

goals called for accelerating revenue growth, identifying and quickly developing new income streams from emerging market segments, and establishing itself as an industry leader. The first phase established the EMC Enterprise Storage Network™ (ESN) at the company's headquarters to support corporate SAP R/3 operations. The second phase brought the Microsoft Exchange environment, currently supporting 9,000 users and rapidly becoming a lifeline for business communications, under the same high availability of the IT environment as SAP R/3. In the third phase the company broadened the ESN to tie into their information infrastructure the rapidly growing number of applications such as ERP (SAP), customer relationship management (CRM), supply chain management (SCM), and data warehousing (DW). These applications in turn support the company's business processes that are carefully mapped to corporate goals and strategies. By placing information at the center of this environment, the company is well positioned to make sound business decisions based on timely information, adjust rapidly to changing business conditions, maintain tight control over manufacturing, order processing, and distribution functions, and maximize customer satisfaction. The following results have been achieved: significant improvement in company's performance, \$510,000 annual savings in people costs, \$1.4 million annual savings for disaster recovery contract, and others.

AGILE ENTERPRISE

The mass production of standardized goods was the source of America's economic strength for generations. But in today's turbulent business environment, mass production no longer works; in fact, it has become a major cause of the nation's declining competitiveness. The most innovative companies are rapidly embracing a new paradigm of management – mass customization – which allows them the freedom to create greater variety and individuality in their products and services at desirable prices.

New ways of managing, together with new technology, now enable savvy businesses to provide each customer with the attractive “tailor-made” benefits of the pre-industrial craft system at the low cost of modern mass production. Companies that have discovered and successfully implemented mass customization are swiftly outpacing their competitors in gaining new customers and achieving higher margins.

Among the firms that are leading their industries to this new frontier are McGraw-Hill, which can deliver custom-made classroom textbooks in quan-

Table 2-2: Evolution of the Factory

Factory Focus	Mass Production	Flexible Production	Mass Customization
Period	1900 - 1970	1971 - 2000	2001 - 2020
Typical Number of Machine-tools	150	50 - 30	25 - 20
Products Made	10 to 15	100 to 1000	Unlimited
Products Reworked Due to Poor Quality	25% or More	0.02% or Less	Under 0.0005%

Source: *Business Week: Special 1994 Bonus Issue*, p.158.

tities under 100 copies; Motorola, which can manufacture any one of 29 million variations of pagers within twenty minutes after receipt of the order.

The evolution of the factory is shown in Table 2-2.

Flexible production is characterized by the integration of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) under the supervision of Management Information Systems (MIS) and within an environment of Office Automation (with e-mail). This type of integration is called Computer Integrated Manufacturing (CIM), and in a broader sense - Computer Integrated Operations. This programmable technology may deliver 100 to 1000 different products, or, still standardized ones for a given group of customers. The next step in the development of the factory is the creation of variety and customization through flexibility and quick responsiveness to individual customer needs.

Mass customization is emerging, and is caused by the following factors (Pine II, 1993):

- Demand for individual products has been unstable. What used to be a large demand for standard mass-market products has fragmented into demand for different “flavors” of similar products.
- Because demand has fragmented, the large, homogeneous markets have become increasingly heterogeneous. The niches are becoming the market, shifting power to buyers who demand higher-quality goods that more closely match their individual desires.
- Along with a shorter development cycle comes a shorter product life cycle. Driven by the need to more closely fulfill customer desires, products and technologies are constantly improved upon and replaced.

Advances in the speed, capacity, efficiency, effectiveness, and suitability of IT constantly lower the cost of increased mass and customization in service as well as in production. One can recognize the following ways of managing mass customization:

- The integration of CAD, CAM, MIS, and Office Automation systems into one Computer Integrated Operation, which is reprogrammable and reduces setup and changeover times, and lowers run size and the cost of customization.
- Just-in-time delivery and processing of materials and components that eliminate process flaws and reduce inventory carrying costs.
- Compressing cycle times throughout all processes in the value chain, which eliminates waste, decreases costs, and increases flexibility and responsiveness.
- Producing upon receipt of an order instead of a forecast, which lowers inventory costs, eliminates fire sales and write-offs, and provides the information necessary for individual customization.

The new competition on total process efficiency results in joint management/worker involvement in defining and improving the process: the integration of *thinking and doing*. This attitude leads to the elimination of waste in the process.

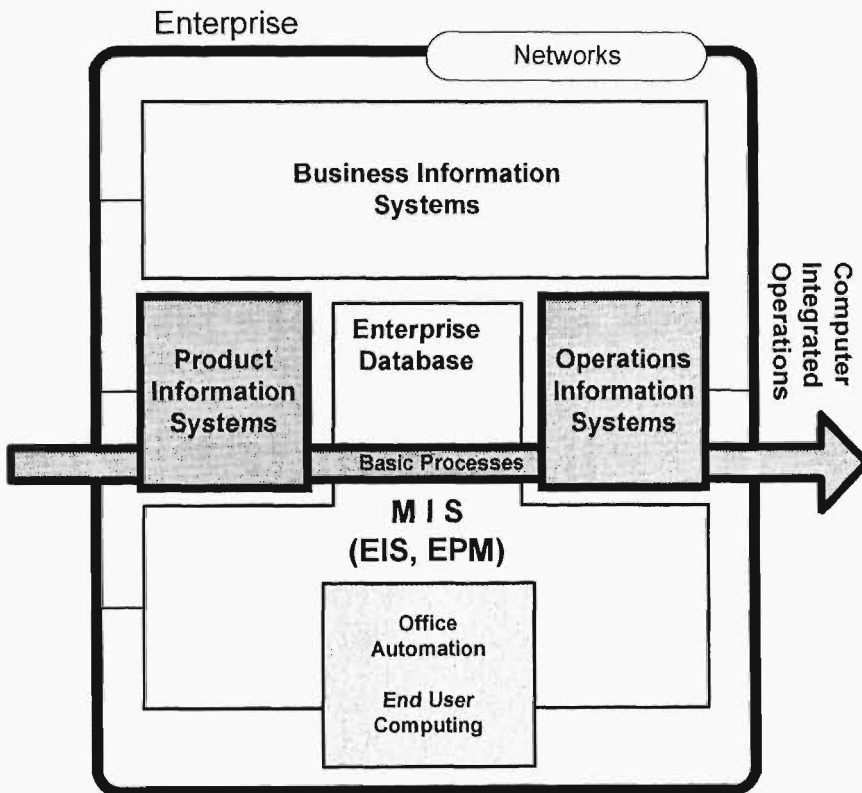
One example is the perception that work-in-progress (WIP) is no longer a buffer and hedge against uncertainties of the process and the market, but rather it is waste that adds costs and inefficiency. One measure of this is WIP turnover: the ratio of total sales to the value of the WIP inventory. In the late 1970's, when American automobile manufacturers were operating about 10 WIP turns a year, Japanese caretakers were between 50 and 200; by 1982 Toyota was turning over its WIP inventory more than 300 times due to the just-in-time system (Abegglen and Stalk, 1985). Abegglen and Stalk estimate an increase of 35% to 40% with every doubling of WIP turnover through the just-in-time-system. This is certainly a positive factor.

It is 2010, and you need a new suit—fast—for overseas business trip. No problem. You head to the department store at the mall. You step into a kiosk-like contraption, and an optical scanner automatically

measures your body. Seconds after you record your choice of style and fabric, the information is relayed to a plant, where lasers cut the cloth precisely to your size. A few days later, the suit is ready (*Business Week*, Special 1994 Bonus Issue, p. 158).

Not only clothes, but a huge variety of goods, from autos to computers, are manufactured to match each customer's taste, specifications, and budget. Mass customization marks the synthesis of the agile enterprise. Some of the production work that went offshore in the 1980's has been returning in the 1990's. One reason is that companies have discovered that moving products through an international pipeline eats up more time than the labor savings are worth. Items that have come back to agile factories range from some of Caterpillar Inc.'s huge earthmoving equipment, for a while made in Korea, to

Figure 2-4: A Model of Agile Enterprise



computer modems from U.S. Robotics Inc., which used to outsource the production of components to Mexico.

The agile enterprise might do more for U.S. employment than the post-industrial work that was supposed to supplant manufacturing. Nobody expects blue-collar jobs will grow. Agile factories will be smaller, with fewer but smarter machine tools that need only token human care—yet they will turn out a far richer variety of goods. So, shop-floor employment is heading the way of farm labor. However, agile technology is also spawning new white-collar jobs in support industries, just as modern agriculture has created a myriad of jobs in packaging design, food engineering, marketing, and other services (Port, 1994). A model of an agile enterprise is shown in Figure 2-4.

The number of U.S. workers employed in manufacturing in 1998 has fallen by 3.2 million since the peak of 21 million in 1979. Yet the manufacturing output has remained stable as a percentage of the gross national product. As these factory jobs vanish, a new manufacturing-driven economic sector is emerging—industries such as computer software, robot making, and countless services that add jobs to supply leaner manufacturing operations. These support industries, with their high component of knowledge skills, constitute nothing less than a second tier of the manufacturing industries. A smaller percentage of the workforce will be in production, but a much larger percentage will be supporting that. Systems analysts, computer programmers, and software engineers will increasingly be selling their wares around the globe.

INFORMED ENTERPRISE

Once the installation of computer networks and the integration of enterprise systems has been completed, companies look for the added value that information systems can bring to management and business. So far the computerization of information processing has been based on automating information routines and integrating them into a cycle of “planning—control.” This approach is called OLTP—On-line Transactions Processing, while the next step in computerization leads to OLAP—On-line Analytical Processing, containing such systems as EIS—Executive Information System, EPM—Enterprise Performance System and others.

As IT has automated blue and white-collar jobs, achieving unprecedented speed and consistency, it has also robbed workers of whatever skill and gratification they might retain, and has increased the impersonality and remote-

ness of management. The same technology, however, may “informate,” empowering ordinary working people with overall knowledge of the production/service process, making them capable of critical and collaborative judgment about production/service and distribution/sales. As these new opportunities unfold, the function of management and the conventions of work organization are being transfigured. Ironically, Zuboff (1988) argues, if those in command choose to automate rather than “informate,” many commercial advantages of the computerization will be lost.

An informed enterprise is such one where its information resource can generate a value added knowledge about its business/organizational processes for the purpose of optimizing decision making.

We know that the source of wealth is knowledge, a uniquely human attribute. If we apply knowledge to tasks we already know how to do, we call it *productivity*. If we apply knowledge to tasks that are new and different, we call it *innovation*. Only knowledge allows us to achieve these two goals. The next step in the enterprise evolution is the development of computer-driven knowledge management.

Knowledge is composed of scientific data, rules, laws, and behavioral patterns that are used to interpret a given concept (*increasing awareness of a decision-maker*) and choose (*applying his/her wisdom*) among actions to achieve established goals/objectives. Knowledge may be recorded in an individual’s brain or stored in the enterprise’s processes, products, systems, and documents. Such intellectual capital requires investments and recognition.

Knowledge management, the process of capturing a company’s collective expertise, is big business; about \$5 billion is paid annually to consulting firms. Knowledge management is appealing to companies ranging from Big Six consulting firms to Big Three automakers.

A variety of information systems can make up knowledge management systems (KMS):

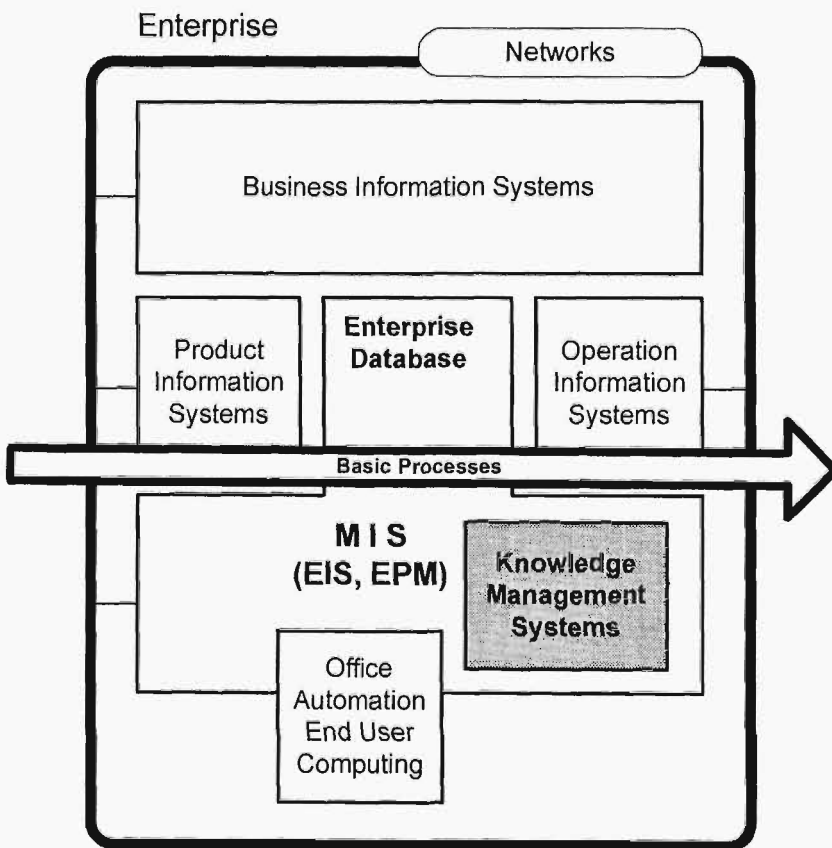
- Decision Support Systems (DSS),
- Expert Systems (EXS),
- Data Warehouse, Data Mart, and Data Mining,
- Neural Networks,
- Artificial Intelligence,

- Groupware, and
- Other.

The architecture of an Informed Enterprise is shown in Figure 2-5.

The backbone of KMS is a data warehouse and data mining. A *data warehouse* is an extract of the most important data from a production database. The latter is usually closed for end-users, which could harm it either on purpose or unintentionally, due to a lack of skills. *Data mining* is a process which uses mathematical algorithms to find patterns in data, for example, about customers' behavior. Perhaps the first solution of KMS was the emergence of enterprise information portals in 1999, also called corporate portals, enterprise knowledge portals, and collaborative portals⁴.

Figure 2-5: A Model of Informed Enterprise



Knowledge management is the broad process of locating, organizing, categorizing, storing, retrieving, accessing, transferring, interpreting, and using expertise within an enterprise. Knowledge contains everything from creating a filtered newsfeed containing competitors' press releases, to assessing patent portfolios to identify licensing opportunities, to providing initial and continuing employee education.

Networked computing environments facilitate users' easy access to unstructured information in a narrative text form from different internal and external sources. Very often it contributes to information overload, the antithesis of knowledge management. The task of good knowledge management is to structure information under the form of scientific data, rules, laws and their systems as well as behavioral patterns of stakeholders.

Consider the following scenario: Tim is the manager of a retail chain that specializes in upscale travel gear. When he reviews the monthly reports he sees that sales and profits for most of the franchises are down, for the third month in a row. Bad news, he thinks, we really have to do something. The question is, what? Reduce overhead, change the product line, increase the marketing and advertising effort, change the management team, or close some of the stores?

This dilemma provides a simple illustration of the most common information problem, and the facts are not enough. Instead, the facts have to be seen within a context to give them meaning. In this case, the context includes information about other retailers in this market, information about individual products in the product line, details about the relative performance of the franchises to one another, changes in the productivity of the employees, and news that might affect business in general. Only within such a context do performance statistics become truly valuable as the basis for making an informed decision.

By generating a variety of other performance reports, Tim can get answers to his questions about how various stores and products performed relative to one another. He notes that the stores in the Southwest are doing particularly poorly, but that the corporate ad campaign and promotional sales increased sales at all locations, including the underperforming stores. By displaying and sorting several news items to which he subscribes, he finds that the largest

employer in that area recently announced major layoffs, which would help explain the substandard performance of those stores. By querying his company's database on competitive information, he finds that the competitors' nationwide results are even worse. And by checking his travel statistics, he sees that pleasure travel is at its lowest point in years. Given that context, the bad news suddenly starts to look good.

However, he also sees that product Y, a new product in the product line, is not selling as well as projected by several market surveys. He sends an e-mail to his key sales people to ask them about their experiences with the product. The result surprises him, as most sales associates do not know how to properly position or sell the product. A search of available training courses shows that none of them cover how to get the most benefits from this type of product. He calls his training manager, Sandra, and they decide to address the problem with a one-hour course, filmed with a live trainer and delivered via Internet technology to the sales associates of each store. Sandra proceeds to search the company's Human Resources database for a course developer with experience in both the product area and in developing courses for distance learning.

Tim's discussion with Sandra raises another issue: a large number of new employees are having problems with the end-of-day reconciliation procedures. After observing several employees at this task and talking with them about their difficulties with the procedure, Sandra decides that a job aid would solve the problem. This time she searches the Human Resources database for a technical writer, who reports that an existing procedure in the system documentation could be easily modified to show simple instructions right beside the actual work area on the screen (mySAP.com White Paper).

Here we concentrate our attention on IT's application in knowledge management(mySAP.com White Paper):

Just as the Web as a way to communicate between businesses and their customers has grown explosively, the corporate Intranet has become the primary way to communicate with employees. In just a few years, over 90% of organizations now have some sort of



Intranet. These sites generally combine corporate information for all with specialized access for certain groups, and the ability to meet personal information needs. At SAP, for example, employees can see daily corporate news, video clips of speeches by executives, and corporate policies and benefits. They can order material via linked B2B transactions, search for people, apply for vacations, register for courses at the corporate university, find and contribute to project documents, or find someone who has a rare Beatles album.

The SAP Knowledge Warehouse provides a repository to manage site and navigation structures of internal or external websites, as well as the tools for creating and editing content and links. It is simple to use for knowledge consumers and occasional authors and provides complex possibilities for modeling and managing content for administrators. Its abilities to grant (or not to grant) role-based access to whole structures or single documents and to manage multiple versions and languages make the Knowledge Warehouse a powerful solution for managing international information of different degrees of sensitivity.

Every company needs to create and distribute information about itself. One audience of such information are an organization's employees, who need to stay informed on corporate strategy and who need to access corporate policies, instructions on how to do their work, and so on. Another audience are potential customers, who need to find out whether a product will meet their needs. Because this information needs to grab attention and convince, many companies go beyond printed materials to provide Web animations on their sites or multimedia presentations at trade shows or on CD-ROM.

The following uses for knowledge management provide an overview of the breadth of knowledge needs within an organization. Depending on your company's needs, one or all of these scenarios may be of interest:

- Creating a Web presence and an Intranet,
- Creating information products,

- Supporting collaboration,
- Creating corporate universities,
- Developing certification programs,
- Supporting SAP implementations and continued improvement,
- Supporting SAP end-user training and performance.

The idea that knowledge should be shared is obviously not new. The pursuit of any significant human activity, including business management, typically leads to the knowledge acquisition by those with better know-how skills. When the knowledge process can be captured, and communicated and shared with others, it can enable subsequent practitioners – or even generations – to build on earlier experience and obviate the need of costly rework or of learning by making the same repetitive mistakes. We do not need to continually re-invent the wheel.

Today, a range of technologies from computers to teleconferencing for distance learning offers unprecedented opportunities to disseminate know-how (knowledge) and insights rapidly and cheaply to a world-wide audience.

COMMUNICATED ENTERPRISE

The importance of communication in business is central to management success. In fact, the network of communication channels, methods, and skills are paramount, regardless of one's business major or type or size of business enterprise. Communication is critical to any business. It takes place among the enterprise's stakeholders (owners, customers, executives, managers, workers, and society).

The purpose of communication in a business enterprise is to establish a common experiential base, a system of significant, indexed concepts and relationships that enables mutual understanding which is required to accomplish business aims by stakeholders. Communication is an interactive process in which communicants exchange a message (content) that must be understandable in order to support meaningful performance.

A communicated enterprise applies a developed matrix of mediated channels, such as:

- Telephone,
- Fax,
- E-mail,
- Workgroup,
- Internet,
- Intranet,
- Extranet,
- E-commerce,
- E-meeting,
- Teleconferencing,
- Telecommuting,
- Other.

These channels (technologies) will be analyzed in more detail in Part II of this book. These channels' matrix facilitates the following communication methods:

- *Interpersonal Communication* – takes place among individuals who transfer personalized and psychological information to emphasize reciprocal feelings and bonds that determine a relationship.
- *Business Communication* – takes place under the form of business speaking, written business reports, letters, memos, and visual techniques.
- *Organizational Communication* – takes place in formal and informal structures in the context of communication networks, climate, culture, and targets: power, politics, and influence.

- *Professional Communication* – takes place among professionals from the same kind of profession; it applies a given profession's symbolic contents, context, culture, and channels.
- *Managerial Communication* – takes place among managers (peer communication techniques), between managers and subordinated workers (superior/subordinate techniques) in modes of command/control, negotiation/motivation, conflict management, information exchange, and issue management. It emphasizes feedback, motivation, and performance.
- *Cross-culture Communication* – takes place among communicants from different cultures that have different values, virtues, communication styles, and tradition. Usually this takes place at the international level, but is not limited to it.

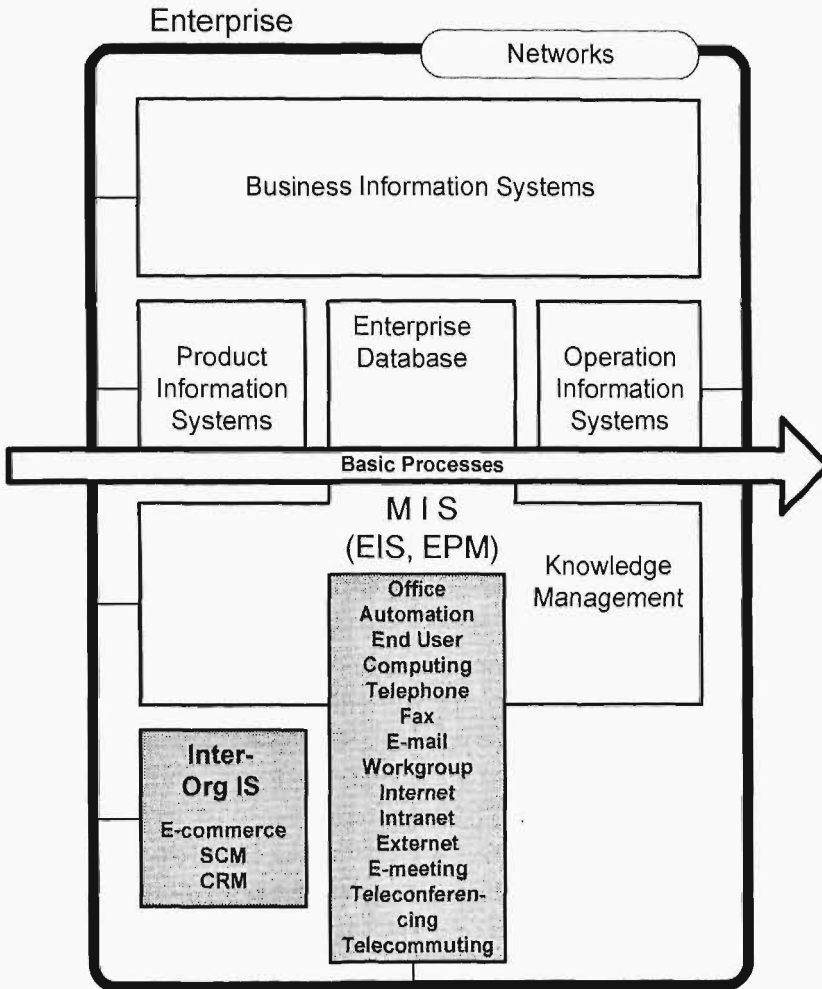
It is necessary to notice that an informed enterprise uses some sort of basic communication technologies, however in a limited manner, while a communicated enterprise is based upon an intensive use of all sorts of communication media. When an enterprise is informed it is time to communicate its content-based messages around stakeholders. A vice-versa process may increase “empty” communication that very often takes place in practice.

The media-communicated enterprise is equipped in computer networks, integrated, and informed. Because the enterprise is also “communicating,” it is relatively easier to communicate “knowledge” among enterprise stakeholders. So far knowledge has been generated in the informed enterprise, which has limited media to communicate. At the stage of the media-communicated enterprise (MCE) it is much easier to share knowledge among stakeholders. The development of MCE is necessary if knowledge generation and dissemination is a target.

The architecture of the communicated enterprise is shown in Figure 2-6. The inter-organizational communications trigger the development of inter-organizational IS such as Supply Chain Management (SCM), Customer Relations Management (CRM), and e-commerce.

The communicated enterprise is based on the *Internet* and its derivatives such as the *Intranet* and *Extranet*. Customers, as well as producers, escape the limits of geography. Until recently, if you needed a mortgage, you would stop at the local bank. Now, you can electronically travel to Bancrate.com and shop for the best mortgage rates from financial institutions across the country.

Figure 2-6: A Model of Media-Communicated Enterprise



E-commerce breaks every business free of its geographic moorings. Amazon.com bookstore spans the globe, selling 20% of its books to foreign destinations. A physical bookstore serves an area of a few square miles, while e-Amazon sells in France and Nigeria and is a click away.

The death of a distance makes it difficult for producers to set different prices around the world. This is already a reality for software that is paid for and downloaded over the Internet. No longer is a customer willing to pay \$200

in Warsaw for a piece of software that costs \$100 in Detroit. On-line commerce is destroying these discrepancies. No company will be able to charge a premium when consumers know precisely what goods cost elsewhere.

New types of e-business communities (EBC: customers, producers, suppliers, distributors, and commerce providers) are evolving in the new economy (Tapscott, 1998, and the author):

- **Value Chain EBC.** One of them is Cisco Systems, which makes networking products, such as routers, that shuffle data from one computer to another over the Internet or corporate computer networks. About 64% of its \$8.5 billion in annual sales are made on-line. Yet it does not actually manufacture anything. It sits at the top of the “food chain,” marketing and managing customer relationships. All other functions are outsourced. Cisco is successful because it carefully and efficiently manages the flow of information from customer input (customers order directly through the Web site) to product development. In the process, it manages to achieve \$585,000 in revenue per employee, about double that of more traditional competitors. And Cisco is always working with the best possible team of players. A network of distributors, manufacturers, and suppliers constantly compete with one another, which drives innovation. Information is shared among competitors, leading to a healthy combination of competition and collaboration. This level of coordination would be unthinkable without the Net.
- **Open Market EBC.** Priceline.com is a Web site that lets consumers bid for their plane tickets, and more recently cars and hotel rooms. Buyers submit a “guaranteed bid” for desired flights—the lowest price they think they can get away with. Priceline forwards the bid to participating sellers. The first airline to accept gets the sale. Priceline completes the transaction. As an open market EBC, Priceline creates a market on the Web for buyers and sellers. Not all of Priceline’s partners have joined the system with enthusiasm, and some airlines have refused to participate. As a liquidation channel, Priceline threatens the industry’s ability to offer seats at different prices for the same flight because it lowers the perceived value of full-fare tickets.
- **Aggregation EBC.** HomeAdvisor, Microsoft’s answer to home buying, does not just offer hundreds of listings on its Web. It also has developed

a variety of partnerships to provide real-time mortgage calculators, crime and school statistics, maps covering every U.S. metro area, live e-mail updates, and loan qualification service. What HomeAdvisor offers is a total home-buying solution—from searching to financing. This is called an aggregation EBC master, where one company positions itself as an intermediary between producers and consumers. Unlike the Priceline model where bids are directed to several sellers, an aggregator sells a branded set of products and services at stable prices. For now HomeAdvisor only brokers loans, but like Priceline, it has strategically positioned itself between buyers and sellers. In consumers' minds, it will not make sense to shop for a house through one group of people, and then shift industries to finance the purchase if they can do it all through the same channel. Priceline "mind share" is a major achievement. And home buyers might one day even negotiate their mortgages directly with the "Microsoft Bank."

- **Alliance EBC.** The most evaluated type of EBC is illustrated in the 3Com PalmPilot case. It is an example of an Alliance EBC—the most "virtual" and free-flowing type of EBC. PalmPilot is unique because most of its product development happens outside the company. But unlike Cisco, there is no one in charge. The EBC instead works more like a giant on-line jam session. Rather than guarding its programming secrets, 3Com makes its "code" available to one and all. The result? A huge community of users (most of them hackers) and partners are developing support software, parts, and accessories. PalmPilot benefits from an increase in the number of functions it performs, not to mention a growing community of users. Another example is Boeing, which becomes a design, networking, project management and marketing company, working with suppliers and customers in EBC to design aircraft in cyberspace.
- **Business-to-Consumers (B2C).** An example is the electronic bookstore Amazon.com, which sells 3 million books and whose market value is greater than Barnes & Noble's bookstores.
- **Business-to-Business (B2B).** An example is General Electric's practice of marketing and selling its industrial products through the Web to the EBC for its products.

- **Creators-to-Consumers (C2C).** The singer known as Prince sold 100,000 CD's directly to fans on-line, by-passing all distribution channels.

Constant change has become a part of doing business. Today as geography has receded in significance, relationships have replaced products and services. The most important trait for winning in business will not be having the best products or services but having the best relationships (based on communications).

MOBILE ENTERPRISE

A mobile enterprise emerges along with the applications of mobile handheld devices such as personal digital assistants (PDA), handheld personal computers (HPC), computer panels, Web-enabled mobile phone handsets, and in-home consumer Internet access appliances. These devices take advantage of the General Packet Radio Service and Wireless Application Protocol (WAP). At the first glance, a mobile enterprise looks like a communicated enterprise. It is true, however, that the former requires a different *modus operandi* than the latter, as its operations require more complex business processes and management.

Wireless networks and satellite technology have developed to the extent that, in most places, one can connect to a LAN, WAN, and GAN. These networks are evolving to achieve the higher speeds, greater reliability, and easier access.

The applications of mobile devices differ among countries. In Japan and in most of the Asian countries mobile computers are used as desktop computers because of limited desk space. In Asia the young generation for years has been used to cellular phones, so it is natural for it to extend functionality of wireless phones in accessing enterprise systems or end-user computing.

In Europe and the U.S the populations have been familiar with using smart card in buying and paying almost for everything, so it is natural for them to expand capabilities of those cards under the form of expanded (digital) phones. In Finland, Nokia's country, there are more wireless phones than wired phones.

Those types of users are natural candidates for the users of a mobile enterprise. The power and features of mobile phones and handheld computers