Global business drivers: Aligning information technology to global business strategy

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The alignment of worldwide computer-based information systems and integrated business strategies is critical to the success of multinational firms in a highly competitive global market. In this paper, information technology (I/T) solutions are explored that drive firms toward making economic decisions based on worldwide distributed knowledge. These solutions focus on a number of entities (or global business drivers) that identify where a firm can benefit most from the management and application of the technology. A variety of approaches for overcoming the barriers and risks of applying this technology are also discussed.

In the forefront of the transition of a firm to a globally coordinated and managed organization is information technology. Information technology can drive the change, be harnessed to it, or rise up as a severe impediment. The chief executive of a major corporation has suggested that "globalization is no longer an objective but an imperative, as markets and geographical barriers become increasingly blurred and even irrelevant."[1] This paper explores how the application of information technology to the transition process can result in successful firms in a global market.

Information technology (I/T) can drive a firm toward globalization in a number of ways. Using computer and communications technologies,

firms can extract the information components from tangible products, or substitute knowledge for material, and then instantly transport the electronically represented information or knowledge throughout the world. Value can be added or an information-based product can be used at the most economically advantageous location. The time delays, high costs, and lack of customer responsiveness associated with transportation, reproduction, and inventory can be reduced or even eliminated. This instantaneous "world reach" produces major changes in order management, manufacturing, and marketing cycles. For example, the Society for Worldwide Interbank Financial Telecommunications (SWIFT) system electronically moves money freely and rapidly across national boundaries and toward those investments that offer the greatest return. The system allows credit transfers between some 1500 banks in approximately 70 countries. In a given day, as much as $700 billion is transmitted through the system.[2] Hamilton argues that information technology in the financial services industry has created a totally new system of world finance: "The growth of international communications, the de-

velopment of the data-processing capability of the big computer and the personal desk-top facility, and the arrival of the day of the wired society have revolutionalized the way in which finance is transacted."[3] I/T is also transforming the international transport and logistics businesses.[4] Large players in these industries have little choice but to learn to be a part of this global environment.

Information technology can facilitate a global strategy. I/T can be a key facilitator of day-to-day global operations. Many semiconductor manufacturers coordinate and control globally dispersed operations for maximum economic value, known as a "value chain." Wafer fabrication processes are capital-intensive and are performed in countries with high technology centers. Packaging, by contrast, is labor-intensive and is placed where labor costs are low. This requires moving work-in-progress and finished goods from country to country between such stages as fabrication, packaging, assembly, testing, and customer delivery. In an interview with the authors, one executive commented, "This is a business where a device that costs less than one dollar might travel 20,000 miles before it is at its final destination." A dispersed value chain requires tightly-knit information linkages. For example, Texas Instruments Incorporated facilitates its global business strategy with a single-image worldwide telecommunications network connecting several dozen plants in nearly 20 countries. The firm's multi-vendor fiber-optic computer network allows sub-second response time throughout the world. Common worldwide strategic systems have been implemented for procurement, logistics, manufacturing, financial planning, demand forecast, order fulfillment, and inventory management. These systems are run from the main data center computers in the firm's headquarters.[5]

Information technology also may present a barrier to globalization. Few multinational firms can boast of the globally integrated information processing environment that Texas Instruments semiconductor business has engineered to support its global strategy.[6] For many firms not committed to global coordination, parochial management of information technology has become a major liability. After identifying areas where global coordination can provide competitive advantage, executives often become discouraged to find country-specific applications of information technology emerging as barriers to implementation. Past investments in information systems, usually reflecting a history of local autonomy, can institutionalize country-specific business practices. Such investments make it costly and difficult, if not impossible, to share large amounts of product-, market-, operations-, and financial-related information across country boundaries.

This paper examines how information technology can facilitate the global strategies that firms are pursuing. The concept of global business drivers is described, followed by a suggested method to provide direction in the determination and prioritization of common, globally integrated I/T solutions. We then explore the "networked organization," an emerging structure that can provide the organizational infrastructure necessary for managing global drivers. Finally, we examine barriers and risks in implementing and managing a global information technology.

An example of the I/T quandry

The story of Worldwide Oil Field Manufacturers (WOFM), a real oil field service firm whose identity is disguised in this paper, provides an example of the information technology quandary facing many firms.

WOFM, a supplier of equipment and materials for oil field production operators, had major production facilities in the United States and eight other countries, with sales offices in another 16. Historically, WOFM products had been developed for the home country market. Products were then adopted, where appropriate, for markets outside the United States by the eight relatively autonomous national business units. Prior to the arrival of the current chief executive officer (CEO), information systems, like most other support functions, had been the responsibility of local country management. In those years, the financial results of the country units were sent via telex each month to the company headquarters where the data were re-entered into a corporate financial reporting database system.

In 1983, a new CEO ordered the development of a worldwide financial reporting system, an inventory management system, and a new customer profitability analysis system. These were to be installed in the various country offices and run on identical mainframe computers. The CEO sought

tighter financial control of this diverse empire and saw an opportunity to spread the development costs of the expensive inventory and profitability analysis systems across the organization. It was also hoped that a common inventory system might eventually lead to regional rather than country-by-country inventories of the high-cost replacement equipment the firm was compelled to carry in inventory for its large customers.

Four years and several million dollars later, these initiatives were seen as having been a failure. The financial reporting system provided timely and accurate data, but it had strained the relationship between the CEO and the general managers of the country units. Exchange rates, local tax laws, and country-specific accounting practices all presented stumbling blocks to successful implementation. So too did the lack of vendor support, the unavailable local software, and the widespread apathy of the managers of the various country information systems groups. The use of the inventory management and customer profitability analysis systems had met stiff resistance. In countries where the inventory system had been installed, massive changes were required to meet local requirements. Some changes reflected anticipated language and currency requirements, but the biggest problems centered around the unanticipated differences in operating environments. For instance, variations in distribution channels and methods from country to country required varying approaches to customer profitability analysis. The high costs of telecommunications in many countries required distributed applications that were contrary to the mainframe computer-based solution in the United States. In some countries, telecommunications were so rudimentary that a stand-alone computer workstation solution was the only viable alternative.

Despite the previous setbacks, the CEO in 1991 was more convinced than ever of the necessity for integrating information systems on a worldwide basis. The oil field services industry, always active internationally, had now become a global industry. Quality management initiatives and stiff competition were driving the large oil companies WOFM served to demand consistent standards of performance and service on a worldwide basis. At the same time, the efficiency of foreign competitors increasingly forced the firm to seek out the best suppliers, leading to an increased reliance on

offshore suppliers. High labor costs and a shortage of qualified engineers in the United States, coupled with available and inexpensive engineering talent in other country units, made offshore

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Without a shared business vision, developing a common global information technology is costly and may be strongly resisted.

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product development look preferable. The CEO was convinced that WOFM required a tightly-knit worldwide operation to compete effectively in this new marketplace. But such worldwide coordination and control required the firm to revisit a previous failure—the development of common global systems. This time, the CEO knew, the firm must carefully target the business opportunities that would best benefit from global systems.

Global business drivers

As illustrated in the case of WOFM, without a shared business vision, developing a common global I/T is costly and may be strongly resisted by country managers. However, failure to unearth integration opportunities can result in losses in efficiency, lost market share to local competitors, or dissatisfied global customers.

The investment required for global systems may be substantial. Even executives committed to globalization may be reluctant to approve such an investment without a compelling understanding of how it will contribute to achieving global objectives. As recently discussed by Daniels and Keen, information technology managers must be proactive to identify information solutions that the firm needs to be competitive worldwide and tie them to strategic business imperatives.[7]

The global business driver approach provides a tool for envisioning the business entities that will benefit most from an integrated global I/T management. The approach provides a rich language

Figure 1 Alignment of global vision with information technology
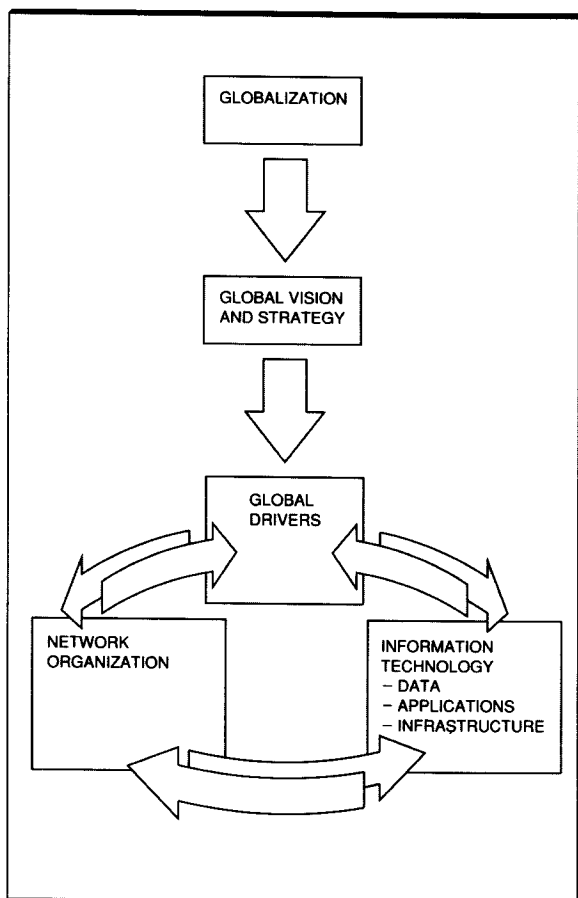
for communicating information technology requirements of a firm's global vision and strategy within the frame of reference of nontechnical executive-level managers. The objective is a close alignment between the firm's global vision and the firm's I/T strategy and architecture (see Figure 1). Our studies of over one hundred multinational firms[8] strongly suggest that if information technology is to add value to international business operations, it must be applied through the firm's global business drivers. Global business drivers (GBDs) are those entities that benefit from global economies of scale and scope, and thus contribute to the global business strategy. Managing or partially managing these entities on a global basis, rather than on a domestic or multinational scale, allows a firm to obtain desired incremental benefits.

GBDs are a means for assessing high-level global information requirements. They focus on broad business entities (e.g., customers, suppliers, orders, projects, storage facilities), and capture current and future information requirements that are shared across dispersed operating units within a firm's business. GBDs focus on shared entities where the meaning, or the semantics, of the data must be consistent throughout the world.

GBDs can be contrasted with critical success factors[9] (CSFs) that are those few things that must go well to ensure success for a manager. CSFs focus on business processes and functions, and address an individual manager's information requirements. They address functions, or views of the data, and tend to be locally driven. However, CSFs can be helpful in identifying global business drivers when they are collected across country units, functional areas, and levels of management.[10]

The global business driver analysis assumes that the most important prescription for successful global implementation of business application is a shared common data model. Commonality in the hardware, systems software, and organizational structures are secondary concerns. Both the technology architecture and the organization's structure can accommodate some amount of international variability as long as: 1) data can be successfully passed from node to node in a communication network, 2) there is shared meaning of data, and 3) an organization-wide agreement exists regarding how work is to be allocated among country units.[11-12] Of course, there may be opportunities to achieve economies of scale within the systems function by instituting a more standardized approach to managing hardware, software, and telecommunications. As we discuss later in the paper, systems economies are not, by themselves, usually compelling enough to justify a worldwide approach toward managing information technology.

Once GBDs are agreed upon, they form the basis for the I/T strategy and an applications portfolio. For instance, the growing commonality among the world's automobile markets, where much of the market is driven by the shared culture of entertainment technologies, makes a common global product, or "world car," a viable option. Such a product could permit significant savings by elimination of redundant product development

Table 1 Analysis of some global business drivers

Global Business Drivers	Analysis Questions	Example Entities
Joint resources	Can you electronically move work to countries with a highly skilled workforce and favorable wage levels? Can you compose and manage work teams with globally dispersed members? Do you manage human resources skills on a global level?	Employee location, employee skill, employee position, work assignments, employee compensation, standard work tools, relationship history between customers and employees
Rationalized and flexible operations	Can you move production around the world? Can you rapidly move knowledge work around the world? Can you share production resources across country boundaries? Are you optimizing plant locations and production planning on a global scale?	Production plan, production schedule, product demand, plant capacity, vehicles, storage facilities
Risk reduction	Do you manage your monetary flows and the associated risks on a daily and hourly basis at the global level? Are you vulnerable to political and economic conditions in particular countries?	Investments, pending investments, foreign exchange, assets, safety of assets
Global products	Are there opportunities for global products and brands? Do you need to launch synchronized product introductions on a global basis?	Product standards, process standards, legal requirements, repair records, marketing plans
Quality	Can you identify the source of a defective component on a global basis? Are you conducting competitive benchmarking on a worldwide basis?	Competitive benchmarks, internal performance standards
Suppliers	Can volume discounts be negotiated on a global scale? Do you know your global position with a major supplier?	Supplier information, parts and material, procurement standards, innovations
Corporate customers	Are your leading-edge customers becoming global? Can you ensure consistent product and service regardless of the location? Can you provide seamless worldwide ordering, order tracking, and billing? Do the needs of global customers provide new business opportunities?	Customer information, customer quality standards, customer product specification, local preferences, preorder history, order status

operations. A former chief executive officer of Ford Motor Co.[13] asked management to strive for "world car engineering." This vision entailed eliminating redundant engineering activities and dramatically reducing the time required to bring new products to markets. The global business drivers of the vision were a global product, rationalized operations, and human resources. An information technology strategy and applications were needed to facilitate the shared management of these entities. At Ford, this required coordinated engineering-release databases, common computer-aided design tools, and a common re-

pository of national environmental and safety laws. Together, these facilitate the manufacturing and marketing of any part or a whole vehicle in any region served by Ford regardless of where the product is designed or engineered.

Examples of global business drivers

Next we describe typical examples of global business drivers and then use the earlier described example of an oil field services firm, WOFM, to illustrate their applicability. We first discuss global business drivers that are somewhat inter-

nally controllable and then turn our attention to marketplace drivers. The list, though reasonably comprehensive, is not complete; firms may have GBDs that are not included among these categories. Table 1 illustrates some questions that are used in the analysis, and also identifies some examples for each of the drivers discussed.

Joint resources. Human resources will increasingly become a key global business driver for many firms. Historically, organizational design focused on efficiently allocating people to work tasks. Throughout the industrial revolution, assembly lines, corporate hierarchies, departmental structures, and the scientific management movement all sought to physically align people so as to most efficiently attack the work. In an information- and knowledge-based economy, the rules are reversed. Information-based tasks can be moved to the worker. Only about 3 percent of the cost of a typical semiconductor, for example, is sand and other raw materials. Much of the remainder of the costs are attributed to workers such as design engineers, research scientists, computer programmers, investment bankers, and lawyers who provide problem-solving, problem-identifying, and strategic-brokering activities. Information-based work of these people, whom Reich[14] calls "symbolic analysts," can be transported, at high speed and low cost, to the lowest cost source of qualified labor.

As knowledge flows replace the material flow in production of goods, firms will learn to electronically share valued human resources on a global scale. Investment bankers, chemical engineers, product designers, accountants, management consultants, and strategic planners possess considerable knowledge of value to customers. The relationships those professionals have established with existing or potential customers are invaluable strategic assets. Carefully chosen investments in employee skills databases, teleconferencing facilities, and electronic-mail and voice-mail can provide the mechanisms to locate and leverage those human resources through a far-flung multinational corporation. In such an environment, team members working on the same product can be scattered throughout the world. Texas Instruments, for example, designs management systems in Japan, Europe, and the Far East as well as in their Dallas, Texas, headquarters using electronically coordinated teams. In addition to the global communica-

tions network, a common computer-aided software engineering tool enables the coordinated effort.

At another firm, managers are beginning to use an experimental system to assemble work teams from around the world. A manager inputs the skills required for a particular team and profiles of the likely candidates. A color picture and description of a prospective team member who might be located (from anywhere in the world) then appears on the manager's computer display. The system can also be used to interview the candidate.[15]

One systems integration company has developed a common set of computer-based training programs that are used in major training facilities in Europe and the Far East. Programs such as those on operating systems and computer languages ensure consistency in systems engineers' skill levels and common terminology. This facilitates the smooth transfer of personnel from one customer account to another regardless of location. The highly interactive educational programs run on a computer mainframe in a regional data center with local interface support from the computer workstation.

Rationalized and flexible operations. Global interdependencies found in operations can be a global business driver requiring integrated I/T solutions. Operational interdependencies might arise from the need for rationalized or flexible production or manufacturing. In *rationalized* operations, different country units build different parts of the same product based on availability of skills, raw materials, or favorable business climate. In *flexible* operations, operations are moved from one country to another, such as in response to labor strife, or raw material or skill shortages. The interdependency among country units is a fairly recent phenomenon in the history of American and European multinational firms that have tended to allow their foreign subsidiaries to operate rather autonomously.[16]

In rationalized operations where the production function is dispersed throughout the world, airlines·might move planes, people, and crews from one country to another. This requires careful international coordination of requirements for passenger reservations, fuel, scheduled and unscheduled maintenance, spare parts, and for the

planes themselves. International freight carriers face similar requirements for globally dispersed production functions. In addition, they must interface with shippers and their agents, freight forwarders, recipients, domestic carriers, insurance companies, banks, and government customs departments. The vice president of distribution for a large United States retailer once reported that he maintained "a binder an inch thick full of required documentation for every major import from Asia."

MSAS, a large international airfreight firm, is currently replacing its many incompatible, country-specific information technology solutions, customer files, and order information systems with one integrated worldwide information system to support its agent network of 291 offices in 29 countries. Running on multiple IBM Application System/400* processors, the system supports a distributed database design. Sixty percent of the data (for example, route pricing) is stored concurrently in computers in each regional center. The remaining 40 percent of the data at each site are data unique to that site. If necessary, however, local data in a country such as Malaysia can be accessed and updated by MSAS computers throughout the world. The system will provide real-time information on the status of any international shipment that the firm has been contracted to handle. If a delay or an exception occurs at any of the predetermined 16 control points, the customer will be notified by MSAS personnel and the exception is explained.[17] The chairman of the company firmly believes that once the system is fully implemented, "half of our business can be processed without manual intervention." According to the director of logistics, "The system will make it possible for us to accept initial bookings automatically, schedule the transportation automatically, and obtain customs' pre-clearance on the documents before the merchandise arrives at its destination."

Flexible operations can also provide new economies of scale. The ability to shift production schedules from one country to another helps to optimally manage manufacturing capacity. Firms also may attempt to share logistics resources as they ship work-in-progress around the world. Others share plants or storage facilities across country units. In 1986 Air Products and Chemicals, Inc., implemented a mainframe computer-based maintenance management system for the United States to manage the inventory of expensive spare parts used to repair plants. Six months later the same system was installed on a mainframe computer in the United Kingdom to provide European-wide coordination of spare parts. Requests for spares from anywhere in the world can now be quickly processed. Even after six years, the two versions of the system remained 99 percent common.[18]

Firms pursuing strategies that entail globally dispersed production functions and rationalized and flexible operations find it necessary to share manufacturing planning systems, process control systems, and work-in-process inventory systems across country boundaries. A large industrial equipment supplier installed a worldwide manufacturing planning and scheduling system to support plants in the United States and Europe. The integrated manufacturing system (e.g., forecasting, master scheduling, order entry, materials requirements planning, inventory control, and factory planning and control) runs on mainframe computers in five different data center locations supporting 20 plants. The operational databases of the systems are separate and reside in each plant; however, the data structure in each database is the same, which facilitates shared meaning of data, and allows rapid access and aggregation of data via a network.

Risk reduction. Another business driver relates to managing the firm's cash flows and assets that are affected by real shifts in currency values. This means diversifying the value of the firm's assets. In the aftermath of the developing nations' bad debt crisis, it became apparent that many international banks did not recognize the vulnerability of their portfolios to investments in similar loans. Part of the problem was traced to the lack of coordination across portfolio managers located around the world. Similar problems occur for multinational firms in managing cash flow, overnight investment of cash, purchases of commodities, or oil drilling leases. In this latter case there is a risk that sister divisions of the same firm might be bidding against each other on the same lease. Currency and security traders face a similar need to centrally coordinate risk, as do treasury managers seeking short-term investments for cash. Central databases, risk management systems, and international communications networks provide solutions to these problems. Portions of a

portfolio can be assigned to particular managers or even handed off from manager to manager via an electronic trading system through a 24-hour trading cycle. In either case, the firm's total risk position can be readily assessed and properly managed. For example, one financial services firm's worldwide risk management system for capital market trading is updated throughout the day, so as to provide "near" real-time information on the instruments being traded by the firm's traders around the world. Instantaneous or nearly instantaneous information lowers the risk associated with foreign instruments due to exchange rate shifts or other economic uncertainties. Instantaneous access to information will also effectively prohibit the firm's traders from bidding against each other. According to a senior executive in the firm, the system is not only helping "the left hand know what the right hand is doing . . . in some ways the system is leading our business. Because of the system, new financial instruments are being developed."

Global products. This business driver is related to products being introduced that are identical or nearly identical across national boundaries. The reasons are varied. First, global products are emerging because of the increasing influence of multinational corporate customers who seek consistency across their dispersed operations. Second, globe-traveling consumers demand products and services regardless of location. Third, global products can provide the basis for economies of scale. Levitt[19] has proposed a fourth explanation for global products; consumer needs and wants are becoming more homogenized around the world because of both communication technologies and travel. Competitive pressures provide a fifth argument for product consistency. The more rapidly and more widespread a firm can introduce a new product, the greater the potential benefits derivable from both market saturation and subsequent low-cost positioning.

Whatever the reason, world products are becoming more common. Rapid development of products that can be easily modified to different national or regional markets requires considerable coordination and control. Tight international coupling will be necessary during the initial stages of product design and concept testing. For example, an automobile designed to be sold in multiple countries must conform, or be subsequently modified, to meet the safety and environmental standards of each selling country. To ensure conformance, Ford, for example, provides designers in its design centers with a global database of vehicle safety regulations. Similarly, in a large engineering firm, a database of previous designs, accessible from throughout the firm, permits engineers in one country to benefit or embellish work performed elsewhere. Recently, this engineering firm merged its European and United States data centers, thereby partially eliminating some barriers to further I/T compatibility. The technology facilitates the firm's vision of being able to engineer and manufacture equipment in any part of the world, regardless of where the deal is signed.

Designing a world product can be difficult. Timely introduction of that product throughout the world can be even more challenging. For example, preparing the necessary marketing literature, training programs, documentation, advertising copy, product warranties, commission plans, and labeling for 30 countries in 10 languages is a daunting proposition. The task is made no simpler by the varying requirements of such items as copyright laws and product labeling. After-sale service, product recalls, and similar activities lead to further complications. In the pharmaceuticals industry, country-by-country testing and approval can consume a large percentage of a product's patentable life. Advances in information technology can help meet requirements of timeliness, consistency, and low cost. One firm, General Electric Co. Plastics, believes that their worldwide communications network is essential for keeping employees up-to-date with the latest products, while ensuring equivalent offerings regardless of location.[20]

Quality. Total quality management is emerging as another key global business driver. As firms benchmark their operations against "world class" standards and as interdependence increases between their domestic and international operations, a requirement for a cross-border approach to quality improvement is gaining force. In many industries, advances in information technology already permit a defective product to be traced back to a particular worker, machine, or supplier. For instance, an apparel manufacturer uses its sophisticated information system and work-in-progress bar code labels as the basis of its employee incentive system. If a customer receives a size or color that was not ordered, the system can be used to identify the worker who

packed the container and instantly adjusts the incentive component of that person's pay. But many companies have yet to fully take advantage of the quality improvement opportunities presented by integrated databases. For instance, an automobile manufacturer was recently required to call back 55 000 vehicles because it was unable to pinpoint the specific cars in which airbags containing one of 135 defective subcomponents had been installed. In a globally interdependent organization, component- or subcomponent-level tracking will become a necessity, with obvious implications for both the development of common systems and corporate-wide standards.

Human resources, quality, operations, and product design are global business drivers for managing the firm's own internal value chain more efficiently and effectively on a global scale. But there are even more compelling global business drivers that manage the relationship of the firm with its business partners, customers, and other external stakeholders. These interorganizational interdependencies are driving firms toward major internal transformations. Information technology is a key enabler of these transformations.

Suppliers. The opportunity to deal with a supplier as one global entity is an exciting potential driver for worldwide integration and coordination. Worldwide procurement offers opportunities for competitive advantage through economies of scale, enhanced buyer power, increased reliability, and the opportunity to redirect shipments among production facilities. For example, volume discounts, once negotiated, can motivate otherwise autonomous plants to rely on preferred suppliers, thus further increasing both the discount and the firm's power over the supplier. Such a shift in supplier power may provide the firm with an opportunity to influence the supplier's subsequent research and development investments, to mandate investments in quality programs, to guarantee the availability of critical inputs in times of shortage, or to be invited to join strategic alliances for the testing and introduction of new innovations. In an industry in which technological innovation is rapid, the advantage will often go to the firm that can most quickly diffuse breakthroughs in materials, components, or tools emerging from their supplier's research and development facilities.

Although such coordination in procurement seems obvious, there continues to be resistance. The following anecdote describes the rocky road that one multinational firm traveled before it finally recognized suppliers as a global business driver and developed a database to support integrated global procurement.

Fifteen years ago a corporate systems director envisioned an integrated procurement system and supplier database. The director felt this could provide value to the firm's many relatively autonomous business units and production facilities. When this vision was shared with the divisional purchasing agents, none were impressed and some were threatened. After several years and a number of division failures attributed to global competition, a corporate head of procurement was appointed. This corporate head also recognized the benefits that could be harvested by a more coordinated approach and once again the business units were invited to participate. Again, there was no interest. After further plant closings and losses due to global competition, the purchasing agents of the larger units formed their own consortium. To the current information systems executive's delight, the consortium asked for assistance in establishing a common supplier database.

Corporate customers. Perhaps the most common drivers of global integration today are customers who are themselves seeking globalization. Such customers will increasingly seek out suppliers who can treat them, to a greater or lesser extent, as a single entity and provide them with consistent service that spans national borders. Providing worldwide support requires rapid and accurate communication and information processing across the firm's country units. For example, Polaroid Corp. is integrating its order management systems in Europe so that a customer can order goods in one country to be shipped to another.[21] This initiative is partially in response to firm remarketers who have purchased Polaroid film in one market and resold it to others, thus gaining a profit from disparities in Polaroid's pricing policy or its slowness to respond to currency fluctuations.

Many firms still find it difficult to provide global customer service. For example, an international oil company sought a computer vendor to help it

establish an office automation network that would interconnect the 60 countries in which the firm does business. The hardware consisted of personal computers on the desktop of professionals and secretaries (over 20 000 estimated users), mini- or mainframe computers as office processors, and a global network that would connect all office processors. The hardware and software was to be installed and maintained by the computer vendor's various country offices. But the customer wanted to do the planning for the system out of its offices in the United States. The bill for the system was to be divided up among the customer's several regional offices. The master plan called for identical computer terminals, but with the capability to handle the local language for screens and printed reports. All user documentation was required to be in the local language.

Such requirements are a nightmare for a vendor organized as a collection of autonomous national units. Each of the vendor's country units may still have its own billing procedures and local commission and installation plans. The ramifications are particularly far-reaching for accounting systems that have to handle payments stretched out through time and originated from many sources. The freight forwarder, MSAS, for instance, frequently established separate accounts in several regional offices for the same customer.[17] MSAS recognized that a supplier who could successfully coordinate its international services via globally integrated databases and common systems would have a decisive advantage in serving a multinational customer as a unified worldwide entity. Firms that cannot meet their global customers' requirements will lose in competition to suppliers who can. In the past, this might have meant a small lost exporting opportunity. Now the threat is the potential loss of all or a sizable share of the entire worldwide account. For example, one corporate customer we recently interviewed compared the responses of two value-added telecommunications suppliers when asked to put together a global electronic mail network: "Our regular supplier gave us a list of office phone numbers for their foreign subsidiaries and wished us luck. The other [supplier] told us they would handle the complete job, from specification to training and installation in all of our remote locations. They got the job, and are now getting a big share of our domestic business."

Providing for the unique needs of global customers can also be the source of new business opportunities. QAD, a software company with head-

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Global drivers can address both the internal value chain and the external partners of the firm.
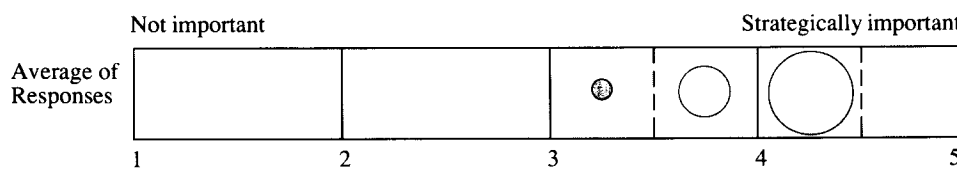
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quarters in the United States, designed their manufacturing, financial, and distribution management software to focus on integrated global companies whose requirements were not satisfied by regionally focused software vendors. The manufacturing and distribution management software system runs on a wide range of platforms from personal computers to networks, in mini- and mainframe environments, under a variety of operating systems. The product also provides multiple currency transactions in all modules, support for local tax structures, and concurrent multiple language capability. Ten languages are supported.

Applying the global business drivers. In summary, global drivers can address both the firm's internal value chain and its external partners and constituents. As shown earlier in Figure 1, GBDs serve to catalyze the common global vision and business strategy of a firm. Table 1 illustrates questions that may help to uncover GBDs and also identifies some examples of business entities that might be globally shared in an I/T solution supporting a particular GBD.

In Table 2 we illustrate some GBDs by industry. The data represents averaged survey responses from 105 multinational organizations with headquarters in the United States. The respondents were asked to indicate the importance of particular global business drivers in a business unit that was the most globally integrated.[22] For example, the transportation companies such as shipping lines and freight forwarders rated global corporate customers as the most strategic GBD. Table 2 must be viewed cautiously because the GBDs of individual firms are likely to differ widely in any

Table 2 Importance of some global business drivers by industry

Industry	Number of Responses	Global Business Driver						
		Joint Resources	Flexible Operations	Rationalized Operations	Risk Reduction	Global Products	Scarce Supplies	Corporate Customers
Transportation	5	○	○	○	○	○		◯
Financial Services (noninsurance)	12		○		◯	○		◯
Petroleum	14	○			◯		◯	
Petroleum-Related Manufacturing and Services	5	○	○	○	○			○
Mining	4	○			○		◯	
Computers and Communication	8		○	○		○		○
Semiconductors	2	○	◯	○		○		◯
Aerospace Manufacturing	9			○				○
Motor Vehicles	10			○	○	◯		
Other Manufacturing (i.e., supplies to global firms)	11		○	○		○		○
Foods and Consumer Goods	8			○		○		
Chemicals	12			○	○			○
Pharmaceuticals	3	○	○	○		○		
Medical Equipment	2		◯	◯		○	○	

	Not important				Strategically important
Average of Responses			○	○	◯
	1	2	3	4	5

industry; GBDs are closely tied to the particular global strategy a firm or a business unit is pursuing at a given time.

An analysis of global business drivers could have helped WOFM (the disguised oil field service firm previously described) better prioritize their global systems requirements. They were being pushed by their corporate customers toward consistent standards of performance and service on a worldwide basis. Global customers, world products, and worldwide quality standards are emerging in this industry as global drivers. Foreign competition forces a firm to look for major cost-saving opportunities. WOFM frequently looks outside of the United States for suppliers—another necessity that is a potential global driver, though probably only for a relatively small number of items. In the future, the high cost and shortage of qualified engineers within the United States may force WOFM to move product development to locations outside of the United States or to share it across globally dispersed locations. That requirement, and the need to promote personnel from throughout the company, may turn human resources into a global driver as well.

WOFM's management has chosen a growth strategy focused on providing consistent and integrated customer service to worldwide customers. The requirements of local customers will essentially remain in the hands of country management. However, a set of global products and a single customer database will be required to serve worldwide customers. The satisfaction of the requirements of global customers appears to be the best starting point. Here the benefits of successful integration are shared throughout the firm and the risk of failure to meet key customer requirements will be obvious to all.

Caveats of the analysis. While the benefits of GBD analysis can be great, there are a few dangers. First, the analysis can be performed at too high a level. "Global competition," "unified Europe," "joint venturing," "the opening up of Eastern Europe," "global markets," and "Pacific rim" are phrases that can quickly capture management's attention and may be life-and-death concerns for many firms. But such generalities are far removed from the day-to-day realities of running a business. The analysis using GBDs must emphasize the specifics of the business, their suppliers, distributors, products, and customers.

Another danger in the analysis comes from failing to recognize differences within the firm. Global business drivers are seldom exactly the same across business units. Although there may be opportunities to build synergy across businesses, the richest opportunities are at the business unit level. For example at Air Products and Chemicals, Inc., global corporate customers are a much more important driver for the Chemicals and Process Systems groups than for the Industrial Gases division.[23] Similarly, in the downstream petroleum industry, global corporate customers are rarely a driving force, but the airlines and shipping firms that are customers of the petroleum company's aviation and marine fuel businesses have for many years required integrated global support.

The third danger is related to cultural differences across country units that may make it difficult to reach consensus initially on the GBDs. For example, Kanter in her recent article demonstrates that there are sharp differences across countries in the factors thought to contribute to a firm's success. While United States managers rated customer service as the most important element, West German and Japanese managers, respectively, thought that work force skills and product development were most significant.[24]

The fourth danger comes from the lack of senior business management involvement in the GBD analysis. Senior management must be willing to sponsor and participate in the GBD analysis and play a leadership role in the move to an integrated global information technology.

Alignment in the networked organization

Global business drivers are tools to envision and communicate the global requirements of information technology. The prescribed systems and databases, however, will provide few benefits without an organizational infrastructure that is capable of delivering and using them. A new type of organizational form, the electronically-wired network organization, can help satisfy the global consistency and efficiency requirements, while simultaneously maintaining local responsiveness, flexibility, and accountability. We next discuss this new organization form required to harness global business drivers.

We generally think about organizations as hierarchies because, as business historian Chandler has shown,[25] that type of structure has typified successful firms. A hierarchical structure often proved to be the most effective as firms expanded internationally and encompassed multidivisional, multifunctional organizations. Firms like E. I. Du Pont de Nemours & Co., General Motors Corp., Siemens A.G., and Matsushita Electric Industrial Co., Ltd., exploited this type of structure during the first half of the twentieth century. Dubbed the "M-form" organization by economist Williamson,[26] this approach to organization helps generate economies of scale and creates cost advantages through centralized global-scale operations. In the M-form organization, information flows up to the center of the organization and instructions flow down to the local units.

Not all global businesses, however, work best using this structure. Some, for example, require a strong local presence in various countries in order to achieve the sensitivity and responsiveness necessary to satisfy national differences. Unilever N.V., though recently restructured,[27] operated very successfully for many years using this strong local-presence model. In this type of company, information is, for the most part, developed and retained for use at each local site.

Both of these approaches have deficiencies for competing in today's global environment. The M-form lacks the speed and agility necessary to respond effectively to dynamic global markets. It was designed to manage high volumes of consistent, stable activities. The decentralized, local dominance form misses the global view by focusing on the local view. It forsakes opportunities for the firm to deploy its resources, and to disperse its value-chain activities dynamically to the location that can provide the most competitive advantage.

The networked organization was conceived to deal with these deficiencies. In order to create a network, a business clusters its assets and competencies in units (nodes) spread throughout the world so that they are dispersed, interdependent, and specialized. That is, functions are performed at a node where they are best done. Furthermore, not all of these nodes must be owned or managed by the firm. They can result from a strategic alliance.

Reich, providing a rich image of the networked organization, describes it as the "new web of enterprise,"[28] one that resembles a spider's web. Strategic brokers—that is, executives who manage ideas rather than material things and coordinate the activities of others—are at the center. However, there are all sorts of other connections and activities being conducted that do not involve these executives directly. In addition, new connections are being spun (created) or undone all of the time.

According to Miles and Snow, this "dynamic network" organization has four major features:

1. *Vertical disaggregation.* The firm's value chain is dispersed globally and its business functions, such as product design, development, manufacturing, marketing, and distribution, are performed by independent organizations within a network.
2. *Brokers.* Since each function is not necessarily part of a single organization, business groups are identified, assembled, placed in a location, and coordinated by means of brokers.
3. *Market mechanisms.* The major functions are held together primarily by mechanisms such as transfer prices between business units rather than by the plans and controls typical in a hierarchical organization. Contracts and direct payment for results are used as tools of management control more frequently than are progress reports and personal, hierarchically-based supervision.
4. *Full disclosure information systems.* Widely accessible computer-based information systems are used as substitutes for authority relationships and lengthy trust-building experiences. (Trust, however, is still very important to ensure the proper sharing of accurate and formerly proprietary information.) The participants in the network agree on a general structure of payment based on the value they add. They then hook themselves together in a continuously updated information system so that each contribution can be mutually and instantaneously verified.[29]

A prototype illustration of alignment among business strategy, network organization, and I/T in operation can be found at Rosenbluth Travel Agency Inc.[30] Rosenbluth, whose home office is in Philadelphia, Pennsylvania, is one of the five largest travel agencies in the United States. Since

1980 it has grown from a regional agency with annual sales of $40 million into what Miller, the firm's chief information officer, calls a "global virtual corporation." Annual sales now exceed $1.3 billion. Responding to an opportunity to satisfy the needs of global customers who travel between countries, the company formed Rosenbluth International Alliance (RIA) and entered into partnerships with some 34 local travel agents spanning some 37 countries. The alliance's niche strategy is to provide high quality local service for a globe-traveling corporate customer regardless of where the customer might travel. Information technology is the loom that weaves the alliance together and provides RIA's global presence. According to Miller, "Information technology enables the company to coordinate travel services throughout the world. Using relational database technology, specific information concerning clients and travelers is available anywhere in the world to provide superior service to the global traveler. And, through I/T, information can be consolidated across the world to coordinate decision making, and to leverage global purchasing power."[31] A global information system is also used to keep track of the payments and commissions system that binds RIA together. The alliance also spreads the costs of the global I/T infrastructure across the member firms.

A global alliance requires that we decide on the best organizational relationships to establish. Reich identifies five basic forms of relationships that can be instituted between an organization and its nodes in order to create a global network:

1. *Independent profit center*, where authority for product development and sales is pushed down to each node. In this case the node is owned but is rather autonomous.
2. *Spin-off partnerships*, where independent businesses are spawned from the main organization using former employees and assets. The node then contributes to the organization on a contractual basis.
3. *Spin-in partnerships*, where ideas and unique assets from external groups are acquired or set up as separate units and become nodes in the organization itself.
4. *Licensing*, where the headquarters contracts with independent businesses to use its brand name, sell its special formulas, or market its technologies.
5. *Pure brokering*, where the headquarters contracts with independent businesses to solve problems, perform knowledge-based activities, or to undertake direct production or service activities.

Using these categories, RIA is best described as a spin-in partnership. Each partner has an equal vote and an equal say in decisions facing the alliance. In addition, RIA relies on the services of Apollo, an airline reservations system. All members of the alliance access the various functions through Apollo. Apollo provides the normal reservations services as well as a conduit to a customers' profile and itinerary information. Forthcoming front-end interfaces will provide alliance members with easy-to-use access to the functions of the system. An electronic mail system provides direct connections between alliance members.

Global cooperative information processing relationships have also become common among airline reservations systems providers and among global transportation firms. Industry convergence on electronic data interchange (EDI) standards allows a reservation clerk in Europe to access a reservation stored on AMR Corp.'s SABRE** system. The long-term goal of the industry alliances is that a reservation taken anywhere in the firm is nearly instantaneously updated in different reservations systems in the alliance. Similarly, GLS Worldwide, an alliance between Lufthansa, Air France, Cathay Pacific, and Japan Airlines Co. Ltd., was created to develop an automated cargo information system. The system will connect the regional distribution systems of different firms at a global level and provide shippers and forwarders with direct access to the in-house computer systems of the airlines to enable them to make cargo reservations and track shipments.[4]

Information technology makes these new organizational relationships possible on a worldwide scale. Ownership and traditional hierarchical structures are no longer required to provide effective and coordinated worldwide operations.

Keys to successful implementation

We have proposed that global business drivers can serve as the basis for focusing global information technology investments toward areas with immediate and substantial worldwide payoffs. Yet, moving toward globally-integrated systems

is a journey with many pitfalls. Not the least of these is an over-reliance on systems savings as a justification for global sharing. Too often the push for global systems comes with the intention of avoiding investments in apparently redundant systems. Systems already in use or under development at a central headquarters are used as a readily available, "quick and dirty" solution to an apparent lack of technology base in foreign operations. Unfortunately, as we saw illustrated at WOFM, these solutions tend to fail more often than they succeed. Attempting to save systems investments without simultaneously applying global business driver approaches is a recipe for failure. Subsidiaries see little or no gains from adapting to headquarters' solutions; instead, they are likely to anticipate a loss in their own autonomy.

But ensuring appropriate alignment with global business drivers is still no guarantee of success. Next, we discuss a variety of approaches for overcoming barriers to global systems. Among these are managing project risk, utilizing partnerships, and building global infrastructure.

Project risk. Global systems tend to be high risk projects. McFarlan divides risk into three categories: size, structure, and technology.[32] As we describe below, global projects typically score high in all three dimensions.

Global projects tend to be large. An executive in charge of international financial systems commented, "We seldom work on a system with less than three quarters of a million lines of code and that doesn't require an IBM 3090* processor to run." Such projects can span multiple years, even if developed in phases. For example, Ford's Worldwide Engineering Release system, which provides a standardized, computer-based format for all engineering release documents, took more than five years to develop. We previously described a risk management system developed by a financial services company; that project began in early 1984 and was finally operational in all major trading offices in 1990. MSAS, the global freight management company, initiated its global operations support system in 1986; by May of 1992, after a specification freeze, major delays, cost overruns, a change in systems architecture, and the involvement of over 100 development personnel, the system was nearing firm-wide implementation.[17]

Long development cycles introduce problems related to diverted resources, inflated user expectations, and lost project champions. There is also the risk that a gap will emerge between the business strategy the system was designed to support and the strategy the company has evolved toward while the system was under development. For example, one information systems manager we interviewed observed, "We have been working on this system for five years and we have never once operated from a level table; our company has undergone dramatic changes via functional reorganizations, new acquisitions, joint ventures, etc. Since the project started, both the president of the company and the project's original sponsor have left. After every management shake-up we've had to resell the project."

As this example illustrates, structure, or the lack of it, is another contributor to project risk. The requirements for global systems are frequently difficult to specify with sufficient accuracy in advance. Undiscovered differences in the way the business is conducted in different countries, local customer requirements, government regulations, or the evolving needs of a global customer can all introduce uncertainty. In a firm operating in multiple countries, no single individual at the beginning of a project is likely to be familiar enough with operations to have a good understanding of the degree of commonality or local requirements that exist across worldwide operations. The differences that emerge can often be dramatic. An engineering firm working out of the United States, for instance, typically interfaces only with its contractors; its European division, however, orders materials for the contractor, negotiates directly with subcontractors, and provides considerably more detailed instructions about work to be performed. Obviously, this has important implications for a system designed to aid in construction project management.

The final element of project risk, unfamiliar technology, is also common with global systems. Even if the technology is mundane to headquarters' personnel, it is likely to be a large leap forward (or backward) for other parts of the organization. Technological solutions that have worked well at the headquarters might not be available elsewhere in the world. Even if they are, the level of support may be far less than headquarters' personnel are accustomed to. Vendors, particularly software vendors, frequently rely on

agents to distribute and support products in some parts of the world. Some vendors will refuse to market software products in certain countries due to weak or nonexistent intellectual property rights legislation. Even if vendors have worldwide operations, local representatives will tend to provide service commensurate with local commissions and standards of performance. Communications vendors, often arms of local governments, may be unresponsive or present major obstacles to progress. Moreover, local country unit systems personnel may have vested interests and significant investments in existing local systems solutions.

The risks of global projects can be reduced. Large projects can be broken into phased deliverables, vendors offering worldwide support can be relied on, and country units converted one at a time. Initial resistance can be overcome by demonstrating feasibility in a country that has the most to gain and the least to lose from joining in a global solution.

Partnerships. Partnerships are one of the most important risk management approaches. Both the lack of structure and the various contributors to technological risk inherent in global projects suggest that both external and internal project integration techniques will be required to reduce project risk. External integration teams can link the systems developers to business representatives to help overcome the lack of structure. Internal integration mechanisms, such as technical design review committees, help to mitigate the risks associated with unfamiliar technology.

Partnerships between headquarters and subsidiary I/T organizations and user areas are critical; no single group or individual is likely to have a complete picture of where similarities and differences lie. A global project manager noted, "The two biggest challenges in getting worldwide requirements are understanding the local customs and distinguishing between what is done because of real local requirements and that which is done because it has always been done that way." Steering committees drawn from systems and business areas and across geographical boundaries can provide an executive level review board. At this level cross-border re-engineering opportunities can be explored, priorities established for particular systems development projects, development responsibilities assigned, and agreements negotiated as to how systems costs will be allocated.

Successful global projects often employ an international design team. The international composition means that the team lives in a multicultural environment on a day-to-day basis, and reflects the environment that the resulting system must accommodate. For example, the design team for a worldwide logistics system included eight people located in two locations in the United States, six located in the Far East, and five others in France. The project manager worked in a location in France. The team met quarterly with their international executive steering committee. Between meetings the design team made heavy use of information technology infrastructure to coordinate their activities. They used the same systems development methodology, computer-aided software engineering tools, and worldwide corporate data standards. Modules to be developed were assigned depending on the expertise within each country unit's systems development staff. Electronic mail was used extensively for daily communication among the team members. Electronic mail bridged the time zone differences and helped to maintain (but not necessarily create) personal relationships between the business and systems personnel.

Infrastructure. The lack or incompatibility of standards in communications and computer infrastructure is a major problem in developing global systems. In the area of communications, these inconsistencies are caused by monopolistic firms that control what communications equipment can be sold and used in a country. In the mid-1980s, for example, a firm that wished to establish an offshore software development operation built a satellite transmission facility for the country. They then were forced to turn the facility over to the government communications agency that leased time back to the firm.

Hardware inconsistencies can also result from governmental policy. To protect their domestic computer industry, several countries have placed limits on importation of computing equipment and services. For example, one executive told us that in Indonesia all equipment must be purchased by a local distributor; if the local distributor does not sell a particular product, it cannot be used in the country.

Human resources can be another infrastructure-related barrier. There will be significant levels of difference across countries in terms of computer

expertise and acceptance. In some environments, systems personnel will be few in number and poorly trained. Consulting expertise may also be difficult to obtain. In such environments, firms might choose to provide support from facilities located elsewhere.

But great inconsistencies in infrastructure have usually been brought on by the firm's own management. The comment of one information sys-

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The winners will be the firms that can align worldwide information systems with integrated global business strategies.

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tem executive is typical of many we interviewed: "Our worldwide standards are a joke—we are unified only by a common logo." Often there has been no concerted effort to settle on a consistent worldwide information technology infrastructure. As one executive noted, "If you examined our worldwide hardware portfolio you might imagine that we had gone to a vendor convention with the sole intention of satisfying everyone by acquiring some of their equipment." Even organizations that sought consistency were often driven by economic disparities to incompatible solutions. For example, the high costs of telecommunications in Europe throughout the 1980s drove many systems groups to distributed processing solutions. Meanwhile their sister organizations in the United States were settling on centralized processing approaches. The relative costs of hardware and labor have forced similar choices of incompatible architectures in business units throughout the world.

Some firms have tried to enforce connectivity across platforms by centralizing all hardware and software acquisitions. For example, in one upstream petroleum company, the approval of the director of the global information system has been required prior to the purchase of any piece of hardware (except stand-alone personal comput-

ers). Other systems executives have negotiated worldwide contracts for software applications, thus providing an incentive for widespread adoption of consistent solutions. Still other firms provide compatability through the consolidation of data centers; large semiconductor manufacturers, among the most globally integrated of industries, are consolidating their worldwide operations into two or three data centers.

Other barriers. A variety of other hurdles await the developer of global applications. Profit and loss responsibility often lies at the country level, complicating project prioritization and allocation decisions. Local country units may expect global systems to provide the same functions as their current systems and may be reluctant to convert from those current systems. Cultures also differ in the use of and importance placed on information in decision-making and control activities. Language presents predictable problems though the firm may have settled on a single official language. Even then, however, there will be major failures in interpersonal communication. Shop floor or customer interface systems probably will need to be in the local language. The common modules of systems are usually developed in English, but exit points for (or branches to) modules accommodating local requirements and language must be provided. Often, these modules are themselves written in the local language. Currency translation is another obvious requirement; it, like many other barriers, is one that European and Asian systems developers are often far more familiar with than their counterparts in the United States. Transborder data flow restrictions, predicted during the 1980s to be a major concern, apparently have had little impact outside of the area of human resources.

Conclusion

Information technology simultaneously drives and facilitates global business. Worldwide networks of computers are inexorably transforming the nature of business even as firms seek to harness this technology to the task of managing that transformation. The winners in this global environment will be the firms that can align worldwide information systems with integrated global business strategies. The synergy that develops from a close strategic linkage between I/T and business strategies will be central to success in highly competitive global markets.

Global business driver analysis helps to identify the business entities where global coordination can provide a competitive advantage and where an integrated global I/T portfolio and infrastructure can realize that advantage. But dangers lie in wait for even the best aligned project. The size of the global I/T projects, the complexity of the environments, the geographical distance, the disparity of available I/T solutions across countries, and the strong likelihood of resistance from subsidiaries all combine to significantly increase the risk and potential magnitude of failure. Cultural and language differences further raise the risk. Managing that risk requires that we focus investments in global systems on those applications where the payoffs will be high. Global business drivers provide the criteria for such a prioritization scheme. Once identified, such drivers can be nourished by, or help define, a network organization. Global applications and databases must be readily accessible throughout the network, whereas local I/T solutions ensure the flexibility required in dealing with problems and opportunities unique to local environments.

We believe that for most industries, the trend toward globalization will only be avoided by focusing on narrow niche markets. As global markets evolve, many previously successful firms will immerse themselves in the unsuccessful concentration on worldwide approaches. Entire industries, such as customs brokerage or freight forwarding, may disappear as integrated information systems transform traditional industry boundaries. Other industries and businesses will evolve that uniquely serve these new global markets. We believe the winners in this chaotic environment will be those firms that understand how information technology is transforming business and then can harness that technology to integrated global business strategies.

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**Trademark or registered trademark of American Airlines, Inc., a subsidiary of AMR Corp.

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