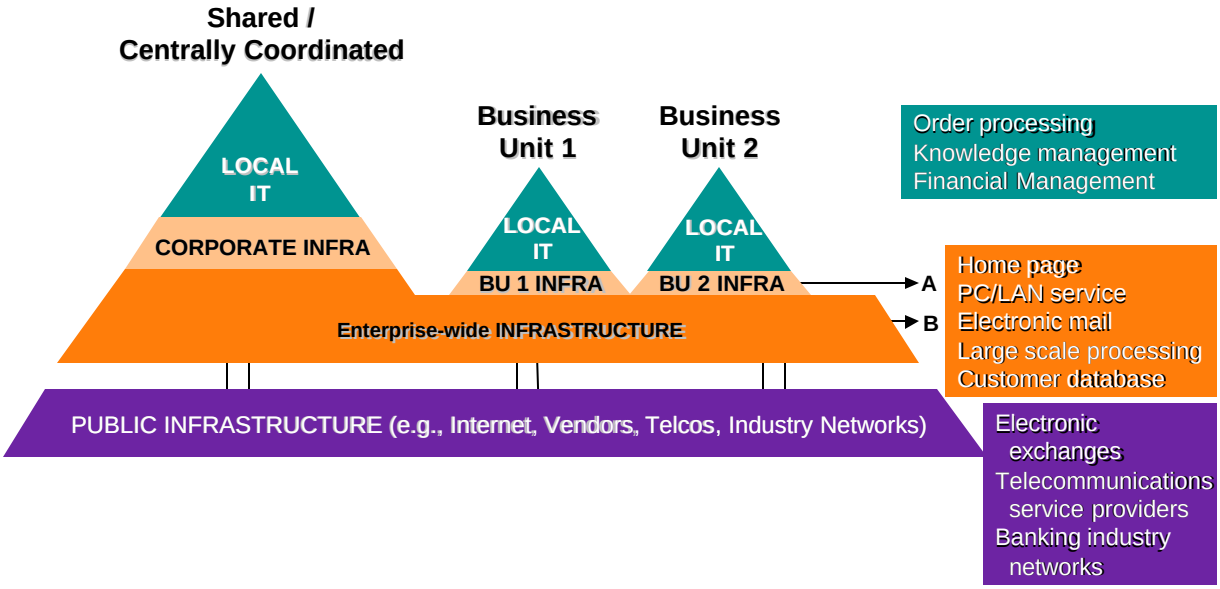
components change. For example, a PC LAN service was needed five years ago and will be needed five years from now. While the technology components underlying the service such as the PC, the server, and perhaps the network will change over time, the service and the service level agreement are stable. A few new services will emerge every year or two, such as wireless based channels, but the basic set of services is relatively stable. In contrast, both the applications using the services and the technology making up the services change more rapidly.

Infrastructure services are deployed at several levels and the location is an executive decision

Many enterprises comprise more than one business or business unit with multiple portfolios of investments at different levels. IT infrastructure services can be deployed at these different levels (see Figure 1). Where to place the IT infrastructure capability (e.g., enterprise-wide or in a business unit) is a strategic decision depending on the maxims for doing business across the enterprise. For example, many enterprises aim to have one contact point for customers across multiple business units. To deliver on this aim, the enterprise's information technology infrastructure must integrate information from separate business units so that the customer can obtain the desired business service from the chosen point of contact. In turn, this creates the ability for the enterprise to take full advantage of a customer's transaction with one part of the business and attempting to cross-sell related products and services from other parts of the business.

Business maxims such as "a single point of customer contact" or "capitalize on our economies of scale" drive many enterprises to create or expand shared IT infrastructure services units (point B on Figure 1) transferring infrastructure out of the business units (point A on Figure 1) to an enterprise-wide capability. For example, State Street, a very successful $3.6b financial services enterprise serving over 90 markets in 23 countries, moved from a strategy of independent business units to "One State Street." To deliver on this new strategy, State Street created a shared IT services unit to support their large number of innovative business units. Shared IT services enabled an improved customer experience including a centralized gateway with single sign-on and personalized institutional customer dashboard with consolidated services. In addition, establishing an enterprise technology services unit created economies of scale, shared development capability leveraging IT expertise in a wide range of technologies and increasing reuse.[v]

Figure 1: IT Infrastructure can be deployed at multiple levels



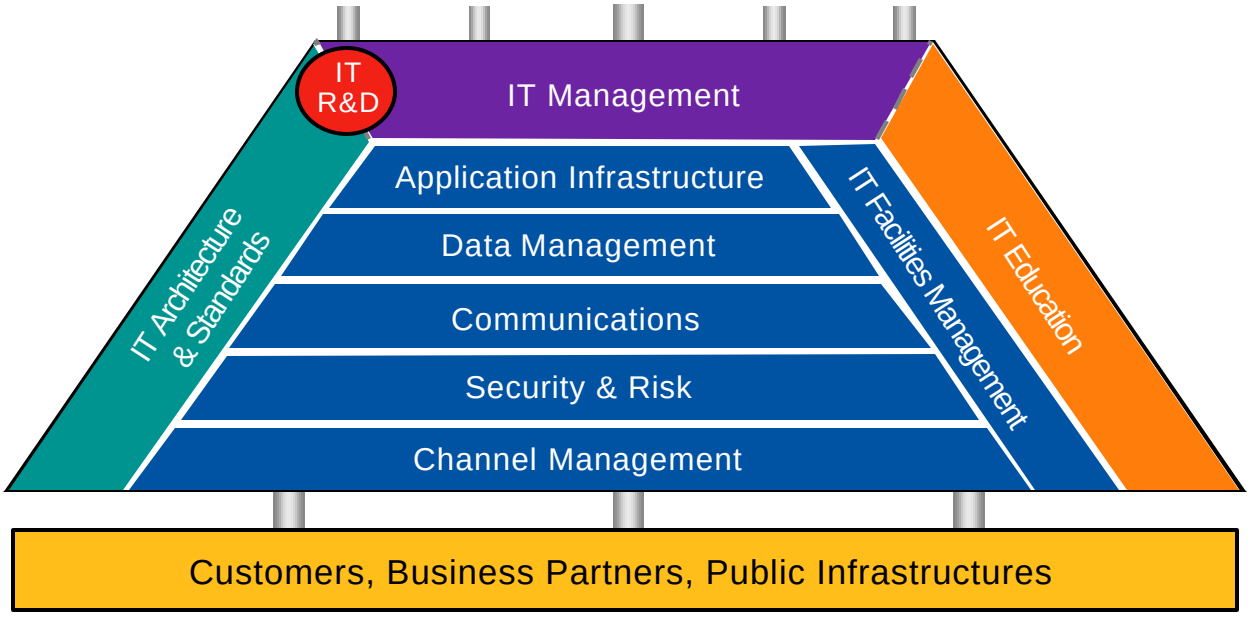
An integrated IT infrastructure capability draws from seventy services in ten clusters

An integrated IT infrastructure combines the enterprise's shared IT capability into a platform for electronically-based business. The extent of the capability of the infrastructure depends on the business needs. The Executive Vice President of Customer Service at Delta Airlines describes their integrated IT infrastructure as a "digital nervous system" and explains how it is used:

> "The whole notion around the Digital Nervous System is if we were to have a change in our operations control center—let's say a cancelled flight—with one or two entries, that information would be pushed into all of the operating and customer groups without an individual or 25 individuals having to actually access or send that information. The information would come to the reservations call centers; it would go to the airports; it would go to the Crown Room Clubs. It would actually go to customer PDAs, cell phones, beepers; even customers' laptops, giving them the information around the fact that Flight 222 from Washington to Atlanta has cancelled, and we've rebooked you on Flight 223 that leaves two hours from now. So, the real power behind the Digital Nervous System is having the ability to push the technology out into ways that would make it easier for customers who do business with us."[vi]

A complex infrastructure like Delta's requires a variety of services integrated together to create a unique capability for the enterprise. Analyzing the infrastructure services provided by the 89 leading enterprises studied indicated that there were up to 70 different infrastructure services in ten capability clusters.[vii] The ten capability clusters and their interrelationships are illustrated in Figure 2. A full list of the infrastructure services comprising each of the infrastructure capability clusters is provided in the Appendix 2.

Figure 2: An Integrated IT Infrastructure with Ten Capability Clusters



An integrated infrastructure supports the enterprise's IT applications via standardized interfaces depicted by the five short rods on the top of the infrastructure in Figure 2. The infrastructure connects externally to business partners via agreed standards as illustrated at the bottom of figure 2. Six clusters comprise the physical layer of capability (shaded blue) and four comprise the management-oriented capabilities. The clusters are arranged in Figure 2 to highlight the most important links; clusters that share a border have strong dependencies within the infrastructure. For example, *IT R&D* is strongly linked to *IT management* (i.e., specifying needs and opportunities for the use of new technologies in the enterprise) and *IT architecture and standards* (i.e., specify the blueprint of how the technologies will be implemented in the future).

Six clusters comprise the physical layer of IT infrastructure capability

Cluster 1: Channel Management

Enterprises are increasingly recognizing the need to link to a wide variety of customers and business partners via electronic channels. Usually the channels include a combination of physical outlets (e.g., store or branch with point of sale device), web, email, physical mail (scanned), interactive voice response, wireless devices such as cell phones, kiosks and a direct point-to-point connection (e.g., private network). Integrating all of the channels to the customer to deliver a single picture of the customer's relationship with the enterprise is a significant challenge in many business initiatives.

Take the example of a typical bank. Each channel was probably developed at different times on different technology platforms, many of which have become legacy systems. Data definitions for common fields such as customer name or address or product name were probably developed independently, leading to incompatible data architectures. Banks are investing heavily in technologies such as data warehouse systems, web services, middleware and translation tables effectively integrating their different platforms. In recent years, the requirements of ebusiness initiatives have raised the stakes for integration across all of these different channels. For banks to effectively service the Internet customer, the personalized financial web page needs to be integrated at the back end to reflect up-to-date information as transactions are made online. To accommodate customers who use multiple channels, perhaps on the same day, conventional operations also need to be integrated to provide up-to-date balances through any channel at any time.

Providing this level of service and integration in the financial services industry is a competitive advantage today, enabling cross-selling opportunities to all customers and rich data for new product development. Going forward, this level of integration will become the norm, requiring enterprises to push these boundaries in search of differentiating advantages. The criticality of providing such real-time capability—often extremely challenging technically—varies across industries. Sprint PCS, the large cellular phone service provider, allows customers to access their usage statistics and the number of minutes left on their cell phone plans. However, this information is updated only once a day in batches and customers are provided the status of their account reflecting all transactions as of the previous day.

Interaction with the customer and partner via integrated channels needs security and risk management services to protect the electronic assets of the enterprise.

Cluster 2: Security and Risk Management

Security and risk management provide protection for the enterprise's brand, reputation, data, equipment and revenue stream. Digital security boils down to a management decision about the level of acceptable risk balanced against the cost to achieve each level of protection. Security and risk services include the provision of firewalls, the establishment of security policies (e.g., for remote access, encryption, use of passwords) as well as disaster planning and recovery. Ensuring business continuity following natural disasters, terrorist attacks, power outages and many other potential causes of disruption is part of the security and risk infrastructure capability cluster.

Cluster 3: Communication

The electronic interactions with customers and partners occur via the set of *communications* services. Typically the *communications* services include a network linking all points within an enterprise and providing the gateway to electronic channels to customers and partners. The *communications* services often include broadband (e.g., video) as well enterprise-wide intranets and extranets. Connected to the backbone network are number of local area networks to service particular regions or business units.

Cluster 4: Data Management

A key asset in an electronically connected business world is enterprise data including information on customers, products, processes, performance and capabilities. Enterprises are striving to manage these key data assets independently of applications, making them available enterprise-wide to promote

initiatives such as cross-selling more products to each customer and new product development. Large storage farms or storage area networks are required to ensure access to this data and many enterprises have adopted data warehouses and web services to summarize or access key information from decentralized databases. The data assets to aid decision-making can be accessed through intranets or electronic reporting techniques such as executive information systems, dashboards and email distribution lists. Knowledge management services—either through efforts to identify and codify knowledge or pointers to individuals possessing key knowledge—are part of this cluster of services. These services aim to enable access to the intangible information assets from anywhere across the enterprise.

Cluster 5: Application Infrastructure

On top of the data sits a series of infrastructure applications—applications that are shared and standard across the enterprise. *Applications infrastructure* often include enterprise-wide systems that support shared services in areas such as accounting, human resource management and budgeting. Some enterprises have chosen to standardize on one type of enterprise resource planning (ERP) package and that becomes part of the *applications infrastructure*. A major thrust in many enterprises is to standardize and consolidate the plethora of applications in various business units into a shared services group or a common application run independently. The aims are to reduce cost, increase reliability and enable standardization as well as encourage and enable the integrated operation of multiple business units.

Cluster 6: IT Facilities Management

IT facilities management coordinates and spans the physical infrastructure layers described so far, providing services such as large scale processing, server farms and a common systems development environment. *IT facilities management* adds value by integrating the five other physical infrastructure layers, optimizing operations.

Four clusters comprise the management–oriented layer of IT infrastructure capability

Cluster 7: IT Management

The *IT management* services coordinate the integrated enterprise infrastructure and manage the relationships with the business units. Typically the management services include IS planning, project management, service level agreements and negotiating with vendors and outsourcers. The *IT management services* provide links to the adjoining clusters on Figure 2. For example, *IT management* services are strongly linked to the *architecture and standards* services to coordinate IT use across the enterprise. The *IT management* and the IT *architecture and standards* clusters interact with the *IT research and development* clusters to take account of new technologies with high potential value for the enterprise.

Cluster 8: IT Architectures and Standards

The *IT architecture and standards* cluster spans the physical layers of infrastructure services and interacts directly with *IT management* and *IT research and development*, and often with customers and

partners. The *IT architecture and standards* services[viii] form the core set of policies and rules that direct and govern the use of information technology and plot a migration path to the way business will be done in the future. This architecture is not set in concrete and needs constant review. In most enterprises, architecture provides technical guidelines rather than enterprise rules for decision-making and may be specified for use inside or outside the enterprise. For example, UPS publishes application program interfaces (APIs) for applications such as package tracking which enterprise resource planning (ERP) producers incorporate in their logistics modules so that users of ERPs (potential customers of UPS) can seamlessly link to UPS services.[ix] The increasing use of electronic means to integrate different players in the value chain as in the UPS example raises the stakes in the setting as well as the implementation of *architectures and standards*, calling for greater senior management involvement and oversight of the activity.

Architectures have to cope with both business uncertainty and technological change making it one of the most difficult tasks for an enterprise.[x] A good architecture evolves over time and documents the set of detailed definitions of the recommended standards and identifies the set of acceptable options in five broad areas: technologies (both hardware and software), data, communication, applications and work (e.g., work processes and flow). Each architectural decision that enforces specific technical choices needs to incorporate the business logic underlying the selection so that these standards can evolve as business conditions change.

We distinguished between specifications or recommendations and the subsequent enforcement of these across the enterprise. For many enterprises specifying architecture and/or standards was sufficient. For other enterprises enforcement of architectures or standards was critical. This importance of architecture and the marked difference in approach across the enterprises studied leads to this cluster having the largest number of services.

Cluster 9: IT Education

IT education and training is a critical and often forgotten component of IT infrastructure capability. This cluster includes training in the use of the enterprise's specific technologies and systems as well as more general management education about how to envision, invest in and use IT to create business value. Enterprises that spent above industry average percentages of their IT budget on training had statistically significantly lower total costs of ownership of workstations. The average percent of the IT budget invested in training was just below 2%. Increasing the spending on training to 4% paid off not only in lower total cost of ownership but also with superior business process performance measured in terms of cost and time.[xi] Despite the clear benefits of investment in training, it is ironic that each time the economy dips, the IT training budget is often an early casualty in the drive to cut costs.

Cluster 10: IT Research and Development

The infrastructure service cluster of *IT research and development* includes the enterprise's efforts to look for new ways to use IT to create business value and to evaluate proposals for the use of new technologies. *R&D* services are typically industry or enterprise specific and build on the more generic work of the research firms who track technology trends. For example, a $15b retail group in our sample had a team of retail IT specialists who traveled the world looking for new technologies that might create value. They investigated technologies for self-service checkout lanes and video shopping carts with advertising, recipes and directions. When we talked with them, the group was investigating the use of digital price tags on store shelves updated via signals carried over light waves from the fluorescent

lights in the stores connected to a server. The system would enable dynamic pricing but also involved a considerable change to pricing, merchandising and logistics processes.

Match integrated infrastructure capabilities to strategic direction and initiatives

None of the enterprises we evaluated had all 70 services represented across the ten clusters. A superior IT infrastructure contained an integrated set of services in each of the ten capability clusters consistent with the enterprise's desired future strategic direction. Enterprises competing by having above industry average strategic agility via IT had more services in each capability cluster and more expansive implementations of each service, each with more demanding service level agreements. Enterprises competing on other capacities had smaller sets of services tailored for their unique business principles.[xii] Each infrastructure service was provided enterprise-wide, at the business unit level or some other level such as country or sector. Appendix 3 (column 2) identifies the average capability in terms of numbers of services by cluster. For example, the average enterprise had four of the six possible data services at the enterprise level and one of the six data services provided at the business unit. Having more services than the average for any particular infrastructure cluster indicates the firm had above average capability for that cluster.

IT infrastructure enables or constrains business initiatives

The relative infrastructure capability is an important metric in understanding how IT enables or constrains business initiatives. The time required to implement a new business initiative depends significantly on the enterprise's infrastructure capability. For example, in building a new web-based housing loan system, a large bank needed to use a variety of IT infrastructure services: mainframe and server processing, customer databases, security (firewall and passwords systems) and both local area and national communications networks. Taking advantage of existing infrastructure services significantly reduced the time and cost to build the loan system. However, the release of the newly built system was delayed until firewall security services were installed to support the integration of customer data and credit scoring systems with the web-based customer interface. The security services related to direct customer access were not incorporated in the initial design of infrastructure services. However, once established enterprise-wide, the capability can be reused in web-enabling other applications.

We now examine the link between specific patterns of IT infrastructure capabilities and strategic agility.

High capability infrastructure enabling Strategic Agility

We think of strategic agility as a broad concept encompassing the family of business initiatives an enterprise can readily implement. Many elements contribute to an enterprise's strategic agility including: customer base, brand, core competences, employee's ability to change, and infrastructures. Organizing and coordinating these into an integrated group of resources results in an enterprise capability.[xiii] When an enterprise can perform a capability better than its competitors, that capability

becomes its distinctive competency. Distinctive competencies make an organization "unique" amongst competitors.[xiv] An example is the competence to integrate key technologies realizing price-performance ratios and customer service levels that exceed those of its competitors.[xv]

This research enables us to draw links between strategic agility—in the form of a family of electronically-enabled business initiatives that are readily implemented—and IT infrastructure capability. The objective is to help managers decide what parts of the infrastructure they should build beyond an industry average capability thus creating a distinctive competence. We will refer to this distinctive competence as a *high capability infrastructure*. To understand the impact of infrastructure on strategic agility we studied the types of electronically based business initiatives enterprises implement.

Types of electronically based business initiatives

Electronically based business initiatives have an almost unlimited scope. To help understand the IT infrastructure implications we needed a way to classify these business initiatives. We found three classifications of business initiatives useful as together they map out different types of strategic agility enterprises seek: (a) position on the value net (i.e., supply, internal, customer), (b) type of exchange (business to business—B2B, or business to consumer—B2C), and (c) type of innovation (i.e., new product and/or market).

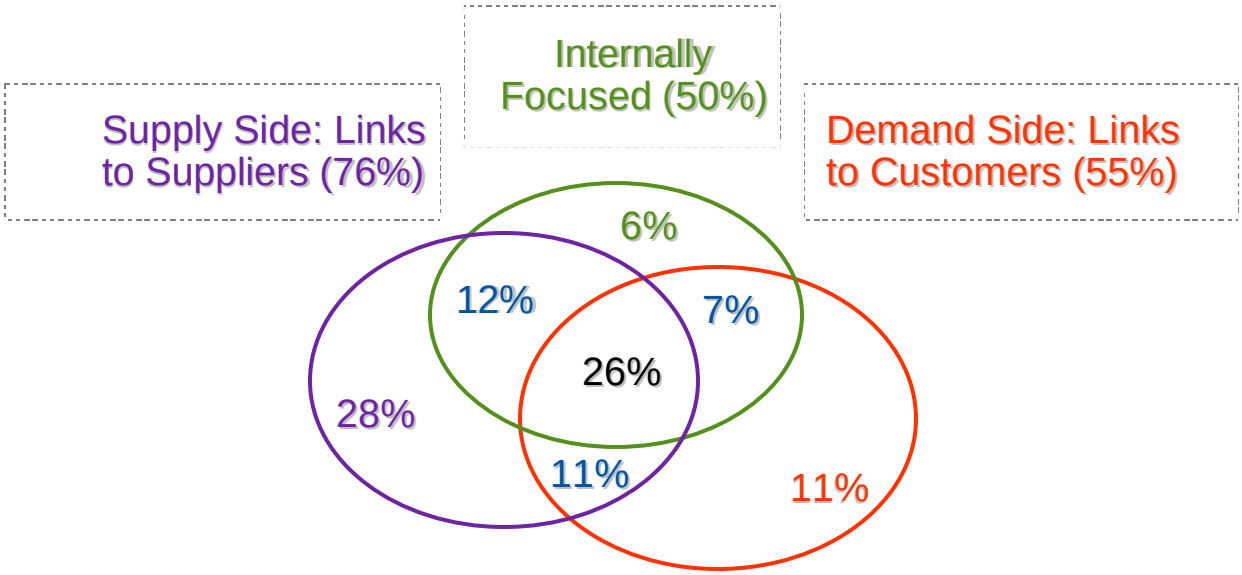
Examples of initiatives studied and classified by type include:

- Web site to disseminate the request for, and submission of, tenders for a water utility's engineering works (Supply/B2B/Existing Product/Market).
- Monitoring retail flooring product sales by manufacturer to reduce lead times and inventory (Demand/B2B/Existing Product/Market).
- Online reservation systems to streamline bookings at franchisee and co-owned hotel properties (Demand& Internal/B2B/Existing Product/Market).
- Bill payment and presentment by post office (Demand/B2C/Existing product/New Market).
- Enable pubs to purchase products from brewer via web site including stock levels, pricing, order tracking, cost comparisons, and customized promotion deals (Demand/B2B/Existing Product/Market).
- Business to business steel trading portal (Demand/B2B/New Market/New Product).
- Publishing house creates all digital workflow (Internal).

Position on the Value Net

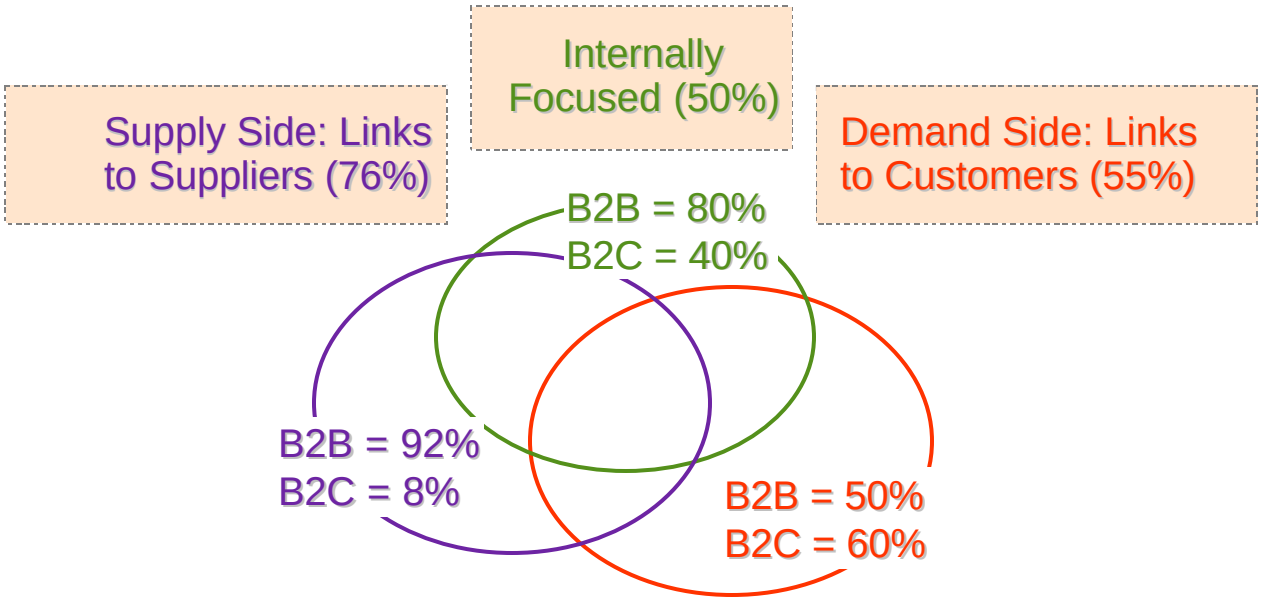
The concept of a value chain describes a linear process where goods move from suppliers to customers with the enterprise adding value at various stages.[xvi] A series of support infrastructures including technology and human relations enable the value chain. The pervasiveness of information technology has dropped the cost of search, coordination and other transaction costs creating a richly interconnected system, better described as a value net than a linear chain.[xvii] Each participant in the net is able to communicate more easily with other participants and point-to-point coordination occurs breaking down the previously linear value chain. From the perspective of an enterprise we represent the value net as three intersecting circles: demand, internal and supply. Value can be created in any part of the net and initiatives occur throughout the net as illustrated in Figure 3.

Figure 3: Distribution of Initiatives Throughout the Value Net



The numbers in the circles in Figure 3 present the percentage of the electronically-based business initiatives that occurred in the different parts of the value net and add to 100 percent. The numbers in parentheses describe the percentage of initiatives that addressed each of the three parts of the value net and total more than 100% due to initiatives involving more than one part of the net. For example, 55%of the initiatives were in the demand side of the net with 11 percent focusing only on the link to customers and partners while 7% focused on the demand and internal parts of the net. The largest proportion—76% of all initiatives, addressed the supply side of the net and 50% streamlined internal processes. Illustrating the integrated nature of the net, 56% of initiatives covered two or more parts of the net and 26% combined all three aspects of the value net. This level of overlap by the majority of initiatives demonstrates the increasing integration of elements of the enterprise as it moves from a linear value chain to value net. This change will deliver a more integrated response to customer needs but also often slows down system development and process redesign because the creation of a new initiative and the resulting systems will have more touch points to exiting processes and systems.

Figure 4: Business Initiatives Classified by Type of Exchange



The type of exchange: Business or Consumer

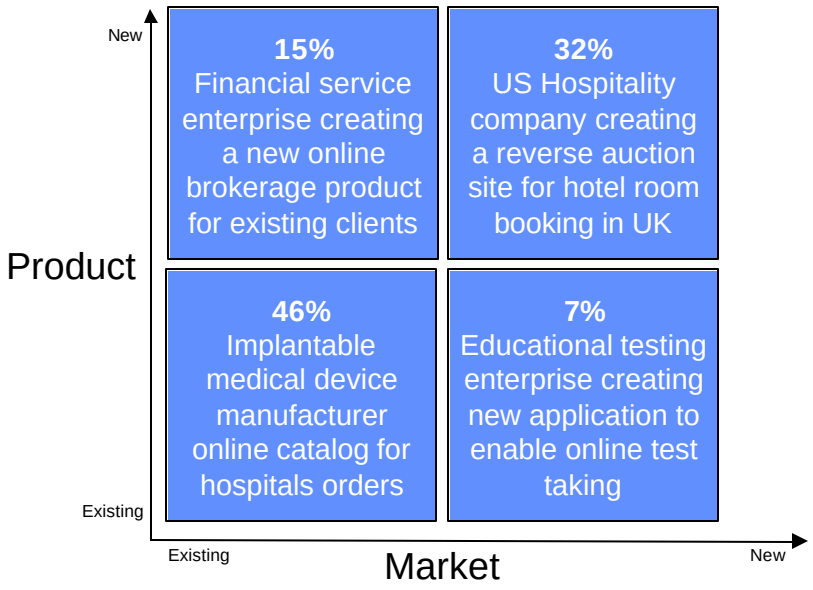
Understanding the types of exchanges involved in the business initiatives is an important predictor of the different IT infrastructures required.[xviii] B2B initiatives tend to involve a small, focused set of customers with large transaction volumes per customer, periodic consolidated payments and significant customization of the products and services. In contrast, B2C initiatives tend to involve large numbers of individual customers with intermittent transactions, lower dollar values per customer transaction and online electronic payments linked to each transaction. Both types of exchange are likely to involve significant use of customer, product and financial data.

Of the 55% of initiatives on the demand side of the value net, 50 percent were B2B, 60% were B2B and 10% of initiatives were both B2B and B2C. Of the 50% of the initiatives that were internally focused, 80% were B2B and 40% were B2C with 20% both B2B and B2C. Of the 76% of the initiatives on the supply side of the net, 92% were B2B and 8% were B2C.

Type of Innovation: New Products and/or Markets

Initiatives in the different parts of the value net can be further classified by type of innovation as opposed to current business processes that are redesigned to leverage new technologies. An initiative can be innovative either on the product dimension or the market addressed or both. Figure 5 illustrates the percentage of business initiatives classified by innovation with examples. Nearly half of the initiatives studied involved electronically-based implementations of existing products in existing markets.

Figure 5: Business Initiatives Classified by Type of Innovation



IT infrastructure capabilities required for different business initiatives

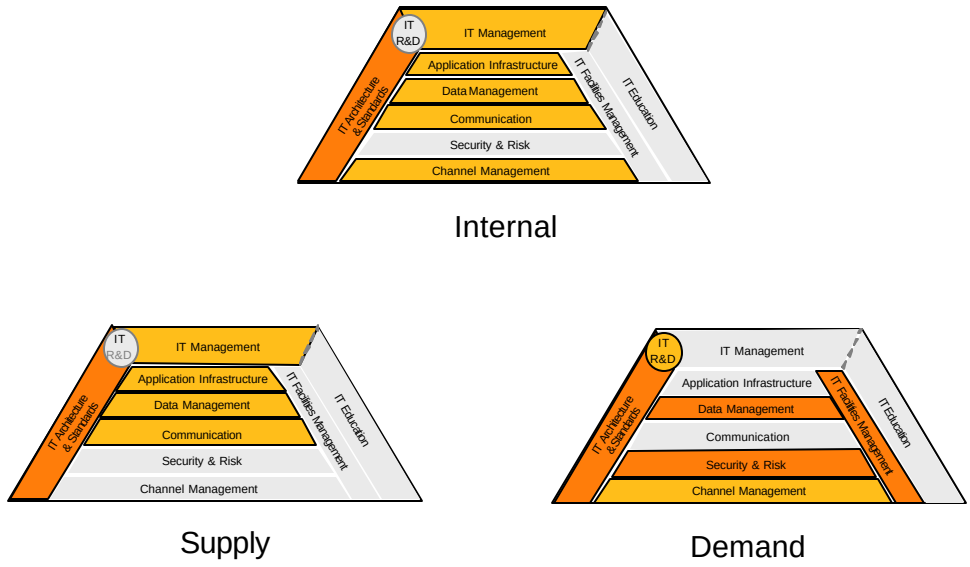
After classifying the business initiatives studied, we examined the extent of IT infrastructure capabilities evident by cluster and the location of that capability (enterprise-wide or at the business unit level). All relationships described in this section were determined by identifying statistically significant correlations between an enterprise's business initiatives and their infrastructure capabilities.[xix] A statistically significant cluster can be interpreted practically as requiring a high capability in that infrastructure cluster (i.e., well above average capability) to achieve that type of strategic agility (e.g., demand side electronically-based initiatives). We will describe the high infrastructure competencies required for different types of initiatives on the value net in more detail (see Figure 6) and then briefly summarize the infrastructure needs for the other types of initiatives (see Figure 7).

Initiatives in the Value Net

Supply-side Initiatives

In supply side initiatives, the single critical enterprise-wide high capability cluster was *IT architecture and standards* (see Figure 6). *IT architectures and standards* provide the framework for designing and integrating systems across the enterprise. Supply side initiatives appear not to need much enterprise-wide infrastructure capability except for the overarching guidelines provided by enterprise architectures. Having *enterprise-wide architecture and standards* allows linking of independently developed functional systems to create purchase economies and reduce the number of disparate technical platforms and data architectures to manage.

Figure 6: Critical Infrastructure Capabilities Differ by Position on the Value Net*



Note: Enterprise Wide Competencies shaded Orange (darkest gray);
Selective BU level Capabilities shaded Yellow (medium gray)
***All relationships shown are statistically significant**

Interestingly, all other important high capability clusters were at the business unit level, suggesting that supply side initiatives were typically business unit specific. *Application infrastructure* and *data management* were critical in enabling supply side initiatives in the business units and were apparently sufficiently different for each business unit to warrant BU infrastructure capability. Despite the clear potential for enterprise-wide services for the *IT management* and *communications*, these high capability clusters were also provided at the BU level. This pattern by top performing firms suggests that the requirements of supply side initiatives are significantly different among BUs (e.g., economic or strategic) not justifying the extra effort of sharing services across business units.

Internal Initiatives

For initiatives streamlining internal processes, *IT architecture and standards* offered centrally with a broadly enforced set of technology standards are the key to high enterprise-wide infrastructure capability. For internal electronically-based initiatives, the need to coordinate, link and standardize systems across BUs is high, requiring an enterprise architecture. In contrast, the provision of the other key high capability infrastructure clusters that support these initiatives are typically provided at the BU level to enable tailoring and responsiveness to local needs. Specifically, the high capability *application infrastructures, data management, channel management* and *communications* clusters are different for each BU unit and provisioned locally. Interestingly, high levels of *IT management* capability are also provided at the BU level suggesting that services such as IT planning and the establishment of service level standards are also very business specific.

Demand-side Initiatives

As with supply side and internal enterprise process integration initiatives, the availability of enterprise-wide *IT architecture and standards* is important for demand side initiatives. *Architecture and standards* is the only enterprise-wide high capability cluster important for all three parts of the value net, illustrating the pivotal role of architecture in the creation and leveraging of enterprise competencies. In our discussions, managers often commented that the architecture was one of the hardest competencies to develop and implement. Manheim Auctions, is the leading player in offline vehicle remarketing in the United States. Manheim also provides online auctions and other services, selling 140,000 cars online with a value of $1.9 billion in 2001 and growing rapidly over the last three years. The director of Software Development at Manheim Interactive reflects on the need to establish and maintain a strong architecture for demand side initiatives:

> "The ability to always respond quickly eventually became a problem. We became very good at scrambling to meet demands very quickly but that has a cost and eventually we just said 'Okay, we're out of magic dust now. We need to rethink.'"[xx]

In addition, high capability enterprise-wide *security and risk* and *IT facilities management* infrastructure capability were important for demand side activities. An enterprise-wide high capability in *IT facilities management* has multiple payoffs. First, customer take up of demand side initiatives is difficult to predict and traffic volumes can vary wildly. Under-performance in this area by one BU can rapidly affect the overall corporate image as well as the brand franchise. High capability enterprise-wide *IT facilities management* was a way to manage this business risk. Second, given the proliferation of technologies and instability of the innovative startups providing the technologies, centralizing activities enables enterprise-wide oversight and the ability to capture and consolidate lessons learned across multiple BUs. High s*ecurity and risk* capability for demand side activities are particularly critical as the enterprise opens its systems and data for access by a wide variety of external users. Establishing successful demand side linkages, often involved a 'one face to the customer philosophy' that cuts across BU lines. A financial service enterprise attempting to allow customers to have a unified view of investment, brokerage and banking accounts is a good example. The ability to execute such ambitious initiatives required consolidation and unified presentation and manipulation of accounts currently managed by multiple business centers. Not surprisingly, a high capability *data management* infrastructure cluster was managed centrally across all BUs for demand side initiatives. In contrast, for supply side and internal integration initiatives, this high capability cluster was managed locally by BUs.

For demand side initiatives we found high capability *channel management* and *IT R&D* clusters important at the business unit level. The establishment of effective channel linkages hinges on addressing the complexity of interfacing with different customer segments—issues that are tacked most effectively on a local basis by business units in direct contact with that segment. Similarly, given the variety of contexts involved for successful customer facing initiatives, *IT R&D* needs tailoring by individual business units to resolve the complexities around integrating the electronic channels to the customer. This approach of enabling local exploration of technologies is effective, particularly in the context of considerable uncertainty around the robustness and long-term viability of ebusiness technologies from innovative startups. Citbank Asia attributes attributed part of its success in demand side initiatives to the policy of allowing considerable latitude to local BU level *R&D* efforts. A technology solution piloted in Singapore was such a conspicuous success that it became the model for

replication by other groups in Asia and then Europe significantly lowering the cost and the time to market for the countries that followed.[xxi]

Leading with Electronically-Based Initiatives Across the Entire Value Net

To lead in all three parts of the value net required an enterprise to have the high capability IT infrastructure in the shaded areas of all three parts of Figure 6 combined. This combination required a high competency in all of the clusters—a completely integrated IT infrastructure—with the exception of *IT education*. Importantly, the integrated infrastructure required for strategic agility across the entire value net was not provided firm-wide. Instead only the *IT architecture and standards*, *security and risk* and *IT facilities management* high capability clusters were firm-wide. The *IT management*, *applications infrastructure*, *communications*, *IT R&D,* and *channel management* were provided at the business unit. *Data management* required special attention to resolve the conflict of where the high capability should be provided. For internal and supply side initiatives, *data management* was best provided at the business unit but for demand side initiatives *data management* was needed enterprise-wide. Many enterprises never resolve this conflict inherent in *data management*, and thus turf battles and difficulties in data sharing are rife. Enterprises who resolve this conflict pay special attention to *data management* often by creating a federal structure for data by identifying which data elements (e.g., product, financial, customer, process, etc.) are best managed at the enterprise and business unit levels respectively. These enterprises identify data custodians for each data element whose role includes defining, cleaning, managing and sharing their data. Figure 7 summarizes the high capability infrastructure clusters for different types of electronically based business initiatives.

Figure 7: Infrastructure Competencies for Types of Business Initiatives*

	Supply		Internal		Demand		B2B		B2C		Products		New Mkts.	
	Firm Wide	Bus. Unit	Firm Wide	Bus. Unit	Firm Wide	Bus. Unit	Firm Wide	Bus. Unit	Firm Wide	Bus. Unit	Firm Wide	Bus. Unit	Firm Wide	Bus. Unit
Channel Management				X		X						X		
Security & Risk Management					X			X	X				X	
Communications		X		X										
Data Management		X		X	X				X					
Application Infrastructure		X		X				X						
IT Facilities Management					X			X	X				X	
IT Management		X		X				X	X					
IT Architectures and Standards	X		X		X									
IT Education											X			
IT Research & Development						X	X			X		X		

***All results are statistically significant**

Business to Business and Business to Consumer Initiatives

B2B and B2C initiatives require different patterns of high capability infrastructure both in terms of the clusters and their location. Nearly 75% of initiatives had a B2B component. In contrast, about 35% of the initiatives had a B2C component. B2B initiatives tended to focus on converting interactions that would have otherwise occurred through conventional channels to IT-enabled transactions. B2C initiatives were strongly associated with enterprises breaking new ground, both in the form of providing new products and entering new markets. Given the differing market orientations for these initiatives, the infrastructure services supporting them were also different (see Figure 7). For example, reflecting the considerable variation of operating contexts underlying B2B interactions, all high capability infrastructure clusters were managed at the business unit level to match local conditions. In contrast, for B2C the high infrastructure capabilities were largely centrally coordinated with the emphasis on uniformity across BUs to provide a consistent electronic front to customers across the enterprise.

New Products and New Markets

Enterprises pursuing innovative initiatives involving new products and new markets had different patterns of high infrastructure competencies. In new product initiatives, *IT R&D* and channel *management* were local to BUs. Both high capability clusters were chosen and managed by individual business units to enable local tailoring. New Product initiatives were also characterized by only one high capability enterprise-wide infrastructure cluster—*IT education* (how to use the technology to enable the new product). In contrast, new market initiatives required high capability enterprise-wide clusters for s*ecurity and risk* and *IT facilities management*.

Critical high capability infrastructure clusters

In summary, we draw the following lessons from these top-performing enterprises:

- A high capability in *IT architecture and standards* is needed for strategic agility in any or all three positions on the value net. Executives consistently reported that *IT architecture and standards* was the hardest infrastructure capability to do well.

- Leading with electronically-based initiatives in any position on the value net required substantial IT infrastructure including some high capability clusters. Infrastructures that support supply-side and internal initiatives are the most similar.

- Leading with demand-side initiatives required predominantly high capability infrastructures enterprise-wide rather than at the business unit level.

- High capability in two clusters—*IT architecture and standards*, and *data management*—are important for leading on initiatives all through the value net, although the location of responsibility for each differs.

- A high capability *data management* cluster is important for leading on initiatives throughout the value net but there are conflicts about where to best locate responsibility. Locating at the business units works best for supply and internal initiatives with firm-wide high capability needed for demand side initiatives. A federal structure for data stewardship is one way to balance this conflict.

- Leading with B2B and B2C initiatives requires similar patterns of high capability infrastructures but differs in the location of their responsibility.

- High capability in *IT education* was particularly needed for new product initiatives.

- To lead in several types of strategic agility requires an integrated infrastructure with high capabilities in all infrastructure clusters. However, the leading enterprises provided these capabilities in a federal model with some clusters provided enterprise-wide and the rest at the business units, paying special attention to *data management*.

Investing in IT Infrastructure for Strategic Agility

The evidence over a ten-year period from top performing enterprises indicates that different types of electronically based business initiatives need specific high capability IT infrastructures. A high capability infrastructure takes time, money, leadership and focus to create. Achieving different types of strategic agilities—a leading ability to implement a family of business initiatives of one type (e.g., demand side or new product)—requires distinct patterns of high capability infrastructures with specific positioning in the enterprise (e.g., enterprise-wide or business unit).

Getting the right balance of high capability infrastructure is difficult. Under investing reduces strategic agility and slows time-to-market. Infrastructure investments must usually be made before application investments. Making infrastructure investments at the same time as applications often results in fragmented infrastructures optimized for particular applications. Pulling them together requires large infrastructure investments later. Over investing in infrastructure adds unnecessary costs to the business particularly if the infrastructure is not utilized or is the wrong infrastructure.

Investing in IT infrastructure is like buying an option.[xxii] Infrastructure enables faster time-to-market if exercised or else results in higher costs with inadequate return if underused. Successful enterprises get the infrastructure balance right more often than not, because they make regular, systematic, modular and targeted investments in IT infrastructure based on an overall strategic direction. These leading firms also have a clear picture of their overall infrastructure capability and how each incremental investment adds to the overall capability.

Building an infrastructure tailored to an enterprise's strategic context takes considerable time and expertise. While the components are commodities, the management processes used to implement the best mix of infrastructure capabilities to suit a specific enterprise are a much scarcer resource.

To address this infrastructure challenge we propose a series of steps:

1. **Clarify the nature of the type of strategic agility desired.** Using the three frameworks for describing a business initiative—position on the value net (i.e., demand, internal, supply), type of exchange (i.e., B2B, B2C) and type of innovation (i.e., new product or market)—identify the family of electronically-based business initiatives the enterprise desires to lead their industry with. This is a process of strategic choice involving trade offs when competing. Without trade offs there would be no need for choice and thus no need for strategy[xxiii] (Porter 1996)

2. **Identify the current IT infrastructure capability in each of the clusters.** Review each of the ten IT infrastructure clusters and in turn, identify the current capability and potential for meeting increased demand. Complete this process for each of the 70 services in all of the ten clusters in Appendix 2. The tables in Appendix 3 provide the average capability for each service cluster as a benchmark—we suggest adding the enterprise's current capability for each cluster to these tables. We also suggest creating a depiction of the current capability of the infrastructure using a version of Figure 2 color coded for capacity—green for excess capacity, yellow for meets current needs and red for an inability to meet current needs. One version of this diagram is needed for the enterprise-wide infrastructure capability plus an additional diagram for each business unit.

3. **Compare the enterprise capability with future needs for strategic agility and identify pressure points.** Using Appendix 3, identify the high capability infrastructure clusters needed for the strategic agility identified as desirable in step one. Map the capability (i.e., number of services) and location of the enterprise's existing service clusters against the infrastructure requirements for the type of strategic agility required and identify the gaps. Appendix 3 provides the benchmarks for low and average capability for all clusters. The number of services required for each cluster to be a high capability[xxiv] where that cluster is important for a particular type of strategic agility is also found in Appendix 3. For example, to be agile in demand side business initiatives requires high enterprise-wide capability in four infrastructure clusters including *data management*. The average capability for *data management* is four services while a high capability is five of the six possible services. A low capability is three services.

4. **Create an IT infrastructure investment plan to fill the gaps.** Turning this gap analysis into an investment program requires confidence in the strategic thinking necessary to complete step one. Once the needs for the type of strategic agility have been identified, the information in this paper will help identify the infrastructure capability required in each cluster and whether the capability should be enterprise-wide on in a business unit.[5]

[5] The results of this paper come from the past experience of top performing firms—probably the best predictor of the future we know. Of course, the future will be different from the past and some new infrastructure capabilities will become important.

Appendix 1: Glossary of Terms

IT conducted business initiatives. Business initiatives implemented via electronic processes and networks.

Value net. The evolution of the value chain as business no longer takes place in a linear sequence. Many initiatives now encompass more than one part of the value chain concurrently.

Position on value net. Those parts of a value net—supply-side, internal, demand-side—that are the focus of a business initiative. The three positions are no longer mutual exclusive as technology enables initiatives to link suppliers and customers directly.

Exchange types. Types of linkages in IT conducted business initiatives. This report focuses on two: business-to-business (B2B) and business-to-consumer (B2C).

IT infrastructure. The shared and reliable services that provide the foundation of the enterprise's IT portfolio. Examples of services are provision of large-scale data processing, negotiation with suppliers and outsourcers, and disaster planning for business applications. Seventy infrastructure services were identified and are listed in Appendix 2.

IT infrastructure service clusters. The 70 services are grouped into ten clusters of like services (listed in the Appendix 2). For example *large scale data processing* is part of the *facilities management* cluster; *negotiation with suppliers and outsourcers* is part of the *IT management* cluster; *disaster planning for business applications* is part of the *security* cluster. These clusters provide the basis for discussion and analysis in this paper.

Enterprise IT infrastructure capability. A specific combination of infrastructure services, that an enterprise puts in place. In this report this capability is discussed in terms of the ten service clusters. The combination yields an IT infrastructure service strength.

High capability IT Infrastructure. A significantly above average capability in a particular cluster found in enterprises with a particular pattern of strategic agility.

Infrastructure location. Where responsibility for an infrastructure service cluster resides, either at the corporate level to provide enterprise-wide capabilities, or with individual business units for their individual use.

Appendix 2: Seventy Infrastructure Services in Ten Clusters

CHANNEL MANAGEMENT: provide electronic channel to the customer or partner to support one or more applications
EFTPOS/POS (electronic funds transfer/ point of sale)
Kiosks
Web sites
Call centers
Interactive Voice Response (IVR)
Mobile phones
Mobile computing (e.g., via dial up, wireless networks)
SECURITY
Security policies for use of information systems (e.g., data protection, access privileges and hacker protection)
Enforce security policies for information systems
Disaster planning for business applications
Firewall on secure gateway services
COMMUNICATIONS
Communications network services (e.g., full Service TCP/IP networks linking all points within a business)
Broadband communication services (e.g., higher bandwidth activities such as video)
Intranet capabilities (e.g., an intranet to support a variety of applications including publishing, co. policies, directories, message boards etc)
Extranet capabilities (e.g., providing information and applications via TC/ICP protocols to a select group of customers and suppliers)
Workstation networks (e.g., workstation networks, LANs and POS networks)
EDI linkages to customers and suppliers
Electronic support to groups (e.g., groupware)

DATA MANAGEMENT
Manage key data independent of applications (e.g., centralized product data)
Centralized data warehouse (summarizes key information from decentralized databases)
Data management advice and consultancy
Electronic provision of management information (e.g., EIS)
Storage farms or storage area networks (e.g., major storage separate from LANS and workstations)
Knowledge management (e.g., contact database, knowledge management architecture, knowledge databases, communities of practice)
APPLICATIONS INFRASTRUCTURE
Set and communicate Internet policies (e.g., employee access, URL logging)
Provide Internet capability and enforce policies
Set and Email policies (e.g., inappropriate and personal mail, harassment policies, filtering policies)
Provide email capability and enforce policies
Centralized Management of Applications (e.g., centralized management of applications owned by, or on behalf of the business units)
Centralized management of infrastructure capacity (i.e., monitoring and optimizing server traffic and adding new capability)
Integrated mobile computing applications (e.g., laptop dialup, ISP access, handheld infrastructures for internal users, etc.)
Enterprise Resource Planning (ERP) services. (e.g: operating ERPs, implementing new modules, upgrading versions etc.)
Middleware linking systems on different platforms (i.e., integrating web "shopfronts" to ERP systems)
Wireless applications (e.g., applications for wireless devices used by customers and partners)
Application services provision (ASP) (e.g., applications used by business units, centrally provided and charged by usage with an ASP model)
Workflow applications (e.g., applications to manage and monitor work flow moving tasks between workstations)
Payment transaction processing (e.g., electronic funds transfer {EFT})

IT MANAGEMENT	
IS project management	
Negotiate with suppliers and outsourcers (e.g., centralized and negotiated pricing for software)	
Service level agreements (e.g., agreements between Corporate IT and BU's)	
IS Planning, Investment and Monitoring (e.g., forward plans and strategy, IT investment process, aligning IT to strategy, value management)	
ARCHITECTURE AND STANDARDS	
Specify architectures (set high level guidelines and blueprint for the way information technology will be used and integrated)	***Data***
	Technology
	Communications
	Applications
	Work
Enforce architectures (enforce compliance with high level architectures)	***Data***
	Technology
	Communications
	Applications
	Work
Set standards for IT architectures (e.g., set standard operating environment to implement architectures for personal computers or servers)	***Data***
	Technology
	Communications
	Applications
	Work
Enforce standards for IT architectures	***Data***
	Technology
	Communications
	Applications
	Work

IT FACILITIES MANAGEMENT
Large scale data processing facilities (e.g., mainframe)
Server farms (e.g., mail server, web servers and printer servers)
Installation and maintenance of workstations and LAN's
Common systems development environment (e.g., create firm-wide competencies to develop or acquire applications, accreditation etc.)
Pilot new initiatives (e.g., pilot web ebusiness initiatives or product configuration tool for customers)
IT R&D
Identify and test new technologies for business purposes
Evaluate proposals for new information systems initiatives
IT EDUCATION
Training and use of IT
Management education for generating value from IT use

Appendix 3: IT Infrastructure Capabilities for Different Types of Strategic Agility

Enterprise-Wide IT Infrastructure Capability for Strategic Initiatives

			Value Net													
			Supply		Internal		Demand		B2B		B2C		New Products		New Markets	
Capability	Full	Ave	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Application Infrastructure	13	8	6		6		7		6		6		6		6	
Communications	7	5	4		4		4		4		4		4		4	
Data Management	6	4	2		2		3	5	2		3	5	2		2	
IT Facilities Management	5	4	2		2		3	5	2		3	5	3		3	5
IT Management	4	3	2		2		2		2		2	4	2		2	
Security & Risk Management	4	3	2		2		3	4	2		3	5	2		2	4
Architectures and Standards	20	16	13	18	15	19	15	19	14		15		14		14	
Channel Management	7	3	2		2		2		2		2		2		2	
IT R&D	2	1	0		1		0		1	2	0		0		0	
IT Education	2	1	0		0		0		0		0		1	2	0	

Average = the average # of services of all firms studied

Low = minimum capability required

High = the minimum # of services for high capability when that service cluster was statistically significant for the type of strategic initiative

Business Unit IT Infrastructure Capability for Strategic Initiatives

			Value Net													
			Supply		Internal		Demand		B2B		B2C		New Products		New Markets	
Capability	Full	Ave	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Application Infrastructure	13	3	2	6	2	6	1		2	5	0		2		1	
Communications	7	1	0	2	0	2	0		0		0		0		0	
Data Management	6	1	0	3	0	3	0		0		0		0		0	
IT Facilities Management	5	1	0		0		0		0	2	0		0		0	
IT Management	4	1	0	2	0	2	0		0	2	0		0		0	
Security & Risk Management	4	1	0		0		0		0	2	0		0		0	
Architectures and Standards	20	3	1		0		0		1		0		0		0	
Channel Management	7	1	0		0	2	0	2	0		0		0	3	0	
IT R&D	2	0	0		0		0	1	0		0	2	0	1	0	
IT Education	2	1	0		0		0		0		0		0		0	

Average = the average # of services of all firms studied

Low = minimum capability required

High = the minimum # of services for high capability when that service cluster was statistically significant for the type of strategic initiative

Appendix 4: Qualitative Data Analysis Methodology

Detailed qualitative data was used from interviews with managers in all firms, either from the transcriptions of taped recordings or detailed interviewer notes. The data was coded for statistical analysis using a combination of a qualitative data analysis tool—NUDIST and human coders familiar with the domain who read the transcripts. The coding provided a rating of the extent to which enterprises emphasized different Value Net initiatives (Supply Chain, Internal, Demand Side), the extent to which the initiatives were oriented towards B2B or B2C exchanges and the extent to which the initiative involved a new product or targeted a new market.

The criteria used to classify the initiatives into the different categories are provided below. NUDIST was used to generate the number of proximal occurrences of related keywords in the interviews and to mark the location of these keywords in the transcript for reference by coders. Using this data and a contextual reading of the interview, each enterprise initiative was scored on a 7 point scale on each of these dimensions.

DEMAND SIDE INITIATIVES
Technologies for self-service
Investments /Initiatives to link to customers
One face to the customer
Integrating processes across business units for customers

SUPPLY SIDE INITIATIVES
Deployment of information technologies to link to suppliers,
Participation in electronic exchanges, emarketplaces
Providing online access for suppliers to enterprise data

INTERNAL INTEGRATION
Investment in digitizing processes
Digital workflow initiatives
ERP implementations
Integrating business unit processes

B2B OR B2C
Emphasis on transactions with business partners
Establishment of ongoing periodic business interaction
Creation of interface to service customers on the web

NEW PRODUCT
Introduction/development of new products
Product extensions with novel features
Investments/focus on innovation, investments/focus on R&D,
Creation of New Processes to support products
Redesign of Process to deliver products
Changes to products

NEW MARKET
Investments/focus on developing new channels,
Addressing new market segments
Traditional processes moving to self-service

[i] P. Weill and M. Broadbent, *Leveraging the New Infrastructure: How market leaders capitalize on information technology*, Boston, MA: Harvard Business School Press, 1998, pp. 58–62.

[ii] Worldwide IT Trends & Benchmark Report 2001: Vol. 2, Rubin Systems Inc. /META Group.

[iii] See Barney, J., "Enterprise resources and sustained competitive advantage," *Journal of Management* 17, No. 1 (1991): pp. 99–120.

[iv] Keen, P. G. W. (1991). *Shaping the Future: Business Design Through Information Technology.* Cambridge ,MA., McKay, D. T. and D. W. Brockway (1989). "Building I/T Infrastructure for the 1990s." *Stage by Stage* (Nolan Norton & Company) 9 (3): pp. 1–11.

[v] For more information on State Street Corporation see "State Street Corporation: Evolving IT Governance" MIT Sloan Center for Information Systems Research Working Paper #327 by Richard Woodham and Peter Weill, 2001.

[vi] Ross, J.W. "E-business at Delta Airlines: Extracting Value from a Multi-Faceted Approach" MIT Sloan Center for Information Systems Research Working Paper #317, 2001, http://web.mit.edu/cisr/www.

[vii] The starting point was the list of 25 infrastructure services in Figure 4-2 on page 88 and the cluster of eight infrastructure services in Figure 5.3 on page 119 as well as the services in M. Broadbent and P. Weill. "Management by Maxim: How business and IT managers can create IT infrastructures," *Sloan Management Review*, Vol 38, No 3, Spring 1997, pp. 77–92. The ninth category of infrastructure services "channel management" was added to include the ability of the enterprise to support a direct electronic connection to the customer via a variety of channels. The set of 70 services was validated in interviews with more than 50 businesses over a period of five years.

[viii] For two excellent discussions of information technology architecture see, P.G.W. Keen, *Every Manager's Guide to Information Technology*, 2nd ed. (Boston, MA: Harvard Business School Press, 1995); and M. J. Earl, *Management Strategies for Information Technology* (London: Prentice-Hall, 1989).

[ix] Ross, J.W. "United Parcel Service: Delivering Packages and E-Commerce Solutions" MIT Sloan Center for Information Systems Research Working Paper #317, 2001, http://web.mit.edu/cisr/www.

[x] To reach this description of information technology architecture we have drawn on the written work of, and discussions with, a number of people. We would like to acknowledge Peter Keen, Margrethe Olson, Michael Earl, Stewart Neimann and B. Robertson-Dunn.

[xi] Weill and Broadbent's study of PC LAN infrastructure services: Peter Weill, Marianne Broadbent and Adrian Goh, "Desktop Business Value: A Study of the Management and Value of Desktop Infrastructure" Final Presentation August 1998.

[xii] Broadbent Marianne and Weill Peter, "Management by Maxim: How business and IT managers can create IT infrastructures," Sloan Management Review, Vol 38, No 3, Spring 1997, p. 77–92.

[xiii] Tsang, E.W.K. "Transaction Cost and Resource-Bases Explanation of Joint Ventures," *Organizational Studies* p. 216, 2000.

[xiv] Quinn, J.B. and Hilmer, F.G. "Strategic Outsourcing," *Sloan Management Review*, 35, 4, 1994, pp. 43–55.

[xv] Prahalad, C.K. "The Role of Core Competencies in the Corporation," *Research-Technology Management*, 36, 6 1993, pp. 40–47.

[xvi] Porter, M. and Millar, V., "How information gives you a competitive advantage," *Harvard Business Review*, Jul–Aug 1985, pp: 149-160.

[xvii] Nalebuff, B. J and Brandenburger, A.M., "Co-opetition: Competitive and cooperative business strategies for the digital economy," *Strategy & Leadership*, 25, 6, (1997), pp. 28–35 and Malone, Thomas W., Joanne Yates and Robert I. Benjamin, "Electronic Markets and Electronic Hierarchies: Effects of Information Technologies on Market Structure and Corporate Strategies," *Communications of the ACM*, 30, 6, (1987), pp. 484–497.

[xviii] Rappa, M. "Business Models on the Web," http://ecommerce.ncsu.edu/business_models.html, Timmers, P. 1998. "Business Models for Electronic Markets," *EM-Electronic Markets*, 8, 2: pp. 3–8, Weill, P. and Vitale, M. 2000. *Place to Space: Migrating to eBusiness Models*, Boston, MA: Harvard Business School Press, 2001.

[xix] A bivariate correlation analysis between the percentage of the services in each cluster provided by the enterprise and the types of electronically based business initiatives implemented using a single tailed test with a probability of significance (alpha) of 0.1 or smaller suitable for an exploratory analysis.

[xx] Woodham, R. and Weill, P. "Manheim Interactive: Selling cars Online," MIT Sloan Center of Information Systems Research Working Paper #314, 2001, http://web.mit.edu/cisr/www.

[xxi] For more information see: "Citibank Asia Pacific: Positioning IT as a Strategic Resource" by Brand, A., Weill, P., Soh, C. and Periasamy, P., Melbourne Business School Case Study, 1999.

[xxii] Amram, M. and Nalin, K. *Real Options*, Harvard Business School Press, Boston, 1998.

[xxiii] Porter, M., "What is Strategy?' *Harvard Business Review*, 74(6), 1996, pp: 61–78

[xxiv] The threshold for the number of services required to create a distinctive competency (i.e., high in Appendix 3) was computed as being 1.3 standard deviations above the mean number of services reported by firms in each cluster. The threshold for a distinctive lack of competency (i.e., low in Appendix 3) was computed as being 1.3 standard deviations below the mean number of services of firms in the cluster.