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International Information Systems Management

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In this chapter, the basic issues of international information systems (IS) management are introduced. The chapter discusses the characteristics of computer-based information systems (CBIS) and the benefits they will bring to the firm. It elaborates on the IS applications that enable the firm to link with its suppliers, customers, and other organizations, including the government. These include supply chain management (SCM), enterprise resource planning (ERP), and electronic data interchange (EDI), as well as the use of the Internet. The chapter explores the ramifications of internationalization on the IS function in the firm. It examines various IS options and suggests the alternatives available to multinational companies (MNCs). Also in this chapter, we learn about the impact of information technology (IT) on MNC operations. Based on MNCs' requirements and the environmental limitations that they experience, this chapter makes several suggestions for the deployment of specific IS. Finally, the impact of the internationalization of the firm on the chief information officer's (CIO's) responsibilities and duties is discussed.^a

Chapter Vignette

Rohm and Haas (R&H) is one of the world's largest manufacturers of specialty chemicals. R&H's worldwide headquarters is located in Philadelphia, Pennsylvania. With more than 17,000 employees and billions of dollars in sales, it operates approximately 140 research and manufacturing locations in 27 countries. Some of R&H's products are adhesives and sealants, automotive coatings, electronic materials, plastics additives, powder coatings, and salt.

Inadequate global information was causing R&H to spend millions of dollars carrying unwanted inventory, which was costing the company a lot of money and lost business. Its 35 production units around the world operated independently. For example, if a customer needed a product that was out of stock in France but thousands of units of the product were in storage 20 miles away, across the border in Germany, no one had access to this information. To improve its information-processing capability, R&H installed a new company-wide materials management system and a global demand-planning system. It also upgraded its manufacturing, execution, and control system and its worldwide order-entry system. These changes reduced inventory costs by \$40 million and improved on-time delivery performance by 10%. This gave R&H a stronger position in the global market. Consequently, customers around the world can now receive the requested products on time even if the products are not available locally.

R&H has built a management and IT infrastructure to improve its capacity for receiving and sending the right information within its different global business units. This new management and IT infrastructure also helps researchers and marketers in extracting the information they need. With this infrastructure, R&H can standardize the software applications throughout its global organization. These applications include accounting, human resources, materials management, production scheduling, procurement, maintenance, and sales and distribution. All data are stored in a central database providing every employee the required access to the most accurate and up-to-date information. This enables R&H to make better business decisions, improve forecasting and report capabilities, and have faster and better e-commerce connections with its suppliers and customers. Another advantage is that R&H is able to close its books in 3 working days at the end of the fiscal year, a process that usually took 12 days.

IT was also used to implement the Environmental Health and Safety Management System (EHSMS) worldwide. The EHSMS, which was installed in the 1970s, provides specific requirements and guidance covering areas such as safety, employee health, and environmental protection programs for each global unit. The system enables R&H to maintain worldwide operations that protect the environment, enhance the safety and health of all employees and the public, and improve the safety and environmental impact of R&H processes, products, and services.¹⁻⁴

Introduction

We are living in the information age. Information and IT are governing every aspect of our lives. The ever-growing reach of the Internet and the World Wide Web has brought together individuals and public and private organizations as at no other time in human civilization. The Internet, as a decentralized global network of computers, has become the de facto standard medium to transfer data, voice, and video anywhere and anytime.

Information can be considered the lifeblood of business and a strategic resource that can provide a competitive advantage. The ability to gather, store, and process information is essential for making timely decisions. As much as 80% of an executive's time is devoted to receiving, communicating, and using information in performing a variety of tasks (p. 8).⁵ Because all organizational activities depend on information, systems must be developed to produce and manage them. No complex organization can function without an IS. "An information system is a set of people, data, and procedures that work together to provide useful information" (p. 8).⁵ Organizational success greatly depends on effective information management and dissemination. The need for an effective management information system (MIS) function is particularly crucial for the survival and success of MNCs. Crossing national borders, MNCs are vulnerable to the uncertainties associated with the multiple political, cultural, and economic systems within which they operate. Therefore, an effective MIS is integral to the success of an MNC.

An organization's MIS is a system for obtaining, processing, and delivering information that can be used in managing the organization (p. 6).⁶ The mission of IS is to improve the performance of people in the organization through the use of IT (p. 14).⁷ Before the advent of computers, due to technological limitations, the bulk of MIS consisted of paper reports generated by functional areas, such as accounting, manufacturing, and marketing. Accessing this information was very slow and time-consuming. There was a time lag between the generation of information and its use. Depending on the physical distance between the source and the user of information, the time lag ranged from a few hours to weeks. As a result of the limitation in information management, greater geographical distances from the headquarters implied a higher degree of autonomy for the subsidiaries. Today, IT comprises computers and telecommunication networks that allow instantaneous

access to information regardless of the physical distance between the source and the user of the information. The newfound MIS capability not only allows more timely decision making, it also enables better control of distant operations. Such a capability is especially beneficial to MNCs. IT affects MNCs in two different ways. First, it provides a coordination mechanism for geographically dispersed activities, thereby facilitating globalization. Second, it provides a mechanism for building a coalition among separate organizations, making global operation more cost-effective.⁸

Computer-Based Information Systems

CBIS play a vital role in today's businesses. The many benefits organizations seek to achieve through CBIS may be classified as follows: (1) efficiency gains, (2) effectiveness gains, and (3) competitive advantage.

Efficiency gains are concerned with doing more with the same or fewer resources. CBIS can bring about efficiency gains by automating tasks in the factory as well as in the workplace.

Effectiveness gains are concerned with doing the right things and achieving the established goals. CBIS can bring about effectiveness gains by improving internal as well as external communications and by facilitating superior managerial decision making.

Competitive advantage is concerned with providing the organization with a significant and long-term benefit vis-à-vis the competition. CBIS can bring about competitive advantage by allowing the firm to differentiate itself from its competitors, become the lowest-cost/price producer in the marketplace, or carve market niches for itself through innovative services and/or products.

It is precisely because of the major impact that IS can have on corporate strategy that today's managers must be not only computer literate but also IS literate. Computer literacy is the knowledge of computer technology. IS literacy encompasses how and why IT is applied in organizations. A knowledge of organizations, managerial levels, information needs, and decision-making approaches is an important aspect of IS literacy.

Today, no company of even modest size can operate without support from IS. But at a time when business is increasing its dependence on IT, technology is changing so rapidly that businesses are threatened by its pace. New developments arise before older ones can be assimilated, and systems purchased today are, at times, outdated even before they are put into use. It is, however, too late to stop. The use of any tool creates dependence, and computers—the most enabling tool created by man—are heavily used already. By the same account, nearly half of all capital investment in the United States is being put into IT.⁹ To cease to invest, or even invest slowly, is to accept the premise that new operations and opportunities can be developed without IT support, when the old ones cannot be sustained without it! Therefore, management of IT investment has become a critical concern,

because there are real risks associated with an inept organizational response to the rapid pace of developments in IT.

Information Architecture (IT)

The solution that emerged in the late 1980s to deal effectively with the rapid pace of change in IT was to build an *information architecture*—that is, to create a framework within which current as well as future organizational needs for information could be met with impunity from changing technology. The IS architect, however, must often pay dearly for the mistakes of the past. IS, like buildings and streets, have a tendency to grow haphazardly. As in a building, we do not like to break down an “outside wall,” but if we cannot modify the inside walls to make the architecture useful for today’s context (i.e., information needs), then there is no other choice. A well-planned information architecture should, as much as possible, obviate the need for the demolition of outside walls.¹⁰

Figure 10.1 depicts a model information architecture. It is based on providing infrastructures for communication integration as well as data integration on which the IT portfolio (i.e., the various application systems ranging from purchase order entry to research and development planning) would be developed.¹¹ Together, communication integration and data integration ensure that data are stored in a nonredundant fashion and that every authorized user can gain access to and update the required information from anywhere. These infrastructures must be provided to support the tactical deployment of IT, ensure that developing problems and opportunities can be addressed, and guarantee that catch-up time would be short and, thereby, little ground would be lost to a competitor who leads with an innovative business idea based on IT.

In addition, the above model emphasizes four application portfolios that mature IS would comprise:

1. *Institutional portfolio*: IS applications are directed at recording and reporting on business activities. Examples include transaction processing systems such as payroll, order entry, purchasing, production scheduling, and accounting IS.
2. *Professional support portfolio*: IS applications are directed at managerial problem solving and decision making, competitive intelligence, and personal productivity. Examples include critical success factor reporting systems, decision support systems, expert systems, and such tools as are used for document preparation, computer-based messaging, electronic meetings, and workgroup computing.
3. *Physical automation portfolio*: IS applications are directed at replacing manual work with IT, on the factory floor as well as in offices. Examples include computer-aided design and engineering, robotics, automated response units, and workflow automation.

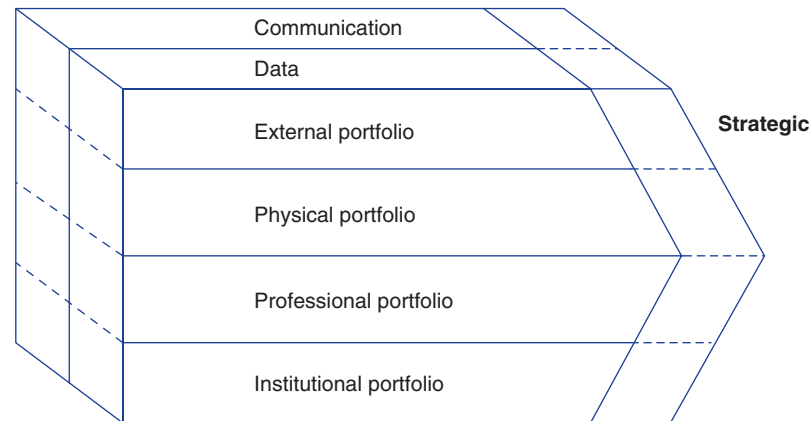


Figure 10.1 Model Information Architecture

4. *External portfolio*: IS applications are directed at linking the firm with its suppliers, customers, or other firms for the purpose of creating a strategic alliance. Examples include ERP, SCM, EDI, and interorganizational systems.

It is important to note that while the above model acknowledges that the application portfolios must address the information requirements at all levels of management, it neither assumes a particular hardware or software architectural platform nor advocates a centralized or decentralized approach to building the architecture. These choices are left to the eventual architect, who must fit the suggested architectural form to the specific context of the organization. The remainder of this chapter will use this model architecture as a backdrop to examine the ramifications of internationalization on IS architecture. However, because of the significant role that SCM, ERP, and EDI play in helping MNCs manage their worldwide operations, they are discussed subsequently.

Supply Chain Management

Supply chain management can be defined as the way a company finds the raw components it needs to make products or services, produces those products or services, and delivers them to customers. To have better SCM, most companies implement the following five basic steps.

1. *Plan*: Establish a plan to manage all the resources that go toward meeting customer demand for products or services.
2. *Source*: Choose the suppliers that will deliver the required components, materials, parts, or services. Also, develop a set of pricing, delivery, and

payment processes with suppliers and create measurements for monitoring and improving relationships with them. Then, put together processes for managing the inventory of goods and services that are received from suppliers, verifying them, transferring them to the manufacturing facilities, and authorizing payments.

3. *Make*: Schedule the activities necessary for production, testing, packaging, and preparation for delivery of the goods or provision of the services.
4. *Deliver*: Coordinate the receipt of orders from customers, develop a network of warehouses, select carriers to deliver the products to customers, and set up an invoicing system to receive payments.
5. *Return*: Create a network for receiving defective and excess products returned by customers and supporting customers who have problems with the delivered products (www.cio.com/research/scm/).

As an example, Wal-Mart has implemented a global SCM system. This system gives its major suppliers a complete view of the inventory position of their own products in each of Wal-Mart's stores. Therefore, Procter & Gamble can make Tide detergents and ship them to Wal-Mart's distribution centers based on the actual sales performance in stores. Or, similarly, a supplier in Taiwan can make DVD players and ship them to Wal-Mart as needed in what amounts to a vendor-managed inventory.

Enterprise Resource Planning

ERP's main objective is to attempt to integrate all departments and functions across a company onto a single computer system that can serve all those departments' particular needs—for example, building a single software program that serves the needs of people in the finance department as well as those of the human resources (HR) department and in warehousing. ERP creates a single, integrated system that runs on an enterprise-wide database, so that the various departments can more easily share information and communicate with each other. The integrated approach can have a tremendous payback once the organization adopts and adapts to the business processes implemented by the ERP software.

Each department typically has its own computer system optimized for the particular ways that the department operates. For instance, when a customer places an order, that order begins a mostly paper-based journey from one in-basket to another around the company, often being entered and reentered into different departments' computer systems. As a consequence, the repetition of the in-basket process and data entry causes delays and lost orders. All the data being entered into different computer systems invites errors. Meanwhile, no one in the company truly knows the status of the order at any given point, because there is no way for the finance

department, for example, to get into the warehousing department's computer system to see whether or not the item has been shipped.

ERP replaces the old stand-alone computer systems in different departments with a single unified software system. The finance, manufacturing, and warehousing departments still have their own software, but now they are all linked together by an enterprise-wide integrated database. Consequently, people in the finance department can look into the warehousing records to see if an order has been shipped (www.erpcentral.com/, www.erpfans.com/).

General Motors, for example, uses ERP software to connect all its worldwide operations as well as its suppliers and dealers in a global network that permits sharing of up-to-the-minute information. An assembly plant in Atlanta, Georgia, for instance, knows exactly when it will receive body parts from the plant in Mexico and leather seat covers from China. It can also make adjustments if one of the suppliers runs into problems and faces delays.

Electronic Data Interchange

EDI¹²⁻¹⁵ is the exchange of documents and information in standardized form between organizations in an automated manner directly from a computer application in one organization to an application in another. EDI's roots go back to the time of the Cold War. In 1948, for 1 year, the Soviet Union shut down access between Germany and the parts of Berlin that were controlled by the United States, England, and France. To deal with such a crisis, in 1949, a U.S. Army Master Sergeant, Edward A. Guilbert, and other officers developed a manifest system that could be transmitted by telex, radio-teletype, or telephone. By 1968, truckers, airlines, and ocean shipping companies were using electronic manifests and formed the Transportation Data Coordinating Committee (TDCC) to create cross-industry standards. In 1975, the TDCC published its first EDI standards.

Due to the wide range of benefits that EDI provides, it is increasingly becoming a preferred way of carrying out business transactions among trading partners. The following are some of the benefits of EDI.

- Higher processing speed, shorter turnaround time, and greater efficiency
- Less data reentry and transcription, less likelihood of error, and greater accuracy
- Lower cost and more convenience with less physical transportation of documents
- Less paper consumption due to electronic transmission and storage transactions

The automotive industry is a champion of EDI. By reducing the time taken to process orders, EDI has enabled cost savings through just-in-time management of automotive parts. Similarly, the transportation industry, which continuously exchanges routing and customs documents, has embraced EDI.

Ramifications of Internationalization for the IS Function

The expansion of a company from a domestic corporation to a multinational one brings with it special challenges for the IS function. Consider the following ramifications of internationalization for the IS function:^{16,17}

1. Although it is highly desirable to have common computer (e.g., PC) standards, local service issues and the level of support vary so widely that this seemingly straightforward issue becomes a complex one. The support and service issue notwithstanding, it may simply be overwhelmingly advantageous to improve government relationships by choosing a local brand even at the expense of the system integration problems that this may cause.
2. Although it is highly desirable to have system developers located physically close to the end users of the system being developed, the wide disparity between salaries abroad vis-à-vis the United States may make it overwhelmingly attractive to move portions of large development efforts overseas and risk coordination problems.
3. Expansion overseas also causes problems with scheduling and coordination. A business that crosses four time zones has 5 business hours that are supported in common by all portions of its operation, while one spanning more than eight time zones would have no common business hours at all. This shift in schedules can result in increased reliance on background transfers of information (such as e-mail), which do not require human interaction in real time.
4. Due to technological advances and the use of the Internet, communication costs are continuously decreasing. In general, however, communication costs increase with distance; this will hold true until the use of the Internet becomes universal. This creates an incentive to disperse data to reduce transmission costs, a strategy that can result in the loss of information control and increased security risks.
5. The use of personal data generates a wide range of sensitivities in different countries. What is seen as a consumer micromarketing information system in one country may be regarded as quite intrusive in another. Moreover, existing legislation regarding computer privacy, computer security, software licensing, and copyrights remains substantially fragmented among countries. The Internet, however, is rapidly forcing the international community to develop uniform standards.
6. Expansion into other countries also causes problems with language. Global IS must be designed to support people speaking different languages. Also, data entry as well as reporting programs must be written to accommodate different alphabets, printing directions (e.g., from

right to left instead of left to right), and collating sequences. Thus, in some countries, pages are sequenced and numbered from right to left.

7. In some countries, the installation of new telephone lines still requires a lead time of more than a year, making the planning and implementation of an adequately redundant (fault-tolerant) communication infrastructure a time-consuming ordeal.
8. Great disparities in local technical support exist between one country and another. This can lead to considerable reliance on the parent company for troubleshooting, for system development efforts, and for scanning emerging technologies that might affect the firm's operations.

As can be seen from the items listed above, the IT function, like all other functional areas, is considerably affected by internationalization. And like all other functional areas, its response to internationalization will be affected by country variables as well as company variables.

The IS Function Within the Multinational Corporation

Not surprisingly, MNCs have adopted different approaches for their IS functions. Some are centralized, some are decentralized, and some are distributed. Some are integrated but most are not.

There are several classifications of international IS. The following provides a useful starting categorization.

1. *Multinational information systems*: This most prevalent model is characterized by essentially autonomous data-processing centers in each nation-state in which the MNC operates. This approach suffers from problems of redundancy and duplication in data, applications, and operations. However, it historically represents the easiest solution available to the MNC given the conditions of national markets (i.e., regulations, language problems, facilities problems, etc., as we have discussed in previous chapters) that have encouraged the autonomy of business operations in each country.
2. *International information systems*: This model is characterized by a computer network that operates in more than one nation-state and in which data cross international borders in the process of completing a transaction. This model is now increasingly based on the Internet as its medium of data transfer.
3. *Global information systems*: This relatively new model is fundamentally characterized by the integration of data. Support for manufacturing operations that must coordinate inputs and outputs of plants located in different countries on a real-time basis has been one of several driving forces leading to the establishment of such systems.

Another impetus has been the desire to present a consistent face to a customer that may have dealings with the MNC in several countries in which it operates. However, only the recent advances in distributed database management and communication technologies have made this model a viable alternative.

Distance Is No Barrier

The new computer technology enables large corporate computing centers to serve multiple operations located in different geographic areas around the world. The computing services of global companies, however, must work within the limits of local communications capabilities. In Thailand, for example, when there was a lack of adequate data transmission and processing capabilities, Exxon-Mobil used satellites to transmit data from Bangkok to Houston for processing and back to Thailand. The distance that data had to travel from Bangkok to Houston and back added only about 1 s to the response time of the system, but it reduced computing costs at the Thailand facilities by 10%.

Telecommunications technology allows access to information regardless of the location, whether on ships at sea or at drilling rigs or production sites in remote places. With the use of modern telecommunications equipment, for example, Exxon-Mobil has been able to improve the quality and reduce the cost of ship-to-ship and ship-to-shore communications. The ships are connected to a satellite network, so they can receive and initiate instantaneous telecommunications, including voice, data, e-mail, and facsimile—just as if they were in a modern office building instead of being thousands of miles away from civilization in the middle of the ocean (based on Ref. 18).

It should be noted that the above three categories of IS follow the three strategies of host country focus, international, and global described in Chapter 6. The match between IS and strategies of MNCs is due to the fact that the information processing needs and, along with them, the IS design of MNCs vary. Decentralized MNCs will pursue independent IT operations in each country. A global or centralized firm, on the other hand, must create its IT configuration in a centralized manner.¹⁹

International IS Issues

IT is an important mechanism to facilitate, sustain, and promote international business. King and Sethi²⁰ and Keohane and Nye²¹ have categorized international IS issues into intracorporate, intergovernmental, host government, and reactive international IS issues.

Intracorporate IS Issues

Intracorporate interactions provide the interface between the corporate unit (and its IS function) and its overseas subsidiary (and its IS function). In this category, there are two IS issues: (1) those pertaining to the IS function only and (2) those pertaining to the role of IS in supporting competitive strategy.

The issues pertaining only to the IS function emanate from the design of the *linkage* between the IS function at the corporate unit and the IS function in the overseas subsidiary. The linkages are of three types:

1. *Organizational linkage* design must address the organizational structure of IS at the subsidiary, its control systems and reporting procedures, and its participation in the IS function of the corporation as a whole. Both company-level variables and subsidiary-specific variables must be taken into account in designing the organizational linkage. The former includes the overall organizational structure and organizational strategy, while the latter involves the information dependency of the subsidiary, its importance (knowledge contribution), and its ownership.
2. *Architectural linkage* design must address the issues of communication integration, data integration, application portfolio, and hardware and software platforms. What is the desired level of connectivity? What is an acceptable level of standardization of codes (e.g., ethnic classification codes)? What is a tolerable level of redundancy in the databases? What is the desired degree of freedom in developing an application portfolio? And what is an acceptable level of incompatibility of equipment? The Internet has influenced all this. For this reason, at the end of this section, a brief discussion on the Internet is provided.
3. *Personnel linkage* design must address the functions of selection, staffing, appraisal, and compensation of IS personnel in subsidiaries. What is the appropriate mix of local employees, who speak the language and understand the culture and the political system, and expatriate employees, who can emphasize firmwide rather than local objectives?

The issues pertaining to the role of IS in supporting competitive strategy are influenced by industry-level variables as well as country-level variables. When MNCs in the same industry operate in the same countries, they cannot exploit comparative advantage sources (e.g., lower labor costs, raw material, etc., in one country vis-à-vis another). In such cases, the IS function must focus on maintaining firm-specific competitive advantage; for example, by transferring systems (such as order entry terminals placed at customer premises) that have created such an advantage in the home country to the host country. On the other hand, when similar MNCs operate in different countries, the IS function should focus its efforts on exploiting sources of comparative advantage.

Intergovernmental IS Issues

The interactions between the IS function and intergovernmental units are concerned with either technical issues or regulatory concerns. There are several benefits from user participation in standard-setting organizations such as the International Standards Organization (ISO). Perhaps the most important of such benefits is remaining closely informed of directions in open systems (i.e., nonproprietary) standards and technologies and assessing their impact on the corporation's IS infrastructure.

While developing coherent international standards is important for any IS function, a consistent pattern of international regulatory practices is a prerequisite to information transfers required by the global firm. As a result, we find that telecommunications and IS issues have been prominent at various international negotiations, including those sponsored by the World Trade Organization (WTO). Liberalization of global communications, in particular, can bring significant advantage to MNCs.

Host Government IS Issues

Issues pertaining to the interactions between the IS function and a host government emanate from an MNC's deployment of information technologies and the host government's reaction to it. These issues can be divided into four categories: (1) political, (2) economic, (3) technological, and (4) sociocultural.

1. Chief among the *political issues* is the concern for ownership and the sovereignty of a nation over its resources, including its information resources. IT, in the form of satellite communications, for example, can render national control of information ineffective. Similarly, it is, at times, feared that MNCs headquartered in developed countries can, through the use of IS and transborder data flow (TDF), remotely control the physical operations of their factories and potentially bring operations in a less developed country to a halt.
2. *Economic issues* have typically surfaced in the form of restrictive policies against the use of IS for fear of displacement or unemployment of workers. In addition, host government policies for the development of indigenous IS industries can force the MNCs' IS function into an unfavorable reliance on outsourcing in the host country and the deployment of less than optimal technologies.
3. *Technological issues* relate to host governments' IS-related policies regarding access to communication facilities and international networks. Host governments have a keen interest in IS through which technology transfer takes place.

4. *Sociocultural issues* deal with the stance of host governments on protecting the needs of the individual versus the needs of society. While there are no universal standards in maintaining a balance between the two, host governments often would like to see that an MNC's practices do not stir up opposition from groups or interests within the society.

Reactive International IS Issues

Often, national IS-related policies are formulated in response to changes in similar policies in other countries. These policies have an enduring impact on the IS functions of MNCs. As pointed out by the National Telecommunications and Information Administration (NTIA), "As direct beneficiaries or victims of many policy decisions, private firms have a critical stake in the nature and effectiveness of governmental decision making" (p. 25).²² European policies on the development of standards for telecommunication services and equipment, for example, prompt corresponding decisions by the U.S. government, which in turn will have ramifications for MNCs operating in the United States.

In addition to the above four categories of IS issues, there are also intergovernment interactions as well as interactions between governments and intergovernmental bodies.²⁰ These interactions primarily translate into bilateral, regional, and multilateral negotiations regarding issues that directly or indirectly affect the IS function of MNCs. As an example, the North American Free Trade Agreement (NAFTA) includes computer and telecommunications service agreements to provide nondiscriminatory access, maintain existing rights of access, and limit anticompetitive practices, and it contains provisions for TDFs and access to data banks.

The Internet

The Internet is a revolutionary medium of information creation, manipulation, transmission, storage, and management that functions on a global scale. The origin of the Internet goes back to the 1960s and a daring scheme imagined by the technological warriors of the U.S. Defense Department (pp. 6–7).²³ Their aim was to prevent a Soviet takeover or destruction of American communications in the event of a nuclear war. Ultimately, the network set up by the Defense Department became the foundation for the Internet, a global, horizontal communication network of thousands of computer networks. The end result was a network architecture made up of thousands of autonomous computer networks that have innumerable ways to link up, going around electronic barriers. It is a highly flexible, self-healing, powerful medium that cannot be controlled from any center. It has been adopted for various purposes and uses, far removed from the now extinct Cold War concerns, by individuals, groups, and firms

around the globe. It has spawned an industry that can be classified in four layers:

1. The first layer consists of the companies that provide the Internet infrastructure. The firms in this layer are telecommunications companies, Internet service providers, Internet backbone carriers, final access providers, and end-user networking manufacturing companies. Well-known firms such as Qwest, Corning, and Mindspring are in this group.
2. The second layer comprises the firms developing Internet infrastructure applications. These firms develop software products and services for Web transactions. Consulting and service companies designing, building, and maintaining Web sites, including portals, e-commerce sites, and audio and video delivery sites, are in this layer. Examples of companies in this layer are Oracle, Mirosoft, and Adobe.
3. The third layer is formed by companies that generate revenues not directly from business transactions on the Web but from advertising, commissions, and membership fees, in exchange for providing free services over the Web. Content providers and market intermediaries such as the news media, brokerage firms, resellers, portals, and other intermediaries are in this layer. They include such companies as Yahoo!, eBay, and E*TRADE.
4. The fourth layer consists of the companies that conduct Web-based economic transactions, such as Amazon, E-toys, Dell-Direct World, and The Street.com. *E-commerce* is the common term used for the business of these companies.

The Internet economy and the IT industries have become, qualitatively and quantitatively, the core of the U.S. economy. MNCs are among the major beneficiaries of the Internet. The Internet has enabled MNCs to coordinate geographically dispersed subsidiaries and activities economically.

With the advent of the Internet, more companies are able to expand their businesses through the development of Web sites where customers can easily download software, purchase products, obtain financial information, and get basic information. As a result, the responsibilities of corporate network managers are growing at a rapid pace. The ability to translate data into useful information, interpret it, and execute the necessary actions is important to managers. As a consequence, failure to do so regularly leads to loss of competitiveness.

The expansion and commercialization of the Internet is reshaping the roles of IS managers and IS/IT departments. Increasingly, IS and network executives are playing crucial roles in their employers' strategic business activities, gradually making IS organizations central to their companies' ongoing success.²⁴

Global IS Management

The model presented in the previous section provides one means by which to organize and discuss issues pertinent to global IS management. Another approach is to undertake an empirical study to identify and rank important global IS management issues for MNCs. Two such studies will be summarized in this section.

In one study, the top IS executives of U.S.-based MNCs identified and ranked important global IS management issues.²⁵ They identified “educating senior personnel on the role and potential of the contribution of MIS on an international scale” as the most important issue and “export restrictions on data processing equipment and software” as the least important issue at the time of the study. Although such rankings of issues are clearly of interest, more insight is offered by classifying the issues of concern to IS executives as being in the domestic or the international arena.

Based exclusively on the rankings of the 32 issues in the study, 14 are international IS issues and 18 are domestic concerns. Of the issues that pertain solely to operating in an international arena, technological issues, such as “international protocol standards,” dominate both political issues, such as “transborder data flow restrictions,” and cultural concerns, such as “learning to conduct business in other countries.” Those, in turn, dominate economic issues, such as “export restrictions.”

Similarly, researchers have identified eight important IT management issues:²⁶ (1) IT transfer, (2) cultural differences, (3) international standards, (4) IT infrastructure, (5) global IT applications, (6) global IT policy, (7) global IT marketing, and (8) TDF.

The IS executives of U.S.-based MNCs considered two of the eight issues to be of most concern to them. The two issues were TDF (restrictions on the flow of data, data security vulnerabilities, and telecommunications management) and the lack of international standards (in telecommunications, software development, and computer architecture). Both TDF and the lack of international standards underline a very important issue of national security that is discussed below.

IS Security

The information explosion, including the use of the Internet, has been a boon to both big and small businesses. The use of the Internet has drastically reduced the cost of global business transactions. Outsourcing through the Internet and the availability of cheap communication services have benefited all businesses. For example, VoIP (voice over the Internet protocol), such as Skype or Vonage, substituting for regular phone services, has reduced the cost of international telecommunication, especially for otherwise heavy users of regular phone services. The information explosion has also made it easier for various groups to engage in terrorism. This adversely affects international business and poses serious questions regarding activities

that involve cross-border transactions. Security of the electronic media drew the attention of scholars and the police many years ago when criminals started using them illegally. Recently, however, the illegal use of electronic information has become a national security issue.

Prior to the tragedy of September 11, 2001, almost all illegal activities on the Internet either had purely criminal profit-making origins or were acts of vandalism. Very seldom were abuses of the Internet for other purposes. Even then, while it was difficult to determine the purpose, we were reasonably sure that there were no terrorist motives behind them. For example, computer viruses that are plaguing the Internet were around even before the recent waves of terrorism.

After the tragedy of September 11, we have learned that securing the Internet and providing for safe international business transactions, through the use of secure IS, would be a very difficult task. Also, we have learned that we can use IT to thwart terrorist actions. For example, experts have proposed measures for the safety of the logistic supply chain.²⁷

Terrorists, it has been suggested, may secretly use multitudes of containers going through various U.S. ports. In one of these containers, a weapon of mass destruction could enter the country undetected. To prevent such an act of terrorism, the application of radio-frequency identification (RFID) has been proposed. RFID devices can be used to electronically detect the closing and opening of a container or a trailer. As such, RFID can provide for continuous monitoring and tracking of the location of inbound shipments while in transit. It can electronically record and report any tampering with a container or trailer. However, the lack of worldwide standards for RFID is an impediment to its use.²⁸ The lack of global standards for RFID makes it less effective. It is also very costly, and it is impossible to construct a globally useful system. Therefore, the future of container security, according to experts, lies in a satellite solution, which by its nature avoids the limitations and infrastructure costs of a land-based system.

The preceding discussion points out the similarities between IT issues in both the domestic and the international arenas. In the next section, we present a guideline for building a global information system that addresses these issues.

Building a Global Information System

The challenge of setting up an information system spanning continents is no longer limited to the very large companies. The number of firms operating internationally—for production, distribution, or some other business function—is growing. The evidence indicates that multinational firms are earning more, and growing faster, than firms without global operations. The IS directors of the firms venturing into foreign markets quickly realize that the challenges faced by IS range from the broadest organizational issues to the most detailed programming dilemmas.²⁹

Express delivery companies are using the Internet to offer better services. They are trying to integrate an online customer service technology with other SCM operations. DHL, FedEx, and UPS initially permitted customers to book shipments electronically, but now with the Internet, these companies are implementing new tools that provide accessibility to a wide range of software packages such as DHL Connect and DHL EasyShip. DHL EasyShip is targeted to meet the needs of high-volume customers. It can be installed across a shipper's network for multiuser access and shipment data transfer from the shipper's own system. Similarly, FedEx has launched a Web site called FedEx Insight where customers can create a customized view of shipment information, and they can also request detailed information about shipping events. UPS is making some changes as well. It expanded the international availability of an option to download its OnLine Tools Application from the Web. It has also teamed up with PayPal, an Internet payment service, to completely integrate the online payment process with digital tools. OnLine Tools enables companies to seamlessly integrate UPS shipping functions, such as tracking and rates, and service selection into their own Web sites, avoiding jumps from one Web site to another.³⁰

Esprit's Experience

The clothing manufacturer Esprit de Corp, in San Francisco, found out the hard way that sharing software on a global basis does not always work according to plan. Faced with problems, Esprit's U.S. subsidiary adopted a production management system developed at the company's Far East affiliate. The software would track where an item was manufactured, sewn, pressed, and so on. But the software was only a moderate success in the United States because the ways of doing business are quite different in the two hemispheres. Similar to the experiences of virtually all major corporations that do business overseas, Esprit ran into a wall. It found that despite good intentions and the apparent benefits, sharing software across borders is not always the best choice. Work habits around the world are different.

Although many companies are going global and IS groups are under increasing pressure to maximize technology investments, seasoned IS experts say that not all software can or should be common everywhere. In the Far East, for example, it is standard for the shop sewing a garment to handle the other steps of finishing and washing it. In the United States, however, convention dictates that the individual steps be contracted out to different parties.

For Esprit, the end result was that the system that Hong Kong put together lacked features that would allow the U.S. operations to manage effectively the transition from factory to factory. Consequently, Esprit's U.S. Group abandoned software sharing with overseas units.³¹

When Federal Express expanded outside the United States, the cultural nuances of billing resulted in revisions of their billing system. In Britain, customers do not pay from an invoice but from a statement sent after the invoice. In Japan, the invoicing protocol calls for invoices to be sent within a specific time period after the sale and to have a specific format.

When the bicycle and race-car helmet maker Bell Sports began exporting to Europe, the IS staff back in its Rantoul, Illinois, factory ran headfirst into European safety regulations requiring statements on packages and labels inside helmets. To efficiently get the right labels on the right helmets, the IS department had to rewrite portions of its material requirement planning II (MRP-II) system (an inventory control method).

When Ikea, a large home-furnishing company from Sweden, opened its first U.S. store, the IS department had to make a variety of modifications to their store systems. For example, the IS staff had to do some “keyboard mapping” to allow the U.S. staff to prepare reports with umlauts. Also, report programs had to be adjusted to deal with American-sized paper stock. More important, however, order entry/billing programs had to be rewritten so that American customers could arrange to have furniture shipped to their homes. In Europe, the shipping company takes ownership of the order, and customers pay the shipper cash on delivery. In the United States, these procedures were unacceptable, and the programs had to be rewritten to accommodate payment in advance of delivery.

As the preceding examples illustrate, building a global information system presents a variety of challenges for the IS manager. Nevertheless, the experience of successful companies indicates that one key to success stands out: Global operation demands global information, which in turn calls for a global infrastructure in planning, data integration, communication, and information resource management.

Planning Globally

Because of the wide geographical distances separating MNCs’ global divisions from their headquarters and from each other, IS play a critical role in strategic planning, implementation, and control of MNCs. Therefore, taking a reactive approach to building a global information architecture is nothing less than accepting a position of competitive defensiveness or, possibly, competitive disadvantage.³² Nevertheless, as several studies have indicated, most senior managers do not have a clear and personal business vision for IT. To help relate business integration and technology integration, Keen³² suggests a framework that defines the business functionality of the firm’s IT facilities in terms of the two dimensions of *reach* and *range* (see Table 10.1).

In this framework, *reach* (vertical axis) determines the six locations the firm can link to: (1) locations within a single site, (2) the entire domestic operation, (3) locations abroad, (4) customers and suppliers domestically, (5) customers and suppliers internationally, and (6) anyone, anywhere.

Table 10.1 Relating Business Functionality to Data and Communication Integration

Reach Whom?	Range (What Services Can We Deliver?)			
	Standard Messages	Access to Stored Data	Single Transactions	Cooperative Transactions
Anyone, anywhere				
Customers, suppliers, regardless of IT base				
Customers, suppliers, with the same IT base				
Intracompany locations, abroad				
Intracompany locations, domestic				
Intracompany locations, single site				

The *range* (horizontal axis) determines the nature of the information that can be shared directly across systems: (1) standard messages, (2) ad hoc access to data, (3) arbitrary single transactions to be completed by one party (node), and (4) cooperative transactions to be completed by several nodes.

Reach and *range* together determine the extent of business options available to the firm. In Table 10.1, for example, the shaded cells in the bottom row signify an integrated database within a single site allowing various departments to share and update common data, while the absence of shading in the next to last row depicts the inability to process updated transactions from remote locations even within the same country. Therefore, the *reach* and *range* framework serves to translate the IT integration issues for senior management as *what option is implied by our business plans?* A firm may opt to build an enterprise-wide totally integrated IT infrastructure aiming for the maximum in *reach* and *range*. To do so, it needs to consider a variety of issues. One issue is the extent of the firm's centralization. In general, it is easier to put in place the rules and constraints of a global IT infrastructure when a corporate culture for centralization exists. Another issue is the availability of capital.

E-Commerce

E-commerce has evolved from the practice of conducting basic transactions on the Web to a complete retooling of the way partners, suppliers, and customers transact. Today, you can link dealers and suppliers online, thus reducing both lag time and paperwork. Procurement can be

managed online by setting up an extranet that links directly to vendors. This cuts inventory-carrying costs and makes the firm more responsive to customers. Financial relationships with customers and suppliers can be streamlined by Web-enabling billing and payment systems.

There are enormous advantages in using Internet technology to improve relationships with customers and suppliers. The advantages are more efficiency, better services, and improved relationships. Most companies enlist the assistance of a resourceful IT partner that enables them to integrate with any of their business partners. The IT partner can provide the firm with IT solutions that have built-in flexibility in features such as content management, order management, dynamic pricing and payment, and international trading capabilities.

Increasingly, success means being first to the market. Therefore, a firm that engages in e-commerce needs options, such as outsourcing and hosting capabilities. More than ever before, customers expect and employees require access to the information anytime, anyplace. This means customized information that is tailored to a range of devices such as PDAs (personal digital assistants), mobile phones, and so on. Internet technologies enable the firms to effectively respond to these demands.³³

Because most companies are not well centralized or awash in capital, they must rely on multiple IT architectures (each signifying a different combination of *reach* and *range*) rather than the ideal totally integrated (global) infrastructure. These multiple IT architectures are too often determined first by geography and then by function. Unfortunately, such a traditional approach usually proves counterproductive, simply because a decision in one area of the organization quite often affects other areas. A better alternative is to take a business process perspective. This means viewing a business in terms of major processes such as order fulfillment and customer service rather than functional areas. The business process perspective enables us to overcome geographical boundaries in planning for IS in a global concern.

Communication Integration in the Global Organization

Regardless of the number of business processes that a firm chooses to support with a global IT architecture, there will be a substantial cost associated with establishing and maintaining the requisite communication infrastructure. It would be a serious mistake to assume that the only difference between building a global network and building a domestic one is a matter of size.

Global communications networks, like their domestic counterparts, can provide both internal and external benefits to the firm. Internally, a global network can, at the very least, improve management control by facilitating

communication among international business units and, at best, support an online, real-time, integrated database for transaction processing as well as managerial decision making worldwide. Digital Equipment Corporation, for example, reports that its global computer network helped it save \$700 million in inventory-related costs over a 2-year period by increasing control over the movement of inventory between its worldwide manufacturing plants.³⁴

Externally, a global network can be used to advance a company's competitive strategy. Federal Express's global network connects the U.S. network with more than 60 subsidiaries worldwide to implement the company's differentiation strategy based on real-time tracking of packages. Marriott and Scandinavian Airlines have linked their global networks to create an interorganizational system focused on providing added value (convenience) to a shared customer by checking in customers' luggage for a flight at the hotel reception desk. Despite such benefits, global networks are far from widespread for the following reasons: (1) the high costs involved, (2) the existence of politically imposed constraints, and (3) technical problems.³⁵

The costs of global networks can be substantial for a combination of reasons, including the following:

1. The telephone service in other countries is considerably more expensive than in the United States.
2. Lower speeds of transmission lines in other countries mean more time spent for data transmission.
3. The cost of transmission may vary depending on the direction of data flow. For example, it costs four times as much to send data to the United States from Portugal as it does to send it in the opposite direction.³⁶
4. The arrangements between telephone companies for handling international calls are based on cost sharing at each end of the link. The formulae penalize the low-cost U.S. carriers by paying, on average, 75% of the call charge to the high-cost foreign PTT (Poste Telegraphe et Telephonique). In the case of Brazil, 99 cents on each dollar of telephone charge from the United States to Brazil is paid to the Brazilian PTT.³²
5. The PTTs are government or quasi-government monopolies for telecommunications and are very unwilling to break up their cartels, which, in turn, have controlled international telephone pricing and revenue sharing.³²

The high costs associated with global networks are compounded by the political constraints imposed on TDF. Although some of the TDF regulation problems encountered by multinational corporations increase the cost of communication between parents and their subsidiaries, their real impact is to create a control *barrier*.¹⁶ Examples of such barriers include the following:

- Required use of locally manufactured data-processing equipment, communication services, and software
- Restrictions on the availability of flat-rate leased lines
- Restrictions on satellite transmission, for example, to receiving data only
- Required processing of certain data locally
- Restrictions on the flow of data across national borders—for example, restriction of the export of personnel-related data
- Threat of a tax on the value of data

To deal with such TDF regulations, multinational companies can resort to one or more of the following strategies:¹⁶

1. Decentralization of data processing on a geographic basis
2. Preprocessing of data to filter out restricted information
3. Alternative information channels to move data to the parent company
4. Database duplication and reprocessing at the parent company to obtain the desired level of reporting and control

In addition to the high costs and political constraints associated with building global networks, there are technical problems involving the quality of services and operability that must also be overcome. Simply stated, to build an efficient global network, a company must be prepared to mix a variety of technologies and deal with compatibility issues.

In Europe, the integrated services digital network (ISDN) and cable modem are widely deployed to provide basic access to two full-duplex 64-kbps (kilobits per second) channels from the desktop. Most PTTs also offer a primary rate interface consisting of thirty 64-kbps channels capable of handling digitized voice, video, and/or data. (The definition for the primary rate interface differs in the United States and signifies twenty-three 64-kbps channels.)

As in Europe, most major cities in the United States currently offer ISDN and cable modem. Bell Atlantic (Philadelphia), Bell South (Atlanta), Pacific Bell (San Francisco), and U.S. West (Denver) are leading contenders in the deployment of ISDN. Although service offerings vary according to carrier, most services are aggressively priced. Therefore, it may not be unreasonable to expect that despite the current clamor over frame relay and asynchronous transfer mode (ATM) technologies, a great deal of telecommunications traffic between U.S. multinationals and their subsidiaries in Europe will traverse the ISDN. Where ISDN is not an option, traditional analog lines or digital lines (T-1 services operating at 1.5 million bps) or fiber-optic connections (OC-1 services operating at 45 million bps) can provide the needed connectivity even across oceans.

Digital subscriber line (DSL) has surged ahead of its rival technologies, cable modem and ISDN. DSL means high-speed Internet access up to

100 times faster than today's dial-up modems. With this new Internet connection, people can share an Internet connection across all the computers in an office or home. Besides the fast rate of data transfer, DSL has other benefits as well. The user, for example, can leave the connection open and still use the phone line for voice calls; DSL uses the same wires as a regular phone line, and the company that provides the services will supply the user with the modem as part of the installation.^{37,38}

Then, of course, there are those situations where a company's only reliable means of data communication is through a wireless medium. Very small aperture terminal (VSAT) satellite networks have had the same major impact on data communication as PCs have had on computing. And it is expected that wireless networks, both spread-spectrum radio frequency and infrared, will provide a pathway in those places where a company must have a wireless link or no link at all.

Reebok Tracks Athletes

To track more than 1,000 athletes around the world, Reebok uses Lotus Notes. These athletes' endorsements of its products constitute the heart of Reebok's promotional campaign. With Lotus Notes, a groupware application, Reebok maintains a global database of the results of their endorsements. These endorsements constitute a major investment in terms of payments to the athletes, which needs to be tracked and compared with product sales. Also tied into this system is the legal department that is attempting to standardize endorsement contracts. Similarly, the company's transaction-processing systems use the Notes database for near-real-time reporting of the results of promotional activities around the world.

At Reebok, both regional and global specifications and standards are used in designing various products. With the help of Notes, Reebok designers can work collaboratively while serving their local markets. Notes enables designers to disseminate digitalized drawings and textual communications among all the company's design centers.³⁹

Data Integration in the Global Organization

To understand the data integration issue, consider a global company that has determined order fulfillment to be its strategically important pacing process to be globally supported. Among other things, integrating these functions requires that information about stock availability be accessible from any of its business units around the world, and even though the customer's order has to be fulfilled by shipments from several sites, the customer is presented

with a single invoice, and information about the customer is entered only once. To accomplish such data integration, a company has several alternatives.

Centralized database, centralized processing: In this approach, the database for order fulfillment resides in one location, and all processing takes place in that location, with remote sites acting as online data entry/update terminal nodes. This is similar to the traditional mainframe/dumb terminal computing model.

Centralized database, decentralized processing: A significant problem with the above alternative is that the centralized facility must be powerful enough to accommodate hundreds, or even thousands, of online terminals. In the centralized database/decentralized processing approach, although the database remains centralized, all the processing, including the handling of issues related to concurrent update of shared data and backup and recovery, takes place at remote computers. This is similar to the local area network computing model.

Centralized database, distributed processing: There are two problems with Alternative 2. First, because each remote computer must run the database management software as well as the order fulfillment application, there is still considerable computing power required of each node. Second, because the database is centralized, each remote query for, say, worldwide stock availability for a particular item requires the *entire* stock file to be transmitted to the remote site for processing the request.

In the centralized database/distributed processing approach, the order fulfillment program is broken into two components: database management system (DBMS) and user interface issues. The DBMS issues of concurrency control, backup, and recovery, as well as searching the database to retrieve or update records matching specific criteria, are delegated to the *server* component of the program, while the user interface issues of displaying data and accepting keyboard input or responding to mouse movements are handled by the *client* component. Therefore, in our example, a remote query to obtain the worldwide stock availability for a particular item is obtained by *the client program* from the user, which in turn forwards the query in a standard format such as SQL (structured query language) to *the server program*, which processes the request and transmits only that *portion* of the stock file related to the requested item to *the client program* to display it for the user. This is similar to the centralized client/server computing model.

Distributed database, distributed processing: A basic shortcoming of Alternative 3 is the absence of fault tolerance. That is, should anything go wrong with the centralized database, all database access and processing comes to a halt.

In the distributed database/distributed processing approach, the database is logically and physically partitioned. For example, each site will have its own stock file, and the customer file is divided (nonredundantly) among the various sites. As a result, there will be no single point of failure. Queries

about enterprise-wide stock availability for a particular item are handled in a *location-transparent* manner by the underlying distributed DBMS. Distributed DBMS software such as Oracle and DB2 support such a distributed client/server computing model.

Global Operation Demands Global Information

"If you're really going to compete on a global scale, you'll think of your manufacturing or processing plants as one, and you'll move your capacity around the world," explains Tobey Choate, Vice President and Managing Director of IT at the consultancy Arthur D. Little in Cambridge, Massachusetts.

"You'll think of your (entire) customer base as one, and you must have a fairly uniform and detailed level of information to do that. If you're using the same manufacturing (information) system worldwide, you will get the same information, which will allow you to manage that capacity worldwide."

Most companies today do business internationally, but few have stepped up to the challenge of real globalization, according to Alan C. Stanford, National Director of IT Consulting in Ernst & Young's Chicago office. "They don't operate globally in that they do not coordinate between their (international business) units. They certainly don't align their business processes."^{40,41}

Heterogeneous database processing: All the preceding alternatives assume either that the organization is initiating data processing operations at remote sites or that it is willing to scrap existing computing arrangements and reengineer them for the sake of supporting its strategically important pacing process. However, in those circumstances when a company acquires subsidiaries with established data processing and a dissimilar DBMS environment, an interim solution would be to create a heterogeneous distributed database processing environment. It is possible to create a conceptual model of the overall database and allow users and programs to formulate their requests for enterprise-wide information against this view while translating each request, behind the scenes, into a collection of cooperating transactions against various DBMs at different sites. The advent of XML (extensible markup language) allows information between disparate systems to be exchanged.

In general, retrofitting existing application systems in various countries to create a single system is more difficult than starting with a clean slate, but it is best to decide on a case-by-case basis.

The IS Application Portfolio in the Global Organization

The cardinal rule in deciding which IS applications should be made global is that not every application needs to be a global application. Accounting and payroll systems are best left to local developers and maintenance programmers. Countries such as France impose a statutory chart of accounts,⁴¹ and each country has its own taxation laws and its own version of the United States' Internal Revenue Service with reporting forms such as the W-2, 1099, and so forth. Therefore, it is a good rule of thumb not to globalize government reporting applications. Nevertheless, there still remains a requirement for the consolidation of financial results as well as performance comparisons across subsidiaries, which must be met by developing global applications.

As already pointed out, the decision as to which applications must be supported by a global architecture must emanate from global planning for IT. A company must start with its global strategy and identify those applications that are critical to its success. Those applications then comprise the company's initial global IS portfolio.

The traditional portfolio development has followed a chronological sequence of systems development and has moved from transaction processing to management reporting, decision support executive information, and finally, workflow IS. It is interesting to note that a company's IS department might find it easier to pursue the development of a global portfolio in the reverse chronological order (Table 10.2).

That is, it appears that a greater chance of success exists if the IS department were to first bring electronic messaging and workgroup computing to the global organization. Next, it could target the development of a global executive information system that does not have to deal with the more difficult problems of providing ad hoc access to, or update of, databases. At that point, the company can move into global decision support systems that

Table 10.2 Traditional Versus Global IS Portfolio Development Order

Traditional IS Portfolio Development Order

Transaction processing systems
 Management reporting systems
 Decision support systems
 Executive information systems
 Workflow information systems

Global IS Portfolio Development Order

Workflow information systems
 Executive information systems
 Decision support systems
 Management reporting systems
 Transaction processing systems

can employ historical data as well as more or less predefined snapshots of present databases. Next, it could support ad hoc access to enterprise-wide data for reporting purposes, which would, at a minimum, require the development of a conceptual model of the organization-wide integrated database. Finally, it can begin addressing the rewriting of applications to support cooperative transaction processing and the real-time update of data at multiple sites.

Programming for International Use

When writing a program to be used by an international audience, a variety of adjustments need to be made. Language on screen and on reports needs to be translated often to character strings longer than the English equivalent, and language-sensitive input needs to be modified. For example, if a "Yes" or "No" input is needed, expecting a Y or N will not work in France, as *Oui* does not start with a Y. The basic program design rule is to place all constant input and output strings outside the program in a language-specific data file.

There are also other problems. Some non-European languages such as Chinese and Japanese require special video support since they use double-byte character sets. Other languages, such as Thai, use multibyte character sets; sometimes it takes one byte to get the character on screen, and at other times it may take as many as three bytes. Then, there are the Middle Eastern languages such as Arabic, Persian, and Hebrew, which are written from right to left. And in the case of Arabic and Persian, the shape of a letter depends on its position in the written word (first, middle, last, or by itself).

Currency formats and date formats need to become country specific too. And an important decision must be made regarding at which stage in a transaction currencies are exchanged.

Redefining the CIO as the Global Information Officer

The operational requirements of a truly global organization significantly increase the difficulties faced by its CIO. IT investment and coordination issues for multinational corporations are vastly more complex than for purely domestic ones, involving not only the domestic issues but also the additional difficulties discussed in this chapter. As a global information officer (GIO), the CIO's responsibilities and performance expectations are transformed—both quantitatively and qualitatively.

What are the salient attributes of an effective GIO? Let us begin with those characteristics that one would expect to find in any CIO regardless of

the global scope of his or her responsibilities. First, the CIO must provide the necessary guidance for developing an information architecture. On the one hand, this requires an in-depth understanding of information technologies: hardware and software platforms, telecommunications and networking strategies, centralized and distributed database management, open systems standards, and end-user computing tools and practices. On the other hand, it requires experience in managing IS personnel and the ability to administer complex, multifaceted projects. Second, the CIO must be especially responsive to evolving user requirements and changing corporate strategy. This requires staying informed about the business and operational requirements of the firm and positioning IS to respond to evolving needs quickly. Third, the CIO cannot afford to be hands-on all the time, and thus, the actual running of networks and data centers must be delegated to others. This, of course, requires effective delegation skills.

What is needed to transform the CIO to a GIO involves more managerial skills than technical expertise. The effective GIO must master how to manage the distributed resources of the parent company and its acquisitions to align the company's IS with its strategic plan and, in doing so, address, to the extent possible, the cultural differences, language issues, business practice variations, and technology limitations of the various host countries.

Kanter and Kesner⁴² identify the following as six critical success factors for the effective GIO: management style and leadership, organization and structure of the IT function, skill base, commitment to TQM (total quality management), openness to outsourcing, and technology transfer along with change implementation. It should not be surprising that the leadership qualities vital to the success of a GIO are identical to those expected from any executive officer. They include the following: (1) strategic focus, (2) flexibility in addressing tactical issues, (3) people- as well as task-oriented project management style, (4) the ability to delegate and manage through others, (5) ruling through consensus, and (6) a team approach to problem solving.

To be effective, the GIO and the IT function must be appropriately positioned within the larger organization. This means that the GIO must report to the chief executive officer and be an equal member in the top management team that deals with components of corporate strategy.

The effective GIO must have a comprehensive knowledge of the corporation, its products and services, its functional requirements, and its business processes. The GIO must understand the ramifications of emerging information technologies on the corporation and be on the lookout for disruptive technologies that can redefine the competitive marketplace. The GIO must have an understanding of the different countries and cultures in which the corporation operates to factor in the impact of the work ethics and motivation levels of people of different nationalities in optimizing global IS projects.

In a world of time-based competition, where a late system project directly affects the bottom line, the effective GIO must implement and enforce a TQM program within the IT function to ensure that projects are

done right the first time. Viewing software as an engineered product subject to quality assurance and market acceptance and viability is the fundamental cultural change that such a commitment brings to the IT function.

Instead of relying entirely on in-house solutions, the effective GIO practices the wisdom of outsourcing for specific expertise or relying on the cooperation of hardware and software vendors.

Finally, the effective GIO must facilitate the discovery of appropriate new technologies; fund pilot projects; and for those that look promising, serve as the change agent for successfully implementing them in the organization.

Summary

Technological changes and innovations affect all aspects of our lives and the conduct of business, locally and globally. No technological change has had as profound an impact in a short time on modern enterprise as the advent of computers and telecommunications. The ability to send, receive, process, and otherwise manage an immense amount of information enables MNCs to exercise closer control over their foreign subsidiaries. IS management can be used not only to enhance internal operations but also to create a competitive advantage. Instantaneous information exchange among MNCs' worldwide operations drastically reduces geographical distances and brings dispersed subsidiaries closer to one another. While IS decrease the barriers to centralization, they also create opportunities for decentralization. The constant flow of information between MNCs' headquarters and their subsidiaries empowers them to operate more locally and at the same time allows their headquarters to formulate strategies globally.

Discussion Questions

1. Why is IS management critical to MNCs?
2. How do the information needs of MNCs differ from those of domestic firms?
3. What are the ramifications of internationalization of the firm on the function of its IS?
4. MNCs have adopted different IS functions. Elaborate on the reason(s) for the differences.
5. Describe intracompany IT issues.
6. Describe intergovernment IT issues.
7. Describe host country IT issues.
8. Elaborate on the internal and external benefits of communication integration to the MNCs.

9. What is supply chain management, and how can MNCs benefit from it?
10. What is enterprise resource planning, and how can MNCs benefit from it?
11. Explain how the Internet has influenced MNC operations.
12. The Internet has spawned an industry that can be classified in four layers. What are the four layers?
13. MNCs have different options for data integration. Briefly describe these options and explain the reason for their use.
14. What are the differences between the roles of chief information officer and global information officer?

Note

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