



How to Apply E-engineering for an Industrial Products Supplier in Thailand

by

Mr. Piyawong Sirsangnam

A Final Report of the Three - Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
Assumption University

March, 2000

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The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

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ABSTRACT

This project shows how to apply E-engineering for an industrial products supplier in Thailand. It is meant to be the guideline for reengineering and applying the organization into E-business world.

The revolution in business caused by the Internet and its related technologies demonstrated that information systems and information technology are the essential parts for an organization. Business professionals have to know how to use and manage a variety of information technologies to revitalize business processes, improve managerial decision-making, and gain competitive advantage. The study conducted is to identify major considerations of management and system designer in term of business process, work procedure, and information technology by using the Internet, Intranets, and Extranet as the medium. The purposes of the new system are to reposition business functions and to improve overall business operation of the organization. The project also demonstrates how the Internet, Intranets, and Extranets, and many other information technologies can give a business a strategic technology platform that supports electronic commerce and enterprise collaboration among the internetworked organization in global business environment.

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I. INTRODUCTION

Reengineering was well-known in the mid of '90s by Michael Hammer, author of the 1993 book, on reengineering the corporation, "A Manifesto for Business Revolution." He mentioned three fundamental rethinkings for any business as Dramatic, Radical, and Process Improvement. These would help a company to improve their business operation by shortening their operational process. It will change from an old process to the reengineered process as outlined below.

Company old process (20 weeks)



Company reengineered process (14 days)



Figure 1.1. Comparison on Company Old Process with Reengineered Process.

The hallmarks of reengineering that Michael Hammer stated are as follows:

- (1) Seeking dramatic improvement for the company's process.
- (2) Shattering assumptions.
- (3) Reinventing people. Make them look at world differently and understand the new whole process.
- (4) Exploiting technology to improve and develop new ways of working.
- (5) Evolving and experimenting to have the best developed-process.

But for today, the Internet's expansion and its speed of communication have

gradually transformed Re-engineering process to another process, called E-engineering. Companies have realized that it's not the true value of Internet's usage to put up only simple websites for customers, employees, and partners. To take full range of Internet's advantage, they have to make changes of the way they do businesses. They have to modify their systems of how they distribute goods, collaborate inside the company, and deal with suppliers. By implementing the new process, they can save time, money, and opportunity cost.

As for examples, technology companies like Intel, Dell, and Cisco Systems were among the first to seize on the Net to overhaul their operations. At Intel Corp., for example, web-based automation has liberated 200 salesclerks from tediously entering orders. Now, they concentrate, instead, on analyzing sales trends and pampering customers. Cisco Systems Inc., for its part, handles 75% of sales online. And 45% of its online orders for networking gear never touch employees' hands. They go directly from customers to company's software system and on to manufacturing partners. That helped Cisco increase productivity by 20% over the past two years.

Therefore, it is definitely that E-business can or even has to apply the principles and concepts of reengineering to its environment for survival. As Michael Hammer said "Companies are exhausted". The world has been changed everyday. Everyone has to keep pace with those changes. It is true to businesses, both online and off-line, to seek ways to improve their performance. At today Internet era, any business should exploit the available technology for its own development.

II. THE MEANING AND CONCEPT OF E-ENGINEERING

E-engineering is the creation of a dynamic, integrated product development and realization process, one with the necessary agility and deftness to respond to the demands of an electronic commerce world. E-engineering will maximize the usage of Internet in supporting their organization, working ways, communication, and definitely profits. To understand more on E-engineering, we should understand the meaning of "reengineering", "e-business", and electronic commerce" first because each of them is the main component of E-engineering.

Reengineering is the radical redesign of business processes for dramatic improvement. Radical redesign means starting over, instead of changing or modifying our existing ways of working. A business process is a group of activities that create value for the customer. Order fulfillment, for example, is a process that consists of many activities, from order entry to shipping. Dramatic improvement means a quantum leap in performance, a tenfold increase in productivity or an 80 percent reduction in cycle time. Reengineering leads to bigger jobs that are focused on whole processes and that give people large amounts of responsibility and autonomy. People who work in reengineered organizations are enthusiastic about what the results have meant for them. They talk of increased job satisfaction and of looking forward to going to work every day. There are seven capabilities which must be parts of reengineering to make it succeed:

- (1) The ability to conduct reengineering in accordance with a comprehensive, systematic methodology. Reengineering is too important and complex to be done on the back of an envelope. A fully systematic approach to re-designing the business processes should always be used. Furthermore, this

methodology should always begin with a detailed mapping of the current business process.

- (2) Coordinated management of change for all of the affected business functions. Business operation must response to changes initiated by four forces: competition, regulation, technology, and internal improvement. To best react to change, an operation must be flexible and it must be designed for ongoing modification. Reengineering represents a systematic response to change. If properly used, it becomes a change methodology, a standard approach of modifying operations. As such, it will encompass many components of the business, such as marketing, corporate planning, quality initiatives, human resources, finance, accounting, information technology, and even physical plant. Because of the high degree of interdependence among these activities, a reengineering project that ignores these areas will probably fail during implementation. For this same reason, the reverse is also possible: an action external to the reengineering effort can reduce its effectiveness.
- (3) The ability to assess, to plan, and to implement change on a continuing basis. Business process reengineering almost always encounters two very difficult problems. The first results from the sheer size of the projects; they tend to be very large. Management is justifiably intimidated by reengineering projects seem to put their whole fate of the company at risk. The second difficulty that seems inherent in reengineering is the improvements will give competitive advantage for only a short time. There is a solution to both of these problems. Reengineering can be done on a continuous basis. Instead of trying to implement a major project that will

restructure the entire corporation, a series of smaller projects can alter the business a little at a time.

- (4) The ability to analyze the full impact of proposed changes. Since the processes typically cross organizational lines, a reengineering approach should provide the ability to analyze the impact that changes in any process will have on all organizational units. To do this, it is necessary to understand all the relationships among organization, operation, business function, planning, policies, human resources, and information services support. Based on these relationships, any change can be followed through its association, to determine the full potential impact of a proposed action.
- (5) The ability to model and to simulate the proposed changes. Fundamental to the reengineering effort is the ability to simulate the changes that are being proposed. This allows the testing and comparison of any number of alternative designs. This ability is based on the use of business process models and some method by which the costs and benefits of each suggested design can be assessed. A computerized modeling system, of course, provides the easiest way to simulate these alternatives.
- (6) The ability to use these models on continuing basis. The designs drawn for the new business processes should not be used only in the implementation of the new processes and then discarded. Nor should they be stored on a shelf and become obsolete. The reengineering process costs too much; the design are too valuable. The obvious use for the reengineering designs and models is supporting future reengineering efforts. If a total quality initiative is implemented, the company will need to change its processes on a frequent basis as improvements are implemented. For control, these activities should

be performed following reengineering methods and all documentation should be updated.

- (7) The ability to associate all of the management parameters of the company with each other. To begin reengineering, the project team will require rapid access to all of the information related to the business processes being reengineered, the company's plans, the current information systems, organization charts, mission statement, and job description, as well as many other details of business administration and work organization. As important as all this data is to the project, the relationships among the data items are equally so. The reengineering approach, therefore, must have the ability to gather and combine this management information.

E-business is the conduct of business on the Internet, not only on buying and selling but also on servicing customers and collaborating with business partners. The reasons and benefits for the explosive growth of e-business are:

- (1) Convenience
- (2) 24 hours x 7 days availability
- (3) World-wide reach / market
- (4) More self-service
- (5) Decreases the need for fixed assets — creation of virtual companies
- (6) Increase the interaction with customers and business partners
- (7) Allow for customization of offerings / allows for more targeted selling
- (8) Sell direct to consumers — cut out the middleman

Electronic commerce is the buying and selling of goods and services on the Internet, especially the World Wide Web. Electronic commerce can be divided into:

- (1) Virtual storefronts on the web sites with online catalogs.

- (2) Electronic Data Interchange (EDI), the business-to-business exchange of data. EDI involved data exchange among parties that know each other well and make arrangements for one-to-one (or point-to-point) connection.
- (3) E-mail, fax and telephone, and their use as media for reaching prospects and subscribers.
- (4) Business-to-business buying and selling.
- (5) The security of business transactions.

For some time now, large business organizations have used electronic commerce to conduct their business-to-business transactions. The Internet is already changing the way that many companies conduct their business. As that influence grows, and more companies use the Internet, the possibilities for conducting business-to-business commerce on the Internet will expand greatly, and become more of a routine part of commerce than it is today. From its inception, electronic commerce had included the handling of purchase transactions and fund transfers over computer networks. It's grown now to include the buying and selling of new commodities such as electronic information and the opportunities for companies seeking to take advantage of the capabilities of electronic commerce and greater than merely adopting our present view of commerce to performing those same transactions over electronic networks.

Despite electronic commerce's past roots in transactions between large corporations, banks, and other financial institutions, the use of the Internet as a way to bring electronic commerce to the individual consumer has led to a shift in viewpoint. Over the past few years, both the press and the business community have increased their focus on electronic commerce involving the consumer.

Meanwhile, business-to-business electronic commerce is rolling along, stronger than ever. The Internet has also given business-to-business electronic commerce a

boost. And businesses of all sizes are finding whether they can take advantage of the Internet to lower the cost of electronic commerce, either by replacing other networks, or by using the Internet as another communications medium, converting their business data to digital form and incorporating it with their business practices.

Electronic commerce is a system that includes not only business transactions that center on buying and selling goods and services to directly generate revenue, but also those transactions that support revenue generation such as generating demand of those goods and services, offering sales support and customer service, or facilitating communication between business partners.

E-engineering is the combination of reengineering and electronic commerce to look at what work is required to be done and focuses on rethinking work from the ground up, eliminating work that is not necessary and finding better, more effective ways of doing work by utilizing the Internet as medium for business operation. E-engineering is not only involved with organization itself but also effects customers and business partners. E-engineering is not simply about making an organization more efficient. You cannot have the most efficient organization in the world, unless it effectively serves its customers and improves relationships among business partners outside the organization. E-engineering lets the organization to conduct business with customers and suppliers electronically, minimizing or eliminating the cumbersome problems associated with paper-based system by using Electronic Data Interchange (EDI).

Electronic Data Interchange may be broadly defined as the automated exchange of basic business documents among business partners. The goal of doing business with EDI is to simplify and accelerate standard business dealings between organizations.

Basic EDI transactions include orders, invoice, requests for quotations, and other purchasing or tracking related communications.

Consider how a business operation might be done by using E-engineering. The buyer would visit the web sites of distributor and select the appropriate product by matching the needs with data in an online catalog. The employee would then use electronic mail to send a digital request to the manager for approval. Once approved, the manager would simply e-mail to forward the request to purchasing. Purchasing could then copy the necessary information into their order database, and send an electronic order to the supplier, via EDI or another form.

When the supplier receives the order, a computer program might automatically insert the order into a database of pending orders, check inventory at the warehouses, check your company's credit status, and earmark the item for delivery. This same program might then pass a shipping order electronically to the appropriate warehouse and create an invoice. If a shipping agent were used, the warehouse would notify the shipper via e-mail. Once the product was received, account payable would instruct the bank, via e-mail, to transfer the appropriate funds to the supplier.

Table 2.1. Compare Purchasing Transaction between Traditional Way and E-engineering System.

Sales Cycle Step	Traditional Commerce (Multiple Media Employed)	E-engineering System (Single Medium Employed)
Acquire product information	Magazines, flyers, catalogs	Web pages
Request item	Printed forms, letters	E-mail
Check catalogs, prices	Catalogs	Online catalogs
Check product availability and confirm price	Phone/fax	Online catalogs
Generate order	Printed form	E-mail / Web pages
Send order (buyer)	Fax / mail	E-mail
Receive order (supplier)	Fax / mail	EDI
Prioritize order	Manual	Online database
Check inventory at warehouse	Printed form, phone, fax, internal computer system	Online database, Web pages
Schedule delivery	Printed form	E-mail / online database
Generate invoice	Printed form	Online database
Receive product	Shipper	Shipper
Confirm receipt	Printed form	E-mail
Send invoice (supplier)	Mail / people	E-mail
Receive invoice (buyer)	Mail / people	EDI
Schedule payment	Printed form	EDI / online database

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Table 2.1. Compare Purchasing Transaction between Traditional Way and
E-engineering System. (Continued)

Sales Cycle Step	Traditional Commerce (Multiple Media Employed)	E-engineering System (Single Medium Employed)
Send payment (buyer)	Mail	EDI
Receive payment (supplier)	Check payment	Electronic Funds Transfer

E-engineering implementation has consistently reported significant advantages over paper-based systems. First, the use of E-engineering allows transactions to be processed quickly and with fewer errors. Data is only entered once and the controls imposed by standard forms guarantee a greater degree of accuracy. E-engineering also provides cost savings through elimination of all processes associated with sorting, mailing, and storing of paper-based transactions. E-engineering implementation reduces labor costs and enhances relationships between business partners. The speed of E-engineering transactions combined with close trading business relationships can also serve to simplify implementation of just-in-time inventory systems. E-engineering is the process of any organization both internal and external. Much attention must be paid to how core processes interact with customers and business partners. E-engineering efforts streamlining internal processes while, at the same time, automating external transaction with the Internet and electronic commerce will have far more impact than one only looking inward. E-engineering is not a promise of the future, it is here today. Those organizations understanding the concept and those now building their processes will prosper tomorrow.

III. E-ENGINEERING PRINCIPLE

Businesses have been using information technology for many years to automate business processes and support the analysis and presentation of information for managerial decision-making. However, E-engineering shows how information technology is being used to restructure work by transforming business processes. A business process is any set of activities designed to produce a specified output for a customer or market. Using information technology for globalization and E-engineering frequently results in the development of information systems that help gives a company a competitive advantage in the marketplace. Businesses are becoming internet-worked organizations. The Internet and Internet-liked networks, inside the organization (Intranets), between an organization and its business partners, and other networks have become the primary information technology infrastructure that supports the business operations of the organization.

E-engineering involves the use of groupware tools to support communication, coordination, and collaboration among the members of networked teams and workgroups by using the Internet, Extranets, and other networks to implement such systems. It uses a variety of information technologies to help people work together by helping us to communicate ideas, share resources, and coordinate our cooperative work efforts.

The Internet

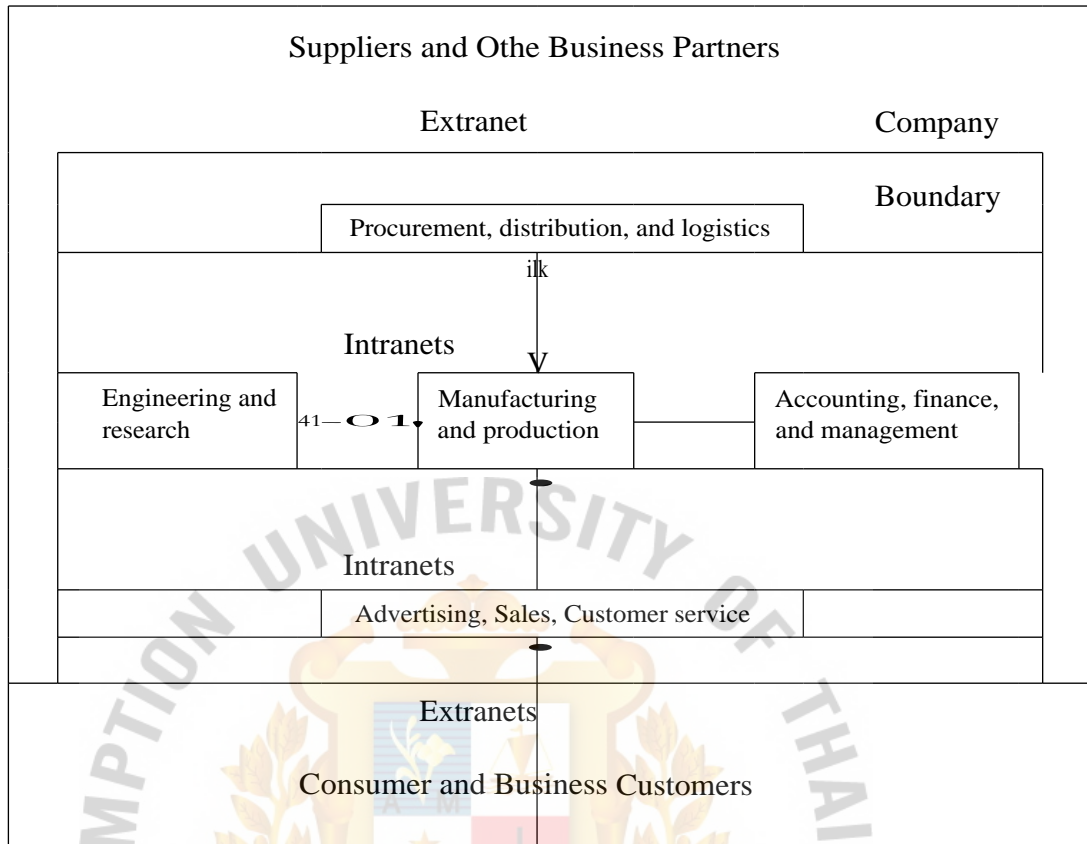


Figure 3.1. E-engineering Depends on the Internet for Enterprise Collaboration among a Company's Business Function, and the Support of Electronic Commerce with Customers, Suppliers, and Other Business Partners.

An Intranet is a network inside an organization that uses Internet technologies (such as Web browsers and server, TCP/IP network protocols, HTML hypermedia document publishing and databases, and so on) to provide an Internet-like environment within the organization for information sharing, communications, collaboration, and the support of business processes. An Intranet is protected by security measures such as passwords, encryption, and firewalls, and thus can be accessed by authorized users through the Internet. Extranets are network links that use Internet technologies to interconnect the Intranet of a business with the Intranets of its customers, suppliers, or other business partners.

E-engineering plays three fundamental roles in the business success of an organization:

- (1) Support of its business processes and operations.
- (2) Support of decision-making.
- (3) Support of its strategies for competitive advantage.

In term of the business operation, E-engineering is the process to:

- (1) Streamline the operation
- (2) Reduce costs
- (3) Improve quality
- (4) Increase revenue
- (5) Improve customer orientation
- (6) Improve business partner relationship
- (7) Merge acquired operations

3.1 Apply Network Systems

Streamline the Operation

Streamlining is the attempt to bring a business process to its most efficient form. A streamlined operation provides efficient, flexible activity by eliminating redundant operations, improving work flow, improving support systems, and even anticipating the effect of actions on the other departments.

Reduce Costs

Cost reduction is one of the main reasons to E-engineering. While this is certainly an important goal, it is recommend that it be viewed as a secondary objective, with operational streamlining and quality improvement being of more immediate concern. The reason is that, if these two goals are met, costs will be reduced. Furthermore, continuing progress toward quality and efficiency will continue to provide additional

cost savings. While costs can be saved in all areas of the operation, the most significant areas are labor, information, supply, administration, communication, and the cost of money.

Improve Quality

Improving quality in all processes will certainly increase the value of products and services, and reduce costs by cutting down waste. It is measured in terms of reliability, consistency, and longevity. The measurement of a product or service against these elements determines its worth. Quality improvement for any process is directed toward improving the product and minimizing the amount of rework and scrap. It also involves the ability to obtain consistent results while adhering to increasingly high standards. The continual tightening of standards applying to all operational activities is indeed the best assurance that quality is improving.

Increase Revenue

Obviously increasing revenue is, with cost reduction, one of the two basic methods by which profit can be increased. The easiest way to increase revenue is to decrease costs. In fact, the most obvious changes to the business process that may increase sales (reducing costs, improving quality, and cutting production time) are stated as goals themselves. However, there are other ways that E-engineering can address increasing revenue such as new or changed products and services can be offered. Other revenue increasing measures can include the improved collection of receivables, and shortened product development, production, and delivery times.

Improve Customer Orientation

Improving the orientation of the organization toward its customers is a significant E-engineering goal. Since the customer's assessment of the organization and its

products are strongly influenced by service, improvements in this area are another good way to increase revenue.

Merge Acquired Operations

When a merger takes place, there is a high probability that an attempt will be made to reduce redundant effort by combining functions.

Apply Network Systems

The rapid pace of change in today's business environment has made information systems and information technology vital components that help keep an organization on target to meet its business goals. Network system is one of the most important trends in information technology. It enables users and workgroups to communicate and collaborate electronically, and to share the use of hardware, software, and data resources.

To accomplish E-engineering to the organization, the team must:

- (1) Understand the process and work flow of the organization, along with the identification of the interrelationships among departments.
- (2) Understand the corporate strategy, its goal, and its problems, for both the corporation and for each department.
- (3) Understand the responsibilities of each department.
- (4) Understand the process and workflow of the company, along with the identification of the relationships among business partners.
- (5) Understand customers' requirements and existing problems.
- (6) Understand the current technology and its status in hardware, software, and communication.

3.2 E-engineering Development Cycle

Developing E-engineering to business is typically a multi-step process. There are five steps of the cycle, which based on the states of the systems approach. They consist of:

- (1) **Systems Investigation.** Step to understand business problem and opportunity. System investigation is the process to determine whether business problems or opportunities exist, to conduct a feasibility study to determine whether a new or improved information system is a feasible solution. The feasibility of a proposed system can be evaluated in term of four major categories as organizational feasibility, economic feasibility, technical feasibility, and operational feasibility.
- (2) **Systems Analysis.** Step to develop an information system solution. System analysis is the process to analyze the information needs of users, the organization environment, and any system presently used.
- (3) **Systems Design.** It is also a step to develop an information system solution. System design is the process to develop specifications for the hardware, software, people, network, data resources, and the information products that will satisfy the functional requirements of the proposed system.
- (4) **Systems Implementation.** Step to implement the information system solution. System implementation is the process to acquire or develop hardware and software, to test the system and train people to operate and use it, and to convert to the new system.
- (5) **Systems Maintenance.** This is the process to use a post-implementation review, the process to monitor, evaluate, and modify the system as needed.

The focus of E-engineering is centered on the World Wide Web, which has become a popular marketing tool and online repository of valuable information. Many

companies have established a presence on the Web to market their capabilities and provide services to an audience that includes all constituencies: prospects, customers, suppliers, partners, and employees. The growth of this phenomenon has been explosive. Since 1994, the number of Web sites has grown from 5000 to more than 100,000.

Integrating Internet commerce into the sales and marketing mix goes well beyond simply selling products or providing an efficient way to offer service and support. Internet commerce also broadens available markets. The result is better business interactions that establish heightened connections between companies and their constituencies.

A seemingly endless array of applications is emerging in the virtual marketplace, where business is conducted in cyberspace. These applications include the ability to initiate and consummate transactions, check the status of orders, gain access to online service and support capabilities, search and use documentation, and gain access to valuable training. These and many other similar capabilities allow users to easily access information and services they need, when they need them, bypassing many of the tedious processes typical in traditional ways of doing business.

Today, Internet commerce holds a competitive edge in the market focus on access to information. It improves access to critical information and services while reducing the complexity of everyday business interactions. It improves productivity and simplifies all elements of commerce. It speeds transactions while reducing the cost of sales. And it personalizes communications by enabling users to interactively access the precise information and services that fit their particular needs.

Therefore, E-engineering takes much of the complexity out of everyday business interactions. It reduces lead times, saves money, and enhances productivity, giving new

meaning to the "faster, better, cheaper" model that forms the underlying principle at the foundation of today's global business arena.

Internet commerce removes the barriers to business-to-business relationships, benefiting customers and sellers alike. While it is becoming more widely understood and accepted, the surface has barely been scratched in creating applications that reduce lead times, save money, and enhance productivity for all users. Once a competitive advantage, Internet commerce is today being added to the list of essential business practices.



IV. A REAL-WORLD APPLICATION OF E-ENGINEERING

4.1 Cisco Systems

Cisco Systems is the worldwide leader in networking for the Internet. Cisco's networking solutions connect people, computing devices and computer networks, allowing people to access or transfer information without regard of differences in time, place or type of computer system.

Cisco provides end-to-end networking solutions that customers use to build a unified information infrastructure of their own, or to connect to someone else's network. An end-to-end networking solution is one that provides a common architecture that delivers consistent network services to all users. The broader the range of network services, the more capabilities a network can provide to users connected to it.

Cisco offers the industry's broadest range of hardware products used to form information networks or gives people access to those networks; Cisco IOS software, which provides network services and enables networked applications; expertise in network design and implementation; and technical support and professional services to maintain and optimize network operations. Cisco is unique in its ability to provide all these elements, either by itself or together with partners.

Cisco serves customers in three target markets:

- (1) Enterprises - Large organization with complex networking needs, usually spanning multiple locations and types of computer systems. Enterprise customers include corporations, government agencies, utilities and educational institutions.

- (2) Service Providers - Companies that provide information services, including telecommunication carriers, Internet Service Providers, cable companies, and wireless communication providers.
- (3) Small/Medium Business - Companies with a need for data networks of their own, as well as connection to the Internet and/or to business partners.

Cisco sells its products in approximately 115 countries through a direct sales force, distributors, value-added resellers and system integrators. Cisco has headquarters in San Jose', CA. It also has major operations in Research Triangle Park, NC, and Chelmsford, MA; as well more than 225 sales and support offices in 75 countries.

In contrast to many technology companies, Cisco does not take a rigid approach that favors one technology over the alternatives and imposes it on customers as the only answer. Cisco's philosophy is to listen to customer requests, monitor all technological alternatives, and provide customers with a range of options from which to choose. Cisco develops its products and solutions around widely accepted industry standards. In some instances, technologies developed by Cisco have become industry standards themselves.

Everyday, Cisco and its customers are proving that networking and the Internet can fundamentally and profitably change the way companies do business. Cisco describes this change in the "Global Networked Business" model. A Global Networked Business is an enterprise, of any size, that strategically uses information and communications to build a network of strong, interactive relationships with all its key constituencies.

The Global Networked Business model leverages the network for competitive advantage by opening up the corporate information infrastructure to all key constituencies. The Global Networked Business model employs a self-help model of information access that is more efficient and responsive than the traditional model of a

few information gatekeepers dispensing data as they see fit. Cisco itself is a leading example of a Global Networked Business. By using networked applications over the Internet and its own internal network, Cisco is gaining financial contribution of at least \$550 million a year in operating costs savings, while improving customer/partner satisfaction and gaining a competitive advantage in areas such as customer support, product ordering and delivery times. Cisco is today the world's largest Internet commerce site, with 83% of our orders transacted over the web.

Cisco is one of America's greatest corporate success stories. Since shipping its first product in 1986, the company has grown into a global market leader that holds No. 1 or No. 2 market share in virtually every market segment in which it participates. Since becoming a public company in 1990, Cisco's annual revenues have increased from \$69 million in that year to \$12.2 billion in fiscal 1999. As measured by market capitalization, Cisco is among the largest in the world. Total Revenues for last four quarters was \$ 13.4 billion. World headquarters is in San Jose', California, USA. Three sites located on West Tasman Drive, first occupied in 1994, comprise 16 buildings (1,800,000 square feet). A fourth site located close to the other three sites will add 19 buildings (3,300,000 square feet) in a phased construction project. Fifteen of these buildings are currently occupied. Additional research, development and marketing operations are in Research Triangle Park, N.C., and Chelmsford, Mass.

4.2 Company Profile

Senior Management:

- (1) John Chambers, President & CEO
- (2) Larry Carter, Chief Financial Officer
- (3) Don Listwin, Executive Vice President
- (4) Judy Estrin, Chief Technical Officer

(5) Gary Daichendt, Executive Vice President, Worldwide Operations

Employment. Approximately 23,492 worldwide, about 10,406 in the Bay Area.

Company Achievements

October 1998: Cisco Wins DataComm 1998 User's Choice Award for International Networking Service & Support. DataComm Magazine's six categories included network planning and design, upgrades, online support, phone support, quality of on-site support and network health checks.

September 1998:

- (1) Cisco chosen by IndustryWeek as one of the 100 Best-Managed Companies. In this, IndustryWeek's third annual report, IndustryWeek highlights those 100 companies that have demonstrated superior, consistent financial performance.
- (2) Cisco Ranks #2 in Information Week's List of 500 Leading IT Corporate Users. The InformationWeek 500 bases its rankings on four evaluation areas: Application Development, E-Business, Data Access and Business Process/ERP.

January 1998: Cisco Ranks 25th in Fortune's "100 Best Companies to Work For in America". The Fortune ranking was based on the results of surveys and comments from 225 randomly selected employees all across the U.S., as well as the completion of an in depth inventory of services, benefits, and employee opportunities.

August 1997: Industry Week - The world's 100 Best Managed Companies: Cisco Systems

July 1997:

- (1) Datamation 100 - The Datamation 100 is a listing of the top IT vendors in the world ranked by revenue. Cisco Systems was ranked as the number 24 with an IT revenue of \$5,406.4 Million.
- (2) Software Magazine World's Largest Software Companies. - Cisco Systems was ranked as the number 79 in the 15th Annual Ranking of the World's Largest Software Companies.

June 1997:

- (1) Computer Reseller News Market Leaders- Cisco is ranked #1 by Computer Reseller News for Network Leaders in an article titled
- (2) The Computerworld Smithsonian Award- Finalist in Business & Related Services Category for 1997 Computerworld Smithsonian competition. Inclusion in the 1997 Innovation Collection, Smithsonian Institution's permanent research collection, National Museum of American History, Washington, D.C.

April 1997:

- (1) Forbes - Forbes 500: Cisco Systems is ranked number 255 in sales, number 82 in net profits.
- (2) Fortune - 1997 Fortune 500 company: Cisco is ranked number 332, (first ever) with \$4.096B in revenues.

March 1997:

- (1) Business Week - Business Week 50: Cisco is ranked number 4.
- (2) Dalton Pen Communications of Excellence - Packet™ Magazine - Award of Excellence - External Publication Dalton is a worldwide competition judged by communicators and journalists with more than 20 years experience in corporate communications, magazines and with PR firms.

(3) VAR Business Magazine - Named One of the Top 10 Manufactures in Channel Partnering for 1997.

January 1997: Financial World - Cisco is ranked in the top five in each of the four categories (historical sales growth, historical earnings growth, return on equity and projected earnings growth) Financial World uses to measure the 100 best growth companies.

June 1996: Computerworld - Ranked Cisco Systems, Inc. number 1 in "The 100 Best Places to Work."

4.3 The Global Networked Business: A Model for Success

"How companies use information technology will define their success in the coming era of virtual business." Glover Ferguson, Andersen Consulting (1¹/₉₆)

The pace of business worldwide is accelerating rapidly. Product cycles are shrinking Just-in-time manufacturing abounds. Decisions are made on the fly. In this environment, access to relevant information is essential to remaining competitive and will mean the difference between survival and extinction for many companies. Yet many organizations still cling to an outdated model of information technology that builds walls around corporate information and systems, limiting access to a select few. Even when internal systems and information are shared, it is often limited to point-to-point applications such as Electronic Data Interchange (EDI).

The level of competition has been stepped up in today's global, networked market. Businesses that fail to take advantage of what the network has to offer are missing opportunities and allowing competitors to gain important economic advantages. Companies must foster interactive relationships with their many constituencies (prospects, customers, partners, suppliers, and employees) opening up internal systems and the flow of information. Achievement of this higher level of competitiveness

requires the openness and information accessibility of a new model---the Global Networked Business.

The Global Networked Business model is based on three core assumptions:

- (1) The relationships a company maintains with its key constituencies can be as much of a competitive differentiator as its core products or services.
- (2) The manner in which a company shares information and systems is a critical element in the strength of its relationships.
- (3) Being "connected" is no longer adequate. Business relationships and the communications that support them must exist in a "networked" fabric.

The Global Networked Business model opens the corporate information infrastructure to all key constituencies, leveraging the network for competitive advantage. A Global Networked Business is an open, collaborative environment that transcends the traditional barriers to business relationships and between geographies, allowing diverse constituents to access information, resources, and services in ways that work best for them. The Global Networked Business model employs a self-help model of information access that is more efficient and responsive than the traditional model of a few information gatekeepers dispensing data as they see fit.

"Global networked business sets new standards of efficiency and productivity within business relationships," says John Chambers, President and CEO of Cisco Systems. "By simplifying network infrastructures and deploying a unifying software fabric that supports end-to-end network services, companies are learning how to automate the fundamental ways they work together."

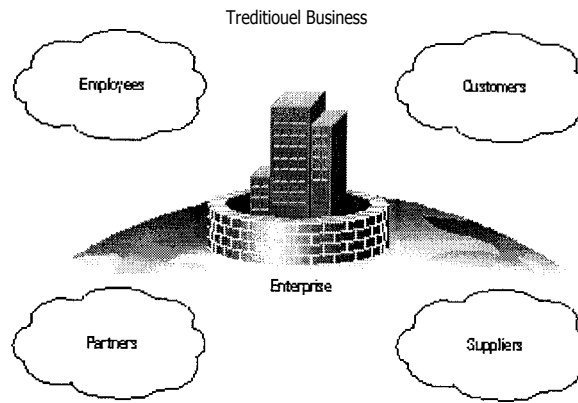


Figure 4.1. Traditional Business Model.

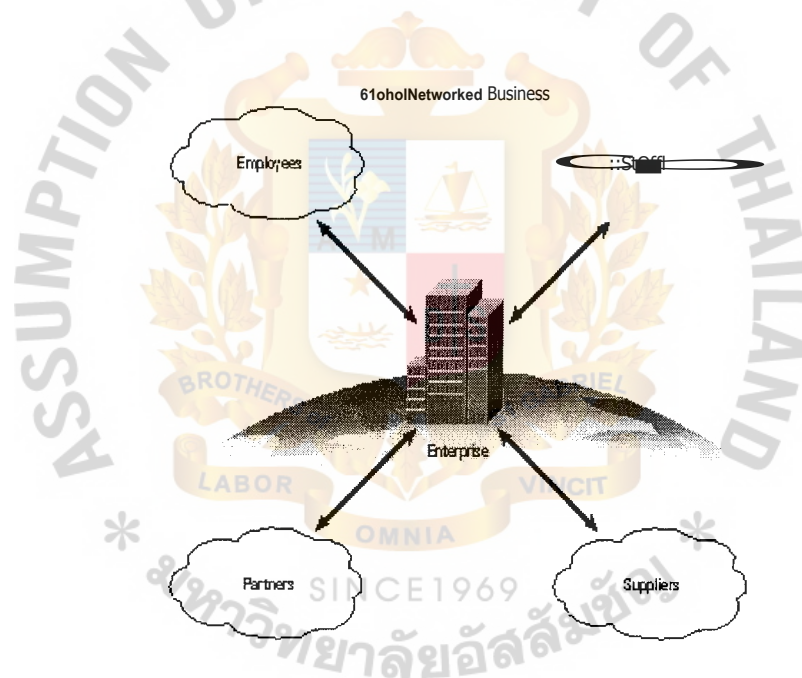


Figure 4.2. Global Networked Business Model.

The new Global Networked Business model seeks to maximize the value of information by sharing it, cultivating ongoing relationships between all parties. Employees have access to information and tools that allow them to do their jobs more proficiently, and prospects have ready access to information that aids in purchasing

decisions. Partners have ready access to a variety of information and interactive applications that help them sell more effectively. Customers have better access to support capabilities that enable them to resolve problems in less time, and suppliers have improved access to inventory levels and manufacturing needs.

The Global Networked Business model is also a better fit with the current business environment. Organizational restructuring is creating leaner companies that can react more quickly and compete more effectively. Corporations want scalable, manageable business systems that allow them to do more with less. The leaders in any industry will be those who effectively employ technology to reach the goals of improved productivity, reduced time to market, greater revenue, lower expenses, and stronger relationships.

But simply throwing money at technology is not the answer. Information technology (IT) expenditures in 1995 were 43 percent of capital spending in the United States, a figure expected to exceed 50 percent by the turn of the century. As the investment in IT continues to grow, chief information officers come under increasing pressure from management to justify expenditures. The Global Networked Business views the network as a means of generating revenue, reducing costs, and improving customer/supplier relationships. Cisco will save \$250 million a year in business expenses through its networked applications. "The first challenge is moving beyond viewing the network only as an information-sharing tool to using the network as a foundation for applications linked to core business systems that serve all business constituents," says Chris Sinton, Director of Cisco Connection at Cisco Systems, Inc. Cisco is not only the worldwide leader in networking, having supplied over 80 percent of the Internet backbone equipment; Cisco is also a leading example of a Global Networked Business, leveraging its IT and network investments by marrying them with

core business systems and operational information to better support its prospects, customers, partners, suppliers, and employees.

4.4 Benefits of a Global Networked Business

Networked applications in a Global Networked Business provide a wide range of benefits to the company and to its prospects, customers, partners, suppliers, and employees. As a successful Global Networked Business, Cisco can point to numerous examples of networked applications that help Cisco meet the needs of all its constituencies. Cisco is not alone, however; examples of Global Networked Businesses can be found in many other industries as well.

Prospects

When facing a buying decision, organizations are often presented with many choices. A key competitive differentiator is the ease with which prospects can access company information to simplify and facilitate their purchasing processes. Cisco's prospects can use the Cisco Connection Online (CCO) Web site. CCO is the foundation of the Cisco Connection suite of interactive, electronic services that provide immediate, open access to Cisco's information, resources, and systems anytime, anywhere, allowing all constituents to streamline business processes and improve their productivity.

Through CCO, prospects gain immediate access to information on Cisco's products, services, and partners. Nearly a quarter-million prospects log in to CCO monthly. CCO allows prospects to register for seminars, purchase promotional merchandise and Internet software, read technical documentation, and download public software files. In 1996, for example, nearly one-fourth of all seminar registrations were completed via CCO, streamlining the registration process for users.

Customers

With expenses rising and qualified sales people in short supply in many industries, many companies are studying ways to reduce the cost of sales while maintaining closer relationships with customers. Cisco's dramatic growth caused it to evaluate alternatives to traditional sales ordering methods. One solution was to create the Networking Products Marketplace, available through CCO, which enables users to place and manage orders for Cisco networking products and services on line. In its first six months of operation, the ordering Tool, one of the Internet Commerce Applications available through the Networking Products Marketplace, processed more than \$100 million in orders, and Cisco continues to see dramatic increases in the percentage of orders received through the application. The ordering Tool assists direct customers and partners in configuring equipment, leading to shorter delivery intervals and more accurate orders than those typically received through traditional sales methods. The end result: customers receive exactly what they need in less time.

The ordering Tool is one of many networked applications that support a multipoint, interactive fabric of networked relationships and applications. Customers have enthusiastically embraced Cisco's Internet commerce applications. Charles Miano, a purchasing agent with Cellular One, states that the site played a key role in his company's decision to standardize on Cisco equipment. While a successful pioneer in Internet commerce, Cisco will not remain alone. Market researcher International Data Corporation (IDC) predicts that, by the year 2000, sales on the Internet will grow to \$116 billion, with more than 70 percent of that volume being business-to-business transactions. In short, the Internet is becoming a key distribution channel. "To remain competitive, all corporations must have a strategy for sales and support over the Internet," says Michael Sullivan-Trainor, an analyst with IDC.

Cisco also provides technical assistance to its customers worldwide through the CCO Internet Web site. Over 20,000 support cases are opened or queried each month. The online service improves the support process, speeds resolution of problems, and provides immediate global access to Cisco's support systems and engineers around the clock.

Cisco has improved access to critical information systems and tools in yet another way, allowing customers to simply download software electronically via the Internet. Through CCO, customers and partners download more than 70,000 pieces of software each month, drastically lowering distribution costs while giving users immediate global access to mission-critical information 24 hours a day, seven days a week. Users also receive interactive guidance in selecting software, simple interfaces for downloading, extensive documentation, proactive defect alerts, and access to updates and new releases.

Partners

Successful partnerships leverage the resources of each partner. Cisco's partners use the Cisco Connection Online Web site, the Web-based Cisco Connection Documentation, and the Sales Tools CD-ROM. Through these networked applications, Cisco extends partner service and support capabilities and provides sales assistance through immediate, 24x7, global access to a complete library of technical and product information.

The Partner-Initiated Customer Access (PICA) program allows partners to offer these online services to their customers. Providing basic self-help support solutions through CCO frees staff to address more difficult questions and problems. Customer issues, in turn, are resolved more quickly. Through PICA, partners may also provide

customers with real-time access to the latest software releases. PICA leverages the resources of partners and fosters higher levels of customer satisfaction and loyalty.

Suppliers

The purchasing function---ordering, delivery, and billing--- can be time and labor intensive as well as expensive. EDI is one networked application that can benefit both suppliers and customers. Suppliers networked to Cisco, for example, have a competitive edge over other firms, potentially leading to increased sales. They are also able to better manage manufacturing schedules, improve cash management, and respond more quickly to Cisco's needs.

Cisco, as a customer, benefits from EDI. Cisco has leveraged its networking expertise to create EDI links to a growing number of its suppliers, resulting in more than \$80 million in purchases per month processed electronically as of January 1997. As a customer, Cisco has gained real-time access to supplier information, experienced lower business costs in processing orders (an estimated \$46 per order), improved the productivity of its employees involved in purchasing (78 percent increase), and seen order cycles reduced substantially. Deploying networked applications such as EDI allows suppliers and customers to truly become partners.

Employees

Information must be readily available to employees if companies are going to compete successfully. Intranet applications provide the backbone for immediate access to current information and services. Cisco's Intranet Web site, known as Cisco Employee Connection (CEC), addresses the unique needs of its 10,000 networked employees, providing instant global communications. Cisco's marketing department, for example, uses CEC to distribute the latest product and pricing information, saving many thousands of dollars in printing and mailing costs and decreasing time to market. CEC

also streamlines business processes, reducing the time employees spend handling repetitive tasks. Employees can use CEC to enroll in internal training courses on line anytime from anywhere without ever speaking with a training department employee. Another networked application enables Cisco employees to view meetings broadcast over the network backbone. All employees, regardless of where they are located, can share the same information simultaneously through the power of networking.

Global Networked Businesses leverage their networks to focus on critical organizational goals such as employee productivity. With the network and client/server applications, employee will be able to pull up a caller's client history and frequently asked questions and answers on their screens before they ever answer the phone, providing faster response to customer requests.

Key Features for Employee:

- (1) Cisco Marketplace: Employees can order sales/marketing information and technical documentation on Cisco products. Online ordering of Cisco promotional items in the Gift Shop.
- (2) Internal Support: On-line technical support through interactive applications and technical documentation.
- (3) Engineering: Departmental information, contacts, technical and process documents, education, useful tools, bug information, upcoming events.
- (4) Sales: A single dashboard with links to all of Cisco's sales information and productivity tools. Contacts, key forms, sales training, news, competitive intelligence.
- (5) Marketing: Complete library of marketing information. Corporate information, publications, key forms, presentations, product and service brochures, data sheets, white papers, bulletins.

- (6) Training: On-line training registration for a variety of internal courses, along with training schedules, and synopses.
- (7) Human Resources: Job listings, insurance-plan information, health-care provider listings, employee address changes, HR forms, new-hire assistance, employment verification, benefits policies, workers compensation, employee and community relations.
- (8) Workplace Resources: Building floor plans, cafe menus, fitness activities, facilities request forms.
- (9) Finance: Stock administration, payroll, corporate purchasing, accounts payable, general accounting.
- (10) Business Units: Internal contacts, product details, competitive information, project management.
- (11) Corporate Marketing: Departmental descriptions, complete contact information, index of available services.
- (12) Travel & Events: Upcoming events, expense reports, event registration, travel profiles.
- (13) News: News releases, stock results, Cisco publications, industry news, world news.
- (14) People: Employee search tools, e-mail alias maintenance, employee Web pages.

Cisco Employee Connection

An Intranet is an internal network based on Internet and World Wide Web technology that delivers immediate, up-to-date information and services to networked employees anytime, anywhere.

Whether providing capabilities to download the latest sales presentation, arranging travel, or reporting a defective disk drive to the technical assistance center, an Intranet offers a common, platform-independent interface that is consistent, easy to implement, and easy to use.

Initially, organizations used Intranets almost exclusively as publishing platforms for delivering up-to-the-minute information to employees worldwide. Increasingly, however, organizations are broadening the scope of their Intranets to encompass interactive services that streamline business processes and reduce the time employees spend on routine, paper-based tasks.

Intranet applications are platform-independent, so they are less costly to deploy than traditional client/server applications, and they bear no installation and upgrade costs since employees access them from the network using a standard Web browser. Finally, and perhaps most important, Intranets enhance employees' productivity by equipping them with powerful, consistent tools.

Cisco's Intranet, known as Cisco Employee Connection, is one component of Cisco Connection, a collection of interactive electronic services that also incorporates selected sites on the Internet as well as CD-ROMs. Cisco Connection is a natural extension of Cisco's history and corporate culture.

A History Steeped in the Internet. With more than 80 percent of routers on the Internet marked with the Cisco label, Cisco is recognized as the world leader in Internet technology. Cisco Connection leverages Cisco's knowledge of the Internet to enhance the productivity of its customers, suppliers, partners, and employees.

Meteoric Growth. As one of the nation's fastest-growing companies, with as many as a thousand new employees signing on in a single quarter, Cisco recognized, early on, the necessity of developing Intranet-based applications that allow Cisco to scale to meet

the needs of its expanding workforce and that encourage customers, suppliers, partners, and employees to work more smartly.

Global Connections. With sales offices in more than 125 locations, Cisco depends on immediate, real-time communications with customers, suppliers, partners, and employees worldwide.

While Cisco Connection addresses the needs of Cisco customers, partners, suppliers, and employees, Cisco Employee Connection is limited to information and services that address the unique needs of Cisco employees. Cisco Employee Connection applications, which are created by nearly every department in the organization, provide employees with the following benefits.

Instant Global Communications. Each of Cisco's 7000 employees is connected through the Cisco network. Cisco Employee Connection adds significant value to that network by affording instant, one-shot communication with each employee. Cisco's marketing department, for example, uses Cisco Employee Connection to distribute the latest product and pricing information to employees in offices around the globe, saving tens of thousands of dollars in printing and mailing costs and decreasing time to market by as much as a week.

Streamlined Business Processes

Cisco Employee Connection's interactive tools reduce the time employees spend handling repetitive tasks and streamline routine business processes. For example, an employee using Cisco Employee Connection to enroll in an internal training course completes the registration online, anytime, from anywhere, without ever speaking to a training department employee. The Intranet application then routes the training class request to the employee's manager for approval; enrolls the employee in the class; and sends the employee e-mail confirming enrollment.

Consistent Business Systems

The Cisco Employee Connection homepage serves as the launching pad for dozens of Web-based information sources and services, all of which share the same navigational tools and a common user interface. An employee can check the online floor plan to locate a meeting room, report a software problem to IS, and glean the details of the latest product promotion---all without leaving Cisco Employee Connection.

Lower Business Costs. Cisco's Intranet applications are far less costly to develop, deploy, and update than traditional client/server applications. Web-based applications work identically on all platforms without expensive porting, so there is no need to develop different versions for the Windows, Macintosh, and UNIXTM platforms. In addition, Intranet applications incur neither installation nor update costs because users always access the latest version from Cisco's Intranet server.

Because of applications' complexity, rewriting applications to make them Intranet-based is not always feasible. In these instances, Cisco applies an 80/20 rule, that is, that users use 20 percent of an application's functionality 80 percent of the time. Cisco developers take advantage of this 80/20 rule by offering users access to that 20 percent functionality through Web-based windows into larger database applications. By accessing databases through this window employees can exploit the Intranet's consistent interface, which is easy to use and is time saving.

Scalability

Cisco's profitability depends on an internal network of systems that can scale to meet the needs of a growing business. Because all Cisco Employee Connection applications are designed to support growth, Cisco can add new employees without stressing its business systems or hiring additional support staff

Cisco Connection		
	Audience	Solutions
Internet	Employees Partners Customers Suppliers	Commerce Agent Suite: — Status Agent — Pricing Agent — Configuration Agent Sales Tools CD-ROM
Cisco's Intranet (Cisco Employee Connection) • Secure, Transparent Architecture • Firma!! Network Security	Employees	Facilities Travel Arrangements (Metro) Technical Documentation Human Resources Training Sales and Marketing Financial

Figure 4.3. The Cisco Connection Comprises CD-ROMs/Intranet Application and Internet Applications.

Intranet features and applications are limited only by an organization's business needs. The following application list highlights the breadth of Cisco Employee Connection interactive services:

- (1) Engineering: All technical documentation, release notes, software library, and bug navigator.
- (2) Sales: Pricing, configuration, and order status information.
- (3) Marketing: Complete technical document library, product catalog, directory of offices and service centers, newsletter, event listings, press releases, advertising, and PacketTM and CiscoLinkTM publications, sales, and marketing material.
- (4) Training: On-line training registration, training schedules, and synopses.
- (5) Financial: Annual report, links to Cisco stock prices and volume histories, financial press releases, downloadable income statements, and balance sheets in Excel format.

- (6) Human Resources: Job listings, insurance-plan information, health-care provider listings, employee address-change forms, news services, clubs and groups, business-unit definitions, and organizational initiatives.
- (7) Facilities: Technical Response Center, network and system performance data, work request forms, floor plans, and cafe menus.

4.5 Cisco's Organizational Model for Intranet Development

Creating an Intranet requires contributions from dozens of departments within an organization. The challenge Cisco faced in setting up its Intranet was to develop a model that scaled and distributed application development while maintaining a unified, integrated, corporate Intranet site with a consistent look-and-feel and navigational structure.

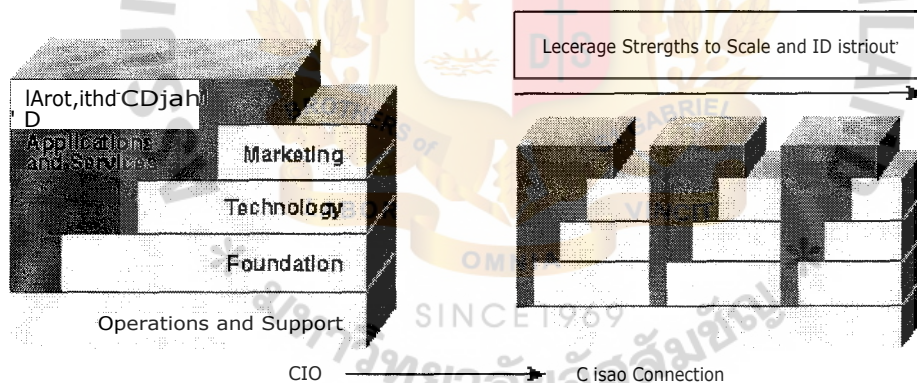


Figure 4.4. Cisco's Organizational Model for Intranet Development Uses a 3-Tier Model That Provides Centralized Support While Scaling and Distributing.

Cisco achieves this balance using a model in which each department and business unit designates its own Intranet content developers and application developers who also leverage Cisco's centralized, three-tiered Intranet development infrastructure. That infrastructure consists of:

Tier 1: Foundation Technology

This tier includes the hardware as well as the technology---including common Web servers, system software, security conventions, and common browsers---required to develop consistent applications that span the corporation.

Tier 2: Centralized Technology Expertise

Cisco's Interactive Technology Group oversees functions related to Intranet, Internet, and CD-ROM applications development. This group's charter is to provide Intranet application developers throughout Cisco with the technical expertise to utilize the foundation technology offered by tier 1's overall systems integration.

Tier 3: Centralized Marketing Expertise

Cisco's Interactive Marketing Tools Group oversees marketing functions related to Intranet, Internet, and CD-ROM applications development. The group is responsible for providing developers key Intranet components---including a consistent look-and-feel, a consistent human interface, and a coherent navigational structure---while facilitating and encouraging content development across the organization.

Planning for the Future

Intranets, with their indisputable benefits and minimal startup costs, clearly are here to stay. Meanwhile, emerging technologies promise to support whole new classes of Intranet applications.

At Cisco, employees already are taking advantage of broadcast video to view scheduled events such as company meetings and training seminars from their desktops. In the future, conference-room and personal-desktop videoconferencing will enable employees across campus or around the world to share applications and white boards, as well as images; video-on-demand will enable employees to download training sessions on to their desktop computers and to collaborate on joint projects.

Meanwhile, in New York City, Cisco is experimenting with a whole new way to work. Thirty Cisco employees share ten workspaces in a virtual office that depends on dynamic addressing to ensure that employees maintain access to Intranet technology regardless of their office's location.

Travel Arrangements Online

Cisco is partnered with SABRE Travel Information Network/BTS and the SABRE system will be seamlessly integrated into Metro. Today, employees rely on agents booking and making travel arrangements for them. With Metro, employees will be empowered to book their own airline flights, car rentals, and hotel reservations according to personal preference and company policy, and will gain the ability to view and change existing reservations. "While Metro will not replace our travel staff, it will be an additional tool to add value for employees," Loftin explains.

Metro has won the approval of Cisco's Travel and Expenses department because it will eliminate the manual data entry that's currently required to transfer data from employees' spreadsheets to a centralized database and because it gives Cisco management a far more accurate picture of the types of expenditures employees make.

Cisco began its foray into interactive Intranet applications with travel arrangement and expense reimbursements because these applications are used by employees at all levels and in all departments. If Metro proves successful, Cisco plans to develop similar interactive Intranet applications for departments, from human resources to manufacturing to finance.

At Cisco, Enterprise Management Begins on the Intranet

Like most large corporate networks, Cisco is comprised of heterogeneous and geographically dispersed computer systems that run hundreds of applications and are linked by a network employing multiple protocols and transmission technologies.

Due to its rapid growth and increased emphasis on distributed client/server applications, Cisco traditionally has taken a decentralized approach to managing this vast array of resources. As a result, engineers in one part of the company frequently didn't know about infrastructure modifications instituted by engineers in another part of the company, and support tools for individual applications rarely were integrated across the enterprise.

After analyzing these issues, Cisco's IS group determined that what Cisco needed was an Enterprise Management System that broadened the concept of network management to all information resources including host computers, desktop systems, databases, and applications. The common interface the IS group chose to deliver that system was Cisco's Intranet.

Cisco Senior Network Engineer Alan Conley explains that the IS group made the Intranet the Enterprise Management System's linchpin for several reasons. First and perhaps most important is the fact that, on the Intranet, users always have the most up-to-date Enterprise Management software. This is critical, since engineers launching new applications and introducing new technologies modify the Enterprise Management System on an ongoing basis.

Ease of Development

Another point in the Intranet's favor is ease of development. Using the Perl programming language, engineers are able to add high-level functionality as well as a consistent look-and-feel to the Enterprise Management System with minimum time and effort. And, because the Intranet serves as a publishing platform as well as an entry point into multiple databases, users go to the same location to access Enterprise Management System data and documentation.

The primary focus of the Enterprise Management System is optimal performance, a goal that it achieved through fault management techniques that detect component failures and performance degradation; then correct those failures either automatically or manually. The Enterprise Management System uses fault management techniques to access a wide spectrum of performance parameters including memory usage, disk usage, CPU usage, network response time, and application response time.

Because the Enterprise Management System works across all system components, engineers can trace problems back to their source. For example, an application developer recently used the Enterprise Management System to determine whether performance problems reported by European users were the result of the application's shortcomings or of network bottlenecks.

Internal Database Access

The Enterprise Management System's effectiveness is due in part to its ability to access Cisco's internal databases. If, for example, an alarm sounds indicating a problem with an application, an operations engineer can click on contact information. The system then pulls relevant data--- including the responsible engineer's phone number and pager number---from the HR database. Access to HR data also enables the Enterprise Management System to automatically remove computer access privileges from individuals who have left Cisco and provides an accurate accounting of the number of individuals at each site, a key factor when determining network bandwidth requirements.

In many ways, Cisco's internal Enterprise Management System is in keeping with the network management approach Cisco affords its customers. Says Conley, "In both instances the architectures are designed to be scalable to support continued growth in

the infrastructure and to be flexible enough to easily adapt to new technologies and requirements."

Video Multicasts Bring Training and Company Meetings to Employees' Desktops
With employees, partners, and customers located in more than a hundred locations worldwide, Cisco's ongoing challenge is to provide its geographically distributed learners with timely, consistent training. Multicasting, or live video on the desktop, represents one of today's most promising technologies for responding to diverse training needs.

Cisco recently has launched two pilot projects aimed at assessing the viability of multicasting as a training and communication tool. Cisco chose Precept Software's IP/TV as the viewing software that brings multicasting to employees' desktops.

"Cisco created the network infrastructure necessary to deliver broadcast video. Precept has taken advantage of that infrastructure to develop broadcast video applications," explains Precept's Joe Huber.

Cisco's first pilot project demonstrated multicast technology's potential as a training aid. Instead of sending each learner to a central location to attend three days of Cisco IOS training, a cross-functional team at Cisco multicast the seminar to selected sales offices throughout the United States.

A Cost-Effective Training Solution

Based on this project's success, John Hara, Program Manager with Cisco's Knowledge Products, is confident that multicast video will provide a highly cost-effective way to deliver distance learning in the future.

"This trial proves that multicast video training at the learner's desktop is easily justifiable when compared to the cost of travel and time lost away from primary responsibilities," Hara commented.

The IOS training session included eighteen presenters and spanned three eight-hour sessions. The live training was videotaped while simultaneously multicast over the corporate network using Cisco technology. Hara plans to rebroadcast the IOS training as scheduled multicasts. Viewers will be able to selectively watch segments of the training at their desktops using a simple software application. Hara also plans to build interactivity into future multicasts so viewers can communicate directly with presenters in real time.

Cisco's second multicast project was to broadcast a quarterly meeting held at its corporate headquarters in San Jose', CA approximately three hundred employees viewed all or part of the multicast. Cisco's global presence coupled with its development of state-of-the-art networking solutions suggests that multicasts of company meetings and market updates are likely to become common occurrences in the future.

"If you think of how extensively personal computers were used ten years ago and how they're used today, you can imagine the future for multicast video," says Dave Evans, an Information Systems analyst at Cisco and a key player in developing Cisco's Intranet video strategy. "The challenge we now face is how to maximize multicast's potential as a communication and training tool."

4.6 The Cisco Networking Products Marketplace

The Value of Placing and Managing Orders for Cisco Networking Products and Services On line

Businesses choose Cisco solutions as much for innovation as for reliability. In today's competitive marketplace, however, purchasing the right product is no longer enough. Businesses must also be able to implement their solutions quickly---the sooner they do, the sooner they and their customers benefit from the networking investment.

Cisco's model for conducting business transactions is based on the understanding that leveraging the power of the Internet not only speeds the implementation of networking solutions, it also enhances interactions between customers, partners, and suppliers. One of Cisco's Internet-powered innovations is Cisco Connection Online (CCO), the foundation of a suite of interactive networked applications that provide immediate, open access to Cisco information, resources, and systems. It allows all constituents to streamline business processes and improve productivity. Through CCO, direct customers and partners can access a variety of applications, including the Networking Products Marketplace, which delivers the Cisco Internet Commerce Applications.

The Cisco Internet Commerce Applications are comprehensive, Internet-based tools that enable users to manage several business processes on line, including product ordering, shipment tracking, and maintenance and warranty monitoring. Available based on entitlement, these applications deliver the same data that is used by Cisco representatives, so customers can access the critical information they need directly from their desktops.

Ensures Order Accuracy

Cisco databases are continually updated to reflect changes in product availability and pricing, ensuring the accuracy of all orders. Cisco Internet Commerce Applications provide immediate access to these databases, so customers and partners always have current information at their fingertips. For example, with the Cisco Pricing tool, users can price a particular product or an entire order; with the Configuration tool, they can create sample configurations or configure specific products for ordering purposes. Both tools automatically validate the accuracy of all data prior to order submission, so they

eliminate the time-consuming rework and costly delays associated with order correction and resubmission.

Reduces Lead Times

Access to timely, accurate information enables direct customers and partners to significantly reduce lead times. With the Pricing tool, for example, users can print, fax, or e-mail price lists, eliminating time differences and greatly accelerating quotes. The Ordering tool allows users to configure, price, and submit their orders directly to Cisco's order processing team via the Internet, eliminating delays due to the mail, manual routing, or order entry. And because this tool also verifies accuracy of all information prior to submission, orders can be expedited for scheduling. International customers benefit greatly from the Invoice tools, which allow the viewing and printing of invoices for faster retrieval from customs---and faster deployment of solutions. The RMA/Service Order tools help speed service part delivery by enabling users to order parts directly from Cisco over the Internet. The Product Upgrade and Returns tools also shorten lead times by allowing users to order product upgrades and submit returns for credit via the Internet rather than phone or mail. Because all of these Internet Commerce Applications enable faster shipment of products, direct customers and partners benefit more quickly from their networking investments.

Ensures Order Security

Automatic encryption ensures that orders cannot be changed or deleted without authorization. The Cisco Internet Commerce Ordering tool employs the most advanced form of encryption available today, ensuring the security of all ordering information.

Reduces Costs, Saves Time

Reducing costs and saving time is key to the success of businesses today. With the Configuration and Pricing tools, users can refine information before committing it to a

purchase order. Benefits include a reduction of costly order changes, prevention of unnecessary returns and restocking charges, and a reduction of billing and shipping errors. With the Online Order Extract tool, users may view or download orders that have been submitted via the Ordering tool within the Networking Products Marketplace. This helps reduce administrative efforts by allowing users to quickly integrate order information into existing reporting, purchasing, or order management systems. Overall, tools such as these improve the flow of information, which saves budget resources and valuable time that can be spent more productively on other projects.

Provides Instant Access to Critical Information

Instant access to current data is critical to managing each phase of the ordering cycle. For example, before ordering, users can use the Configuration and Pricing tools to view up-to-date product configuration and pricing information. They can use the Lead Times tool to access current lead times for a variety of Cisco products. After ordering, users can use the Order Status tool to view real-time order status, or use the Returns Status tool to view the status of products returned to Cisco. For access to maintenance and warranty information, users can use the Service Contract tools to view service contracts and coverage areas. With the RMA/Service Order tools, they can access immediate information on RMA and service order status. Customers may also use the RMA/Service Order tools to check the service order parts catalog---and place parts orders---via the Internet. And if users wish to view or change billing address information, they may do so electronically through the Billing Address tool. As with all of the Cisco Internet Commerce Applications, these tools enable users to access the information they need 24 hours a day, seven days a week.

Improves Order Management and Productivity

With desktop access to Cisco databases, users of the Cisco Internet Commerce Applications can find all of the information they need quickly. This not only provides greater control over orders and improved order management, it also increases the personal productivity of purchasing and finance agents, engineers, and network administrators. For example, with the Aged Account Summary tool, users can see the current status of all open invoices, credits, debits, and unapplied cash at any time. Users can even receive information automatically---without having to search for it---via the Notification tools, which deliver order acknowledgments, pricing updates, shipment notifications, and invoice notifications by fax or e-mail. Capabilities such as these improve a company's ability to quickly deploy networking solutions that have a bottom-line business impact.



Table 4.1. Summary of "Networking Products Marketplace" Applications Online Support.

Name	Description	Tool Feature
Configuration Tool	Configure products without ordering	Search for Cisco products that are configurable; choose a particular model; create a configuration on line
Pricing Tool	Price your orders	Access the online price list; search for product prices based on family, description, or number
Lead Times Tool	Check product lead times	Access current lead times for a variety of Cisco products
Ordering Tool	Configure, price, and place your order	Select, configure, and price Cisco products; create an order; route order to other internal users; submit order to Cisco on line
Order Status Tool	Check order status	Track progress/current status of Cisco orders
Invoice Tools	View invoices, credit, and debit memos	Access/view Cisco invoices, credit memos, and debit memos
Aged Account Summary Tool	View aged account summary (NEW)	Access/view aged account summary
Online Order Extract Tool	View online orders and download data	View/download data for networking product orders placed via the Internet

Table 4.1. Summary of "Networking Products Marketplace" Applications Online Support. (Continued)

Name	Description	Tool Feature
RMA/Service Order Tools	Manage service orders and parts	Access/view status of RMAs and service orders; check Cisco parts catalog; order service parts
		Submit returns for credit to Cisco via the Internet
Returns Status Tool	View return status	View status of returns submitted to Cisco
Service Contract Tools	Manage service contracts	View and search service contracts; identify service levels by region; view service pricing
Product Upgrade Tool	Order product upgrades	Order product upgrades on line
Notification Tools	Receive notifications	Receive order acknowledgments, pricing updates, shipment notifications, and invoice notifications
Billing Address Tool	Change billing address	Change billing addresses on line

The most significant elements of CCO are online customer support service and networked commerce. The support section provides customers with online self-help and

guided assistance. Registered customers can log on anytime to access various tools from the company's databases from intricate details about a particular product or networked environment to bug fixes and software updates. A key feature of CCO is its tight and secure integration with Cisco's Intranet, which spans 150 locations worldwide.

According to the company, the Software Library section, where customers can find the upgrades and utilities they need, encounters over 16,000 download per week. The section also contains innovative tools that help customers locate the exact information, fixes or troubleshooting tips that they are looking for.

Almost half of all customer queries in the US including those from companies like GE and Sprint are now handled through the Cisco Web site. This helps the company avoid backlogging of telephone-based support calls. According to Cisco, 60 to 70 per cent of all inquiries that come into CCO result in users finding an answer.

Cisco's support staff constantly updates the site, so that they remain free to focus on the questions for which they do not yet have an answer. "Without CCO, my staff would have to be about three times larger to handle the same workload," Mr. Jim Abrams, Vice-President (Customer Support) says in a white paper available at the site.

And by obviating the need to print and mail documentation, the company expects the online service to save it as much as \$180 millions in production and distribution costs each year.

4.7 The Marketplace

The Cisco Marketplace section is a virtual shopping center that allows users, partners, and employees make online purchases of its internetworking products, promotional items and software. Customers have a choice of purchasing online or using configuration and pricing tools available here to create and print requisitions for submission to Cisco (or its partners) along with company purchase orders.

The Internetworking Products Center (IPC) at this section, which is accessible by Cisco's registered direct customers and channel partners, takes the difficulties out of ordering configurable products by providing intuitive, easy to understand interface. Cisco claims that as of January 1997, nearly 13 per cent of its weekly orders were made through the ordering applications in CCO.

The "Commerce Agents" family of interactive E-commerce applications at the Cisco Marketplace provide order status information, pricing and configuration details. With Status Agent for example, customers can get details about the PO numbers, order date, expected ship date, and shipping carrier without needing to call Cisco.

They can even link up directly with the Federal Express parcel tracking Web site from within CCO to find out exactly where their order is: the warehouse, on the truck, plane or receiving dock. "This type of precise order tracking prevents all kinds of possible billing and shipping problems and provides accurate proof of delivery. It makes communication with Cisco and the customer clearer, not to mention between the user and his various departments such as finance, receiving, and purchasing," the site claims.

Clear Benefits

According to the company, CCO reported the highest online sales ever over \$100 millions in the first five months since its networked commerce applications were introduced in 1996. Cisco expects 30 per cent of its annual revenue transactions to be conducted via the Net by the end of fiscal 1997.

At the pace at which it was growing with revenues nearly doubling annually for the past five years Cisco feels its move towards Electronic commerce was essential for keeping up with customer and marketplace demands.

"Cisco is using CCO as a secret weapon, rocketing to the top with soaring profits and satisfied customers. Delivering customer support through a Global Networked

Business model helps Cisco manage its high volume of customer needs and requests like never before. And customers say doing business with Cisco is a pleasure," the company's white paper says.

CCO puts the control of the relationship in the hands of the customer and partner, and makes Cisco their partner in success. For example, not only can they use Cisco's powerful search engine to check out its Q&A database, they can actually search for known bugs.

4.8 CCO Access Levels

CCO provides users with two levels of access:

- (1) Guest access for the general public
- (2) Registered access for customers who have either:
 - (a) Purchased a SMARTnet or Comprehensive support contract from Cisco, or
 - (b) Been sponsored by a Cisco-authorized partner

Guest users have access to general company and product information. Registered users have access to all information at the Guest level, plus additional in-depth information and advanced online applications and services.

Guest Access Features

Features of Guest access include:

- (1) Cisco worldwide contacts and events calendar
- (2) Press releases
- (3) Packet, Cisco's user's magazine
- (4) Product catalogue, brochures, and announcements
- (5) Training and seminar schedules
- (6) General service and support information

St. Gablici's Library

(7) Cisco Marketplace and electronic Commerce Agents

Registered Access Features

Features of Registered access include:

- (1) All Guest-level information
- (2) Interactive user applications
- (3) Open Forum, a powerful search engine for Cisco's Q&A database
- (4) Technical assistance (Case Open, Case Query, Case Update)
 - (a) Bug Toolkit
 - (b) Bug Navigator, finds known bugs
 - (c) Bug Alert, proactively alerts customers of possible bugs and fixes
- (5) Software Upgrade Planner
- (6) Software updates and upgrades
- (7) Product bulletins
- (8) Software release notes
- (9) Technical tips and references
 - (a) Known problem and workaround reports
- (10) Installation notes and case studies
- (11) Partner sales information
- (12) Order status checking
- (13) Pricing and configuration of Cisco products

4.9 Alliance Initiatives

EDS, Hewlett-Packard and Cisco Systems come together in the integrates IP Usage Management solution for service providers - the only usage management solution that can help you grow market share, retain existing customers, and improve your profitability.

About HP

Hewlett-Packard Company is a leading global provider of computing, Internet and Intranet solutions, services, communications products and measurement solutions, all of which are recognized for excellence in quality and support. HP has 127,200 employees and had revenue of \$42.9 billion in its 1997 fiscal year.

About EDS

The Electronic Business unit of EDS is focused on moving EDS customers into the global digital economy and helping to transform their business processes. This organization applies an array of electronic business technologies to enable companies to create and fulfill demand, and performs the Internet services to support these activities. Business offerings range from digital supply chain management to legacy transformation services.

EDS, the official information services provider for World Cup 1998, is a leader in the global information services industry. The company's more than 110,000 employees specialize in applying a range of ideas and technologies to help business and government customers improve their economics, products, services and relationships. EDS, which serves customers in 44 countries, reported revenues of \$15.2 billion in 1997. The company's stock is traded on the New York Stock Exchange and the London Stock Exchange.

4.10 IP Usage

EDS, Hewlett-Packard and Cisco Systems come together in the integrated IP Usage Management solution for service providers - the only usage management solution that can help you grow market share, retain existing customers, and improve your profitability.

As a provider of IP services, you have a tremendous opportunity for accelerated growth and increased profit-ability by delivering a wide range of new and differentiated services - from managed bandwidth and virtual private networks (VPNs) to interactive voice, video, messaging and Electronic commerce. It is these new services that will give you a competitive edge in attracting and retaining customers, and your ability to profitably deliver these value-added services will be a critical factor in your future success.

But matching your infrastructure costs to customer revenues and managing your capital outlay is extremely difficult. Worse yet, customer preferences for services are constantly changing, making it almost impossible to analyze usage, performance, and capacity for optimum profitability with traditional usage tools.

So, how can you gain the up-to-the-minute insight to satisfy your customer base, maximize your profits, and cut operating expenses at the same time? Only one offering can do this: the IP Usage Management solution from EDS, HP, and Cisco. It is a complete suite of business support services that can take you into the New World of service management with confidence.

The IP Usage Management solution can help you gain a decisive advantage by allowing you to:

- (1) Understand how your network is performing and how you can leverage it for additional delivery capabilities
- (2) Develop a competitive service differentiation to retain your customers and win new ones.
- (3) Gain a detailed understanding of customer behavior to reduce customer churn.
- (4) Reduce the time-to-market for new services

(5) Improve your staff productivity and asset utilization.

At the same time, the IP Usage Management solution allows you to:

- (1) Strengthen subscriber retention by delivering the choice and flexibility of tailored service plans.
- (2) Improve service differentiation by allowing customers to pay for actual use or value delivered rather than flat-rate billing.
- (3) Improve expense management and accountability by providing internal charge-back capabilities.

EDS, HP and Cisco All in One Solution

The IP Usage Management solution represents the combined strength and expertise of EDS, HP, and Cisco and is focused on delivering the best technology available for successful service provider operations.

Teams of specialists from each of these companies have joined forces to empower you to maximize your profits, improve customer retention, and differentiate your market position. All of this is now possible by leveraging your IP usage data to drive a suite of key business support systems such as billing, network and marketing analysis, and performance management.

How IP Usage Management Solution Works: Best-of-Class Components

The three industry leaders that created the IP Usage Management solution each contributes a unique set of best-of-class offerings to create a single solution.

EDS is a leader in developing end-to-end business-process solutions that span and link an enterprise's operational and business support systems throughout the value chain. Focused on business results, EDS uses best-in-class technologies to provide bottom-line value through innovative solutions. The company's solution objectivity, expertise in business support-system applications and knowledge management, and

experience in network consulting and resources for ongoing support make it an ideal partner for understanding the financial and business implications of a complete IP delivery solution.

HP's Smart Internet Usage (SIU) allows usage information to be collected, aggregated and correlated, and made available in convenient formats for complete capacity planning, billing, data mining, customer behavior analysis and other applications. SIU runs on all the common open computing platforms.

Cisco NetFlow technology, working at the router, identifies IP packet flows, performs efficient data collection, accelerates security filtering, and exports the data to downstream collectors - all while maintaining high router performance. NetFlow's fine-grained metering enables you to flexibly bill usage by time, traffic volume, application, source and destination. NetFlow is available today on Cisco routers and switches and does not require new generations of networking equipment.

By combining EDS' world-class business process management and integration expertise with industry-leading Cisco network services and HP's breakthrough Smart Internet Usage Program, this solution delivers what no other can: a single, integrated system that enables service providers to track the usage of their services down to the individual subscriber, department or company level.

Best of all, it's available now, with all of the advantages these three industry leaders offer, including ongoing product development, world-class billing partners, and worldwide support.

Get the Real Facts Whenever You Want Them

The IP Usage Management solution gives you intelligent visibility at the event level by translating packet information into detailed subscriber information across all of your IP services.

This level of insight and intelligence lets service providers develop new value-added services and monitor the success of each, allowing rapid time-to-market and an unprecedented level of competitiveness. You immediately know detailed customer information as well as how your network is performing. Never before have you been able to roll out new services with the assurance that your network can completely handle the traffic. Even better, you can influence user behavior while maximizing network utilization.

This integrated solution also lets you move from the rigid structure of flat-rate billing to flexible billing based on time, traffic volume, application, source, and destination. It lets you accurately develop multi-tiered structures that are tailored to your customer needs based on actual usage data and up-to-the-minute account information. You can now offer your customers rates based on usage and the value they derive from the network.

In fact, the IP Usage Management solution is designed specifically to work with a heterogeneous network and systems infrastructure, building on the investments you've already made.

The Broad Reach of the IP Usage Management Solution

The IP Usage Management solution opens a new world of services and applications for service providers. Some of its capabilities include:

- (1) Strategic marketing - gain a complete analysis and understanding of your customer behavior
- (2) Capacity planning - apply "just enough infrastructure" policies to optimize capital expenditures
- (3) Fraud management - use real-time, detailed user profiling to spot unauthorized users, non-billed use and excessive data storage problems

- (4) Enhanced billing systems - offload your billing system with IP Usage Management solution's tens of thousands of transactions per second performance at its front end
- (5) Application hosting - reduce your cost of operation by having applications such as general ledger and payroll reside on your server locally
- (6) Remote collaboration services minimize travel costs with videoconferencing, whiteboarding, and audio conferencing on the Internet
- (7) Education and training - offer just-in-time delivery of training and knowledge

If your particular business objectives and revenue goals are related to understanding and responding to customer behavior, the IP Usage Management solution can help you achieve them quickly and precisely. It gives you the advantage of responding to what users do, rather than what they say. And that gives you the inside track on delivering truly relevant differentiation - targeted offerings based on insight obtained from actual subscriber behavior.

Capabilities for the New World of IP

There has never been an opportunity like the one that service providers face today: escalating profitability powered by explosive Internet growth and down-to-the-penny, value-based billing. The business is there for the taking, and starting now, the solution suite to make it happen matches the job. The proven telecommunications, internetworking, computing and systems integration expertise of EDS, HP, and Cisco is now funneled into one solution that will put service differentiation and profitability in your hands.

It took three industry leaders to do this, and there is no other offering that can compete with the IP Usage Management solution which means you can't successfully

compete in the market without it. For more information, call the Alliance Hotline at 1-888-346-8287.

The IP Usage Management solution leverages the technology and expertise of EDS, HP and Cisco to create a continuous feedback and improvement cycle based on actual detailed subscriber event activity to enhance profitable IP service delivery.

The IP Usage Management solution is built on a solid foundation of data collection, aggregation and correlation services from Cisco and HP, and provides valuable network and subscriber insight by leveraging EDS' business process, integration, and application expertise.

Web Commerce Solutions

EDS, Cisco Systems, Inc. and Hewlett Packard Company have created an electronic-business alliance that will provide a single source for establishing a web-based business. This collaborative effort focuses on business-to-business and business-to-consumer applications, helping clients realize significant time saving and reduced start-up costs to do business on the Web.

This "one stop shopping" will combine EDS' premier consulting and systems-integration capabilities, world-class Internet networking solutions from Cisco, and the powerful security of HP servers and software. EDS will also deploy a global solutions center with HP and Cisco that will offer joint testing and integration of electronic-business service offerings.

Communications

The Hewlett Packard-Cisco Global Alliance is revolutionizing telecommunications to create a New World business model, and their strategic partner, EDS, is playing a critical role in helping implement the new solution among service providers.

HP and Cisco will bridge today's communications structure with the New World to deliver immediate strategic benefits to telecom service providers, enterprise customers, and consumers that will:

- (1) Drive a New World Communications Business Model that creates choices for service providers by enabling a wide variety of suppliers to create new services
- (2) Deliver easy, flexible New World services to subscribers
- (3) Optimize time-to-market, differentiation and profitability for service providers.

As part of this announcement, HP and Cisco have created the Usage Management Partner Program to encourage broad industry participation and enable service providers to confidently select usage applications and integration partners suited to their usage-management requirements. HP will work with EDS to ensure integration between the IDR and the application, and will provide comprehensive training on the Internet Usage Platform to maximize success with usage-management solutions and to help EDS more successfully deliver usage-management solutions.

EDS NetConnect'

This is a comprehensive package of mainframe-to-Internet/Intranet integration and seamless networking services offered by the alliance. The EDS NetConnectsm service calls for EDS to provide information technology services, from needs assessment and project management to implementation and systems management, while Cisco provides networking hardware and software.

EDS NetConnectsm helps organizations with legacy transforms from SNA to IP (Internet Protocol). This includes converting mainframes onto IP; and creation of

application development services that "Web-ize" mainframe applications, such as secure and appropriate Web-browser access to critical mainframe business applications.

With EDS NetConnectsm, organizations can:

- (1) Reduce operating costs
- (2) Improve customer service
- (3) Increase employee productivity
- (4) Increase speed-to-market
- (5) Develop innovative applications
- (6) Expand customer base
- (7) Share corporate data
- (8) Maximize processing power

Transform User Data into Revenue

The IP Usage Billing solution helps maximize service provider profitability with the integration of the IP Usage Management solution and Portal's real-time customer management and billing software.

To succeed in the increasingly competitive New World of mission-critical service management, you need an advanced, integrated customer management and billing system that gives your service business real-time support rather than full-time limitations. The IP Usage Billing solution integrates the IP Usage Management solution from EDS, HP, and Cisco with Portal Software's best-in-class Intranet IP customer management and billing software. This comprehensive solution includes a complete suite of revenue-management services that can take you into the New World of mission-critical service and customer management with confidence.

The IP Usage Billing solution allows you to move out of the flat-rate billing paradigm associated with "best-effort" networks. That's critical because as your

differentiated, customized offerings expand into your customers' mission-critical business functions, your ability to enable flexible billing based on usage, content, and other attributes like contracted QoS levels will deliver a clear competitive advantage. The IP Usage Billing solution provides you not only with world-class tools for metering, billing, and customer management, but also with the consulting expertise to design a billing strategy that manages your profit margin and leverages your network as a competitive advantage.

The IP Usage Billing solution allows you to manage user data down to the packet per subscriber level - filtering and aggregating this data into event levels that a subscriber can understand and a billing system can manage. By applying this level of granularity, the IP Usage Billing solution gives you a comprehensive tool to pinpoint revenue opportunities, identify and control network throughput and costs, and balance traffic patterns. The IP Usage Billing solution also greatly cuts time-to-market for new services because it provides you with a single, consistent, rules-based means to generate billing records for all services on your network - independent of the application providing the service.

Customer Management and Billing Applications

One of the key elements to successful growth in the IP market space is the ability to effectively manage customers and bill for differentiated mission-critical services. The IP Usage Billing solution incorporates the ability to provide alternative billing schemes, such as flat-rate, time-of-day, usage-sensitive, application, destination/distance/carrier, class-of-service, or any combination of these rating elements. Using this new degree of flexibility, you can set prices for the services offered that more accurately reflect the delivery cost or enable increased revenue for high-demand service value.

The IP Usage Billing solution uses Portal's real-time customer management and billing software to help service providers rapidly develop, price, and provide new services and effectively manage customer usage and billing. This solution allows providers to generate more revenue and be more competitive by enabling them to bring new services to market more quickly, thus increasing their ability to identify, acquire, and retain customers while increasing profitability.

Some of the benefits of IP Usage Billing include:

- (1) Rapid introduction of new services to the market, keeping you ahead of your competition.
- (2) Revenue assurance by eliminating fraud through real-time authentication and authorization.
- (3) Proof positive that the service provided meets or exceeds the Service Level Agreement.
- (4) Increased revenue through demonstrated value for premium services.
- (5) Accountability for the service provided to customers, regulators, and policy makers.
- (6) Billing options that include electronic bill presentment and payment and transaction-based pricing.

Key Features of the Portal Software Component of IP Usage Billing Include:

Real-time system - allows the service provider to intelligently monitor and manage the interaction between the user and the service during service delivery and exploit this ability for business advantages.

Industrial-strength platform - ensures the robustness and scalability of the mission-critical customer management and billing operation in the service provider's environment.

Flexible pricing tool - makes it easy to add new services, price them, and create combinations of services or bundles to target specific market segments and affinity groups.

Portal's real-time capabilities allow you to respond to customer needs immediately, helping to increase revenues and customer loyalty at the same time. Intranet has a flexible, open architecture that is easily integrated with HP Smart Internet Usage and Cisco NetFlow technology.

The Foundation for This Solution Includes Four Principle Components:

EDS provides expertise in developing end-to-end, business-process solutions that span and link an enterprise's operational and business support systems. Combining this ability with the technologies of HP, Cisco, and Portal, EDS delivers a world-class foundation upon which to build your business.

HP Smart Internet Usage (SIU), an advanced technology, gives service providers and network managers a consolidated Internet data-metering and analysis-mediation platform. SIU enables simplified data mining, tracking, and billing of subscriber utilization of network resources, services, and systems.

Cisco NetFlow technology, working at the router, identifies IP packet flows, performs efficient data collection, accelerates security filtering and exports the data to downstream collectors - all while maintaining high router performance.

Portal Software, Inc. offers a scalable and adaptable customer management and billing software system for service providers. Portal's Intranet software was designed

specifically for the Internet and offers comprehensive functionality to register, manage, and bill customers.

A world-class fully integrated customer management and billing solution make your business more profitable.

In today's competitive IP market, you can't afford to make mistakes when you choose your business partners. With the IP Usage Billing solution, you get the combined strength and expertise of top industry leaders EDS, HP, Cisco, and Portal - strength and expertise that provide a critical competitive advantage.

No other offering competes with the IP Usage Billing solution which means you can't successfully compete in the market without it.

EDS, Cisco Systems, Inc. and Hewlett-Packard Company today announced an electronic-business alliance, led by EDS' Electronic Business unit that will provide a single source for establishing a Web-based business. This collaborative effort focuses on business-to-business and business-to-consumer applications, helping clients realize significant time saving and reduced start-up costs to do business on the Web.

This "one stop shopping" will combine EDS' premier consulting and systems-integration capabilities, world-class Internet networking solutions from Cisco, and the powerful security of HP servers and software.

EDS also will deploy a global solutions center with HP and Cisco that will offer joint testing and integration of electronic-business service offerings. "This could be the 'dream team' of electronic business," said Paul Rudolph, president of the Electronic Business unit at EDS. "Collectively, we have the expertise and the tools to completely change the way a business moves its goods and services from the industrial age to the digital age. Our companies are already providing successful solutions spanning all industries, which differentiates us from other Web teams in the marketplace."

EDS and HP set new records at the World Cup France 98.com site, setting a daily record of 74 million hits on June 30, 1998, demonstrating the enormous impact of Web commerce and Web-based offerings at the World Cup Store. The multi-lingual store, launched in just two months, shipped 400 types of World Cup goods to 55 countries and operated in 11 world currencies.

"A successful Internet commerce recipe includes not only strong technology and platforms, but solid integration of back-end systems," said Melissa Bane, program manager, Internet Market Strategies with the Yankee Group.

"Competitive players don't have time to shop around for the various providers and then determine if they can and will work together. Alliances such as this allow one-stop shopping for competitive Internet commerce hopefuls. Time to market and quality of technology are a necessity to lower costs, increase revenues, reach new markets and gain a competitive advantage."

The applications use the proven delivery record of the EDS Electronic Business unit. Successful implementations of the EDS Web Commerce Services offering include these business-to-business and business-to-consumer applications.

Industrial Products Distribution: Enables distributors to more accurately and efficiently process orders while increasing customer satisfaction. Recent data indicates a 300 percent increase in new orders for some steel distributors using the service. In one case, turnaround time on orders dramatically decreased from two weeks to three days.

Procurement: Improves purchasing practices while reducing administrative costs - allowing large companies, school districts and government agencies to use Web-based catalogs to buy everything from office supplies to computer equipment.

The Initial Business-to-consumer Applications Include the Following:

Financial: Enables the quick creation of Internet retail-banking and bill-presentment Web sites, permitting customers to take care of banking needs from the convenience of home or office.

Sports/Entertainment: Creates an electronic storefront environment that allows organizers of major sporting and entertainment events to sell tickets, promotional items and provide a source of event, team and personnel news.

The Employee Store: Provides a convenient means for employees to purchase discounted products and services through their corporate Intranet - from corporate recognition items to steaks and flowers; and **Customized Services:** Web-enabled services may include EDI services, real-time inventory control, credit-card authorization, automating shipping and tax-calculation charges, and audio and video applications for "live" training or customer service.

"By migrating business functions to the Internet, businesses are increasing revenues, decreasing expenses, speeding time to market and forming tighter links to customers," said Steve Behm, vice president of Strategic Alliances at Cisco Systems. "Our collaborative work with EDS and HP is aimed at developing secure and robust Internet business solutions quickly and easily."

"Performing business over the Web is becoming a strategic component in the success of a company's business," said Nigel Ball, general manager of HP's Internet and Applications Systems Division. "HP, EDS and Cisco are helping enterprise customers expand their Web-commerce offerings through integrated, tested and customized solutions that reduce the complexity and time involved in deploying business over the Internet."

V. CONCEPT OF E-ENGINEERING WITH THE DISTRIBUTION BUSINESS

Distributors have long played a valuable economic role, even before the rise of the Internet and electronic commerce. Distributors make a living by meeting several critical economic functions: they overcome one-sided or prejudiced information about products and parties in a transaction, they make markets by providing a place for buyers and manufactures to meet, and they often provide technical knowledge that would be too expensive for buyers or manufacturers to have on hand.

The Internet has provided new potential for distributors. By providing a communication and transaction infrastructure, the Internet enables distributors to lower their transaction costs. It has also expanded their potential customer base by making operations global.

5.1 Company Background

Borneo Technical (Thailand) Ltd is a member of the Li & Fung Industrial group. The main operation is to be distributor on variety of products divided into distinct categories, each with its own synergy of product lines and customer base as:

- (1) Automotive Products: Transmissions, shock absorbers, spark plugs, tires, belts, refinish paint, and other body shop supplies.
- (2) Car Care Products: Automotive films, lubricants, and other related car care products.
- (3) Industrial Supplies: Hand and power tools, door and window accessories, abrasives, tapes, and maintenance products.
- (4) Engineering: Automatic transmissions, oil and air filters, brake linings, transmissions, converters, axles, and transfer cases.

The Group's unparalleled distribution and logistics network provides access to more than 3,500 dealers and over 1,700 key accounts nationwide.

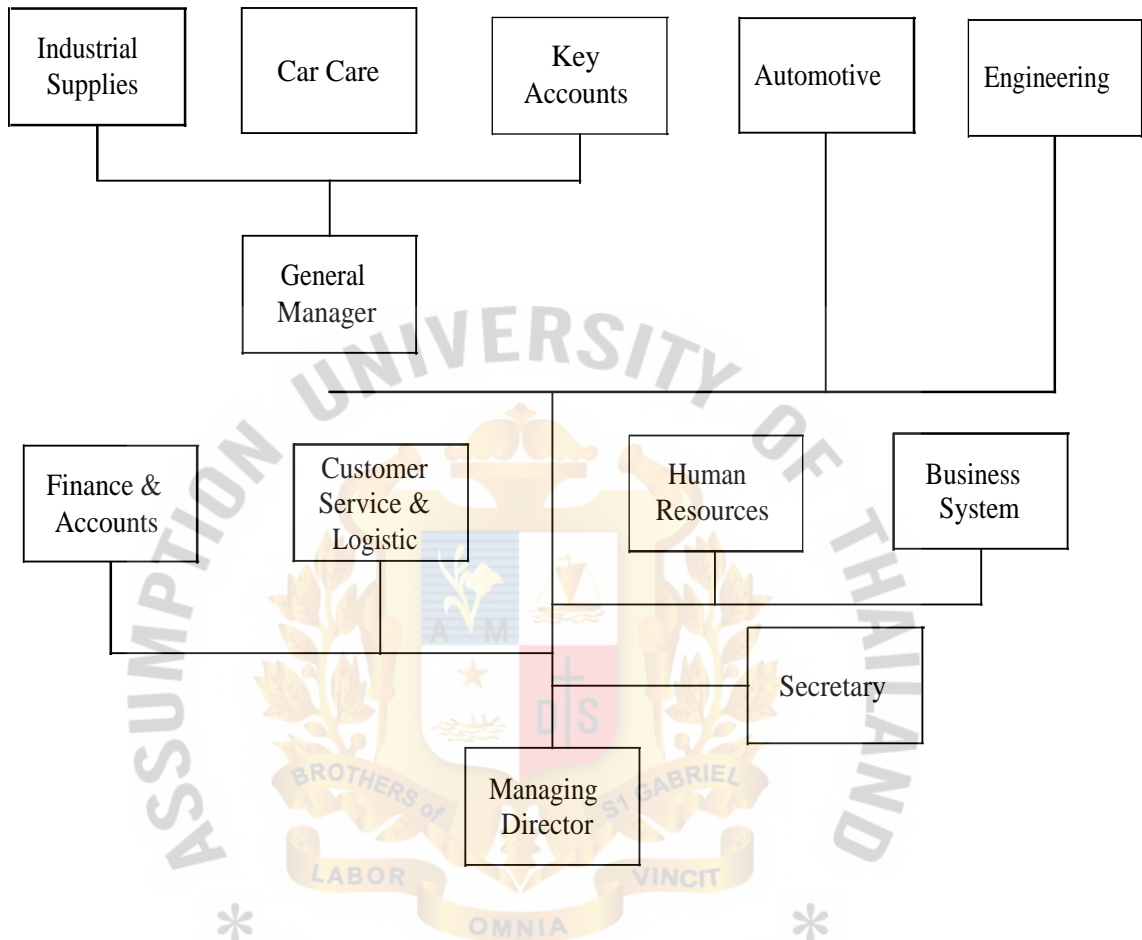


Figure 5.1. Existing Organization Chart of the Company.

There are 2 main direct management control functions. The General Manager takes responsibility for 3 divisions: Industrial Supplies Division, Car Care Division, and Key Accounts Division. The Managing Director is responsible for Automotive Division, Engineering Division, Finance and Accounts Division, Customer Service and Logistic Division, Human Resources Division, and Business System Division.

To improve overall business operations and interrelationships with business partners, suppliers, and customers, the company intends to apply "E-engineering"

concept by using the Internet, Intranet, Extranet, Enterprise Collaboration System, and Electronic Communication tools.

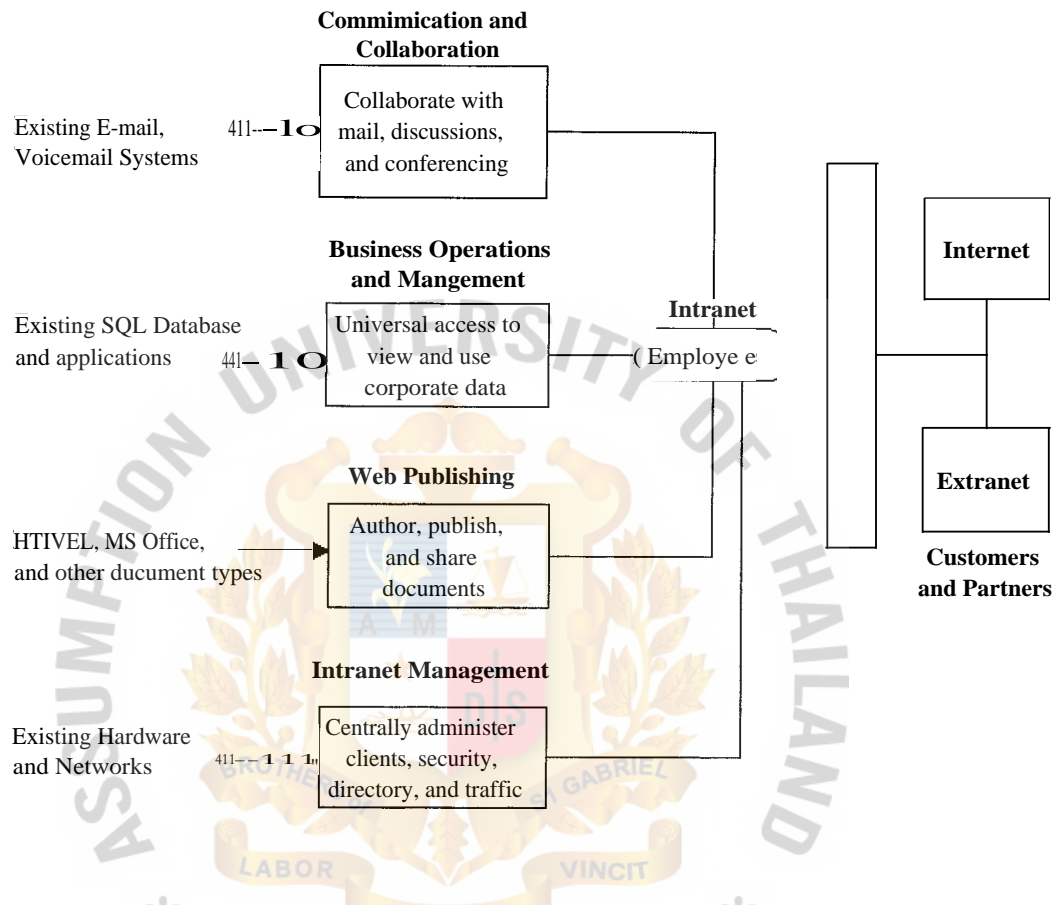


Figure 5.2. The Basic Applications of Intranet Include Communications and Collaboration, Business Operations and Management, Web Publishing, and Intranet Management.

5.2 Organizational Planning

To implement E-engineering, the company goes through an organizational planning process of team building, modeling, and consensus, evaluating what the company has accomplished and the resources it has acquired, analyzing business, economic, political, and social environment, anticipating and evaluating the impact of

future developments, building a shared vision and deciding on what goals the company wants to achieve, and deciding what actions to take to achieve the company's goals.

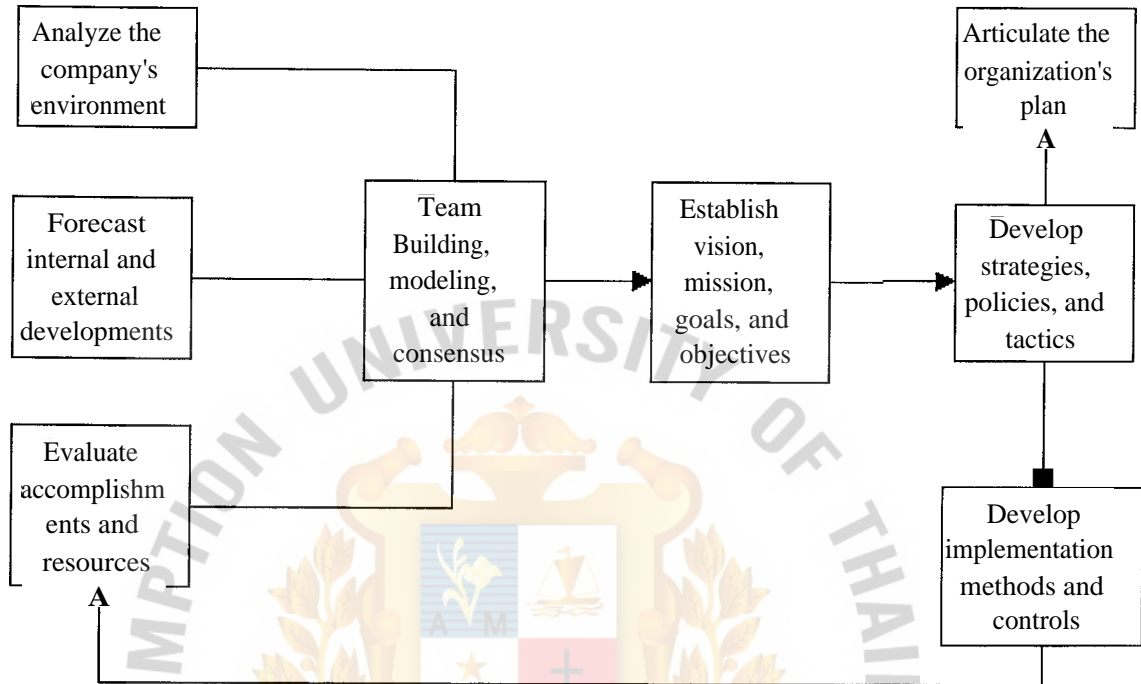


Figure 5.3. The Organizational Planning Process.

The result of organizational planning process formally articulates the actions that are necessary to achieve the company's goals. Organization planning process is an action statement which leads to actions. Actions produce results, and part of planning is learning from the results.

Planning Terminology

A shared vision is a common sense of purpose and values shared by the members of the company. A mission is the company's reason of being. It is a statement of the basic purposes of which the company exists. Goals are broad statements of the ends the company intends to accomplish in order to fulfill its mission. Objectives are most

specific, measurable elements of a goal.

Strategies are general approaches that show how goals should be achieved, and tactics are more specific guides to actions that would implement strategies. Policies are general guidelines that direct and constrain decision making within the company. Policies are implemented by rules and procedures, which are more specific statements than direct decision-making.

Type of Planning

Planning is discussed, typically, in term of the level of planning (strategic, tactical, and operational) and the planning time frame. Strategic planning deals with the development of the company's mission, goals, strategies, and policies. The company begins the process by developing a shared vision using a variety of techniques, including team building, scenario modeling, and consensus creating exercises. Team planning sessions frequently include asking and answering questions about the company. Tactical planning involves the design of tactics, the setting of objectives, and the development of procedures, rules, schedules, and budgets. Operational planning is planning done on a short-term basis to implement and control day-to-day operations.

Long-range planning usually involves looking three to five years (or more) into the future. However, the company has a continual planning process that reviews and modifies its long-range plans on a regular basis. Short-range planning can range from daily, weekly, and monthly planning to a one-year or two-year time frame.

All operational planning and tactical planning are done on a short-range basis. Most strategic planning and some tactical planning are done using a medium-to-long range planning. However, if unforeseen developments with major strategic implications occur, the company would use strategic planning methods within a short time frame in order to confront the crisis.

Strategic Information Systems Planning

Business information systems planning is an important component of the company planning. Strategic planning uses the company's business vision and business drivers to create information technology architecture and tactical information system plans for the business use of information technology.

The company does strategies information systems planning with four main objectives:

- (1) Business alignment. Aligning investment in information technology with the company's business vision and strategic business goals.
- (2) Competitive advantage. Exploiting information technology to create innovation and strategic business information systems for competitive advantage.
- (3) Resource management. Developing plans for the efficient and effective management of the company's information system resources, including information system personnel, hardware, software, data, and network resources.
- (4) Technology architecture. Developing technology policies and designing an information technology architecture for the company.

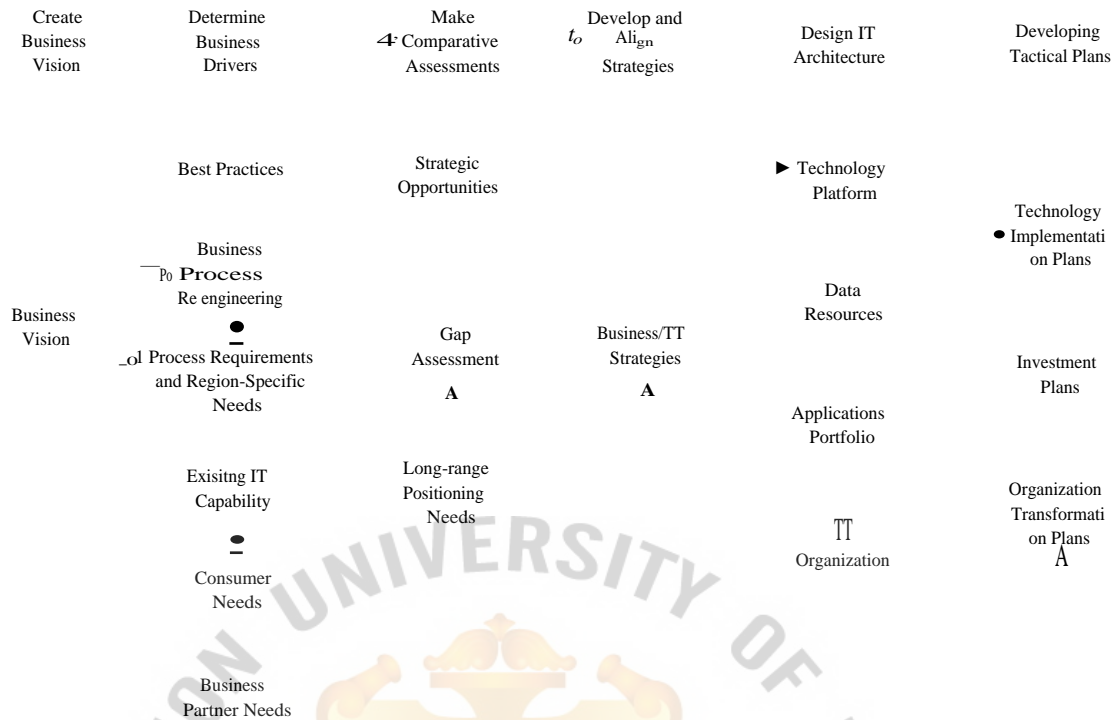


Figure 5.4. Strategic Information Systems Planning.

Strategic information systems planning process is business driven. The company's business vision and business drivers, such as business process reengineering to achieve the best industry practices and the needs of customers and business partners, are what drive the planning process. Business/IT strategies can then be developed based on the strategic opportunities that are revealed. Only then can the information technology architecture for the company be designed. The figure also shows that information technology architecture that is created by the strategic planning process is a conceptual design, or blueprint, that includes the following major components:

- (1) Technology platform. Computer systems, system and application software, and telecommunication networks provide a computing and communications

infrastructure, or platform, that supports the use of information technology in the company.

- (2) **Data resources.** Many types of operational and specialized database, including data warehouses, analytical databases, and external data banks store and provide data and information for business processes and managerial decision support.
- (3) **Applications portfolio.** Business applications of information technology are designed as a diversified portfolio of information systems that support key business functions as well as cross-functional business processes. In addition, an application portfolio should include support for inter-organizational business linkages, managerial decision-making, end user computing and collaboration, and strategic initiatives for competitive advantage.
- (4) **Information technology organization.** The organization structure of the information systems function within the company and the distribution of information systems specialists among the company and business units can be designed or redesigned to meet the changing strategies of the company. The form of the information technology organization depends on the managerial philosophy, business vision, and business/IT strategies formulated during the strategic planning process.

Tactical and Operational Information Systems Planning

Tactical information systems planning build on the business/IT strategies developed in the strategic information systems planning stage. Tactical planning is the last stage of the planning process. Tactical information systems planning produces project proposals for the development of new or improved information systems that

implement the information technology architecture created during strategic information systems planning. These projects are then evaluated, ranked, and fitted into a multiyear development plan. Finally, a resource allocation plan is developed to specify the information systems resources, financial commitments, and organizational changes needed to implement the strategic information technology development plan of the company.

Operational information systems planning involve detailed planning for the accomplishment of new information systems development projects, including the preparation of operating budgets. Annual operation budgets specify the allocation of financial and other resources needed to support the company's information services operations and systems development and maintenance activities. This also holds true for end user departments and other workgroups that do a lot of their own information processing and application development.

Project planning is an important operational planning function. It involves the development of plans, procedures, and schedules for an information system development project. Such planning is an important part of a project management effort that plans and controls the implementation of business projects.

Planning for Competitive Advantage

Planning for competitive advantage is especially important in competitive arena and complex information technology environment. So strategic information systems planning involves an evaluation of the potential benefits and risks the company faces when using information technology for competitive advantage. The company uses of a strategic opportunities matrix as Figure 5.5 to analyze strengths, weakness, opportunities, and threats and to evaluate the impact that each possible strategic opportunity can have on the company and its use of information technology.

Strategic Business Potential	High	High Risk High Payoff Opportunities	High Success High Payoff Opportunities
	Low	High Risk Low Payoff Opportunities	Safe, but Low Payoff Opportunities
		Low	High
		Firm's ability to Deliver with IT	

Figure 5.5. A Strategic Opportunities Matrix.

5.3 Business Information Systems

The advantages of E-engineering is to cut costs, increase profits, improve performance in relationships with customers and suppliers, and develop value-added services that give the company a competitive edge. There are three business objectives as:

- (1) Get the right product to the right place at the least cost.
- (2) Keep inventory as low as possible and still offer superior customer service.
- (3) Reduce cycle times. E-engineering seeks to simplify and accelerate operations that deal with how customer orders which later are processed through the system and ultimately filled.

Components of E-engineering by management category consists of

- (1) Supplier management. Use electronic commerce to help reduce the number of suppliers and get them to become partners in business in a win/win relationship.
- (2) Inventory management. Shorten business cycle with electronic commerce processes, and keep inventory levels to a minimum.
- (3) Distribution management. Use electronic data interchange to move documents related to business process such as purchase orders, delivery order, invoice, and etc.
- (4) Channel management. Use E-mail, bulletin board systems, and newsgroups to quickly disseminate information about changing operational conditions to trading partners.
- (5) Payment management. Use electronic funds transfer to link the company and systems suppliers so that payments can be sent and received electronically.
- (6) Financial management. Use electronic commerce systems to enable the company to manage cash flow.
- (7) Sales force management. Use sales force automation methods to improve the communication and flow of information among the sales and customer service.

However, if we divide each part by department category, the system will consist of 5 parts as marketing, finance, accounting, purchasing, and human resources management.

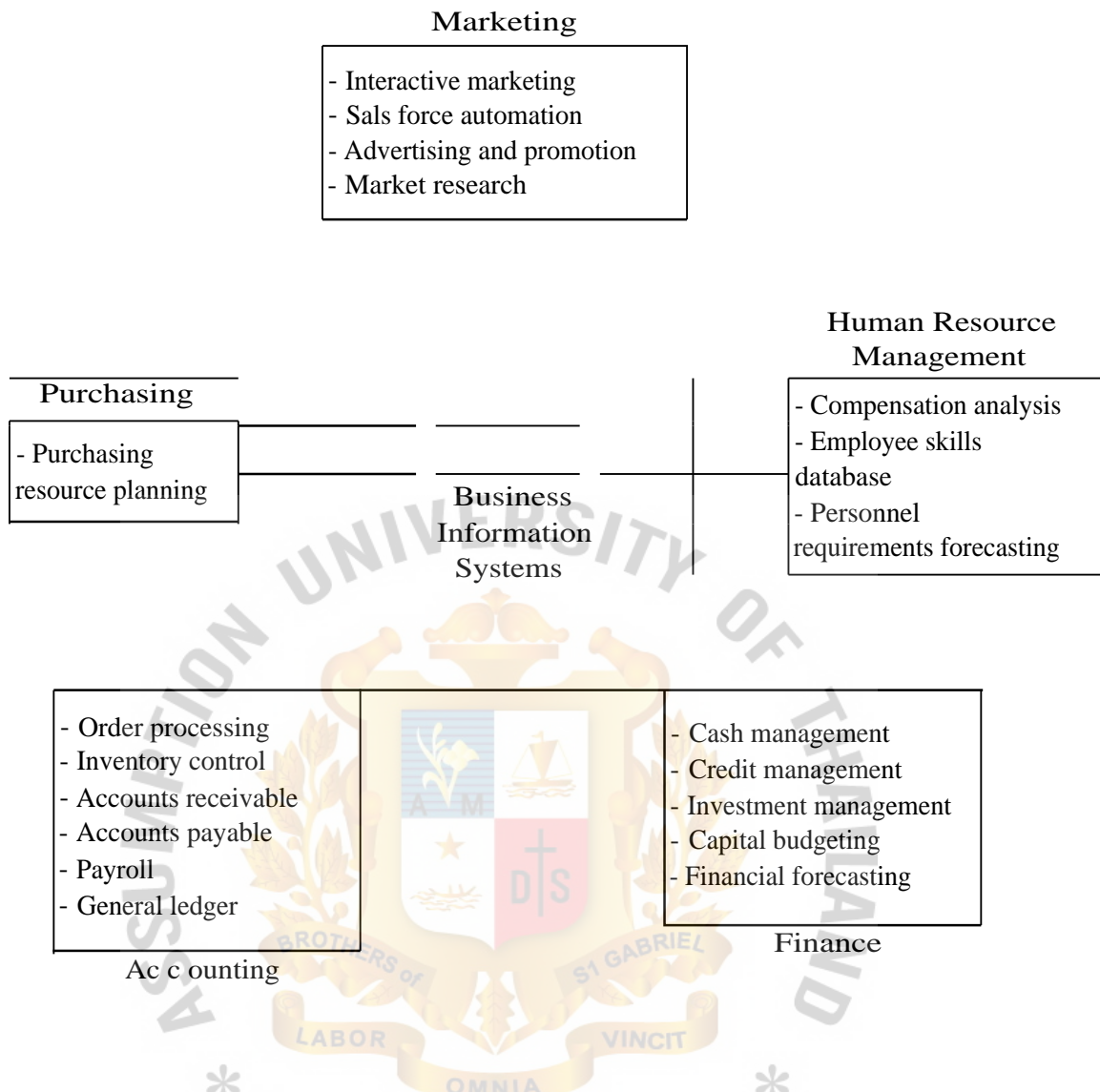


Figure 5.6. Business Information Systems for Borneo Technical (Thailand) Ltd.

The main business functions of the company consist of:

- (1) **Marketing System.** It performs interactive marketing, sales force automation, advertising and promotion, and market research.
- (2) **Human Resource Management System.** It performs compensation analysis, employee skills management, and personnel requirements forecasting.
- (3) **Finance System.** It performs cash management, credit management, investment management, capital budgeting, and financial forecasting.

- (4) Accounting System. It performs order processing, inventory control, accounts receivable, accounts payable, payroll, and general ledger.
- (5) Purchasing System. It performs purchasing resource planning.

Marketing System

The business function of marketing is concerned with the planning, promotion, and sale of existing products in existing markets and the development of new products and new markets to better serve the present and potential customers. The company has increasingly turned to information technology to help the company perform vital marketing functions. Marketing system consists of Interactive marketing, Sales force automation, Advertising and promotion, Sales management, Market research and Forecasting, Customer service and support, and Product management. Internet/Intranet Web sites make an interactive marketing process possible where customers can become partners in creating, marketing, purchasing, and improving products and services. Sales force automation system use Internet technologies to automate many information processing activities for sales support and management. Other marketing information systems assist marketing managers in product planning, pricing, and other product management decisions, advertising and sales promotion strategies, and market research and forecasting.

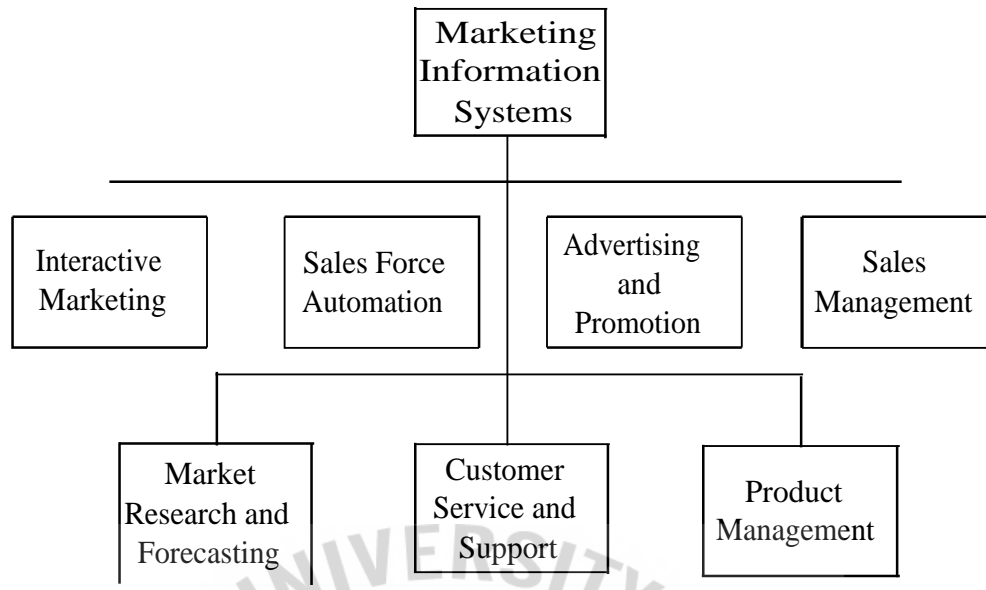


Figure 5.7. Marketing Information Systems Provide Information Technologies to Support Major Components of the Marketing Function.

Interactive marketing has been coined to describe a type of marketing that is based on using the Internet, Intranets, and Extranets to establish two-way interactive between the company and customers or potential customers. The system uses Internet as distribution channel. The use of Interactive marketing will encourage customers to become involved in product development, delivery, and service issues. This is enabled by various Internet technologies, including discussion groups, Web forms, questionnaires, and E-mail correspondence. The expected outcomes of interactive marketing are a rich mixture of vital marketing data, new product ideas, volume sales, and strong customer relationships.

Sales Force Automation is being outfitted with computer, Web browsers, and sales contact management software that connect sales person to marketing Web site on the Internet. This does not only increase the personal productivity of salespeople, but dramatically speeds up the capture and analysis of sales data from the field to marketing

managers at the company. In return, the system allows marketing and sales management to improve the delivery of information and the support they provide to salespeople. To implement sales force automation system, salespeople can use their computer to record sales data as they make their calls on customers and prospects during the day. Then each night sales persons in the field can connect their computers by modem and telephone links to the Internets and Extranets, which can access Intranet or other network servers at the company. Then they can upload information on sales order, sales calls, and other sales statistics, as well as send electronic mail messages and access Web sites support information. In return, the network servers may download product availability data, prospect lists of information on good sales prospects, and E-mail message. The benefits of Web-based sales force automation consist of:

- (1) Shorten the sales cycle through pre-qualification of prospects.
- (2) Increase revenue through targeted marketing.
- (3) Automate the management and qualification of Web leads.
- (4) Capture all customer information directly into a sales database.
- (5) Enhance order management with access to data on pricing, promotions, availability, carriers, and transportation schedules.

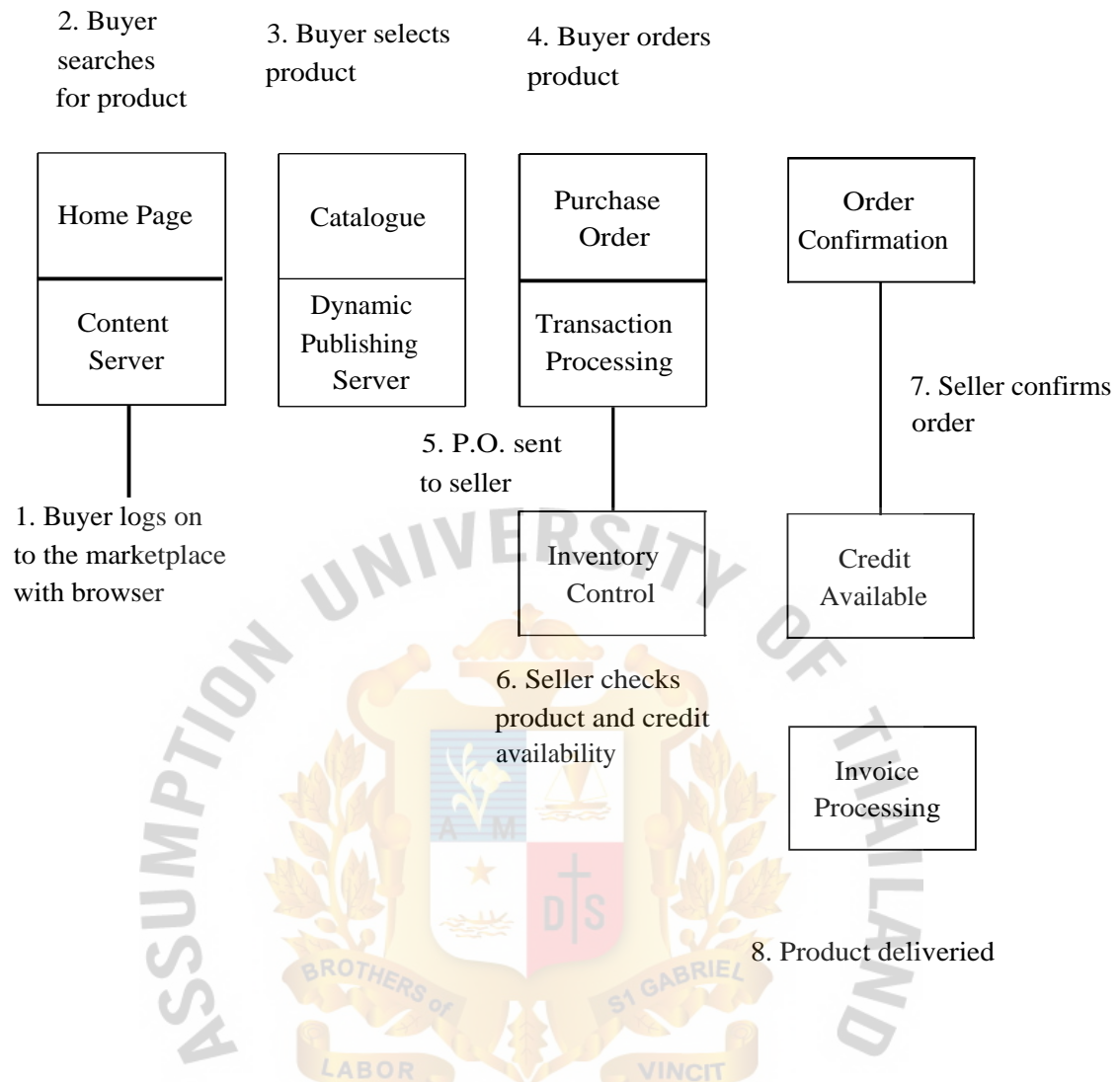


Figure 5.8. The Steps in Order Processing on the Internet.

Sales and Product Management. Sales managers must plan, monitor, and support the performance of the sales people in the company. Therefore, the system must produce sales analysis reports that analyze sales by product, product line, customer, and type of customer, salespeople, and sales territory. Such reports help marketing managers monitor the sales performance of products and sales people and help them develop sales support programs to improve sales results. Product managers need information to plan and control the performances of specific products, product lines, and brands. The system can help provide price, revenue, cost, and growth information for existing

products and new product development. Providing information and analysis for pricing decisions is also a major function of this system. Information is also needed on the distribution resources. Computer-based models may be used to evaluate the performances of current products and the prospects for success of proposed products.

Advertising and Promotion. Marketing managers try to maximize sales at the lowest possible costs for advertising and promotion. Marketing information systems use market research information and promotion models to help:

- (1) Select media and promotional methods.
- (2) Allocate financial resources.
- (3) Control and evaluate results of various advertising and promotion campaigns.

Targeted marketing has become an important tool in developing advertising and promotion strategic for the company. It consists of five targeting components as:

- (1) **Community.** The company can customize Web advertising messages and promotion methods to appeal to people in specific communities.
- (2) **Content.** Advertising such as electronic billboards and banners can be placed on various Web site pages, in addition to the company's home page. These messages reach the targeted audience. An ad for a movie on the opening page of an Internet search engine is a typical example.
- (3) **Context.** Advertising appears only in Web pages that are relevant to the content of a product or service. So advertising is targeted only at people who are already looking for information about a subject matter that is related to the company's products.
- (4) **Demographic/Psychographics.** Marketing efforts can be aimed only at specific types or classes of people.

- (5) Online behavior. An individual can tailor advertising and promotion efforts to each visit to a site.

Market research information systems provide marketing intelligence to help managers make better marketing forecasts and develop more effective marketing strategies. Marketing information systems help market researchers collect, analyze, and maintain an enormous amount of information on a wide variety of market variables that are subject to continual change. This includes information on customers, prospects, consumers, and competitors.

Human Resource System

The human resource management function involves the recruitment, placement, evaluation, compensation, and development of the employees of the company. The goal of human resource management is the effective and efficient use of the human resources of the company. Thus, human resource information systems are designed to support:

- (1) Planning to meet the personnel needs of the business.
- (2) Development of employees to their full potential
- (3) Control of all personnel policies and programs

Originally, the company used computer-based information systems to:

- (1) Produce paychecks and payroll reports.
- (2) Maintain personnel records.
- (3) Analyze the use of personnel in business operations.

The development on E-engineering makes the company beyond these traditional personnel management functions. Human resource system also supports:

- (1) Recruitment, selection, and hiring.
- (2) Job placement
- (3) Performance appraisals

- (4) Employee benefits analysis
- (5) Training and development
- (6) Health, safety, and security

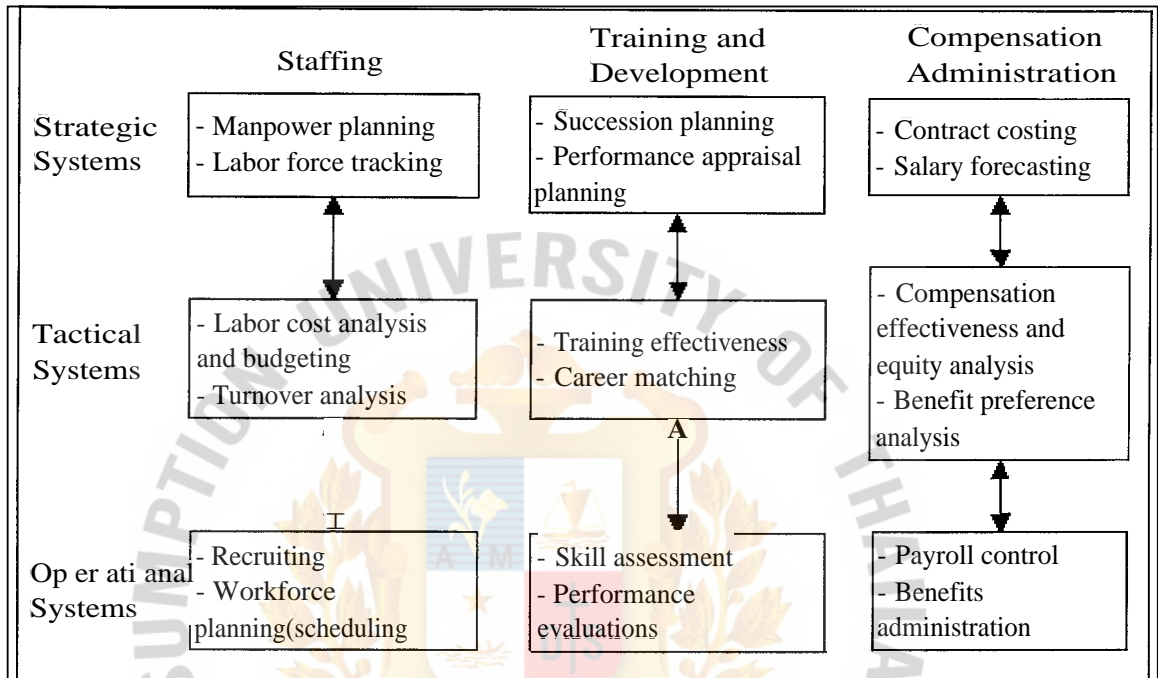


Figure 5.9. How Human Resource System Supports the Strategic, Tactical, and Operational Use of the Human Resource of the Company.

Besides, another benefit of the Intranet is that it can serve as a superior training tool. Employees can easily download instructions and processes to get the information or education they need. In addition, employees using new technology can view training videos over the Intranet on demand. Thus, the Intranet eliminates the need to loan out and track training videos. Employees can also use their corporate Intranets to produce automated paysheets, the online alternative to timecards. These electronic forms have made viewing, entering, and adjusting payroll information easy for both employees and human resource management professionals.

The staffing function must be supported by information systems that record and track human resources within the company to maximize their use. For example, a personnel record-keeping system keeps track of additions, deletions, and other changes to the records in a personnel database. Changes in job assignments and compensation, or hiring and termination that would be used to update the personnel database. Forecasting personnel application provides forecasts of personnel requirements in each major job category for various departments or for new projects being planned by management. Such long-range planning may use a computer-based simulation model to evaluate alternative plans for recruitment, reassignment, and retraining program.

The system helps human resource managers plan and monitor employee recruitment, training, and development programs by analyzing the success history of present programs. They also analyze the career development status of each employee to determine whether development methods such as training programs and periodic performance appraisals should be recommended. Computer-based multimedia training programs and appraisals of employee job performance are available to help support this area of human resource management.

The system helps analyze the range and distribution of employee compensation (wages, salaries, incentive payments, and fringe benefits) within the company and make comparisons with compensation paid by similar organizations or with various economic indicators. This information is useful for planning changes in compensation, especially when negotiations with labor unions are involved. It helps keep the compensation of the company competitive and equitable, while controlling compensation costs.

Reporting to government agencies is a major responsibility of human resource management. The company uses computer-based information system to keep track of

the statistics and produce reports required by a variety of government laws and regulations.

Account System

Account system records and reports business transactions and other economic events. Accounting information system based on the double-entry bookkeeping concept. Computer-based accounting system records and reports the flow of funds through the company on a historical basis and produces important financial statements such as balance sheets and income statements. The system also produces forecasts of future conditions such as projected financial statements and financial budgets.

Operational accounting system emphasizes legal and historical record-keeping and the production of accurate financial statements. Typically, accounting system includes transaction processing such as order processing, inventory control, accounts receivable, accounts payable, payroll, and general ledger. Management accounting system focuses on the planning and control of business operations. The system emphasizes cost accounting reports, the development of financial budgets and projected financial statements, and analytical reports comparing actual to forecasted performance.

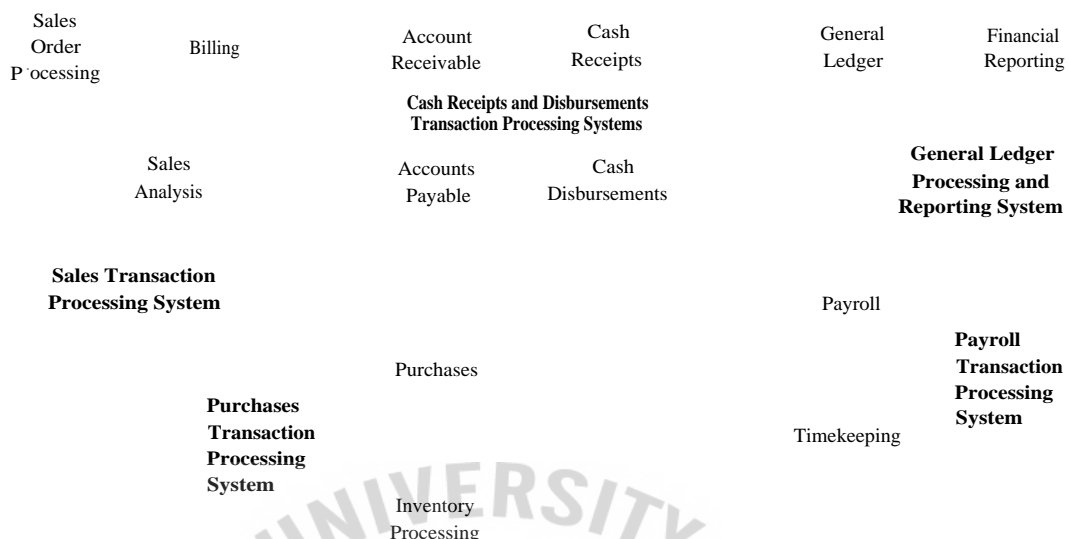


Figure 5.10. The Interrelationships of Several Important Accounting Information Systems.

Order processing, or sales processing, is an important transaction processing system that captures and processes customer orders and produces data needed for sales analysis and inventory control. The company also keeps track on the status of customer orders until goods are delivered. Computer-based sales order processing system provides a fast, accurate, and efficient method of recording and screening customer orders and sales transactions. The system also provides inventory control system with information on accepted orders so they can be filled as quickly as possible.

Inventory control system processes data reflecting changes to items in inventory. Once data about customer orders are received from an order processing system, a computer based inventory control system records changes to inventory levels and prepares appropriate shipping/delivery documents. Then it may notify Purchasing officers about the items that need reordering and provide them with a variety of

inventory status reports. Computer-based inventory control system thus helps the company provide high-quality service to customers while minimizing investment in inventory and inventory carrying costs.

Accounts receivable system keeps records of amounts owed by customers from data generated by customer purchases and payments. The system produces invoices to customers, monthly customer statement, and credit management report. Computer-based accounts receivable system stimulates prompt customer payments by preparing accurate and timely invoices and monthly statements to credit customers. The system provides managers with reports to help them control the amount of credit extended and the collection of money owed. This system helps to maximize profitable credit sales while minimizing losses from bad debts.

Accounts payable system keeps track of data concerning purchases from and payments to suppliers. The system prepares checks in payment of outstanding invoices and produce cash management report. Computer-based accounts payable system helps ensure prompt and accurate payment of suppliers to maintain good relationships, ensures a good credit standing, and secures any discounts offered for prompt payment. The system provides tight financial control over all cash disbursements of the company. The system also provides management with information needed for the analysis of payments, expenses, purchases, employee expense accounts, and cash requirements.

Payroll system receives and maintains data from employee time cards and other work records. The system produces paychecks and other documents such as earning statements, payroll reports, and labor analysis report. Other reports are also prepared for management and government agencies. Computer-based payroll system helps the company makes prompt and accurate payments to employees, as well as reports to management, employees, and government agencies concerning earnings, taxes, and

other deductions. The system also provides management with reports analyzing labor cost and productivity.

General ledger system consolidates data received from accounts receivable, accounts payable, payroll, and other accounting information systems. At the end of accounting period, the system closes the books of the company and produces the general ledger trial balance, the income statement and balance sheet of the company, and various income and expense reports for management. Computer-based general ledger system helps the company accomplish these accounting tasks in an accurate and timely manner. The system typically provides better financial controls and management reports and involves fewer personnel and lower costs than manual accounting methods.

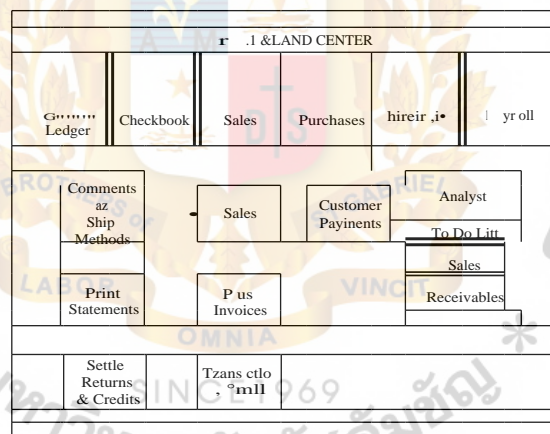


Figure 5.11. Command Center of Computer-based Accounting Systems.

Financial System

Computer-based financial information system supports financial managers in decision concerning the financing of a business and the allocation and control of financial resources within the company.

Major financial information system categories include:

- (1) Cash and investment management
- (2) Capital budgeting
- (3) Financial forecasting
- (4) Financial planning

Cash management system collects information on all cash receipts and disbursements within the company on a real-time and periodic basis. Such information allows the company to deposit or invest excess funds more quickly, and thus increase the income generated by deposited or invested funds. The system also produces daily, weekly, and monthly forecasts of cash receipts or disbursements (cash flow forecasts) that are used to spot future cash deficits or surpluses. Mathematical models frequently can determine optimal cash collection programs and determine alternative financing or investment strategies for dealing with forecasted cash deficits or surpluses.

Online investment management system helps a financial manager make buying, selling, and holding decisions for each type of security so that an optimum mix of securities is developed which minimizes risk and maximizes investment income for the company.

The capital budgeting process involves evaluating the profitability and financial impact of proposed capital expenditures. Long-term expenditure proposals for plants and equipment can be analyzed by using a variety of techniques. The system makes heavy use of spreadsheet models that incorporate present value analysis of expected cash flows and probability analysis of risk to determine the optimum mix of capital projects for the company.

Financial analysis typically uses electronic spreadsheets and other financial planning software to evaluate the present and projected financial performance of the company. The system also helps determine the financing needs of the company and

analyzes alternative methods of financing. Financial analysts use financial forecasts concerning the economic situation, business operations, types of financing available, interest rates, and stock and bond prices to develop an optimal financial plan for the company. Electronic spreadsheet, packages, and Web-based groupware can be used to build and manipulate financial analysts and managers evaluate its financing and investment alternatives.

Purchasing System

Purchase resource planning supports marketing and sales function that includes all activities concerned with the planning and control of product and inventory. The system works closely with sales and marketing and account system to determine appropriate inventory level of the company. The system used for operation management and transaction processing support the company on planning, monitoring, controlling inventory, and purchasing products. Computer-based purchasing system monitors inventory level of products and provides purchasing report. The system analyzes product turnover analysis to determine re-order point of each product while minimizing investment in inventory maximizing the sales. Meanwhile purchasing system is also a major part in considering appropriate inventory level when new products are introduced to the market. The Internet helps purchasing managers to study and evaluate market position of the products.

5.4 Transaction Processing Systems

Transaction processing systems are information systems that process data resulting from the occurrence of business transactions. Transactions are events that occur as part of doing business, such as sales, purchases, deposits, withdrawals, refunds, and payments. They play a vital role in supporting the operations of the company. Transaction processing systems can also play strategic roles in gaining competitive

advantages for the company such as online transaction processing. Such system, which captures and processes transactions immediately, can help the company provide superior service to customers and other trading partners. Once the systems capture and process data describing business transactions, then they update organizational files and databases, and produce a variety of information products for both internal and external use. The transaction processing cycle consists of five stages as:

- (1) Data entry activities
- (2) Transaction processing activities
- (3) File and database processing activities
- (4) Document and report generation
- (5) Inquiry processing activities

The Data Entry Process

The input activity in transaction processing systems involves a data entry process. In this process, data are captured or collected by recording, coding, and editing activities. Data will be converted into a form that can be entered into computer system. It has always been a problem getting data into computers accurately and quickly enough to match their awesome processing speeds. Thus, traditional manual methods of data entry that make heavy use of data media are being replaced by direct automated methods. These methods are more efficient and reliable.

Traditional data entry methods typically rely on the end users of an information system to capture data on source documents such as purchase orders, payroll time sheets, and sales order forms. These source documents are then usually accumulated into batches and periodically entered into computer system. This is accomplished by employees who must enter the data using the keyboards of data entry terminals or

networked PCs. This way requires too many activities, people, and data media. It results in high costs and increases the potential of errors.

Source data automation is the solution on data entry problems. It is the use of automated methods of data entry. Several methods have been developed to accomplish this automation, though very few completely automate the data entry process. They are all based on trying to reduce or eliminate many of the activities, people, and data media required by traditional data entry methods.

Following figure is an example of source data automation which:

- (1) Captures data as early as possible after a transaction or other event occurs by using terminal.
- (2) Captures transaction data as close as possible to the source that generates the data. Sales people at terminal capture and edit data right away.
- (4) Captures data by using machine-readable media initially (bar-coded tags and magnetic stripe cards), instead of preparing written source documents.
- (5) Captures data that rarely changes by prerecording it on machine-readable media, or by storing it in the computer system.
- (6) Captures data directly without the use of data media by optical scanning of barcode packaging.

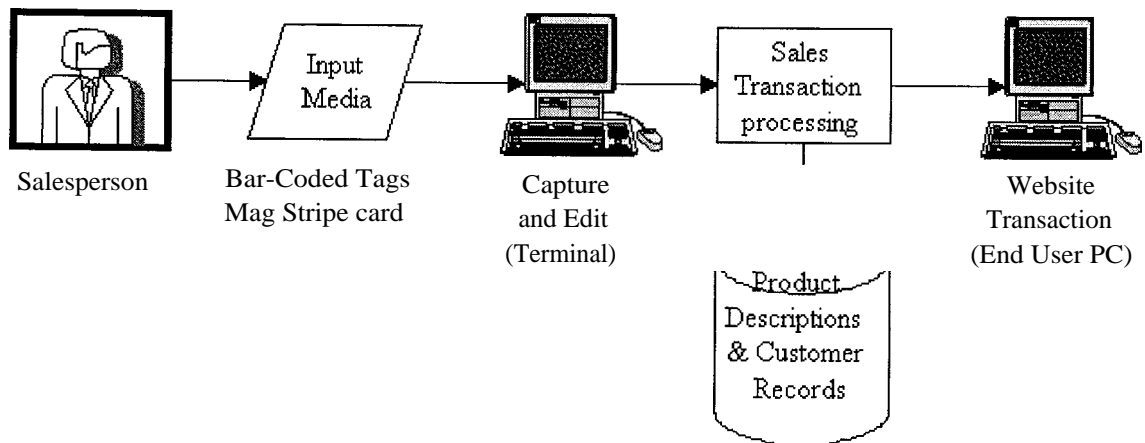


Figure 5.12. An Automated Data Entry on Sales Transaction Processing.

Transaction processing systems process data in two basic ways:

- (1) Batch processing, where transaction data are accumulated over a period of time and processed periodically.
- (2) Real-time processing (also called online processing), where data are processed immediately after a transaction occurs.

In batch processing, transaction data are accumulated over a period of time and processed periodically. Batch processing involves:

- (1) Gathering source documents originated by business transactions such as sales orders and invoices, into groups called batches.
- (2) Recording transaction data on same type of input medium such as magnetic disks or magnetic tape.
- (3) Sorting the transaction in a transaction file in the same sequence as the records in a sequential master file.
- (4) Processing transaction data and creating an updated master file and a variety of documents (such as customer invoices and paychecks) and reports.

(5) Capturing and storing batches of transaction data at remote sites, and then transmitting them periodically to a center computer of processing.

Batch processing not only accumulates the transaction data for a particular application into batches but also runs (processes) a number of different transaction processing jobs periodically (daily, weekly, monthly). The rationale for batch processing is that the grouping of data and the periodic processing of jobs use computer system resources more efficiently, compared to allowing data and jobs to be processed in an unorganized, random manner.

In transaction processing systems, a real-time processing capability allows transaction data to be processed immediately after they are generated and can provide immediate output to end users. Full-fledged real-time systems for transaction processing are called online transaction processing systems. Transaction data are processed as soon as they are originated or recorded, without waiting to accumulate batches of data. Data are fed directly into computer systems from online transaction terminals, and stored online in direct access files. Files and databases are always up-to-date since they are updated whenever data are originated, regardless of their frequency. Response to end users' inquiries are immediate, since information stored on direct access devices can be retrieved almost instantaneously. Real-time processing depends on the Internet, Extranets, and other networks to provide telecommunication links between transaction terminals, client PCs, servers, and other computers.

Database Management

Database maintenance is a major activity of transaction processing systems. The company's databases must be maintained by their transaction processing systems so that they are always correct and up-to-date. Therefore, transaction processing systems update the corporate databases of the company to reflect changes resulting from day-to-

day business transactions. Database maintenance ensures that these and other changes are reflected in the data records stored in the company's databases.

In addition, transaction processing systems process data resulting from miscellaneous adjustments to the records in a file or database. Thus, one of the major functions of transaction processing systems is to update and make changes to the company's databases. These databases then provide the data resources that can be processed and used by management information systems, decision support systems, and executive information systems.

Document and Report Generation

The final stage in the transaction processing cycle is the generation of information products such as documents and reports. Documents produced by transaction processing systems are called transaction documents. There are several major types of such documents:

Action Documents. These are documents that initiate actions or transactions on the part of their recipient such as a purchase order authorized a purchase from a supplier.

Information Documents. These documents relate, confirm, and prove to their recipients that transaction have occurred such as sales receipts, sales order confirmation, customer invoices, and etc. Information documents can be used as control documents, since they document the fact that a transaction has occurred.

Turnaround Documents. Some types of transaction documents are designed to be read by magnetic or optical scanning equipment. Forms produced in this manner are designed to be returned to the sender such as computer-printed invoices consist of a turnaround portion that is returned by a customer along with check payment.

5.5 Decision Support System

Decision support system is a major category of management support systems. It is computer-based information system that provides interactive information support to management and managers during the decision-making process. Decision support system uses analytical models, specialized databases, a decision maker's own insights and judgments, and an interactive, computer-based modeling process to support the making of semi-structured and unstructured decisions by individual managers. The levels of managerial decision-making that must be supported by information technology in the company are:

- (1) Strategic Management. Typically, a board of directors and an executive committee of the top executives develop all organization goals, strategies, policies, and objectives as part of a strategic planning process. They also monitor the strategic performance of the company and its overall direction in political, economic, and competitive business environment.
- (2) Tactic Management. Increasingly self-directed teams as well as business managers develop short and medium range plans, schedules, and budgets and specify the policies, procedures, and business objectives for their divisions of the company. They also allocate resources and monitor the performance of their divisions, including departments, process teams, project teams, and other workgroups.
- (3) Operational Management. The members of self-directed teams or operating managers develop short-range plans such as weekly schedules. They direct the use of resources and the performances of tasks according to procedures and within budgets and schedules they establish for the teams and other workgroups of the company.

Decisions made at the operational management level tend to be more structured, those at the tactical level more semi-structured, and those made at the strategic management level more unstructured. Structured decisions involve situations where the procedures to follow when a decision is needed can be specified in advance. Unstructured decisions involve decision situations where it is not possible to specify in advance most of the decision procedures to follow. At most, many decision situations are semi-structured. That is, some decision procedures can be pre-specified, but not enough to lead to a definite recommended decision.

Therefore, information systems must be designed to produce a variety of information products to meet the changing needs of decision makers throughout the company. Providing information and support for all levels of management decision-making is not easy. Several major types of information systems are needed:

- (1) Management information system
- (2) Decision support system
- (3) Executive information system

Management information system was the original type of management support system, and is still a major category of information system. A management information system produces information products that support many of the day-to-day decision-making needs of management. Reports, displays, and responses produced by such system provide information that managers have specified in advance as adequately meeting their information needs. Such predefined information products satisfy the information needs of decision makers at the operational and tactical levels of the company who are faced with more structured types of decision situations.

Managers and other decision makers use management information system to request information at their networked workstations that supports their decision-making

activities. This information takes the form of periodic, exception, and demand reports and immediate responses to inquiries. Web browsers, application programs, and database management software provide access to information in the Intranet and other operational databases of the company. Operational databases are maintained by transaction processing systems. Data about the business environment are obtained from Internet or Extranet databases when necessary.

Management information system provides a variety of information products to managers. Four major reporting alternatives are provided by such systems as:

- (1) Periodic Scheduled Reports. This traditional form of providing information to managers uses a pre-specified format designed to provide managers with information on a regular basis such as daily and weekly sales analysis reports and monthly financial statements.
- (2) Exception Reports. In some cases, reports are produced only when exceptional conditions occur. In other cases, reports are produced periodically but contain information only about these exceptional conditions. For example, a credit manager can be provided with a report that contains only information on customers who exceed their credit limits. Such exception reporting promotes management by exception, instead of overwhelming decision makers with periodic detailed reports of business activity.
- (3) Demand Reports and Responses. Information is available whenever a manager demands it. For example, Web browsers and database management system query languages and report generators enable managers at PC workstation to get immediate responses or find and obtain customized

reports as a result of their requests for the information they need. Thus, managers do not have to wait for periodic reports to arrive as scheduled.

(4) **Push Reporting.** Information is pushed to a manager's networked workstation.

The competitive and dynamic nature of today's global business environment is driving demands by business managers and analysts for information systems that can provide fast answers to complex business queries. Online analytical processing is a capability of management, decision support, and executive information systems that enables managers and analysts to interactively examine and manipulate large amounts of detailed and consolidated data from many perspectives. Online analytical processing involves analyzing complex relationships among data items stored in multidimensional databases to discover patterns, trends, and exception conditions.

Online analytical processing involves several basic analytical operations, including consolidation, drill-down, and slicing and dicing. Consolidation involves the aggregation of data. This can involve simple roll-ups and complex groupings involving interrelated data. For example, sales offices can be rolled up to districts and districts rolled up to regions. Drill-down is online analytical process that can go in the reverse direction and automatically display detail data that comprises consolidated data. For example, the sales by individual products or sales persons that make up a region's sales totals could be easily accessed. Slicing and dicing refers to the ability to look at the database from different viewpoints. One slice of the sales database might show all sales of product type within regions. Another slice might show all sales by sales channel within each product type. Slicing and dicing is often performed along a time axis in order to analyze trends and find patterns.

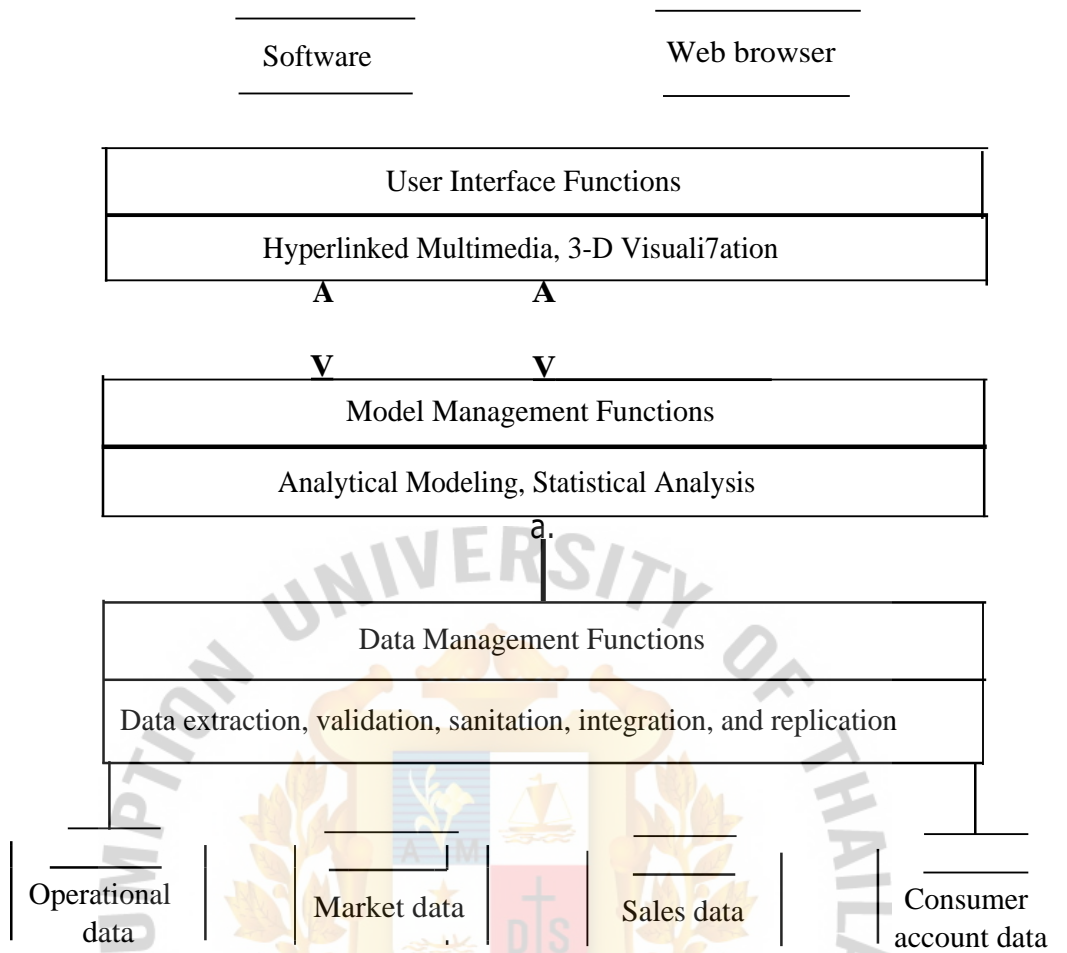


Figure 5.13. Example of Components of Marketing Decision Support System.

5.6 Competitive Strategy

The strategic role of information systems involves using information technology to develop products, services, and capabilities that give the company strategic advantages over the competitive forces it faces in the marketplace. This creates strategic information systems that support the competitive position and strategies of the company. The company can survive and succeed in the long run if it successfully develops strategies to confront five competitive forces that shape the structure of competitive in its industry. These are:

- (1) Rivalry of competitors within its industry.

- (2) Threat of new entrants.
- (3) Threat of substitutes.
- (4) The bargaining power of customers.
- (5) The bargaining power of suppliers.

Information technology can be used to implement competitive strategies as:

- (1) Lower costs. Use information technology to substantially reduce the cost of business processes and to lower the costs of customers and suppliers.
- (2) Differentiate. Develop new information technology features to differentiate products and services. Use information technology to reduce the differentiation advantages of competitors and to focus products and services at selected market niches.
- (3) Innovate. Create new products and services that include information technology components. Make radical changes to business processes with information technology. Develop unique new markets or market niches with the help of information technology.
- (4) Promote growth. Use information technology to manage regional and global business expansion and to diversify and integrate into other products and services.
- (5) Develop alliances. Use information technology to create virtual organizations of business partners. Develop inter-organizational information systems linked by the Internet, Extranets, and other networks that support strategic business relationships with customers, suppliers, subcontractors, and others.
- (6) Improve quality and efficiency. Use information technology to dramatically improve the quality of products and services, to make continuous

improvements to the efficiency of business processes, and to substantially shorten the time needed to develop, produce, and delivery products and services.

- (7) Build an information platform. Leverage investment in information systems people, hardware, software, and networks from operational uses into strategic applications. Build a strategic information base of internal and external data collected and analyzed by using information technology,
- (8) Other strategies. Use organizational information systems to create switching costs that lock in customers and suppliers. Use investment in information technology to build barriers to entry against industry outsiders. Use information technology components to make substitution of competing products unattractive and to help create, share, and manage business knowledge.

One of the strategic business values of information technology is its role in making major improvement in the company's business processes. Making such improvements to its business processes could enable the company to cut costs, improve quality and customer service, and develop innovative products for new markets. Information technology can improve business processes as:

- (1) Transactional. Information technology transforms unstructured processes into routine transactions.
- (2) Geographical. Information technology transforms information quickly and easily across large distances, making processes independent of geography.
- (3) Automational. Information technology reduces or replaces human labor in process.
- (4) Analytical. Bring complex analytical methods to bear on a process.

- (5) Informational. Information technology brings large amounts of detailed information into a process.
- (6) Sequential. Information technology enables changes in the sequence of tasks, often allowing multiple tasks to be worked on simultaneously.
- (7) Knowledge. Information technology allows the capture and dissemination of knowledge and expertise to improve a process.
- (8) Tracking. Information technology allows the detailed tracking of the status, inputs, and outputs of a process.
- (9) Disintermediation. Information technology connects two parties within a process that would otherwise communicate through an intermediary.

Investments in information systems technology can result in the development of unique products and services or processes. This can create new business opportunities and enable the company to expand into new markets or into new segments of existing markets.

Investments in information technology can also allow the company to lock in customers and suppliers by building valuable new relationships with them. The attempts to use information systems technology in these relationships focused on significantly improving the quality of services to customers and suppliers in the company's distribution, marketing, sales, and service activities.

Breaking Business Barriers

Information technology can break time, geographic, cost, and structural barriers to strategic business success. Computers and telecommunication networks break time and geographic barriers. Telecommunication is a lot faster than most other forms of communications. The Internet enables the company to communicate with people almost anywhere in the world. Information technology can break cost and structural barriers.

Computers and telecommunication networks can often significantly reduce the costs of business operations when compared with other means of information processing and communications. They can help the company develop strategic relationships by establishing new electronic linkages with customers, suppliers, and other business entities.

Information technology can shorten the response time to customer demands and reduce inventory investment to a minimum, thus helping to make the company an agile competitor. Products and services can be delivered in real-time relative to competitors who have a strategic advantage. Operating in real-time means no lag time between identification and fulfillment of a need. Every major online uses of information technology in core operations moves the company toward just-in-time inventory, sales, distribution, publishing, scheduling, and reporting. Reducing time and inventory is one of the new business imperatives.

Information technology breaks the geographic barriers that hinder the managerial control of operations, raise the cost of doing business, and limit the quality of services and the coverage of potential markets. The networks link remote locations with company headquarters, other remote locations, and external entities such as suppliers, customers, and other business partners. All of these entities can participate in business activities as if geographic barriers did not exist.

Using Intranets and other telecommunication networks to interconnect key business areas can substantially reduce the costs of inventory, distribution, and communications for the company. Information technology has helped company cuts labor costs, minimize inventory levels, reduces the number of distribution centers, and lower communication costs.

St. Gabriels library

The Internet, Intranets, Extranets, and other telecommunication networks can support innovations in the delivery of services, increase the scope and penetration of markets, and create strategic alliances with customers, suppliers, and even the company's competitors. Extranets and electronic data interchange networks can create strategic links between the company and its customers and suppliers. They become business partners, linked together by the convenience, efficiency, and cost savings of electronic data interchange and their Extranet, and prospective customers for new type of services.

5.7 Security and Control in Information System

Effective controls provide information system security that is the accuracy, integrity, and safety of information system activities and resources. Controls can minimize errors, fraud, and destruction in the interne-worked information systems that interconnect today's end users and the company. Effective controls also provide quality assurance for information systems. They can make a computer-based information system more free of errors and fraud and able to provide information products of higher quality than manual types of information processing. This can help reduce the potential negative impact that information technology can have on business survival and success and the quality of life in society. Three major types of control must be developed to ensure the quality and security of information systems. They are:

- (1) Information system controls
- (2) Procedural controls
- (3) Facility control

Information system controls are methods and devices that attempt to ensure the accuracy, validity, and propriety of information system activities. Controls must be developed to ensure proper data entry, processing techniques, storage methods, and

information output. Thus, information system controls are designed to monitor and maintain the quality and security of the input, processing, output, and storage activities of any information system. For input controls, appropriate controls are needed for the proper entry of data into an information system such as passwords and other security codes, formatted data entry screens, audit error signals, templates over the keys of key-driven input devices, and pre-recorded and pre-numbered forms. Some real-time systems record all entries into the system on magnetic tape control logs that preserve evidence of all system inputs. Computer software can include instructions to identify incorrect, invalid, or improper input data as it enters the computer system. The computer can also be programmed to conduct reasonableness checks to determine if input data exceed certain specified limits or are out of sequence. This includes the calculation and monitoring of selected control totals. Once business data is entered correctly into a computer system, it must be processed properly. Processing controls are developed to identify errors in arithmetic calculations and logical operations. They are used to ensure that data are not lost and do not go unprocessed. Processing controls can include hardware controls and software controls. Hardware controls are special checks built into the hardware to verify the accuracy of computer processing. Software controls ensure that the right data are being processed. Another major software control is the establishment of checkpoints during the processing of a program. Checkpoints minimize the effect of processing errors or failures, since processing can be restarted from the last checkpoint, rather than from the beginning of the program. Once computer processing is done, the system will generate outputs. Output controls are developed to ensure that information products are correct and complete and are available to authorized users in a timely manner. Access to the online output of computer networks is typically controlled by security codes that identify which users can receive output and the type of output

they are authorized to receive. Other important components in computer processing are files and databases. Control responsibilities for files of computer programs and organizational databases may be assigned to data center specialists and database administrators. These employees are responsible for maintaining and controlling access to the program libraries and databases of the company. Many databases and files are protected from unauthorized and accidental use by security programs that require proper identification before they can be used. Typically, operating systems or security monitors protect the database of real-time processing systems from unauthorized use or processing accidents. Account codes, passwords, and other security codes are used to allow access to authorized users only. A catalog of authorized users enables computer systems to identify eligible users and determine which types of information they are authorized to receive.

Procedural controls are methods that specify how the company's computer and network resources should be operated for maximum security. They help to ensure the accuracy and integrity of computer and network operations and systems development activities. The company uses standard procedures to promote quality and minimize the chances of errors and fraud. In addition, documentation of the systems and software design and the operation of the system must be developed and kept up-to-date. Documentation is invaluable in the maintenance of a system as needed improvements are made. Requests for systems development and program changes are subjected to a review process before authorization is given. For example, a system development manager must typically approve program changes requested by end users or generated by maintenance programmers after consultation with the affected business unit. This minimizes their detrimental effects on the accuracy and integrity of ongoing system and network operations.

Facility controls are methods that protect the company's computing and network facility and their contents from loss and destruction. Computer networks and computer centers are subject to such hazards as accidents, natural disasters, unauthorized use, destruction, and theft of resources. Therefore, various safeguards and control procedures are necessary to protect the hardware, software, network, and vital data resources of the company. Facility controls consist of network security, encryption, firewall, physical protection controls, biometric controls, and computer failure controls. Security of network may be provided by specialized system software package known as system security monitors. They are programs that monitor the use of computer systems and networks and protect them from unauthorized use, fraud, and destruction. Such programs provide the security measures needed to allow only authorized users to access the networks. Additionally, security programs monitor the use of computer networks and collect statistics on any attempts at improper use. They then produce reports to assist in maintaining the security of the network. Encryption of data has become an important way to protect data and other computer network resources especially on the Internet, Intranets and Extranets. Passwords, messages, files, and other data can be transmitted in scrambled form and unscrambled by computer systems for authorized users only. Another important method for control and security on the Internet and other networks is the use of firewall computers and software. A network firewall is a gatekeeper computer system that protects the company's Intranets and other computer networks from intrusion by serving as a filter and safe transfer point for access to and from the Internet and other networks. It screens all network traffic for proper passwords or other security codes, and only allows authorized transmissions in and out of the network. Computer and network resources of the company require many types of controls to maximize security and protection. Computer center may be protected from

disaster by such safeguards, as fire detection and extinguishing systems, fireproof storage vaults for the protection of files, emergency power systems, electromagnetic shielding, temperature, humidity, and dust controls. A variety of controls can prevent computer failure or minimize its effects. Computer systems fail for several reasons such as power failure, electronic circuitry malfunctions, telecommunications network problems, hidden programming errors, computer viruses, computer operator errors, and electronic vandalism. The information services department typically takes steps to prevent equipment failure and to minimize its detrimental effects.

Auditing Information Systems

An information services department must be periodically examined, or audited by internal auditing personnel from the company. In addition, periodic audits by auditors from professional accounting firms are a good business practice. Such audits should review and evaluate whether proper and adequate information system controls, procedural controls, facility controls, and other managerial controls have been developed and implemented. There are two basic approaches for auditing information system as:

- (1) Auditing around the computer system
- (2) Auditing through the computer system

Auditing around the computer system involves verifying the accuracy and propriety of the input of data and output produced without evaluating the software that processed the data. This is a simpler and easier method, but does not trace a transaction through all of its stages of processing and does not test the accuracy and integrity of software used. Therefore, it is recommended only as a supplement to other auditing methods.

Auditing through the computer system involves verifying the accuracy and integrity of the software that processes the data, as well as the input of data and output produced by the computer systems and networks. Auditing through the computer requires knowledge of computer system and network operations and software development. Auditing process may use special test data to test processing accuracy and the control procedures built into the software. The auditors may develop special test programs and use audit software packages. The auditors use such programs to process their test data. Then they compare the results produced by their audit program with the results generated by the computer user's own programs. One of the objectives of such testing is to detect the presence of unauthorized changes or patches to computer programs. Unauthorized program patches may be the cause of unexplainable errors or may be used for fraudulent purposes. Another important objective of such auditing procedures is to test the integrity of an application's audit trail. An audit trail can be defined as the presence of documentation that allows a transaction to be traced through all stages of its information processing. This process may begin with a transaction's appearance on a source document and may end with its transformation into information on a final output documentation or report. Electronic audit trail can take the form of control logs that automatically record all computer network activity on magnetic disk or tape devices. This audit feature can be found on many online transaction processing systems, performance and security monitors, operating systems, and network control programs. Software that records all network activity is also widely used on the Internet, as well as corporate Intranets and Extranets. An audit trail helps auditors check for errors or fraud, but also helps information system security specialists trace and evaluate the trail of hacker attacks on computer networks.

VI. CONCLUSIONS

As a future managerial, it is important for the company to realize that E-engineering directly supports both operations and management activities on the business function of accounting, finance, human resource management, marketing, and operation management. It is also important to realize that E-engineering in the real world is typically integrated combination of several types of information technology and management functions. E-engineering is about creating value for the customers, business partners, the company, and other related organizations. Value can be defined as lower costs, higher quality, or increased response time. Business use of the Internet technology is moving from an electronic information exchange to a broad platform for strategic business application. Applications like collaboration among business partners, researching competitors, providing customer and vendor support, and buying and selling products and services have become major business uses of the Internet. The Internet, Intranets, and Extranets support real-time global communications and collaboration among employees, customers, suppliers, and other business partners. These enable members of different organizations and people at different locations to work together as members of virtual teams on business projects to develop, produce, market, and maintain products and services. The Internet, the World Wide Web, and Internet-based technologies provide global links to the company's customers and suppliers. Business operation has become an interactive process. Thus, customers can be interactively involved in the development, marketing, sales, and support of products and services, along with company's research, product selection, marketing and sales staff, and support specialists. Electronic commerce, specifically electronic data interchange is broadly defined as the automated exchange of basic business documents among trading

partners. The goal of doing business with EDI is to simplify and accelerate standard business dealing between organizations. EDI implementation promotes a certain amount of cross-functional reorganization within the company. With the reduction or elimination of paper-based documents being rekeyed, routed, sorted, and stored, comes the opportunity for a significant consolidation of previously independent functions. The Internet technologies enable company to form strategic alliances with customers, suppliers, business partners, and even competitors. Internet and Extranets global links to such business partners support network organizational structures and the formation of virtual company. It means that the Internet enables global alliances of business partners to be quickly formed to take advantage of market opportunities by interconnecting the unique strengths of each partner into an integrated network of business resources and capabilities. Electronic commerce, specifically electronic data interchange is broadly defined as the automated exchange of basic business documents among trading partners.



VII. RECOMMENDATIONS

To implement E-engineering in a company, the management has to understand clearly the fundamental reasons of E-engineering and the use of information technology in business operation. It is an organized combination of people, hardware, software, communication networks, and data resources that collect, transforms, and disseminates information in an organization. The Internet, Intranets, and Extranets can provide the information infrastructure a business needs for efficient operations, effective management, and competitive advantage. However, the system must also support the business strategies, business processes, and organizational structures and culture of the organization. The success of E-engineering should not be measured only by its efficiency in terms of minimizing costs, time, and the use of information resources. Success should also be measured by the effectiveness of E-engineering in supporting the organization's business strategies, enabling its business processes, enhancing its organizational structures and culture, and increasing the business value of the organization in a dynamic business environment. It is important that the management realizes that E-engineering and information technology can be mismanaged and misapplied. They can create both technological and business failure. There are several reasons to be successful in applying E-engineering as user involvement, executive management support, clear statement of requirements, proper planning, and realistic expectations. On contrary, there are also several reasons to fail in applying E-engineering as lack of user input, incomplete requirements and specification, changing requirements and specification, lack of executive support, technological incompleteness, and misunderstanding of business functions and objectives. Therefore, the development

and use of E-engineering and information technology must be carefully managed to avoid failure and achieve success.



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