Management by Maxim: How Business and IT Managers Can Create IT Infrastructures

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Decisions on investments in IT are both critical and contentious. With a thorough understanding of a company's strategic context, managers can identify business and IT maxims that can help them determine the IT infrastructure capabilities necessary to achieve their business goals.

An information technology (IT) infrastructure is vitally important to companies, particularly those in industries going through dynamic change, those reengineering their business processes, and those with widely dispersed operations. Yet executives find decisions on infrastructure investments difficult because they often have to make them before forming specific business strategies.

In this paper, we explain how successful firms create business-driven IT infrastructures. Some firms do not invest in a firmwide infrastructure, while others invest up to 10 percent of their revenues in an IT infrastructure, such as communication networks, databases, and expertise that is shared across multiple business units. Both approaches may be correct, provided they match the firm's specific needs.

Creating a business-driven IT infrastructure involves decisions based on a sound understanding of a firm's strategic context. This understanding can be communicated by what we call business maxims, which capture the essence of a firm's future direction. Business maxims lead to the identification of IT maxims that express how a firm should deploy IT resources and gain access to and use information. IT maxims provide a basis for a firm to make decisions on its IT infrastructure services.

Investments in IT Infrastructure

IT infrastructure investments are long-term commitments that account for more than 58 percent of the total IT budget of large firms and about 4 percent of revenues; they have increased at about 11 percent annually.[1] IT infrastructure capabilities underpin the competitive positioning of business initiatives such as improving cycle time, implementing redesigned cross-functional processes, utilizing cross-selling opportunities, and capturing the channel to the customer. They are the base for computer applications to execute business processes.

A firm's process for making decisions about these critical investments are among the most contentious and least understood. How do boards of directors judge the business cases for IT infrastructure investments? Where, for example, is the chain of evidence linking investments in an improved communication network to reduced cycle time, or linking shared databases and transaction processing to cross-selling? Too often, boards are asked to make decisions based

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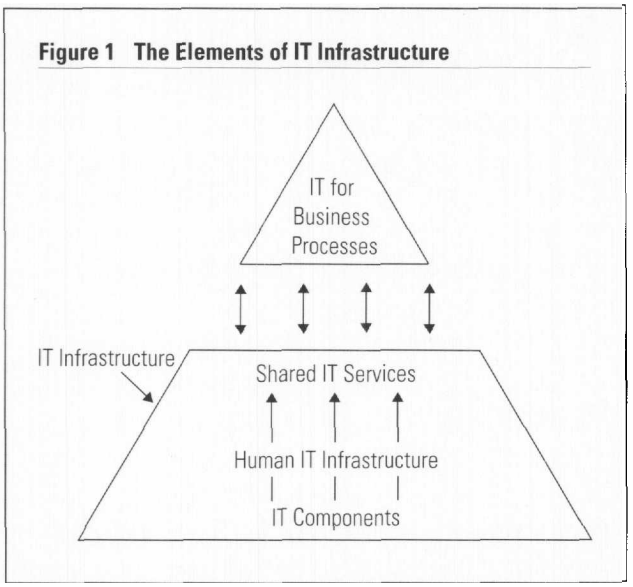


on technical criteria rather than in the context of long-term business needs. At the same time, there are competing demands to show business benefits in short time frames.

Companies are taking different views of the IT infrastructure and making decisions based on their strategic contexts:

- Why is Johnson & Johnson investing in shared IT services across previously autonomous businesses?
- Why have Hong Kong-based conglomerates Jardine Matheson and Hutchison Whampoa decided not to make firmwide investments in IT infrastructure services?
- Why is Citibank Asia centralizing and standardizing all backroom IT processes into one location for its Asian country operations?
- How has Honda Motor Corporation developed its sophisticated communications networks to reduce cycle time in new car production for the U.S. market?
- Why doesn't the Australian-headquartered international paper and packaging manufacturer, Amcor Ltd., have any firmwide IT infrastructure services?

Such questions highlight why IT infrastructure is a strategic issue that concerns executive management. Have these firms made the right decisions? How did they arrive at them? How can executives identify the best choices for their businesses? There has been little guidance on how to make these decisions. In this article, we suggest how executives can identify and describe the IT infrastructure services suited to their business in terms that both the business and IT managers understand. We draw on extensive qualitative and quantitative analysis of more than fifty multidivisional firms in the financial services, manufacturing, petroleum, retail, and telecommunications industries.[2] In more than 200 on-site interviews, senior business and IT executives shared their strategy, planning, and decision-making processes, and data about their IT infrastructure investments and the services delivered from those investments. In twenty-seven firms, we collected extensive data for the past five years covering different IT investments, their performance, and financial and operational company and business performance measures. After analyzing and synthesizing both the qualitative and quantitative data, we developed an approach for identifying the implications of strategizing and planning to understand how firms make sensible IT infrastructure decisions.[3]

We first discuss the nature and components of the IT infrastructure, then explore the framework that has emerged from the best practice of the firms studied, and show how executives can make informed IT infrastructure decisions.

IT Infrastructure Components

An IT infrastructure provides the shared foundation of IT capability for building business applications and is usually managed by the information systems (IS) group. At the base of the IT pyramid are the components, such as computer and communications technologies, that are largely commodities and readily available in the marketplace (see Figure 1).[4] The second layer comprises a set of shared services such as management of large-scale data processing, provision of electronic data interchange (EDI) capability, or management of firmwide databases. People with knowl-

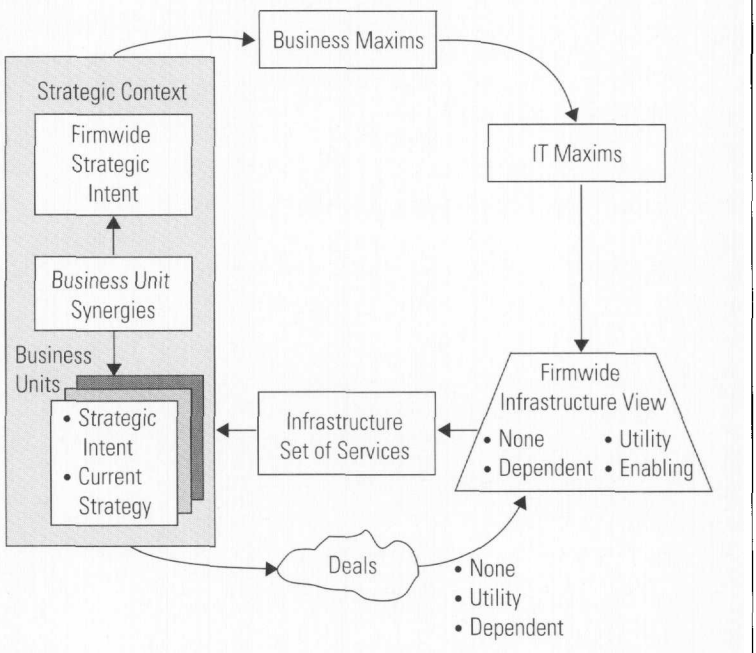
> How much should the firm spend on infrastructure, compared to competitors? How does lack of an appropriate infrastructure hinder a firm's competitive positioning?

edge, skills, and experience bind the commodity components into reliable, shared IT infrastructure services. The business applications, such as order entry, bank account opening, sales analysis, and purchasing systems, that actually perform the business processes utilize the shared infrastructure services.

The challenge for firms is to know which infrastructure services are appropriate for their strategic context. Which applications might they want to develop? Which should they implement as firmwide infrastructure services and which should they leave to the business units? How much should the firm spend on infrastructure, compared to competitors? How does lack of an appropriate infrastructure hinder a firm's competitive positioning?

The many options for configuring IT investments have not made the choices any easier or more obvious. Managers generally accept that they must be responsible for their IT choices and not abdicate to IT managers. But the decision-making process is often convoluted, and the range of possibilities is unclear or presented in technical terms. When they authorize a large IT expenditure, managers may still not be sure what they have consented to or what capabilities will be delivered to support their business. These dilemmas are particularly pronounced when companies decide on long-term investments. Typical management questions are: Is it important for all parts of the firm to keep their information about customers in a standardized format? Do the businesses share some of the same customers? Are there opportunities for cross-selling? Does a company need to know about a customer's total relationship with it? Are there opportunities for economies of scale?

Figure 2 Linking Strategy and Infrastructure



Making IT Infrastructure Decisions

We have distilled how successful firms make their IT infrastructure investment decisions into a framework we call "management by maxim." (Another approach is "management by deals," which we describe briefly later.) The decisions range from having no infrastructure services throughout the firm to making extensive services available to the whole enterprise, including all business units, suppliers, and customers. The essence and challenge of making the investment decision is to choose the IT infrastructure services that will readily enable the family of applications required in the future.

The framework begins with consideration of the company's strategic context, synergies among business units, and the extent to which a firm wants to exploit those synergies (see Figure 2). The strategic statements or business maxims are derived from the strategic context and identify the firm's future direction. From the business maxims, business and IT managers together identify IT maxims, which express the company's need to access and use information and data and the technology resources required to process transactions and ensure adequate technical capabilities, integration, and standards. The framework helps clarify IT investments in terms of the balance between short-term cost with minimum investment levels and future options and flexibility, which might require overinvestment based on current needs.

The business and IT maxims identify the firm's predominant view of infrastructure, which gives a context for decision making about funding for specific infrastructure services. These services provide human and technical capabilities, which then underpin the

business capabilities required for competitive positioning. A company can use this approach in reverse to assess the adequacy and flexibility of its current IT infrastructure and to see if it constrains business initiatives.

Next we discuss each component of the management by maxim framework.

1. Considering Strategic Context

Changing business demands, roles, and relationships are critical to making infrastructure decisions. "Success and survival are based on anticipation, not on hanging on the past," says Robert Shapiro, CEO of Monsanto.[5] When asked what Monsanto would be like in twenty years, Shapiro explained: "[That] depends on what the world is going to look like, and I don't know anybody who can tell you that. . . . We are operating in a condition of high uncertainty." This uncertainty led to the reorganization of Monsanto's four operating units into thirteen strategic business units to give each business more autonomy for its operations, aspirations, and culture.[6] Concurrent with a desire for greater agility is a focus on shared business services, including IT infrastructure services, operating alongside the thirteen businesses to create greater efficiencies across the whole organization.[7]

Many telecommunications and utility groups have also undergone radical change in the past five years. In 1992, Australia's telecommunications provider, Telstra, lost its monopoly position.[8] According to Telstra's CEO: "Rapidly developing new technologies, new markets, fierce competition, and higher customer expectations are combining to generate change on a scale never experienced in the Australian telecommunications industry. . . . The changes we have made deal with the very structure of our organization and with all our systems: management, financial, operating, and product/service development."[9] Telstra's customers now have a choice, which has led to new business imperatives emphasizing customer service and value. This emphasis, in turn, means that formerly separate business units with disparate customer and operational systems reconsider the nature of customer information and the billing system and consolidate both to create a customer-focused business with a single point of contact.

Firms such as Amcor, Citibank, Honda, Johnson & Johnson, Monsanto, and Telstra have different long-term strategic intents, which often give only a few broad clues for deciding on an approach to IT infrastructure services.[10] To clarify infrastructure requirements, companies also need to understand the current strategies and strategic intents of each business unit, the synergies between units, and the firm's experiences and beliefs in the value of leveraging these synergies (see Table 1).

A high level of customer overlap between units provides opportunities to cross-sell products and implies a need for common customer profiles and databases. When there is overlap in suppliers, a firm can derive synergies from a coordinated approach to electronic data interchange and extended enterprise systems and to reduced costs from suppliers. Product similarities indicate that much expertise can be shared among R&D, manufacturing and production, maintenance, and after-sales service. Similar ways of competing across business units often result in similar management approaches and consequent needs for shared information and IS. Many firms want to exploit shared services and achieve economies of scale or scope or expertise in such areas as financial management, human resources management, or information systems.

> Considering strategic context gives insights about what to coordinate across the firm, what to leverage from within business units, and what to leave to local options.

The strategic contexts of Amcor and Honda show why firms develop different approaches to infrastructure services:

• A $5.2 billion company, Amcor Ltd., has moved from paper making to packaging, corrugated boxes, plastic containers, and cans.[11] Its CEO commented: "We now have a very decentralized and very individual set of businesses — each with their own subculture. The overall control mechanism for the group is based around return on assets."[12] While there is some verti-

Table 1 Components of Strategic Context

Firmwide Strategic Intent

- Long-term goals

Potential Business Unit Synergies

The extent of:

- Overlapping customer and supplier bases
- Product similarity among business units
- Expertise that can be leveraged across the firm
- Predominance of one value discipline among the business units
- Similarity in basis of competition among the business units. Do they all compete on cost? Is there considerable variation, with some competing on cost and others on value-added service, high-quality niche products, or a shared capability?

Individual Business Unit Attributes

- Strategic intent: long-term goals
- Current strategies, competitive choices

Synergy versus Autonomy Focus

- Desire for exploiting synergies versus encouraging autonomy

cal integration in the businesses in Australia and the United States where the paper group's mills supply some of Amcor Fibre Packaging's (AFP) box factories, generally the businesses do not share customers or products. The emphasis on operational autonomy is echoed by AFP's managing director: "We have a strong focus on local accountability and prefer to run the business with the minimum of mandates."[13]

- Honda has a transnational orientation and sees its businesses as "a global network with 83 production facilities in 39 countries that supply Honda products to approximately 160 countries."[14] "Product realization" is a capability central to Honda's competitiveness in each business, and there is synergy in the competencies required to make motorcycles and cars.[15] An efficient parts system for all products is part of the business's backbone. Honda's communication network aims at both cutting costs and enabling electronic communication. Honda's systems division general manager recalled the justification for the enhanced network: "Each business and IS group saw the benefits as we did, and the divisions agreed to share the cost. It then became part of the business plan for each business and region."[16] Honda clearly wants to exploit the potential of the synergies that exist among the different businesses.

A firm's long-term and business unit strategies, together with implications of business unit synergies, often are not accessible to those outside the executive team. Yet this information is critical to formulating what should be shared across the firm to business units or process owners; it leads to the second step in linking strategy and infrastructure services.

2. Articulating Business Maxims

Considering strategic context gives insights about what to coordinate across the firm, what to leverage from within business units, and what to leave to local options. A useful way to express this synthesis is as short statements of the business's shared focus or business maxims.[17] The maxims draw on a firm's mission or strategy statements. Their purpose is to articulate an agreed-on position in a form that executives can readily understand and act on.

We suggest that business and IT management jointly develop business maxims to overcome two problems: (1) some firms do not have comprehensive strategic statements,[18] or (2) some firms have much documentation that is insufficiently focused. Business maxims translate aspects of strategic context into terms that can be easily communicated across the firm.

Hence a business maxim for an insurance firm with three business units might be: "All sales employees are decision makers about taking new policies and cross selling." This maxim implies that the firm's infrastructure needs to give all employees (regardless of location) access to the data and systems required to make decisions on insurance policies. This maxim is one of five that, together, strongly and concisely state the firm's business requirements.

Business maxims focus all employees' attention on simple, achievable messages, which express:

- The firm's competitive stance in a clear, actionable way.
- The extent to which the firm coordinates the business units (e.g., autonomy of business units, cross-selling, synergies, and sharing of resources).
- The implications for the management of information and IT.

Changes in a firm's competitive environment require reshaping business maxims. For example, the Royal Automobile Club of Victoria (RACV) is a membership-

Table 2 Sample Maxims

Amcor

- Provide products and services of the highest quality and the most competitive price.
- Expand internationally through creation and acquisition of new businesses.
- Extend activities into selected paper and packaging businesses.
- Optimize returns on shareholders' funds by focusing on core activities.
- Establish local responsibility and accountability with minimal mandates.

Honda

- Innovate continuously through creating and developing new products and adapting products for major regional markets.
- Expedite global operations by maximizing the synergies of production and operations in many countries.
- Continue the focus on reducing cycle time from R&D through production and marketing.
- Establish flexibility to respond to new opportunities and create new markets.
- Hire staff of the highest caliber who excel in working together.
- Commit to minimizing costs where possible.

RACV

- Differentiate via product innovation.
- Set highest possible one-stop service standards from a low-cost base.
- Develop customer needs-driven products and services.
- Grow cross-selling membership and services.
- Sustain and develop member and staff loyalty.

based provider of vehicle insurance and roadside and other services in Victoria, Australia. RACV has a membership base for roadside service covering 60 percent of Victorian drivers and home and motor insurance covering 40 percent of the Victorian market. It faced little competition until the equivalent organization in a neighboring state extended its base into Victoria, resulting in intense competition in the general insurance area. RACV has now developed a strong focus on membership acquisition and customer needs, together with innovative products and services.[19] New business maxims raised the criticality of cross-selling and increased the urgency for sharing customer databases and transaction-processing systems across the businesses.

Business maxims derived from the firmwide strategic contexts of Amcor, Honda, and RACV show different emphases that have implications for business and IT infrastructures (see Table 2). Amcor has strong pressure to respond locally and emphasizes local accountability with a minimum of mandates. Honda seeks to expedite global operations through maximizing the synergies of production and operations in many countries while concurrently focusing on greater localization. Honda refers to this approach as "glocalization," a need for greater localization, particularly in styling, but in the context of sharing expertise in a firm committed to globalizing its operations. RACV views innovation as critical to its mission to expand the membership base and grow its primary revenue earner, insurance. RACV seeks to remain a low-cost provider but sees its role in new ways and is acquiring complementary businesses to develop new products and services. Cross-selling to the membership base is now a strategic focus.

We have grouped business maxims in six categories: cost focus; value differentiation as perceived by customers; flexibility and agility; growth; human resources; and management orientation (see Table 3). Five or six maxims are usually the most that executive managers can communicate and operational managers can understand. Thus managers need to prioritize the relative importance of maxims to ensure that they capture the most important messages.

Business maxims form a base from which business and IT executives can work together to identify IT maxims. Other areas, such as financial management and human resources, can also use them to generate financial and HR management maxims.

3. Identifying IT Maxims

IT maxims describe how a firm needs to connect, share, and structure information and deploy IT across the firm.[20] They identify how a firm must:

- Lead or follow in the deployment of IT in its industry (e.g., leader, fast follower, or user of standardized applications).
- Electronically process transactions.
- Connect and share data sources across different parts of the firm.
- Connect and share data sources across the extended enterprise (e.g., customers, suppliers, regulators, or strategic alliances).

IT maxims specify the firm's approach to:

• The role of IT and levels of investment relative to competitors.
• Transaction processing (standardization, common interfaces, or local tailoring).
• Access, use, and standardization of different types of data (e.g., financial, product, or customer).

We have grouped generic IT maxims synthesized from our research and firms' IT strategies in five categories: expectations for IT investments in the firm; data access and use; hardware and software resources; communications capabilities and services; and architecture and standards approach (see Table 4). The number of maxims will vary among firms, depending on the breadth and depth of implications drawn from the firm's business maxims.

For example, WorldCo., a multibusiness international manufacturing firm, had the maxim: "Selected enterprisewide relevant data must be in a consistent form that facilitates aggregation worldwide. These data are to enable global management of customers and suppliers, provide knowledge of suppliers who are customers and vice versa, and globally manage materials and general finance." WorldCo.'s new CEO described the balance between corporate and business unit operations: "Each business has its own strategic needs that must be served while sharing information at an enterprisewide level. Differences among business units that contribute meaningfully to business results are appropriate; differences that don't are not. IT, in the context of business redesign, is the single most valuable tool to allow us to become more effective in the marketplace." WorldCo. has now identified which data need common systems to be managed across the firm and which do not. WorldCo.'s maxims in the areas of technology resources are:
• Our network must enable business units to access selected applications essential to the firm's shared business objectives.
• The network must provide, as a minimum, e-mail facilities for communication among international business groups and must support the ongoing implementation and use of groupware products.
• Communication systems must facilitate high-quality interaction among R&D staff and among R&D, production, and marketing personnel.
• Adopt an agreed-on IT architecture for those

Table 3 Six Categories of Business Maxims

Cost Focus
- Price products /services at lowest cost.
- Drive economies of scale through shared best practice.

Value Differentiation Perceived by Customers
- Meet client expectations for quality at reasonable cost.
- Make the customer's product selection as easy as possible.
- Provide all the information needed to service any client from one service point.
- Capture the electronic delivery channel to the customer.
- Establish strong customer relationship with superior service.
- Give service that helps customers reach their potential.
- Develop customer partnerships based on long-term relationships.
- Develop customer partnerships worldwide.
- Know what is selling and where.
- Develop win-win relationship with key suppliers.

Flexibility and Agility
- Have flexibility to respond to new markets.
- Grow cross-selling capabilities.
- Develop new products and services rapidly.
- Establish fastest time to market with new products and services.
- Be able to detect and respond to subtle shifts in the marketplace.
- Continuously innovate through new product development.
- Be capable of manufacturing in any location for a particular order.
- Be able to deploy resources for new products quickly and judiciously.

Growth
- Expand aggressively into underdeveloped and emerging markets.
- Establish international reach and presence.
- Grow internationally to meet the needs of expanding customers.
- Target growth through specific product and customer niches.
- Leverage international growth from a domestic base.

Human Resources
- Create an environment that maximizes intellectual productivity.
- Maintain a high level of professional and technical expertise.
- Identify and facilitate the movement of talented people.
- Attract and retain high-caliber staff committed to the vision of the one corporation.

Management Orientation
- Maximize independence in local operations with minimal mandates.
- Make management decisions close to the line.
- Leverage synergies throughout the firm.
- Have a management culture of information sharing to maintain or generate new business.
- Be flexible in making decisions for customers quickly.

Table 4 Five Categories of IT Maxims

Expectations for IT Investments in the Firm

- We use IT to reduce costs through eliminating duplicated efforts.
- Our IT spending must meet defined business needs and show clear cost savings.
- IT expenditure must improve customer service levels.
- IT is viewed as a service provider focused on satisfying end-user requirements.
- IT is used to meet local needs in business units.
- IT has a strategic role in achieving our firm objectives, rather than just a vehicle for cost displacement.
- We develop innovative business and marketing applications of leading-edge (but stable) technologies.
- Our business is about creating new products/services using IT.

Data Access and Use

- The usefulness of data must be recognized beyond the area immediately responsible for its capture.
- Centralized information flow should allow all parts of the firm to quickly spot trends and use them to the firm's advantage.
- Business processes and systems must ensure that financial and sales data are captured and maintained together.
- We need to have a common view of the customer across our businesses.
- Mobile users must have ready access to the same data they have at the desktop.
- Customer service representatives must be empowered with access to a complete file of the customer's relationship with the firm.
- R&D staff in different parts of the world need ready access to each other to communicate their ideas and exchange design concepts.

Hardware and Software Resources

- We will migrate toward hardware and software resources that can process complex transactions globally.
- We will focus on speed of transaction processing by reengineering and automating core business processes.
- We will move toward electronic processing of repetitive transactions.
- Desktop IT must provide all managers and staff with user-transparent applications to empower them to perform complex tasks quickly.
- We will have common order-entry systems across business units that can cross-sell.
- We need to bridge different technical platforms and allow functions and data to be shared between applications.
- We develop common systems in those parts of the firm where there is a strong business case.
- Common systems development is not consistent with the governance of the firm. Thus IT solutions should be shared on an informal basis.

Communications Capabilities and Services

- Our corporate network must provide access to a wide range of applications essential to the delivery of consistent customer service.
- Our corporate network must be capable of carrying high bandwidth applications such as imaging and videoconferencing.
- We require maximum penetration in the use of EDI and related technologies to streamline business processes.
- We need to integrate access to the Internet with our communications network.
- We will maximize the level of our electronic messaging systems for communications and transaction processing.
- Our external communications are seen as providing future channels to our customers, particularly for electronic commerce and service delivery.

Architecture and Standards Approach

- We have a recommended IT architecture covering hardware, software, and connectivity requirements.
- We have agreed-on firmwide IT architecture covering data, hardware, software, and communications.
- An IT architecture approach is not necessary due to the lack of synergies among businesses.
- We need to take a firmwide approach to data management as a basis for future information sharing.
- We require data standardization for financial and sales data only.
- We enforce standards for hardware and software selection to streamline resource requirements and reduce incompatibilities and costs.
- We will coordinate purchasing of IT from major vendors centrally to minimize costs, ensure consistency, and coordinate expertise.
- We select the best application to suit the specific business situation.

parts of the IT infrastructure that support shared services, including standards needed to manage knowledge for enterprise decision support.

- Enforce some standards for hardware and software selection to streamline resource requirements and reduce incompatibilities and costs.
- Provided they meet certain data requirements and selected standards, business units can determine the most appropriate applications for their businesses.

By contrast, Amcor's emphasis on a minimum of mandates leads to an IT maxim such as "IT expertise and technological solutions are shared on an informal basis," which implies no investment in a firmwide IT infrastructure. This maxim is consistent with the firm's strategic context and decision to forgo IT-related synergies.

4. Clarifying a Firm's View of IT Infrastructure

Firms take one of four views of IT infrastructure: none, utility, dependent, and enabling.[21] Each view anticipates different benefits and investments. Up-front investments and the number and depth of IT infrastructure services increase as the view changes from one of no firmwide infrastructure to enabling. None of the views is best for all firms, but one is more appropriate for a particular firm, according to its strategic context and business and IT maxims.

When a company decides to *forgo* synergies or IT economies among its businesses, it does not invest in infrastructure services at the firmwide level (a "none" view). However, there may still be informal interaction among the company's different IT groups in each business. The firm might also choose to invest in shared services at the business-unit level.

A *utility* view implies that expenditure on IT infrastructure is primarily a way to reduce costs through economies of scale and sharing. IT is a utility that provides a necessary, unavoidable service that incurs administrative expenses. Management must minimize the expense for a desired service. We identified a number of process manufacturing firms with a utility view that had some synergy among the business units. Maximizing return on assets in these firms was an important strategic emphasis, while minimizing costs was a high-priority business maxim.

A *dependent* view implies that infrastructure investments primarily respond to specific current strategies. Dependent infrastructure investments are derived from business plans that specify or imply information and IT needs. Honda has implemented infrastructure services based on its strategic context needs. Its transnational orientation, its glocalization policy, and maximized synergies have resulted in IT maxims that emphasize communication requirements of R&D staff, transferring sophisticated design concepts, data, and documentation between major centers in Japan and the United States, and standards and capability to manage selected data (sales, finance, parts) globally.

An *enabling* view implies an overinvestment in IT infrastructure — in terms of current needs. The purpose is to provide flexibility in achieving the firm's long-term goals and to enable quick development of new products. Enabling infrastructures are often created by expanding a dependent infrastructure beyond the current requirements of the business. To financially justify such a view, senior managers must perceive a flexible infrastructure as a core competence that provides competitive advantage.

For example, in the early to mid-1990s, Telstra saw a flexible infrastructure as strategically important in its drive to develop new markets in Australia and internationally. Its first step was to implement an overall systems architecture (OSA) to integrate processes across business units. The OSA enabled IT to be fully exploited in introducing new products, processes, and work practices. "What we ended up with," explained Telstra's CIO, "is an amazing corporate asset. We have the most standard corporate desktop in the world in terms of user numbers (more than 40,000 PCs and terminals in use), probably the third or fourth largest e-mail network in the world, and two large networks taking over from twenty or thirty competing wide area networks that had built up over the years."[22] Telstra now has the information and functionality to service customer needs immediately at the customer service point. It can introduce new products more quickly and easily than ever would have been possible with its previous approach to infrastructure.

Based on our empirical research on twenty-seven firms, we identified typical characteristics of investments and capability for each infrastructure view (see Table 5). Our data collection and analysis revealed that the five characteristics of views of infrastructure all covaried. Thus firms that spent more on IT infrastructure had more services, focused on flexibility during the justification process, and had more extensive services.

In summary, a company with an enabling view leads its industry in infrastructure investment levels and provides extensive infrastructure services in a highly centralized way. It also focuses primarily on strategic flexibility as justification. In contrast, a firm with a utility view has lower than average firmwide IT infrastructure investment and provides basic infrastructure services centrally. It primarily focuses on cost reduction as justification.

A company with a dependent view attempts to balance cost and flexibility in the justification process, which results in an average investment in IT in-

Table 5 Four Infrastructure Views: Investment and Capability Characteristics

Characteristics of Firmwide Infrastructure	None	Utility	Dependent	Enabling
IT as a percent of expenses relative to competitors	Lowest	Low	Just below average	Highest
Firmwide IT infrastructure as a percent of total	Lowest (0%)	Low (37%)	Just above average (45%)	Highest (50%)
Approach to justification	Never supported	Cost saving	Balance flexibility and cost saving	Flexibility
Infrastructure services	None	Basic services (average of 13 listed in Table 6)	Basic services plus strategic services (average of 16)	Extensive infrastructure services (average of 20)

Note: The figures in parentheses are the average of the twenty-seven firms. For example, during our study, twenty-three infrastructure services were provided by firms, and the average firm with a utility view had thirteen services, while firms with an enabling view averaged twenty. Firms with a utility view invested a significantly lower percentage (37%) of their total information technology in firmwide infrastructure when compared to firms with an enabling view (50%).

frastructure for its industry. It provides the basic infrastructure services centrally, along with several that are vital to strategic objectives, such as a shared customer database.

A firm's view of infrastructure should change as strategic context and business maxims change. Before interstate competition, RACV had a utility view of its IT infrastructure investments, driven by constant cost reduction. As RACV's business situation changed, its customer database did not have the functionality or flexibility to support the business maxims of one-stop service standards and cross-selling. RACV now has an enabling view and is investing substantially to upgrade its technology infrastructure and extend its services.

Deciding on Infrastructure Services

What types of services do investments in firmwide IT infrastructure provide? We identified twenty-three infrastructure services in the firms we studied (see Table 6). The companies that had firmwide infrastructure offered five core services in some form.

How firms offer and utilize the basic services is usually related to their view of the role of IT infrastructure. For example, the most common infrastructure service is management of the corporate communications network. The network becomes increasingly important for firms with a dependent or enabling view of IT infrastructure. Firms with a utility view often use the network more for electronic messaging than as part of inter- or intraorganizational systems for executing business processes. In firms with an enabling view, such networks are used extensively for business transactions and business processes both within and between firms and their customers and suppliers.

Telstra, which has a high degree of synergy among its businesses, has firmwide infrastructure services that include:

- Management, maintenance, and support of large-scale data processing facilities.
- Management of communication network services encompassing e-mail, transaction traffic, file transfer, imaging, video, and remote access to mainframe resources regardless of the technical platform or geographic location.
- Management of firmwide databases and applications to enable a one-stop approach for customer service.
- Management of firmwide messaging services.
- Policies and IT architectures.

These infrastructure services ensure that all the information needed to service any customer will be available at any one service point, which supports another of Telstra's business maxims: "First choice among customers with telecommunications needs."

Two Routes: Maxims or Deals

So far, we have focused on the management by maxims approach, one of two routes that firms can take in developing strategically appropriate firmwide infrastructure services. Another approach is "management by deals" (see Figure 2). Next we describe the differences between the two.

The Maxims Route

The maxims route assumes that both business and IT management look at the company as a whole, which occurred in about half the firms we studied. For example, in Johnson & Johnson's maxims approach, the

Table 6 Infrastructure Services

Five Core IT Infrastructure Services

1. Manage corporate communication network services.
2. Manage groupwide or firmwide messaging services.
3. Recommend standards for at least one component of IT architecture (e.g., hardware, operating systems, data, communication).
4. Establish security, disaster planning, and business recovery services for firmwide installations and applications.
5. Provide technology advice and support services.

Additional IT Infrastructure Services

6. Manage, maintain, and support large-scale data processing facilities (e.g., mainframe operations).
7. Manage groupwide or firmwide applications and databases.
8. Perform IS project management.
9. Provide data management advice and consultancy services.
10. Enforce IT architecture and standards.
11. Manage business unit-specific networks (e.g., LANs).
12. Identify and test new technologies for business purposes.
13. Manage and negotiate with suppliers and outsourcers.
14. Develop business unit-specific applications (usually on a chargeback or contractual basis).
15. Implement security, disaster planning, and recovery for business units.
16. Provide management information electronically (e.g., EIS).
17. Manage groupwide or firmwide data, including standards.
18. Manage business unit-specific applications.
19. Develop and manage on-line and/or EDI linkages to suppliers and customers.
20. Develop a common systems development environment.
21. Provide IS planning for business units.
22. Provide technology education services (e.g., training).
23. Develop multimedia operations (e.g., videoconferencing).

business maxims changed to respond to changes in the health care industry (see the sidebar). The firm's desire to leverage its strength with the changing customer base in the health care industry resulted in the business maxim to develop partnerships with large customers across its businesses.[23] It needed to identify some large customers that were dealing separately with different autonomous business units. This requirement changed the amount and kinds of information that J&J operating companies needed to communicate and share worldwide. Accordingly, we derived a set of IT maxims that express the business need to access aggregated data in common systems, deliver customer profiles, reduce duplication of effort, and develop shared services as a foundation for common systems and communication systems that foster personal interaction. J&J has taken a dependent view of infrastructure and developed a specific set of infrastructure services to provide the capabilities required of its business maxims.

If a firm takes the maxims route, any of the four views of infrastructure can result, and any one might be appropriate, depending on the firm's strategic context and maxims.

The Deals Route

The other firms we studied engaged in deal making, which focused on the more immediate needs of each business. IT managers talked with business unit managers, often as part of an annual planning cycle, to understand the units' IT needs based on current business strategies. After discussions with all the business units, IT managers made firmwide infrastructure recommendations based on a combination of the units' needs. After they estimated costs, the IT managers went to each unit with a proposal. They negotiated, trading cost and infrastructure services, and struck a deal.

In firms taking a deal-making route, we observed that one of three views of infrastructure emerges: none, utility, or dependent. No firm had an enabling view and few had a dependent view via the deal process. The pressure of costs and the dominance in the deal process of current strategies over long-term strategic intents prevent an enabling view. This pressure prevents commitment to the flexibility inherent in an enabling view of infrastructure. Our observations suggest that only business maxims set by corporate executive management have the political weight to justify enabling a firmwide infrastructure with extensive services.

The deal-making process is the free market of IT infrastructure formation. The free market often means that powerful, successful, and rich business units are far better served by the firmwide IT infrastructures that are in place. Small but growing business units often complain about the lack of a suitable infrastructure provided by IT management. These small units tend to build their own infrastructures tailored to specific needs. This approach may work for them when there are no business imperatives to exchange and access data or do business electronically with other parts of the firm. However, this approach leads to islands of automation that are difficult to integrate later if strategic needs change. In these firms, we saw a utility

firmwide infrastructure and tailored business unit infrastructures with a dependent or enabling view.

Barriers to Creating Business-Driven Infrastructures

In some firms, clear, concise strategy statements and maxims emerge from their processes for formulating strategy and vision. In other firms, business maxims might not be explicit but rather implicit and easy to locate. There are two major barriers to forming IT infrastructures: expression barriers and implementation barriers. They prevent or retard companies from recognizing and developing appropriate infrastructures for their strategic context.

Expression Barriers

There is an expression barrier when maxims are difficult to locate or articulate, resulting in an operational management that does not understand or is not committed to the firm's strategy. Lack of maxims may be caused by a lack of strategic clarity from:

- Executive managers who don't understand either the firm's strategic intent or its current strategies.
- Executive managers who have not successfully articulated and communicated the message to operational managers.
- Individual reward systems and a culture that deters successful articulation and use of maxims.

While we have observed organizations with expression barriers caused by lack of strategic clarity, they are less common than firms with an inability to communicate or in which nonsupportive cultural and reward systems create barriers. Such barriers mean that IT managers lack information on the firm's strategic context in order to build an appropriate infrastructure.

A strategic-intent expression barrier prevents a company from using business maxims at the business unit level; a current-strategy expression barrier prevents a company from striking deals. When both barriers exist, IT managers may forge ahead and build infrastructures that are excessive or inappropriate. We suggest that IT managers use their knowledge of the firm to develop business and IT maxims that they can discuss with executive management.

Johnson & Johnson's Strategic Context and Infrastructure Services

Business Unit Maxims Example: Consumer Business in One Region

- Respond to subtle shifts in market needs.
- Maintain brand loyalty from customers.
- Quality products linked with a "well-being" image.
- Win-win relationship with customers and suppliers.

Corporate Synergy

- Some business unit synergies.
- Predominant value discipline: product leadership, but customer intimacy very important in some parts of the firm.

Firmwide Business Maxims

- Continuous innovation through discovering, developing, and acquiring new products.
- Production and delivery of high-quality products and services.
- Develop partnerships with customers on a worldwide basis.
- Constant cost reduction.
- Increased operating effectiveness.

Firmwide IT Maxims

- Data must be accessible through common systems to facilitate aggregation.
- Centralized information flow should allow all parts of the firm to more easily and quickly spot trends and use these to the firm's advantage.
- Data standardization across all business units is needed to facilitate information sharing and reduce duplication of effort.
- IT's role is to leverage the information that resides in the firm for competitive positioning and to reduce costs through eliminating duplication of effort.
- The ability to deliver customer profiles to anywhere in the organization.
- Common systems to provide a foundation on which new shared services can be readily developed.
- Communication systems must facilitate person-to-person interaction among R&D staff and between R&D, marketing, and sales managers.
- Information systems must facilitate the monitoring of product and service quality.

Firmwide Infrastructure View

- Dependent: specific benefits linked to business strategies.

Firmwide IT Infrastructure Services

- Development and management of "shared services." These are applications that are standard across the firm worldwide and include financial systems (e.g., general ledger), purchasing, order processing, accounts payable, payroll, and human resources.
- Development of a firmwide information architecture.
- Establishment of selected IT standards to support firmwide information architecture (e.g., data and voice telecommunications, electronic mail, document interchange formats, videoconferencing).
- Development and deployment of an executive support system. The ESS is based on a standard template or shell built with a data warehousing concept.
- Management of selected firmwide IT support services (e.g., firmwide communications network).
- Coordinating the investigation and implementation of emerging technology across the firm.
- Assisting in the identification of business opportunities and implementing applications to meet firmwide business requirements.
- Providing executive education to improve awareness of the impact of IT on the business.

Implementation Barriers

Implementation barriers occur when a firm cannot form the appropriate infrastructure due to causes ranging from organizational, political, cultural, and reward system issues to a lack of IT leadership and technical impediments. Sometimes IT executive managers cannot get the organization to agree to invest in infrastructures, particularly in the case of enabling infrastructures in which business benefits are not based on cost reduction.

This situation occurred at a rapidly expanding Asian bank that had only recently appointed an IT executive. The executive managers had no experience in considering infrastructure investments. The IT executive explained her approach to overcoming implementation barriers: "The challenge here is for the business to understand and own the IT investments. Until a year ago, there was no history of infrastructure investments and little coordination of IT across the bank. At present, I can't sell the concept of infrastructure without it being linked to specific business applications. The result is that we hide the infrastructure costs in business application cases, and thus the infrastructure building process has been piecemeal. I expect that next year, the executives will have a much greater understanding of the role of infrastructure. We will have some new applications in place, and they will see it for themselves. The justification for infrastructure can be made differently once they see what it delivers to the business."

Implementation barriers can also occur when the business and IT maxims are formed in isolation and are not related. For example, an IT group's push to set and enforce firmwide data and computing standards without an appropriate business maxim results in comments like, "Here come the IT police again." Implementation barriers can also result from the technical constraints of the current infrastructure. Often, barriers to increasing the reach and range of services stem from proprietary operating systems or lack of standard data definition. This type of barrier is common in firms that acquired business units or that only recently needed a shared infrastructure to facilitate a new strategic initiative, such as cross-selling between business units. In both situations, companies made the technical decision to form the separate business unit infrastructures without considering integration.

The firms we studied that have successfully created business-driven infrastructures have used either maxims or deals. Maxims provide focus and credibility for IT managers because they build infrastructures aligned to the firm's strategic context. Sometimes the elicitation of business maxims makes clear that they are difficult

Maxims provide focus and credibility for IT managers because they build infrastructures aligned to the firm's strategic context.

to implement concurrently. For example, some firms seek to minimize costs while achieving future flexibility, but executive managers balk at the magnitude of initial investment. Clarification of business maxims can be very useful for prioritizing.

Business and IT Management's Shared Responsibility

To achieve a business-driven infrastructure through management by maxim, business and IT management must share responsibility for the development of infrastructure. We have worked with business and technology managers in workshops to identify the infrastructure services required for a firm's strategic context. For example, at an international manufacturing firm we call WestCo., the corporate management team and selected business unit and IT managers together reviewed the future direction of WestCo.'s infrastructure investments. The participant managers were all intimately acquainted with WestCo.'s mission and strategic thrusts. Before the workshop, their only preparation was to answer questions about WestCo.'s potential business synergies between business units and the preferred balances among them.

The major steps of the workshop were:

1. *Identifying the extent of business synergies.* Participants discussed potential business synergies and agreed that they could achieve greater synergies through sharing expertise in generic cross-business processes, such as managing financial resources; managing human resources, environmental, and safety policies; and providing IS infrastructure.

WestCo.'s Strategic Context and Infrastructure Services

The Firm

- A diversified manufacturing company serving global markets.

Potential Synergies

- Presence of all three value disciplines – operational excellence, customer intimacy, and product innovation – across the businesses, with operational excellence the most predominant.
- Potential synergies
  - Very limited for products, customers, and supplier base across all businesses.
  - Considerable potential for sharing expertise in generic cross-business processes: managing financial resources and services; managing human resources, environment, and safety policy; information systems infrastructure provision.

Use of Synergies

- Very important to utilize potential synergies.
- Local autonomy of limited value.

Business Maxims

- Lowest cost of sales (production, distribution, sell).
- Strong long-term relationship management with superior customer service.
- Flexibility to respond quickly to market changes.
- Realize the benefits of acquisitions and initiatives.
- Identify, attract, and facilitate movement of staff committed to one corporation.
- Exceed client expectations for quality at reasonable price.
- Culture of information sharing for achieving synergies.

IT Maxims

- Each IT investment must support the firm's mission and values and support the current business plan.
- Capture data once and provide appropriate flexible access. Data to include – financial, human resources, key performance indicators, externally sourced.
- Enforce firmwide IT open architecture:
  - computing
  - communications
  - selected data
  - selected applications (e.g., SAP financials)
- Partnering with strong suppliers.
- Firmwide communications capability appropriately available, reliable, and of sufficient capacity.
- User ownership for IT investments and operations, which are measured on performance.

Infrastructure View

- Utility —> Dependent

Firmwide Infrastructure Services Required

- Wide area network (WAN) linking domestic and international operations.
- Firmwide e-mail system.
- Recommendations on standards for all components of IT architecture.
- Enforcement of selected IT architecture and standards through capital expenditure arrangements.
- Security, disaster planning, and business recovery services for the WAN.
- Technology advice and support services available to the business groups.
- Data management advice and consultancy services to the business groups on an ad-hoc but proactive basis.
- Identifying and testing of new technologies for business purposes (in cooperation with the business groups).
- Electronic provision of management information (across all businesses).
- Firmwide executive information system (EIS).
- Managing and negotiating with suppliers and outsourcers.
- Performing IS project management (for firmwide projects).
- Assisting the business groups in their IS planning.
- Implementation of security, disaster planning, and recovery for business units.
- Developing and managing on-line and/or EDI linkages to suppliers or customers for all business units.

2. *Articulating business maxims.* Each participant scored the importance of each generic business maxim (Table 3) to WestCo.'s future performance. While all agreed on four maxims, considerable discussion focused on two, highlighting current debate about priorities and directions. In the end, the managers agreed on six business maxims through iteration of both mission and vision statements and the outcome from ongoing strategizing. The maxims were short, pithy, and easy to remember and communicate.

3. *Identifying IT maxims.* Using sample IT maxims (Table 4), groups of participants presented the IT maxims they had developed, refined, checked for internal consistency and firm specificity, and compared to the business maxims.

4. *Clarifying IT infrastructure view.* The CFO, who chairs the IT council, clarified the firm's expectations for IT infrastructure investments. He verified that the firm currently had a utility view but, to achieve its maxims, it would need to change to a dependent view.

5. *Specifying the infrastructure services.* Using the list of twenty-three infrastructure services (Table 6), the CIO

led a discussion of which services were essential according to the business and IT maxims. Managers agreed that fifteen services were required to provide the necessary IT capability.

6. *Reviewing the linkages: strategy to infrastructure, maxims, and deals.* The IT infrastructure manager stated that two services were not currently offered and that some services needed to be expanded, requiring additional investments. Participants discussed WestCo.'s past reliance on deal-making decision processes and the need to shift in order to fund the infrastructure investments required to meet the firm's emerging maxims.

After the workshop, both business and IT executives better understood WestCo.'s business and IT strategy needs, particularly as they related to long-term investments (see the sidebar). Other firms' business and IT maxims had provided a time- and energy-saving approach that WestCo. adapted to suit its specific needs. The importance of joint business and IT responsibility for infrastructure became evident as IT managers explained what investments and time they would need. They acknowledged that WestCo. would need to change how it usually justified infrastructure investments if it were to achieve its business objectives.

Conclusion

Creating appropriate infrastructure services involves decisions based on a sound understanding of where a firm is going, rather than on where it has been. This understanding starts with the firm's strategic context and its businesses and leads to the articulation of business and IT maxims. Maxims provide a basis for deciding on a view of infrastructure that matches the firm's competitive positioning. The final step is identifying specific IT infrastructure services that meet the firm's strategic context. Executives must have a dialogue to ensure appropriate infrastructure services to reduce fragmenting resources among competing strategies.[24]

Using the steps we've described in reverse can identify whether the current infrastructure is well aligned with a company's strategy and competitive positioning. Managers can assess the capability of current services and determine IT maxims and business maxims that the capabilities support. They can either clarify gaps between what exists and what is desired or find that they have achieved a reasonable match between actual and desired capabilities. ◆

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