I/T VALUE AND THE ROLE OF I/T INFRASTRUCTURE INVESTMENTS

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ABSTRACT

Successful exploitation of I/T by a firm and its business units stems from the alignment between the strategic context of the firm and its I/T portfolio. All I/T investment is not alike, and the I/T-related capability that is the largest contributor to long-term business advantage is I/T infrastructure.

Firms invest in information technology to achieve four fundamentally different management objectives: strategic, informational, transactional and infrastructure. I/T infrastructure is the base foundation of I/T capability, shared throughout the firm and usually provided by the information systems function in the form of reliable services. I/T infrastructure investments are typically large, long-term in nature and underpin the future competitiveness of firms. The direct business benefits of I/T infrastructure are difficult to specify and an analogy can be drawn with investments in public infrastructure at national and regional levels.

What firms expect to get from their I/T infrastructure investments depends on their view of the role of I/T infrastructure. Drawing on recent research in large firms, this chapter identifies and describes three different views of infrastructure in firms: UTILITY, DEPENDENT and ENABLING. The investment, benefit expectations, and value of I/T infrastructure is determined to a great extent by the way a firm views I/T infrastructure, and is linked to the ability of firms to achieve their strategic intent and implement their vision. This is illustrated by examples of these views in three firms.

1. IMPORTANCE OF I/T INFRASTRUCTURE

The role of corporate I/S groups is changing as spending on I/T has been dispersed throughout the firm. An important (or perhaps the only) role for the corporate I/S group in a decentralized environment is to provide the I/T infrastructure as an enabling base for the business units (Ahituv & Neumann 1990:199; Keen 1991a).

Tapscott and Caston (1992) refer to a paradigm shift which underscores the importance of I/T infrastructure investment considerations. The increasing importance of the international business environment and the rise of networked organizations are linked to three critical shifts in the application of information technology: the moves towards work-group computing, to integrated systems, and from internal to inter-enterprise computing. These developments, together with the pressure on firms to be flexible and responsive, requires a purposeful approach to the organization's I/T infrastructure.

Information systems managers are becoming increasingly aware of the role of I/T infrastructure. An annual survey of information systems executives who are members of the Society of Information Management (SIM) identified I/T infrastructure as increasing in importance (Niederman, Brancheau & Wetherbe, 1991). Building a responsive I/T infrastructure was ranked sixth in importance and was the only new issue in the top ten issues raised. The development and implementation of I/T infrastructure was identified in a recent study as the most important technological issue for Australasian information systems executives (Broadbent et al., 1993). The challenge is to provide a flexible infrastructure at low cost which is continually evaluated and updated with emerging new technologies.

I/T investment is highly visible in modern organizations. Appropriate investment in I/T can add value to a firm in many ways and over differing time horizons. In the strategic sense, I/T is aimed at enhancing current and future business results and in improving the way the firm competes and operates. Among the I/T capabilities required, the I/T Infrastructure is the largest contributor to long-term strategic business advantage.

This chapter draws on current industry research into the role and payoff of I/T infrastructure investments. This international project, sponsored by the IBM Consulting Group, is examining the role and value of I/T infrastructure investments in forty large for-profit sector firms. Initial results help answer the questions: Why do firms invest in

I/T infrastructure? What is the role and value of I/T infrastructure in different firms? The experience of the firms in the study indicates that I/T infrastructure is a critical component in positioning to achieve strategic alignment.

The purpose of this chapter is to examine the role of I/T infrastructure as part of the process of managing I/T investments. The strategic context and the role of I/T investments in improving business results are examined. The elements of I/T infrastructure and the different roles for I/T infrastructure in the strategic context of firms are explained using examples of the role of I/T infrastructure in three different firms.

2. STRATEGIC CONTEXT AND ALIGNMENT

Successful exploitation of I/T by a firm and its business units stems from the alignment between the strategic context of the firm and its I/T portfolio. Strategic context has two components (Hamel and Prahalad, 1989): first, the strategic intent or longer term stable goals of the firm; and second, its current strategy, the short-term strategy (e.g., products, markets, prices, etc.) for doing business today. In a multi-divisional firm, strategic intent can be identified at both corporate and business unit levels while current strategies can be identified at business unit levels.

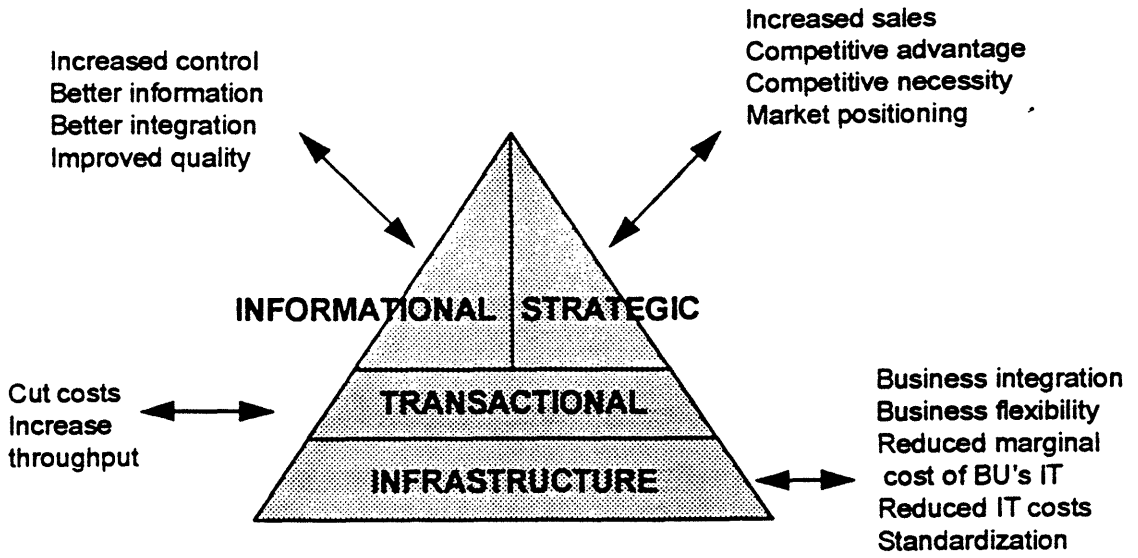
The state of harmony that exists between the strategy (intent and current) of a business and the information technology is referred to as strategic alignment (Butler Cox, 1992). Strategic alignment requires planned and purposeful management processes (within both business and I/S disciplines) and is temporal in nature (Broadbent and Weill, 1993). Non-alignment is the natural state of firms. The achievement of strategic alignment requires a process of continuous adaptation and change (Henderson and Venkatraman, 1993) in light of strategic intent and current business strategies. Strategic alignment operates at both firm and business unit levels.

The I/T portfolio of large firms consists of a myriad of information systems and technologies. Some of this investment is infrastructure, long-term and focused on achieving the firm's strategic intent. Other investments are aimed at the more immediate and direct benefits allied to executing current business strategies. All investment in I/T is not alike and it is helpful to distinguish between the different management objectives.

3. ROLE OF I/T INVESTMENT IN IMPROVING BUSINESS RESULTS

Firms invest in I/T to achieve four fundamentally different management objectives: strategic, informational, transactional and infrastructure. These types of I/T make up the I/T investment pyramid (Weill & Lucas, 1993). Figure 1 depicts these different objectives and their relationships.

Figure 1: Management Objectives for I/T



At the base of the I/T investment pyramid is the I/T infrastructure. I/T infrastructure is the base foundation of I/T capability, in the form of reliable services shared throughout the firm and (usually) provided by the information systems function. The I/T capability includes both the technical and managerial expertise required to provide reliable services. For example, I/T infrastructure services in a firm might include firm-wide communication network services, management and provision of large scale computing, universal file access, the management of shared databases and research and development expertise aimed at identifying the application of emerging technologies to the business. The I/T investment which uses and sits on top of the infrastructure are the applications which actually perform the business processes.

The next level of the pyramid is the transactional I/T that processes the basic, repetitive transactions of the firm. These include systems which support order processing, inventory control, receivables, payables and other transactional processing. Transactional

systems are developed to cut costs often by substituting capital for labor or to make it possible to handle high volumes of transactions. Transactional systems build on and depend on the I/T infrastructure being in place and reliable.

The apex of the pyramid contains both the informational and strategic uses of I/T which depend on and are supported by the infrastructure and the transactional systems. Usually both infrastructure and transaction systems must be in place before informational or strategic systems are feasible.

Informational I/T provides the information for managing and controlling the organization. Systems in this category typically support management control, planning, communications, and accounting. Data for the informational systems comes from summaries of the transactional systems and from data on the industry, competitors, and economy external to the firm.

The objective of strategic I/T investments is quite different. Strategic investments in I/T are made to gain competitive advantage or position the firm in the marketplace, most often by increasing market share or sales. Firms with successful strategic I/T initiatives usually involve a new use of I/T for an industry at a particular point in time (for example, the first finance company to provide online 24 hour, 7-day-a-week loan approvals in car yards using expert systems technology).

The nature and extent of I/T investment for each of these management objectives is determined by the firm's strategic context, that is, the firm's strategic intent and current business strategies. It is the longer term component of the strategic context which must drive I/T infrastructure investment decisions. I/T infrastructure aims to provide the components and services to achieve strategic intent via any number of current business strategies which are consistent with that strategic intent. These current strategies might be, as yet, unspecified.

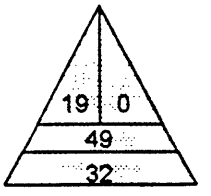
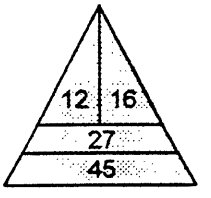
The strategic intent and current strategy, in combination, drive the other I/T investment in the pyramid. Transactional, informational, and strategic systems are likely to evolve with changes in current business strategies. These three types of systems can be conceived of as marginal and tailored investments to deliver business functionality built on a solid base of I/T infrastructure.

The two firms in Figure 2 demonstrate the use of the pyramid to assess the align-

ment of the I/T portfolio with the strategic context. Both are single business unit firms and have strong alignment of their I/T portfolios with business strategy.

The tile manufacturer has a strong growth strategy and values flexibility. This is reflected in their I/T portfolio with a flexible and extensive national infrastructure and applications which position the firm in the market place. The car rental firm has a low-cost, no frills strategy and has a limited, inflexible infrastructure which supports applica-

Figure 2 Comparing I/T Portfolio in Two Firms

Business	Strategic Intent	Current Strategy	Major IT Applications and Infrastructure	% of IT investment in Pyramid
Car Rental	Lowest cost car rental catering to vacationers in a few busy locations	Providing low rates for pre-loved cars available to hire near airports and down-town hotels, strong cost cutting emphasis	Billing Reservations Car tracking Car maintenance General ledger Limited reach and range - minimum infrastructure	
Roof Tiles	Significant growth to product range and geographical coverage, quickly addressing changing customer needs	New range of premium priced tiles with protective coatings for particular geographical conditions in addition to budget range	In store scanners and systems to enter building plans and determine appropriate tiles, quantities and costs, providing a 3D perspective drawing and confirmed delivery date Nationwide reach and extensive range of services	

If either firm had the I/T portfolio of the other, a poor alignment between I/T and strategy would result.

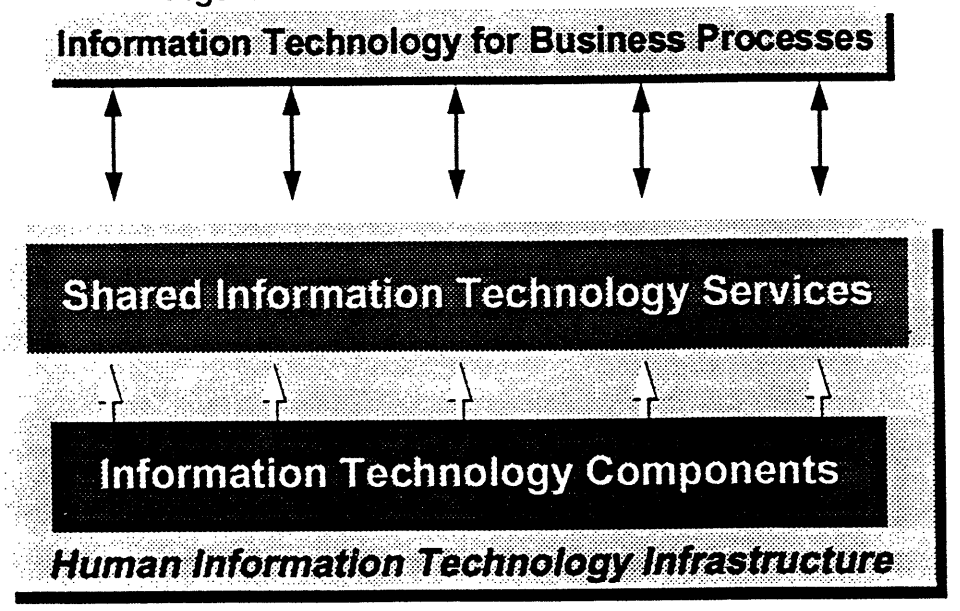
4. NATURE OF I/T INFRASTRUCTURE

I/T infrastructure investments are typically large, long-term in nature and underpin the future competitiveness of firms. These investments often have to be made in anticipation of business developments. The return on infrastructure investments in terms of business results is difficult to track directly. I/T infrastructure investments typically do not necessarily provide direct business performance benefits (Parker and Benson, 1988). The benefits are realized by business systems connected to and enabled by the infrastructure. In the case of enabling infrastructure however, the future flexibility provided by I/T infrastructure can provide direct benefits by enabling economical or rapid implementation of other systems in the pyramid.

The elements of I/T infrastructure are depicted in Figure 3, based on a useful model from McKay and Brockaway (1989). At the base are the I/T components (e.g. computers and communication technologies), which are commodities and readily available in the market place. The second layer above is a set of shared I/T services such as universal file access, electronic data interchange (EDI) or a full service network. The I/T components are converted into useful I/T services by the human I/T infrastructure that can be used as building blocks for business systems. The human I/T infrastructure of knowledge, skills and experience binds the I/T components into reliable service which forms the firm's I/T infrastructure.

The large box on Figure 3 containing both the services and the components is the firm's I/T Infrastructure. The infrastructure set of services is relatively stable over time. Similar services are required from year to year with gradual improvements over time taking advantage of the new technologies and efficiencies.

Figure 3: Elements of I/T Infrastructure



The information technologies for business processes, however, are changed regularly to meet the needs of the current strategy. Often these changes occur on a yearly basis as business processes are changed to better serve customers.

The objective of the firm's infrastructure is to provide a stable base of reliable services to enable the I/T for the business processes to be easily connected and changed.

Infrastructures are usually provided at both the corporate and business unit levels. The business unit infrastructure is more tailored to the particular needs of the business unit and connects in a "plug compatible" way to the corporate infrastructure. Some firms have very little corporate I/T infrastructure while others have little or no business unit infrastructure, rather sharing the centrally provided infrastructure services.

Johnson and Johnson Pacific provides an example of infrastructure that is predominantly corporate. I/T infrastructure services of this health care company, headquartered in Sydney, include:

- corporate telecommunications network, including EDI linkages to clients;
- large scale computing services, including a support facility;
- electronic mail facilities for local and off-shore communications;
- corporate shared application systems such as the general ledger, manufacturing systems and the consolidated customer file.

The Corporate Information Services Department provides these I/T infrastructure services on an AS/400 computer and electronic mail on a Digital VAX computer. These computers are connected via an Ethernet link. Information processing of corporate data

is centralized.

Business unit specific systems, such as sales and retail data, are processed by the Corporate Information Services Department but owned by the business units.

The dimensions of the I/T infrastructure can be specified in terms of *reach* and *range* (Keen 1991) provided by a firm's infrastructure. *Reach* indicates the extent of locations which can be linked. A firm with a limited reach might only be able to link its employees in a single location, while a firm with extensive reach could link customers or suppliers, regardless of their I/T base. *Range* refers to the richness of the services provided. This determines the breadth of functionality that can be directly and seamlessly shared across the systems and services. Infrastructure with a limited range would provide the ability to send only standard messages. A more extensive range would provide the capability to perform multiple transactions which simultaneously updated databases. The combination of the readily available reach and range is useful in depicting the dimensions of the firm's I/T infrastructure.

The extent to which an organization has an appropriate I/T infrastructure in place determines its business "degrees of freedom" (Keen, 1993). Having the appropriate technological platform and service set enables other business systems to be produced. This base capability provides improved flexibility and widens the variety of clients a firm can handle without increased costs (Weill, 1993).

A comprehensive I/T infrastructure provides flexibility in meeting the incipient trends of the market place. For example, Otis Elevators revolutionized the service side of the elevator industry with their highly acclaimed computer-based customer service system, "Otisline" (Otisline 1990). Otis Elevators was able to produce "Otisline" at least four years faster because of the existence of an I/T infrastructure including a flexible database named the Service Management System (SMS). When the database was first installed "Otisline" had not been conceived. Sufficient flexibility was incorporated into the design to enable the production of "Otisline" in a much shorter time than starting from scratch. Valuing the infrastructure before "Otisline" would have been very difficult. However, the value of the flexibility of the investment is clear in hindsight. The four year break on the competition was a significant advantage in the market place.

Building in flexibility, such as the SMS database at Otis, adds cost and complexity

but provides a business option that may be exercised in the future (Kambil, Henderson & Mohsenzadeh, 1992). Otis exercised their option and added the application systems supporting "Otisline," generating significant business benefits to the company.

An I/T infrastructure of greater reach and range, beyond what is currently required by the business units, provides a flexibility or slack for future needs. The existence of the flexibility allows far more rapid response to an emerging business need. One reason firms invest in infrastructure is to buy flexibility.

Thus the I/T infrastructure is a major business resource and perhaps one of the few sources of a long-term competitive advantage (Keen, 1991). Good infrastructure is not a commodity and thus difficult to duplicate. The human I/T infrastructure of knowledge and skills and the I/T management vision provide much of the value added of I/T infrastructure.

5. PUBLIC INFRASTRUCTURE ANALOGY

An interesting and useful analogy to help understand the benefits of I/T infrastructure is public infrastructure such as roads, bridges, sewers, hospitals, schools and public buildings. While investigating the role of I/T infrastructure, Keen[1] studied the development of the railroads in the U.S. and points out the difficulty in directly measuring the business value of the railroads. The business value of applications enabled by the railways is clear: freshness of vegetables, improved production time of newspapers, and reduced travel time to market. The same argument can be made for I/T infrastructure (McKay and Brockaway, 1989; Keen, 1991). Both infrastructures are relatively large investments with long lives. Both are believed to add to the community in ways that could not be achieved through end user or private investment. Understanding more about the role and value of public infrastructure is very helpful in understanding the role of I/T infrastructure.

National Infrastructure

There have been a number of very careful economic studies of the value of public

[1]Reported in *Computerworld*, December 24/January 1, 1991 based on an interview with Peter G.W. Keen, Executive Director of the International Center for Information Technologies in Washington, D.C.

infrastructure. At the international level a strong indicator is the relationship between public infrastructure investment (as a percentage of gross domestic product) and the annual growth of labor productivity. A simple regression of these two indicators, for the "G7" countries, indicates a strong relationship. Countries with higher public infrastructure investment had higher productivity. During the period from 1973 to 1985, Japan had both the highest public infrastructure investment and labor productivity, while the U.S. was the lowest of the seven countries on both these measures (Aschauer, 1989).

At the national level, Aschauer (1989) also shows a strong relationship between the stock of U.S. public infrastructure and output per unit of private capital. Thus infrastructure leverages private investment to provide a greater return. A similar relationship was demonstrated between the stock of public infrastructure and productivity growth. Over the period 1950 to 1985, the investment in public infrastructure tracks and slightly precedes national total factor productivity. The amount of core infrastructure of streets, highways, airports, sewers, mass transit, water, etc. has strong explanatory power of national productivity.

The rationale for public infrastructure investment is that these services will not be produced by the private market (Munnell, 1990a). Private corporations and individuals generally are not motivated or able to provide their own infrastructure, particularly when the infrastructure must exist in other regions. The condition of the infrastructure can be as important as its existence. A highway in poor condition can reduce the productivity of private capital and labor in the form of added time for journeys and wear and tear on vehicles. Maintenance as well as initial capital investment are also critical for infrastructure.

Regional Infrastructure

At the state and regional level the evidence is equally strong. Munnell (1990b) studied the differences between regions in the U.S. There was overwhelming evidence that public capital has a positive impact on private sector output, investment and employment. Estimating the size of the effect, Munnell reports that $1000 more investment of infrastructure per capita resulted in 0.2% increase in annual employment growth. It is not surprising that the state which goes to the trouble of building roads,

sewers, airports, water supply systems, hospitals and schools will attract more new firms. Thus public infrastructure matters in firm location decisions, and affects employment growth.

The effect of regional infrastructure is also pronounced in terms of the level and productivity of private investment. One dollar invested in public infrastructure appears to increase private investment by 45 cents. Larger infrastructure investment also improves the productivity or return on the private capital investment providing a leveraging on the firm's private investment. Public infrastructure investment also appears to come before a pick-up in economic activity (Munnell, 1990b).

Interestingly, the positive effects of public infrastructure are most pronounced in declining regions (Deno. 1988). This suggests infrastructure can prove a powerful policy tool for revitalizing declining areas. Policies can target particular industries which benefit and then pass on the savings to the general community. The U.S. federal-aid highway infrastructure investments between 1950 and 1973 had a strong and positive effect on the productivity of trucking (Keeler & Ying, 1988). Fierce competition in the industry ensured that these benefits would be passed on to the economy.

The benefits of infrastructure are not without limits. Too much infrastructure will deter private investment, and the balance and timing are critical.

Comparing Public Infrastructure and I/T Infrastructure

The analogy between public infrastructure and I/T infrastructure is compelling. There are striking similarities:

(1) Both I/T and public infrastructure are provided by a central agency funded by some form of taxation.

(2) Both types of infrastructure require large investments and are long-term in nature.

(3) The central agency in both cases provides an essential service that users would generally not be motivated or able to provide.

(4) Both types of infrastructure enable business activity by the users otherwise not economically possible.

(5) Both types of infrastructure must be in place often before the precise business activity is known. Thus flexibility is valued in both types of infrastructure.

(6) Both types of infrastructure are difficult to cost justify in advance as well as to show the benefits in hindsight.

(7) The right amount of investment is a delicate balance for both types of infrastructure. Too little will lead to duplication, incompatibility and non-optimal use of resources. Too much will discourage user investment and involvement and may result in unused capacity.

Given the similarities of the two types of infrastructure it is reasonable to expect that many of the benefits demonstrated from public infrastructure can accrue to I/T infrastructure. By analogy, it is reasonable to expect that I/T infrastructure:

- will improve productivity of user groups;
- will leverage user groups own I/T investment;
- will enable new business needs to be met more rapidly.

What firms expect to get from their I/T infrastructure investments depends on their view of the role of I/T infrastructure. The investment, benefit expectations and value of I/T infrastructure is determined to a great extent by the way the firm views I/T infrastructure.

6. THE ROLE OF I/T INFRASTRUCTURE

Three different views of I/T infrastructure have been observed (Weill, 1993): UTILITY, DEPENDENT and ENABLING. These views have now been closely examined in our study of large firms.

We have been able to classify the role of I/T infrastructure in the first ten firms studied to date, following collection of extensive quantitative data and onsite interviews with both business and I/S executives. Data points for classifying views of I/T infrastructure include a combination of:

(1) The management objectives for I/T investments (as described in Section 3) and the placement of the infrastructure throughout the firm.

(2) The basis on which investment decisions related to I/T infrastructure are justified.

(3) The reach and range of the infrastructure services.

(4) The extent of shared standards (evidenced by data standardization) across the firm and across business units.

(5) The locus of responsibility for infrastructure and architecture decisions in the firm.

The different views imply different levels of up-front infrastructure investment, with different approaches to cost justification and different expected benefit profiles. Figure 4 depicts the three views of infrastructure and their primary value driver. We describe

each of these views and then present case vignettes which illustrate these views in firms studied.

A UTILITY view of infrastructure implies that expenditure on I/T infrastructure is seen primarily as a way of saving costs through economies of scale. I/T is seen as a utility that provides a necessary and unavoidable service which incurs administrative expenses. The management thrust is to minimize the expense for a desired level of utility service.

A DEPENDENT view of infrastructure implies that the infrastructure investments are primarily in response to specific known business strategies. DEPENDENT infrastructure investments are derived from business plans which specify, or imply, I/T needs. Thus planning for infrastructure is undertaken after current business strategies have been articulated. For example, a bank might invest heavily by consolidating previously independent databases into an integrated customer relationship database. This infrastructure investment is dependent on a current strategy of differentiating customer service through relationship banking.

Figure 4: Infrastructure Types and Values Drives

View of Infrastructure	Primary Value Driver
UTILITY	Cost savings via economies of scale
DEPENDENT	Business benefits for the life of the current strategy
ENABLING	Current and future flexibility

An ENABLING view of infrastructure implies that infrastructure investments relate primarily to long term requirements for flexibility to achieve strategic intent. These are often created by expanding the reach and/or range of DEPENDENT infrastructure beyond the current requirements of the business. The resulting infrastructure enables new, and as yet unspecified, business strategies to achieve the strategic intent. It provides future options for implementing strategies. The flexibility of the infrastructure enables a number of as yet unspecified business strategies to be implemented more rapidly than

firms with a DEPENDENT or UTILITY view of infrastructure. To take an ENABLING view senior managers must perceive a flexible infrastructure as an asset of the firm providing a competitive advantage. This view also implies that the firm values this flexible asset during the project justification process.

Where greater flexibility and business "degrees of freedom" are part of the firm's strategic intent, an ENABLING, rather than a UTILITY, view of the role of infrastructure provides a higher level of alignment between I/T and business strategy. Alignment between firm-wide strategic context and an appropriate role for I/T infrastructure is achieved through distillation of the implications of strategic intent for long term I/T management decisions on providing information support.

7. CASE VIGNETTES

Summaries of three case vignettes illustrate the role of I/T infrastructure—UTILITY, DEPENDENT and ENABLING—in three firms.

UTILITY View of Infrastructure—CHEMICO

Chemico is a leading supplier of industrial and specialty chemicals. Chemico's employees are spread over 80 locations in the Pacific Basin and total sales for 1992 were over US $1 billion.

Chemico is a divisionalized firm with several business units. Each unit develops and manufactures distinct products and serves largely different markets. We examined the Advanced Technology and Chemicals business units.

Chemico aims to be the undisputed supplier of choice for chemicals and related products and services in the market it serves. The company is intent on developing a culture where continuous improvement is sought in all areas to achieve world class customer service and product quality.

The guiding business principles for the development of I/T infrastructure which emerge from Chemico's strategic context are the provision of I/T which:

- reduces costs;
- supports the information intensive business improvement program; and
- enables the firm to maintain high standards of customer service and product quality.

There is decentralized responsibility for I/S functions in Chemico. Business units have full autonomy in the way they manage their I/T but are encouraged to seek advice from the corporate I/S group and to conform to corporate standards. Chemico has a corporate-wide architecture policy which includes telecommunications, preferred suppliers (IBM or DEC), workstation guidelines (IBM PS/2), electronic mail and general ledger controls. Opportunities exist to move outside these standards with the completion of an exception request which must be justified on business grounds.

The corporate I/S group provides communications services (through a communications network) and processing services (mainframe processing) for all Chemico units. The business units then determine which services they wish to access, usually on a unit charge basis. Use of I/T infrastructure services varies considerably amongst the units. For example, Advanced Technologies controls about 95% of the infrastructure used within that unit and locally supplies processing services using three AS400 IBM computers. All data for the business unit is stored in this system and only data required for corporate reporting purposes is transferred to the corporate processor. The Chemicals unit, in contrast, has virtually no local infrastructure and relies almost solely on the corporate I/S group for the development, management and operation of its business systems. Both business units make extensive use of Chemico's firm-wide communications network.

Chemico's units have a UTILITY view of infrastructure, and are heading towards a DEPENDENT view. I/T planning and development processes are undertaken following on from business strategy.

Planning for corporate I/T infrastructure takes place with input from the I/T Managers in each of the business units. The I/T Manager's estimation of future I/T needs of the businesses is used to predict corporate infrastructure requirements. Tracking of the usage of infrastructure services is an important component of the I/T infrastructure investment decision. In addition, IT infrastructure is primarily viewed as a utility providing the base I/S services at minimum cost. The I/T requirements are determined in consultation with the Business Managers to ensure that the strategic needs of the business are being met.

The past 5 years have seen a major push towards decentralization of management and control within Chemico. I/T management has moved from being a centralized

function to an activity that the Business Units can take total responsibility for, if they so choose. However, there has recently been recognition of the need for some form of coordination to maximize resources and reduce duplication. An I/T Council has recently been established with a major objective to set standards for further direction and strategy. While this may reduce some of the autonomy enjoyed under the present system, it is designed to introduce a more cohesive approach to I/T management across the firm.

The I/T manager's estimation of future I/T trends of the businesses is used to predict corporate I/T requirements.

UTILITY role for I/T Infrastructure

I/T Infrastructure services:

- maintenance and support of the mainframe computing facilities
- communication network services
- electronic mail facility
- consultancy and support services when required
- technology education services

DEPENDENT View of Infrastructure—PETROMARK

Petromark is a major manufacturer and marketer of petroleum products to retail and commercial customers. Petromark also has in excess of 15% share of the Australian domestic market; revenue in 1992 was well over A$1 billion and it employs over 1500 people. Petromark seeks to "make our customers prefer us to any competing company" and be the most successful downstream oil company in Australia. Success is measured as return on assets.

Petromark's steady financial position has been achieved through a continuing focus on minimizing and reducing costs, operational efficiencies and customer service. In a commoditized industry, Petromark presents a strong corporate image of a quality provider of petroleum products. Petromark's re-imaging project has contributed to a public perception of Petromark as a quality brand where the retail outlets provide friendly staff and clean facilities.

The focus for the development of I/T infrastructure which flows from Petromark's

strategic context is relationship building with commercial and retail customers and suppliers in a cost-conscious environment. These relationships require the existence of a firm-wide network and I/T literate staff.

Petromark has decentralized responsibility for I/S functions in each of its business units together with a corporate I/S group. The past five years have seen increased responsibility for I/S planning, development and management at the business unit level with business units now containing I/S staff who report to business unit managers.

Petromark has constantly reviewed its infrastructure investments at both corporate and business unit levels. Major investments at corporate level have been in the development of communications networks amongst commercial, retail, and manufacturing sites and suppliers. Petromark supplies extensive communications services through a robust network with an extensive LAN in place at its head office and in capital cities and other major sites. About 2,000 PC users have whatever multi-host connectivity is required for their business needs.

Business units have undertaken considerable local infrastructure investments, particularly in the commercial area with new distributorship services. The Retail group is currently making major investments in upgraded retail and EFTPOS systems. Meanwhile, at a corporate level, the firm is closely monitoring the implementation of the international affiliates systems renewal project.

Planning for I/T infrastructure in Petromark is based primarily on current business strategies and thus is categorized as DEPENDENT. I/T infrastructure investments, as with other I/T expenditure, must meet a defined business need. They must show clear cost savings and, if part of the customer interface, must demonstrate the delivery of a higher level of customer service. The cost and quality of I/T services are a major topic of discussion between business unit managers and senior I/T managers. Emphasis on business needs is accompanied by a concern for demonstrating increased operational efficiencies, which usually means providing the service at a lower cost to Petromark.

Petromark has extensive reach through its electronic mail system to send standard messages throughout the Petromark group internationally. Petromark has developed an inter-company communications infrastructure based on X.400 network standards. Increasingly, connections to third party networks are put in place to facilitate inter-

company process simplification. The range of services is being extended by current developments. For example, distributorship systems are extending the range of services to customers and suppliers and some EDI arrangements are operational. EDI is also currently under consideration as part of a redesign of Petromark's billing process.

The mission and vision of ISD reflect the focus on providing business benefit by exploiting I/T for business purposes. The 1993 ISD mission is "to provide competitive I/T services in partnership with its clients so that the potential of I/T to achieve Petromark's business objectives is exploited." In this context, ISD "is committed to being the quality I/T service of choice for Petromark in Australia."

ISD provides competitive I/T services in partnership with clients so that the potential of I/T to achieve Petromark's business objectives is exploited.

DEPENDENT role for I/T infrastructure

I/T infrastructure services:

- maintenance and support of mainframe computing facilities
- communications network services
- video conferencing
- electronic and voice messaging
- data consultancy and support services
- business recovery services
- client support and technology education services

ENABLING View of Infrastructure—SOUTHSTORES

SouthStores is amongst the world's top fifteen retailers with revenue in 1992 of over US$10 billion. SouthStores' core businesses are department stores, two mass merchandise store chains, supermarkets and specialty retail operations. In some segments, such as mass-merchandising, its major competitor is from another of the SouthStores business units.

SouthStores aims to continue to grow and develop as a predominantly retail oriented organization which is innovative, competitive and dynamic. SouthStores operates as a divisionalized firm with a corporate group and six relatively autonomous business units. We examined three of these (the department stores unit and the two mass merchandise

chains). A newly appointed CEO has indicated a strong desire to utilize the synergies in the company.

The guiding principles for SouthStores' investment in I/T infrastructure need to be based on a strategic intent of growth, characterized by innovation and competitiveness. In a retail environment this includes flexibility to accommodate different and changing markets, connectivity throughout the firm and synergy to achieve economies of scale and ensure acceptable levels of profitability. These principles imply the development of a sophisticated communications network and positioning for electronic trading.

SouthStores has decentralized responsibility for Information Systems (I/S) functions to its business units as well as having a corporate I/S group, SouthStores Information Services (SLIS). Corporate level SLIS exists to ensure current and future business leverage of economies of scale, expertise and scope. SLIS provides the communications backbone services and manages the operation and maintenance of almost all South-Stores' major data processing services. All large-scale hardware is confined to two sites in the city and these handle the firm's major computing operations. In-store hardware (such as point-of-sale terminals, personal computers), within-store communications and applications development are the responsibility of the business units. The SLIS budget is recouped from payments for services from the business units.

I/T usage is integral to all operational aspects of SouthStores's businesses. As a result of firm-wide and business unit planning processes in the late 1980s, a set of key requirements for the SouthStores' I/T were articulated. These included the need for flexibility to accommodate change, connectivity ("anything to anything"), synergies through economies of scale, growth without corresponding cost growth, reliability, and positioning for new services and technologies.

The firm's hardware architecture includes IBM, DEC and NCR machines. Business groups do not have to limit themselves to the hardware architectures already in place provided there is a sound business case. SouthStores' communications network is large and sophisticated and is based on a layered approach.

Since 1985 the business units have developed their I/T independently from each other but in association with the corporate I/S group. Business units have planning cycles which incorporate I/T considerations at the highest levels. SLIS has a consultative and

advisory role in these processes. In the late 1980s, SouthStores was an early mover into EDI and most business units have now established Quick Response implementation groups. SLIS provided the initial focus, expertise, firm-wide strategy, and contacts for EDI for the business units.

SouthStores' I/T infrastructure planning is based largely on future business strategies. Benefits sought relate primarily to the flexibility required to meet future, and as yet unspecified, business needs. Such flexibility is highly valued and is seen to provide a competitive advantage in the retail industry as well as ultimately lowering the cost of doing business. The firm's I/T infrastructure provides a high level of business functionality in terms of reach and range. SouthStores takes an ENABLING view of I/T infrastructure investments.

SLIS exists to ensure economies of scale, expertise and scope by providing the communications backbone and the operation and maintenance of all major computer installations throughout the firm.

ENABLING role for I/T infrastructure

I/T infrastructure services:

- management, maintenance and support of all large-scale computer hardware
- development, management and operation of the firm-wide communications network
- monitoring of new technology developments
- consultancy and advisory services

SLIS's vision statement emphasizes the ENABLING role of firm-wide I/T infrastructure for the SouthStores retail group. SLIS aims to be "a world class provider of information technology solutions that profitably extends the reach and range of SouthStores retail activities." There was evidence of both DEPENDENT and ENABLING views of the role of local I/T infrastructure in the department stores and the two mass merchandise chain business units.

Discussion

Chemico, Petromark and SouthStores share some similarities in their I/T management:

- they each have business unit responsibility for I/T together with a corporate I/S group;
- each firm spends a similar percentage of its total I/T budget on corporate I/T infrastructure (between 30-36%);
- all firms have both corporate and business unit I/T infrastructures.

Differences between the firms focus on the business use of their I/T infrastructure services and the rationale for these in each of the firms.

- There is an increasing percentage of corporate I/T expenditure which is classed as I/T infrastructure from Chemico (UTILITY), through Petromark (DEPENDENT) to SouthStores (ENABLING). Generally we have found that for firms with an ENABLING view of infrastructure, a high percentage of corporate I/T expenditure is for infrastructure services.
- A firm-wide communications network becomes increasingly important for firms with a DEPENDENT or ENABLING view of I/T infrastructure. In firms with an enabling view such networks are used extensively for business processes within firms as well as between firms and their customers and suppliers. Currently, firms with a UTILITY view use the network more for electronic messaging than as part of inter or intra-organizational systems for business processes.
- SouthStores's corporate I/S group, with an ENABLING view of infrastructure, played a different role from Chemico and Petrolink in relation to new technologies. They were more proactive and anticipatory in identifying new technologies which could be utilized for business purposes.
- Business units in SouthStores appear to have higher expectations of access to business-relevant I/T expertise in their corporate I/S group than did those in firms with the DEPENDENT and UTILITY views.

In Chemico, Petromark and SouthStores, the view of infrastructure can be traced back to the strategic context of each firm.

- The business value Chemico sought from its infrastructure investment was primarily to reduce costs, support the business improvement program, and to maintain quality standards. An emerging focus on customer service, where business processes were more I/T dependent, is resulting in a shift towards a DEPENDENT view of infrastructure.
- Petromark has been making use of its infrastructure to link customers and suppliers to build long-term relationships as part of its current strategy. Petromark staff make extensive use of I/T within the firm for internal communication and for productivity. There is a strong emphasis on a high level of I/T literary staff in Petromark and the communications network supports this.
- SouthStores values future flexibility, together with economies of scale, scope and expertise. SouthStores seeks to be well-positioned for new services and technologies. Each of these firms sees I/T infrastructure as a major component of their I/T

portfolio, though their views of the role of infrastructure differ. Each has an infrastructure appropriate for its strategic intent and current strategy. A shift in that strategic context though, might have implications for the level and nature of support which the current I/T infrastructure can provide.

8. CONCLUSIONS

I/T infrastructure is a critical component of the I/T portfolio. It provides the base foundation of I/T capability for the development of information systems. This I/T capability includes both the technical and managerial expertise required to provide reliable services.

The benefits of I/T infrastructure are difficult to specify, as the value of I/T infrastructure is in enabling information systems to support business processes. A useful analogy can be drawn between I/T infrastructure in firms and public infrastructure investment at national and regional levels.

The benefits firms derive from their I/T infrastructure investments, and the way these investments are justified, are related to the firm's view of the role of infrastructure.

- An UTILITY view is driven primarily by a concern for cost savings through economies of scale.
- A DEPENDENT view is driven primarily by a concern for business benefits from current strategy.
- An ENABLING view is driven primarily by the need for current and future flexibility.

One view of infrastructure is not better than the other. The key factor is the strategic context of the firm, indicating how it wishes to compete in its industry. An appropriate view of infrastructure must be taken for the strategic intent. That appropriate view could be: UTILITY, DEPENDENT or ENABLING.

I/T infrastructure investments are large and long term in nature. They are linked to the ability of firms to achieve their strategic intent and implement their vision. Implementing an appropriate role for I/T infrastructure is a major contribution to achieving strategic alignment between the I/T portfolio and the business needs.

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