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SYLLABUS

MANAGEMENT INFORMATION SYSTEM

C-118

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CHAPTER 1 FOUNDATION OF INFORMATION SYSTEMS

★ STRUCTURE ★

LEARNING OBJECTIVES

After going through this chapter, you will be able to:

- describe role of information systems in business
- discuss fundamentals of information systems
- explain types of information systems and effectiveness and efficiency criteria in information system.

1.1. INTRODUCTION TO INFORMATION SYSTEMS IN BUSINESS

Management Information Systems

Information systems plays a crucial role in the management of any contemporary enterprise such as a small, medium or large organization; a profit making or a social service set-up; a public or a private sector undertaking; a manufacturing or a service organization; a local or a global

corporation; and an upcoming or an established business house. The fast changing scene of liberalization, competition and globalization combined with a never before seen emphasis on quality, timeliness, innovation, customer orientation and efficiency puts a premium on accurate, super fast and timely dissemination of information across the globe. The unprecedented developments in computing and communication technologies have indeed made such demands translatable into realizable goals. Thus, a large portion of the world population has its stake in information systems. Invariably such systems are computer based.

A simple and easy definition of a Management Information Systems (MIS) would then be: *a computer-based system that provides flexible and speedy access to accurate data. Such a definition would suit any personal, professional, organizational, national or global information system.* Obviously, the organizational information systems those pertaining to the planning, operation and control of an enterprise are the most important amongst these. Management Information System refers primarily to such organizational information systems which are generally large, sophisticated, structured, and dynamically evolving and of immense commercial value.

Computers and MIS

While the conceptual MIS does not need computers as a prerequisite, any meaningful MIS today is a computer-based system. Since the major applications of computers today are for the design, development and application of MIS, to a distant observer, computer systems and information systems appear synonymous. But this is far from true. These are two disciplines that overlap and yet have quite independent existence. The following major differences between the two disciplines must be clearly maintained in order to get the maximum advantage from any MIS:

1. Computer Systems provide only the technology component; successful information systems call for understanding of the organizational dynamics, processes, and control system.
2. Information systems discipline is centered on people. To be well-versed in this discipline one needs a number of human qualities—the ability to communicate, the ability to listen and understand problems and resolve conflicts, to respect others opinions and value systems; one also should have vision to set goals and plan strategies to achieve these goals.
3. Information systems are an applied area. It calls for problem solving skills, a knack of making quick and sensible assumptions to solve specific problems in a time-bound manner, often working under time and budget constraints. Computer systems, on the other hand, being a relatively

strategic success of businesses that must operate in an internetworked global environment. Thus, the field of information systems has become a major functional area of business administration.

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An IS Framework for Business Professionals

The IS knowledge that a business manager or professional needs to know is illustrated in Figure 1.1. This included (1) foundation concepts: fundamental behavior, technical, business, and managerial concepts like system components and functions, or competitive strategies; (2) information technologies: concepts, developments, or management issues regarding hardware, software, data management, networks, and other technologies; (3) business applications: major uses of IT for business processes, operations, decision making, and strategic/competitive advantage; (4) development processes: how end users and IS specialists develop and implement business/IT solutions to problems and opportunities arising in business; and (5) management challenges: how to effectively and ethically manage the IS function and IT resources to achieve top performance and business value in support of the business strategies of the enterprise.

Managers or business professionals are not required to know the complex technologies, abstract behavioral concepts, or the specialized applications involved in the field of information systems. Figure 1.1 illustrates a useful conceptual framework that outlines what a manager or business professional needs to know about information systems. It emphasizes five areas of knowledge:

1. Foundation concepts;
2. Information technologies;

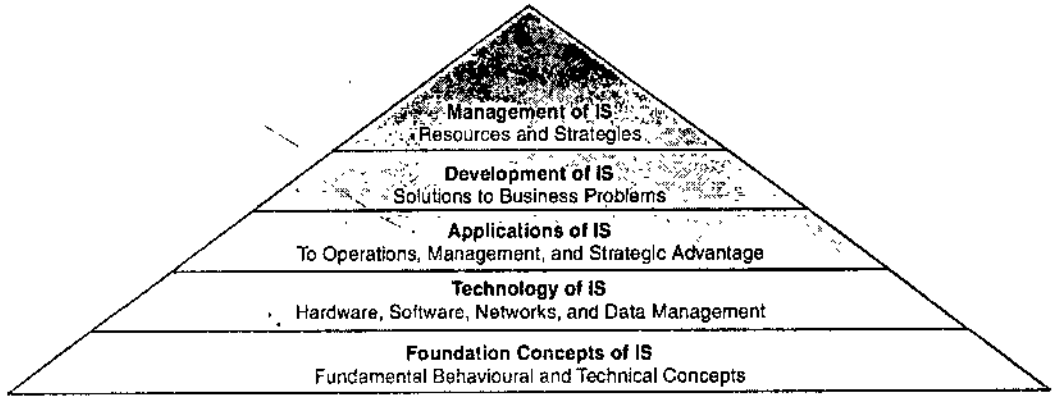

Figure 1.1. *An IS framework for business professionals*

3. Business applications;
4. Development processes ... SDLC (Planning, Analysis, Design, Implementation);
5. Management challenges.

pure area calls for a strong theoretical foundation in engineering and mathematical sciences to solve general problems.

4. Information systems are specific to organizational and managerial contexts. In a sense their focus is on solving problems specific to enterprise management, though enterprises are sufficiently general in scope. Computing systems, on the other hand, are far more generic and address problems in contexts other than managerial, *e.g.*, scientific exploration, education, and entertainment. Thus they are not limited by organizational considerations alone and go much beyond business and commercial activities.
5. Information systems call for a very high conceptual challenge by way of understanding individuals, organizations and their complex interrelationships. The complex thought processes of vastly differing individuals, the subtle interpersonal dynamics between individuals, both in their personal capacity and organizational capacity, their attitudes, aspirations, goals, etc., have to be clearly understood before any information system is successfully implemented. Computer systems, on the other hand, call for a very high order of equally demanding challenges, though in an altogether different plane of intellectual challenge. Computer systems involve a fair degree of abstraction, analytical thinking, generalization and rigorous analysis.
6. The tools of information systems are generally context specific. Many of the successful tools of the present generation of technology may not be successful in a different technological scenario.

Information Systems

An I.S. can be any organized combination of—people, hardware, software, communications networks, and data resources—that collects, transforms, and disseminates information in an organization. People have relied on IS to communicate with each other using:

- a variety of physical devices (hardware);
- information processing instructions and procedures (software);
- communications channels (networks); and
- stored data (data resources) since the dawn of civilization.

Importance of Information Systems

An understanding of the effective and responsible use and management of information systems and technologies is important for managers, business professionals, and other knowledge workers in today's internetworked enterprises. Information systems play a vital role in the e-business and e-commerce operations, enterprise collaboration and management, and

IS (MIS) has been defined differently, depending on who teaches the MIS course. If a professor was from computer science background, he taught MIS in a programming course format. If a professor used to teach Management/Organizational Behavior, he emphasized only managerial perspectives, ignoring technological sides. As shown in this framework, MIS covers not only Information Technologies but also four other areas: Foundation Concepts, Business Applications, Development Processes, and Management Challenges.

The Fundamental Roles of IS Applications in Business

Information technology is reframing the basics of business. Customer service, operations, product and marketing strategies, and distribution are heavily, or sometimes even entirely, dependent on IT.

Let's take a retail store as an example to illustrate this important point. As a consumer, you have to deal regularly with the information systems that support business operations at the many retail stores where you shop. For example, most retail stores now use computer-based information systems to help them record customer purchases, keep track of inventory, pay employees, buy new merchandise, and evaluate sales trends. Store operations would grind to a halt without the support of such information systems. Information systems also help store managers make better decisions and attempt to gain a strategic competitive advantage. This not only supports the decision making of store managers but also helps them look for ways to gain an advantage over other retailers in the competition for customers.

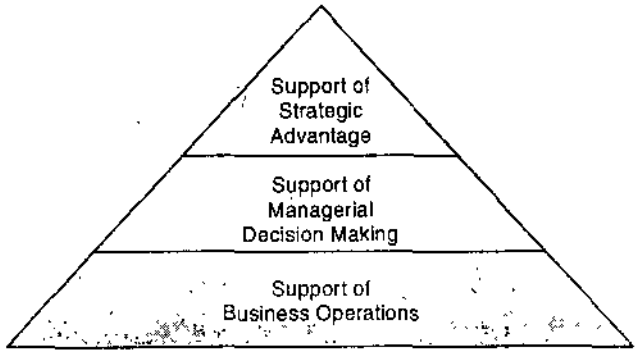

Figure 1.2. *Roles of information systems*

Information systems perform three vital roles in any type of organization. That is, they support an organization's:

- Business processes and operations;
- Decision making by employees and managers.

Strategies for competitive advantage: Three major roles of the business applications of information systems include:

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- Support Business Processes – involves dealing with information systems that support the business processes and operations in a business.
- Support Decision Making – help decision makers to make better decisions and attempt to gain a competitive advantage.
- Support Competitive Advantage – help decision makers to gain a strategic advantage over competitors requires innovative use of information technology.

Globalization and Information Technology

Global companies operate in a competitive environment in which internetworked computer systems make possible global markets that can instantly and cheaply process business transactions. So companies can now operate globally, sometimes by forming global business alliances with other organizations, including customers, suppliers, former competitors, consultants, and government agencies.

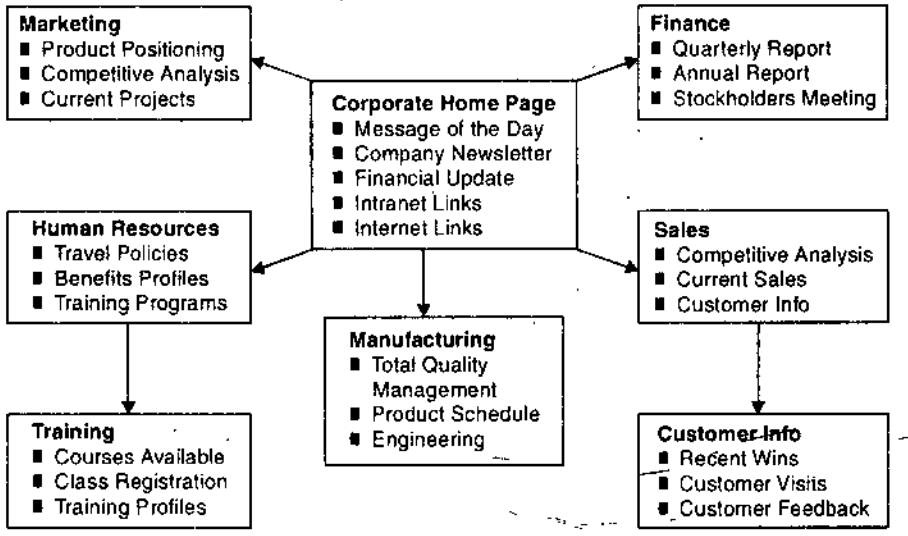

Figure 1.3. *Internet supports enterprise collaboration in the internetworked enterprise*

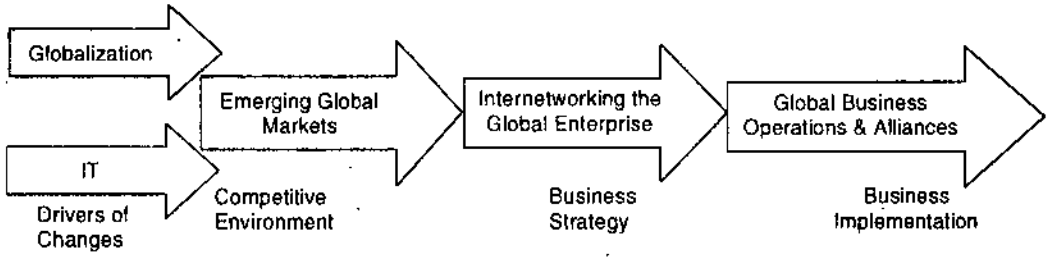

Figure 1.4. *Globalization of business by using information technology*

Businesses are expanding into global markets for their products and services using globalization of business by the proper use of Information Technology in terms of Internetworked Organization.

1.2. FUNDAMENTALS OF INFORMATION SYSTEMS

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Systems

A system is a group of interrelated components working toward the attainment of a common goal by accepting inputs and producing outputs in an organized transformation process. Feedback is data about the performance of a system. Control is the component that monitors and evaluates feedback and makes any necessary adjustments to the input and processing components to ensure that proper output is produced. System concepts underlie the field of information systems. Understanding system concepts will help you understand many other concepts in the technology, applications, development, and management of information systems.

Two additional components of the system concept include feedback and control. A system with feedback and control components is sometimes called a cybernetic system, that is a self-monitoring, self-regulating system.

- **Feedback:** It is data about the performance of a system.
- **Control:** This involves monitoring and evaluating feedback to determine whether a system is moving toward the achievement of its goals. The control function then makes necessary adjustments to a system's input and processing components to ensure that it produces proper output.

System concepts help you understand:

Technology

That computer networks are systems of information processing components that use a variety of hardware, software, data and telecommunication technologies.

Applications

That electronic business and commerce involve interconnected business information systems.

Development

That developing ways to use information technology and business includes designing the basic components of information systems.

Management

That managing information technology emphasizes the quality, strategic business value, and security of an organization's information systems.

System according to traditional definition has three basic interacting components:

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1. Input;
2. Processing;
3. Output.

Types of IS

- Manual (paper-and-pencil) information systems.
- Informal (word-of-mouth) information systems.
- Formal (written procedures) information systems.
- Computer-based information systems.

Computer-based **information systems (IS)** use hardware, software, the Internet, and other telecommunications networks, computer-based data resource management techniques, and other forms of **information technologies (IT)** to transform data resources into a variety of information products for consumers and business professionals.

Components of an Information System

An information system uses the resources of people, hardware, software, data, and networks to perform input, processing, output, storage, and control activities that convert data resources into information products. Data are first collected and converted to a form that is suitable for processing (input). Then the data are manipulated and converted into information (processing), stored for future use (storage), or communicated to their ultimate user (output) according to correct processing procedures (control).

An **information system model** expresses a fundamental conceptual framework for the major components and activities of information systems. An information system depends on the resources of people, hardware, software, data, and networks to perform input, processing, output, storage, and control activities that convert data resources into information products. The information systems model outlined in the text emphasizes four major concepts that can be applied to all types of information systems:

- People, hardware, software, data, and networks, are the five basic resources of information systems.
- People resources include end users and are specialists, hardware resources consist of machines and media, software resources include both programs and procedures, data resources can include data and knowledge bases, and network resources include communications media and networks.
- Data resources are transformed by information processing activities into a variety of information products for end users.

- Information processing consists of input, processing, output, storage, and control activities.

Information System Activities

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Information processing (or data processing) activities that occur in information system include the following:

- Input of data resources;
- Processing of data into information;
- Output of information products;
- Storage of data resources;
- Control of system performance.

★ An information system should produce feedback about its input, processing, output, and storage activities.

★ This feedback must be monitored and evaluated to determine if the *system is meeting established performance standards.*

★ Then appropriate system activities must be adjusted so that proper information products are produced for end users.

★ *Example:* A manager may discover that subtotals of sales amounts in a sales report do not add up to total sales.

- This might mean that data entry or processing procedures need to be corrected.
- Then changes would have to be made to ensure that all sales transactions would be properly captured and processed by a sales information system.

1. **Input activities:** These include the input of Web site navigation clicks and e-commerce and e-business data entries and selections, and online collaboration queries and responses made by customers, suppliers, and employees. Data about business transactions and other events must be captured and prepared for processing by the input activity. Input typically takes the form of data entry activities such as recording and editing. Once entered, data may be transferred onto a machine-readable medium such as magnetic disk or type, until needed for processing.
2. **Processing activities:** Processing activities are accomplished whenever any of computers executes the programs that are part of their e-business and e-commerce software resources. Data is typically subjected to processing activities such as calculating, comparing, sorting, classifying, and summarizing. These activities organize, analyze, and manipulate data, thus converting them into information for end users. A continual process of correcting and updating activities must maintain quality of data stored in an information system.

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3. **Output activities:** Output activities primarily involve the display or printing of information products mentioned earlier. Information in various forms is transmitted to end-users and made available to them in the **output** activity. The goal of information systems is the production of appropriate **information products** for end users.
4. **Storage activities:** Storage activities take place whenever business data is stored and managed in the files and databases on the disk drives and other storage media of computer systems. **Storage** is a basic system component of information systems. Storage is the information system activity in which data and information are retained in an organized manner for later use.
5. **Control activities:** Control activities include the use of passwords and other security codes by customers, suppliers, and employees for entry into e-business and e-commerce websites, and access of their databases and knowledge bases. An important information system activity is the **control** of its performance. An information system should produce feedback about its input, processing, output, and storage activities. Feedback must be monitored and evaluated to determine if the system is meeting established performance standards. Feedback is used to make adjustments to system activities to correct deficiencies.

e-Business in Businesses

The explosive growth of the Internet and related technologies and applications is revolutionizing the way businesses are operated and people work, and how information technology supports business operations and end user work activities. Businesses are becoming **e-business enterprises.** The Internet and Internet-like networks: inside the enterprise **(intranets),** and between an enterprise and its trading partners (**extranets**) – have become the primary information technology infrastructure that supports the business operations of many companies. E-business enterprises rely on such technologies to:

- Reengineer and revitalize internal business processes.
- Implement electronic commerce systems among businesses and their customers and suppliers.
- Promote enterprise collaboration among business teams and workgroups.

e-business: This is defined as the use of Internet technologies to internetwork and empower business processes, electronic commerce, and enterprise communication and collaboration within a company and with its customers, suppliers, and other business stakeholders.

Enterprise collaboration systems: These involve the use of groupware tools to support communication, coordination, and collaboration among the members of networked teams and workgroups. An internetworked e-business enterprise depends on intranets, the Internet, extranets, and other networks to implement such systems.

Electronic commerce: This involves buying and selling, and marketing and servicing of products, services, and information over a variety of computer networks. An internetworked e-business enterprise uses the Internet, intranets, extranets, and other networks to support every step of the commercial process.

Types of Information Systems

Information Systems perform important operational and managerial support roles in businesses and other organizations. Therefore, several types of information systems can be classified conceptually as either:

1. Operations Support Systems.
2. Management Support Systems.

- **Operations support systems**
  - ★ Transaction processing systems (TPS).
  - ★ Process control systems.
  - ★ Enterprise collaboration systems.

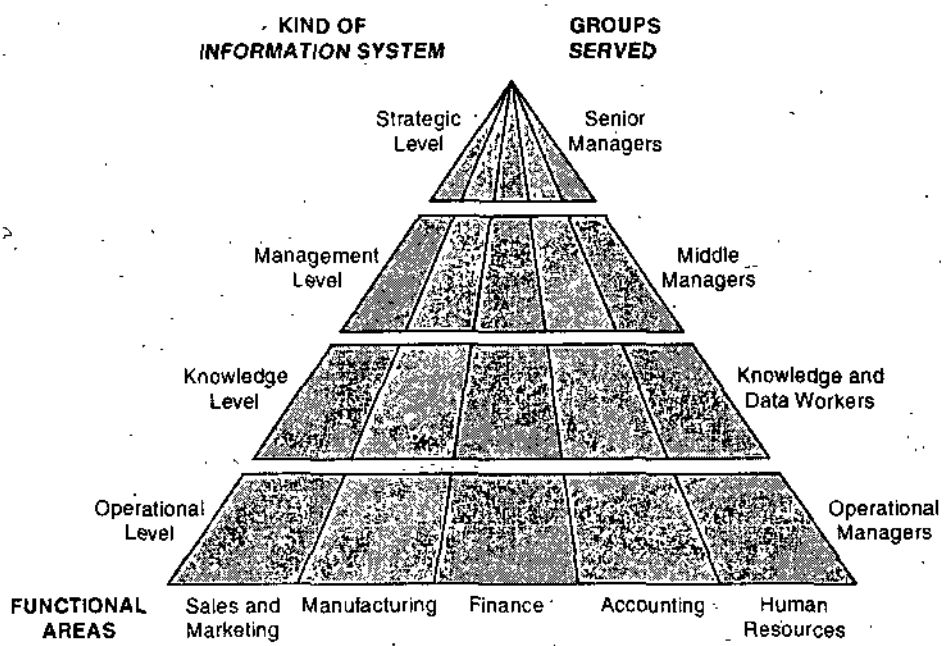

Figure 1.5. *Types of ISs*

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- **Management support systems**
  - ★ Management information systems.
  - ★ Decision support systems (DSS).
  - ★ Executive information systems (EIS).

Operations Support Systems

Information systems are needed to process data generated by and used in business operations. Such **operations support systems** (OSS) produce a variety of information products for internal and external use. However, they do not emphasize producing the specific information products that can best be used by managers. Further processing by management information systems is usually required. The role of a business firm's operations support systems is to:

- Effectively process business transactions;
- Control industrial processes;
- Support enterprise communications and collaboration;
- Update corporate databases.

Transaction Processing Systems (TPS)

Transaction processing systems (TPS) are the basic business systems that serve the operational level of the organization. A transaction processing system is a computerized system that performs and records the daily routine transactions necessary to conduct the business. Examples are sales order entry, hotel reservation systems, payroll, employee record keeping, and shipping. At the operational level, tasks, resources, and goals are predefined and highly structured. The decision to grant credit to a customer, for instance, is made by a lower-level supervisor according to predefined criteria. All that must be determined is whether the customer meets the criteria. Focus on processing the data generated by business transactions and operations. Transaction processing systems record and process data resulting from business transactions (sales, purchases, inventory changes). TPS also produce a variety of information products for internal or external use (customer statements, employee pay checks, sales receipts etc.). TPS process transactions in two basic ways:

- **Batch processing:** In this processing, transactions data is accumulated over a period of time and processed periodically.
- **Real-time (or online) processing:** In it data is processed immediately after a transaction occurs.

Process Control Systems (PCS)

Process control systems are systems, which make use of computers to control ongoing physical processes. These computers are designed to

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automatically make decisions, which adjust the physical production process. Examples include petroleum refineries and the assembly lines of automated factories.

Enterprise Collaboration Systems

Enterprise collaboration systems are information systems that use a variety of information technologies to help people work together. Enterprise collaboration systems help us:

- Collaborate—to communicate ideas;
- Share resources;
- Co-ordinate our cooperative work efforts as members of the many formal and informal process and project teams.

The goal of enterprise collaboration systems is to use information technology to enhance the productivity and creativity of teams and workgroups in the modern business enterprise.

Management Support Systems (MSS)

It focuses on providing information and support for effective decision making by managers. They support the decision-making needs of strategic (top) management, tactical (middle) management, and operating (supervisory) management. The term *management information systems (MIS)* also designates a specific category of information systems serving management-level functions. **Management information systems (MIS)** serve the management level of the organization, providing managers with reports and, in some cases, with on-line access to the organization's current performance and historical records. Typically, they are oriented almost exclusively to internal, not environmental or external, events. MIS primarily serve the functions of planning, controlling, and decision making at the management level. Generally, they depend on underlying transaction processing systems for their data. Conceptually, several major types of information systems support a variety of decision-making responsibilities:

- Management Information Systems (MIS);
- Decision Support Systems (DSS);
- Executive Information Systems (EIS).

Management Information Systems

These are the most common form of management support systems. They provide managerial end users with information products that support much of their day-to-day decision-making needs. MIS provide a variety of prespecified information (reports) and displays to management that can be used to help them make more effective, structured types of day-to-day

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decisions. Information products provided to managers include displays and reports that can be furnished:

- On demand;
- Periodically, according to a predetermined schedule;
- Whenever exceptional conditions occur.

Decision Support Systems

Decision-support systems (DSS) also serve the management level of the organization. DSS help managers make decisions that are unique, rapidly changing, and not easily specified in advance. They address problems where the procedure for arriving at a solution may not be fully predefined in advance. Although DSS use internal information from TPS and MIS, they often bring in information from external sources, such as current stock prices or product prices of competitors.

It provides managerial end users with information in an interactive session on an ad hoc basis. Managers generate the information they need for more unstructured types of decisions in an interactive, computer-based information system that uses decision models and specialized databases to assist the decision-making processes of managerial end users.

Executive Information Systems

Senior managers use **executive support systems (ESS)** to make decisions. ESS serves the strategic level of the organization. They address non routine decisions requiring judgement, evaluation, and insight because there is no agreed-on procedure for arriving at a solution. ESS creates a generalized computing and communications environment rather than providing any fixed application or specific capability. ESS are designed to incorporate data about external events such as new tax laws or competitors, but they also draw summarized information from internal MIS and DSS. They filter, compress, and track critical data, emphasizing the reduction of time and effort required to obtain information useful to executives. ESS employ the most advanced graphics software and can deliver graphs and data from many sources immediately to a senior executive's office or to a boardroom. Unlike the other types of information systems, ESS is not designed primarily to solve specific problems. Instead, ESS provide a generalized computing and telecommunications capacity that can be applied to a changing array of problems. Whereas many DSS are designed to be highly analytical, ESS tends to make less use of analytical models.

It provides top and middle management with immediate and easy access to selective information about key factors that are critical to accomplishing a firm's strategic objectives. EIS are easy to operate and understand.

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Other Classifications of Information Systems

Several other categories of information systems that support either operations or management applications include:

Expert Systems

These are knowledge based systems that provide expert advice and act as expert consultants. It is also called knowledge based information systems.

Knowledge Management Systems

These are knowledge based systems that support the creation, organization and dissemination of business knowledge within the enterprise.

Functional Business Information Systems

It supports the operational and managerial applications of the basic business functions of a firm.

Strategic Information Systems

It provides a firm with strategic products, services and capabilities for competitive advantage.

Cross Functional Information Systems

It is also called Integrated Information Systems. It combines most of all information systems and most information systems are designed to produce information and support decision making for various levels of management and business functions.

1.3. SOLVING BUSINESS PROBLEMS WITH INFORMATION SYSTEMS

The Systems Approach to Problem Solving

The systems approach to problem solving uses a systems orientation to define problems and opportunities and develop solutions. Studying a problem and formulating a solution involve the following interrelated activities:

1. Recognize and define a problem or opportunity using systems thinking.
2. Develop and evaluate alternative system solutions.
3. Select the system solution that best meets your requirements.
4. Design the selected system solution.
5. Implement and evaluate the success of the designed system.

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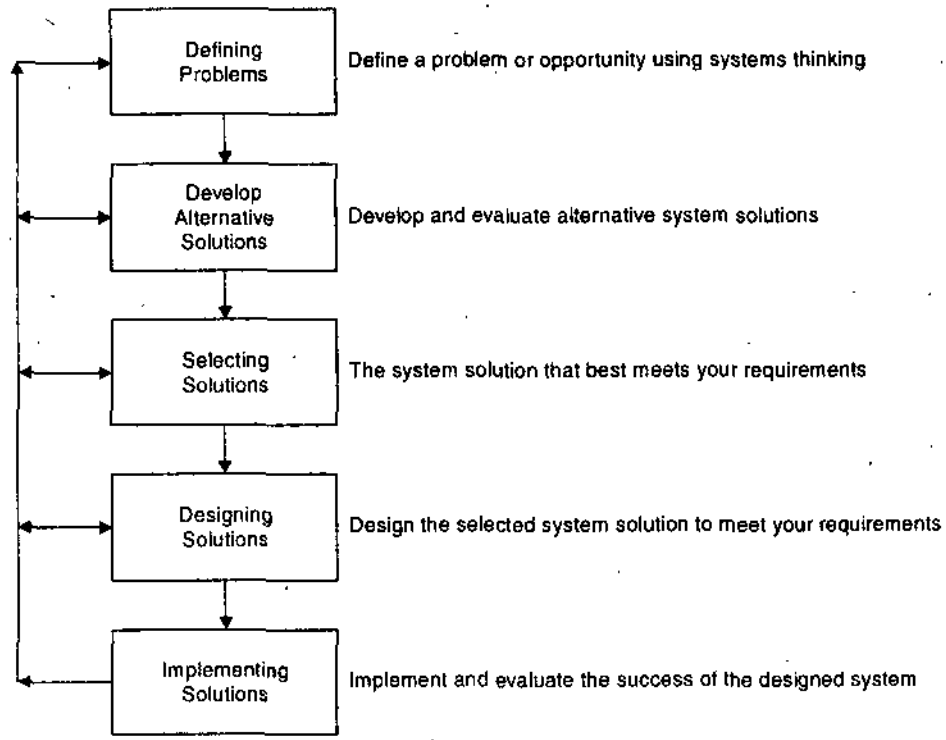

Figure 1.6. *System approach to problem solving*

Defining Problems and Opportunities

Problems and opportunities are identified as the first step of the system approach to problem solving. A problem can be defined as a basic condition that is causing undesirable results. An opportunity is a basic condition that presents the potential for desirable results. Symptoms must be separate from problems. Symptoms are merely signals of an underlying cause or problem.

Systems Thinking

Using systems thinking to understand a problem or opportunity is one of the most important aspects of the systems approach. Management consultant calls systems thinking the fifth discipline. Mastering systems thinking is vital to personal fulfillment and business success in a world of constant changes. The essence of the discipline of systems thinking is seeing the forest and the trees in any situation by:

- Seeing interrelationships among systems rather than linear cause and effect chains whenever events occur,
- Seeing processes of change among systems rather than discrete snapshots of change, whenever changes occur.

One way of practicing systems thinking is to try to find systems, subsystems, and components of systems in any situation you are studying. This viewpoint ensures that important factors and their interrelationships are

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considered. This is also known as using a systems context, or having a systemic view of a situation. For example, the business organization or business process in which a problem or opportunity arises could be viewed, as a system of input, processing, output, feedback, and control components. Then to understand a problem and solve it, you would determine if these basic system functions are being properly performed.

Developing Alternative Solutions

There are usually several different ways to solve any problem or pursue any opportunity. Jumping immediately from problem definition to a single solution is not a good idea. Where do alternative solutions come from? Experience is a good source. The solutions that have worked, or at least been considered in the past, should be considered again. Another good source of solutions is the advice of others. You should also use your intuition and ingenuity to come up with a number of creative solutions. Also decision support software packages can be used to develop and manipulate financial, marketing, and other business operations.

Evaluating Alternative Solutions

Once various alternative solutions have been developed, now it is very big task evaluate these alternatives to choose the best one alternative. The major goal is to determine how well each alternative solution meets our business and other requirements.

Selecting the Best Solution

Once all alternative solutions have been evaluated, we can begin the process of selecting the best solution. Alternative solutions can compare to each other because they have evaluated using the same criteria. For example, the two alternatives can be screened and ranked and selected or rejected, based on individual criteria or overall scores. Of course, it is possible that we might not select the top-ranked alternative. Also new alternative solutions must be identified and evaluated.

Designing and Implementing a Solution

Once a solution has been selected, it must be designed and implemented. We may have to depend on other business end users and technical staff to help you develop design specifications and an implementation plan. Typically, design specifications might describe the detailed characteristics and capabilities of the people, hardware, software, and data resources and information system activities needed by a new system. An implementation plan specifies the resources, activities, and tin.1ing.needed for, proper implementation.

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Post Implementation Review

The final step of the systems approach recognizes that an implemented solution can fail to solve the problem for which it was developed. Thus the results of implementing a solution should be monitored and evaluated. This is called a post implementation review process, since the success of a solution is reviewed after it is implemented. The focus of this step is to determine if the implemented solution has indeed helped the firm and selected subsystems meet their system objectives. If not, the systems approach assumes you will cycle back to a previous step and make another attempt to find a workable solution.

Systems (Software) Development Life Cycle

When we develop a system, there could be many different approaches (methods). SDLC is one of the approaches and the most classical approach to develop an information system. If the system is political system, there should be a right approach to develop such system. However, if it is information system, SDLC is considered the most effective approach.

Need of SDLC

When computers were available in early days (50's & 60's), people attempted to develop an information system without any systematic approach. In other words, they followed a trial & error approach. They wasted a lot of resources (time & money) in developing IS. As a result, SDLC was proposed and accepted in industry over time.

In SDLC, there are five stages (steps) in general:

1. System Investigation or Planning.
2. System Analysis.
3. System Design.
4. Implementation.
5. Maintenance.

Every organization is involved in developing information systems in one way or another. For example, TCS is currently undertaking People Soft systems (for a project) implementation. PeopleSoft is one of enterprise resource planning (ERP) systems vendors. ERP system is a large scale information system that integrates different information system in an organization. Every organization is under pressure, all the time. Some managers consider SDLC a time-consuming procedure. They ignore the SDLC and did not take the planning stage seriously, skip the analysis & design stages, go to the implementation stage right away. The typical results are the cost overrun & project completion time delay, instead of

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time & cost savings. When an organization experiences systems implementation failure, it is common that decision-makers involved in the systems development are ignorant of SDLC. Fortunately, a new president at TCS succeeded to get rid of the four people who were made use into this 10 million dollar cost overrun. They were the previous president, VP in Business Affairs, Project Manager, and Director of TCS.

Planning Stage

The first step of system analysis process involves the identification of need. The analyst (system engineer) meets with the customer & the end user (if different from customer). Identification of need is the starting point in the evolution of a computer based system. The analyst assists the customer on defining the goals of the system:

- What information will be produced?
- What information is to be provided?
- What functions and performance are required?

The analyst makes sure to distinguish between customer "needs" and customer "wants". That is what the main aim behind the system is. Defining aim is very vital in system work. If we do not know where we want to go, we will not know when we have reached there. Once we know our aim, we can try to achieve it in the best possible way. The user department has to define these objectives in terms of their needs. These become the outputs which the system analyst keeps into mind.

Once we know the output, we can easily determine what the input should be. The essential elements of inputs are timeliness, accuracy, proper format and economy.

Here we come to the details of how the inputs are converted into output. This involves the programs and the way in which data is processed through the computer.

Information gathered during the need identification step is specified in a **System Concept Document.** The customer before meetings sometimes prepares the original concept document with the analyst. Invariably, customer-analyst communication results in the modifications to the documents. Limitations or failure of existing systems, or the awareness of technological advances relating to the particular are involved in particular systems which competitors are developing.

Information systems projects originate from many reasons: To achieve greater speed in processing data, better accuracy and improved consistency, faster information retrieval, integration of business areas, reduced cost and better security. The sources also vary project proposals originate with department managers, senior executives and systems analysis. Sometimes

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the real origin is an outside source, such as a government agency, which stipulates systems requirements the organization must meet. When the request is made, the first systems activity, the preliminary investigation, begins. The activity has three parts: request clarification, feasibility study and request approval.

Request Clarification

Many requests from employees and users in organizations are not clearly stated. Therefore, before any systems investigation can be considered, the project request must be examined to determine precisely what the originator wants. A simple telephone call may suffice if the requester has a clear idea but does not know how to state it. On the other hand, the requester may merely be asking for help without knowing what is wrong or why there is a problem. Problem clarification in this case is much more difficult. In either case, before any further steps can be taken, the project requests must be clearly stated.

This phase (initial study) involves estimating whether or not a development project is worthwhile. Problems with the current automated or manual system are identified, as well as the benefits and costs of an alternative system. If the benefits seem to outweigh the costs (especially when compared with competing projects), a green signal may be given to continue the project, and detailed plans and schedules are drafted for making the system a reality.

The proposed solution to the user's problem may involve something between dramatic change (completely new system) and slight change to the present system. If the present system is manual and a computer system is proposed, the development project will probably be very large. At the other extreme are small development project that represent slight changes to existing systems, such as sorting information in a different way or inserting subtotals or adding new columns to a report.

The objectives of this phase are:

1. To determine the feasibility of computerization of a particular system or area of operation.
2. To define clearly the objectives, scope and limitations of the project.
3. To establish a good working relationship between the user department and the data processing (DP) department.
4. To acquaint user management with the approach and method of work in systems development.
5. To estimate the resources required for system development, live running and maintenance.
6. To identify the likely benefits, which should accrue from the introduction of the system?

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Feasibility Study: The data collection that occurs during preliminary investigations examines system feasibility, the likelihood that the system will be beneficial to the organization. Four tests of feasibility are studies: technical, economical and operational. All are equally important.

Technical Feasibility: It involves determining whether or not a system can actually be constructed to solve the problem at hand. Some users expect too much of computers, assuming that computers can accurately predict the future, immediately reflect all information in an organization, easily understand speech, or figure out how to handle difficult problems. Such systems, even if they exist, are not yet available for widespread use.

The technical issues raised during the feasibility stage of the investigation are:

1. Does the necessary technology exist (can it be acquired) to do what is suggested?
2. Does the proposed equipment have the technical capacity to hold the data required to use the new system?
3. Will the proposed system and components provide adequate responses to inquiries, regardless of the number or location of users?
4. Can the system be expanded, if developed?
5. Are there technical guarantees of accuracy, reliability, ease of access and data security?

For example, if the proposal includes a printer that prints at the rate of 2,000 lines per minute, a brief search shows that this is technically feasible. Whether it should be included in the configuration because of its cost is an economic decision. On the other hand, if a user is requesting audio input to write, read, and change stored data, the proposal may not be technically feasible.

Economical Feasibility: It involves estimating benefits and costs. These benefits and costs may be tangible or intangible. Because of confusion between the types of costs, it is sometimes very difficult to decide if the benefits outweigh the costs.

Tangible benefits may include decreasing salary costs (by automating manual procedures), preventing costly but frequent errors, sending bills earlier in the month, and increasing control over inventory levels. Such benefits may be directly estimated in rupees without much trouble. Intangible benefits may include increasing quality of goods produced, upgrading or creating new customer services, reducing repetitive or monotonous work for employees, and developing a better understanding of the market. Such benefits may be much more important than tangible benefits, but they may be ignored because estimating their rupee values involves pure guesswork.

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Tangible costs are easily estimated. They include the one-time cost of developing the system and the continuous costs of operating the system. Examples of development costs are the salaries of programmers and analysts, the prices of the computer equipment, and the expenses connected with user training. Operating costs include the salaries of computer operators and the costs of computer time and computer supplies. Intangible costs are usually not discussed because they are rarely large. Examples of such costs include those associated with early user dissatisfaction and with the problems of converting to the new system.

A system that can be developed technically and will be used if installed must still be a good investment. That is, financial benefits must equal or exceed the financial costs. The economic and financial questions raised by analysts during the preliminary investigation seek estimates of:

1. The cost to conduct a full systems investigation.
2. The cost of hardware and software for the class of application being considered.
3. The benefits in the form of reduced costs or fewer costly errors.
4. The cost if nothing changes (the system is not developed).

Cost and benefit estimates on each project provide a basis for determining which projects are most worthy of consideration. Each estimate can be analyzed to determine how rapidly costs are recovered by benefits, to calculate both the absolute and interest-adjusted amounts of excess benefits, and to establish the ratio of benefits to costs. All of these factors are considered when developing an overall sense of the projects economic feasibility.

To be judged feasible, a project proposal must pass all these tests. Otherwise, it is not a feasible project. For example, a personnel record system that is financially feasible and operational attractive, is not feasible if the necessary technology does not exist. Or a medical system which can be developed at reasonable cost but which nurses will avoid using cannot be judged operationally feasible.

Operational Feasibility: Proposed projects are of course beneficial only if they can be turned into information systems that will meet the organizational operation requirements. Simply stated, this test of feasibility asks if the system will work when developed and installed. Are there major barriers to implementation? Here are questions that will help test the operational feasibility of a project:

1. Is there sufficient support for the project from the management and from users? If the current system is well liked and used to the extent that persons will not see reasons for a change, there may be resistance.

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2. Are current business methods acceptable to the user? If they are not, user may welcome a change that will bring about a more operational and useful system.
3. Have the users been involved in the planning and development of the project? Early involvement reduces the chances of resistance to the system and change in general, and increases the likelihood of successful projects.
4. Will the proposed system cause harm? The following questions are related to this issue:
   - Will the system produce result in any respect or area?
   - Will loss of control result in any area?
   - Will accessibility of information be lost?
   - Will individual performance be poorer after implementation than before?
   - Will customers be affected in an undesirable way?
   - Will it slow performance in any areas?

Operational feasibility is a measure of how people are able to work with the system. For example, a system may require managers to write BASIC, COBOL, or FORTRAN programs to access data. However, managers probably receive the greatest help from a system when they can concentrate on the problems to solve rather than on how programs should be constructed to solve them.

System Analysis

System Analysis refers to the process of examining a situation with the intent of improving it through better procedures and methods. System design is the process of planning a new system to either replace or complement an existing system. But before any planning is done, the old system must be thoroughly understood and the requirements determined. System Analysis is therefore, the process of gathering and interpreting facts, diagnosis problems and using the information to re-comment improvements in the system. Or in other words, System Analysis means a detailed explanation or description. Before computerizing a system under consideration, it has to be analyzed. We need to study how it functions currently, what are the problems, and what are the requirements that the proposed system should meet.

The main components of making software are:

- System and software requirements analysis.
- Design and implementation of software.
- Ensuring, verifying and maintaining software integrity.

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for running the system at an alternative site in the event of the computer not being available.

It is at this stage that the first reliable estimate of the amount of computer programming effort required can be produced. Up to this point the estimates are to a large extent informed guesses and what comes out at the end of this exercise may be quite frightening compared with the previously available estimates. This is a valid reason for ensuring that senior management continues to have an approval role at the conclusion of this stage.

Implementation

Once a new system has been designed it must be implemented. The implemented process activities are

1. Acquisition of Hardware and Software and Services
2. Software Development or Modification
3. End User Training
4. System Documentation
5. Conversion.

Maintenance

It is very important stage of system development cycle. It involves:

- Monitor the system;
- Upgrade;
- Trouble-shooting;
- Continuous Improvement.

This may include a post implementation review process.

Prototyping

- Rapid application design/development (RAD)
- Speeding up the SDLC - *e.g.*, compressing the SDLC stages into three, when you are pressed for time
- Visual Basic programming language is most widely used in business. One of reasons is that people in business are always under time pressure and their first choice RAD tool is VB because Visual Basic is the easiest programming language to develop a business application. So when you are under pressure (which is usual in business), VB is an ideal tool to develop a system quickly, though other programming languages like C++ are known to be more powerful.
- JAD (joint application development) is also undertaken usually with RAD. JAD emphasizes a coordinated effort by all the participants (end-

users, manager, software developer, systems analyst, etc.). They are suggested to work jointly to develop a system quickly.

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1.4. EFFICIENCY AND EFFECTIVENESS

It is often said that the use of information technology makes our work more effective, more efficient, or both. What do these terms mean? Effectiveness defines the degree to which a goal is achieved. Thus a system is more or less effective depending upon

1. how much of its goal it achieves and
2. the degree to which it achieves better outcomes than other systems do.

Efficiency is determined by the relationship between resources expended and the benefits gained in achieving a goal. Expressed mathematically,

$$\text{Efficiency} = \frac{\text{Benefits}}{\text{Cost}}$$

Thus, one system is more efficient than another if its operating costs are lower to the same or better quality product, or if its product's quality is greater for the same or lower costs. The term productivity is commonly used as synonym for efficiency. However, **productivity** specifically refers to the efficiency of *human* resources. Productivity improves when fewer workers are required to produce the same amount of output, or, alternately, when the same number of workers produce a larger output. This is why IS professionals often speak of productivity tools, which are software applications that help workers produce more in less time. The closet the result of an effort is to the ultimate goal, the more effective the effort. The fewer the resources spent on achieving a goal, the more efficient the effort.

Suppose your goal is to design a new car that reaches a speed of 60 miles per hour in 10 seconds. If you manage to build it, then you produce the product effectively. If the car does not meet the requirement, your effort is ineffective. If your competitor makes a car with the same features and performance but uses fewer people and fewer other resources, then your competitor is as effective but more efficient than you.

ISs contribute to both the effectiveness and efficiency of businesses, especially when positioned in specific business functions, such as accounting, finance and engineering, and when used to help companies achieve their goals more quickly by facilitating collaborative work. ISs can be used in a wide variety of applications.

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1.5. IMPACTS OF INFORMATION TECHNOLOGY/ INFORMATION SYSTEMS ON A FIRM'S EFFECTIVENESS, EFFICIENCY AND PROFITABILITY

We have to consider efficiency (productivity) issue when we think of a new information systems (IS) development. The optimal IT choice should be an IS that maximizes output and minimizes input, given business constraints. But a caution should be given to interpret this efficiency because this efficiency measure may not serve properly. For instance, if you use only labor force as inputs, the efficiency will go up tremendously when a new IS replaces some people at work. A new IS development and implementation imposes a lot of financial burden to an organization. Such additional costs should be included into the inputs. In short, efficiency is an important measure, but it can be manipulated. Instead, profitability is a firm's bottom line and always should be concerned more importantly.

Therefore, when efficiency goes up, it does not mean the profitability also goes up. First, the efficiency itself may not be a right measure if it does not include other additional costs. Secondly, the profitability may be compromised if the new IS development takes up too much costs.

In addition, organizational effectiveness does not go along with efficiency all the time. Even if efficiency goes up, the effectiveness may not go up. Suppose a firm's mission statement is to provide customers with quality service. If the new IT replaces a substantial number of customers service agents, the customers may not get the personal customer service any more. Rather they may be put on hold by a machine indefinitely when they call 1-800 numbers. Such poor service may lose a customer permanently. In short, :

1. The new IS may not increase efficiency.
2. The higher efficiency may not come with the higher effectiveness.
3. Profitability is the most important in business.

SUMMARY

- Management Information Systems (MIS) would then be: a computer-based system that provides flexible and speedy access to accurate data. Such a definition would suit any personal, professional, organizational, national or global information system.
- Global companies operate in a competitive environment in which internetworked computer systems make possible global markets that can instantly and cheaply process business transactions.

- A system is a group of interrelated components working toward the attainment of a common goal by accepting inputs and producing outputs in an organized transformation process.
- An information system model expresses a fundamental conceptual framework for the major components and activities of information systems.
- Processing activities are accomplished whenever any of computers executes the programs that are part of their e-business and e-commerce software resources.
- Storage activities take place whenever business data is stored and managed in the files and databases on the disk drives and other storage media of computer systems.
- Transaction processing systems (TPS) are the basic business systems that serve the operational level of the organization.
- Process control systems are systems, which make use of computers to control ongoing physical processes.
- Decision-support systems (DSS) also serve the management level of the organization. DSS help managers make decisions that are unique, rapidly changing, and not easily specified in advance.
- System Analysis refers to the process of examining a situation with the intent of improving it through better procedures and methods. System design is the process of planning a new system to either replace or complement an existing system.

REVIEW QUESTIONS

1. Describe the role of MIS in management.
2. What do you mean by Information Systems explain its importance?
3. Explain with essential diagram the IS knowledge that a business manager needs to know.
4. Describe the fundamental roles of IS applications in business.
5. Define system and explain types of IS and components of an IS.
6. What do you mean by e-Business?
7. Describe the types of Information Systems.
8. Explain the system approach to solve the business problems.
9. What do you mean by term Efficiency and Effectiveness of Information Technology?

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FURTHER READINGS

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CHAPTER 2 AN OVERVIEW OF MANAGEMENT INFORMATION SYSTEMS

★ STRUCTURE ★

LEARNING OBJECTIVES

After going through this chapter, you will be able to:

- define management information system
- explain MIS vs data processing and information resource management
- describe concept of MIS and structure of MIS
- discuss end user computing.

2.1. CONCEPT OF MANAGEMENT INFORMATION SYSTEMS

Information processing is a major societal activity. A significant part of an individual's working and personal time is spent recording, searching for,

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and absorbing information. Computers have become an essential part of organizational information processing because of the power of the technology and the volume of data to be processed. The application of computers to information processing began in 1954 when one of the first computers was programmed to process payroll. The current challenge in information processing is to use the capabilities of computers to support knowledge work, including managerial activities and decision making. The wide variety of computer resources to perform transaction processing, to provide processing for a formal information and reporting system, and to accomplish managerial-decision support are broadly classified as the organization's *management information system* or MIS.

The design and implementation of management information systems in an organization necessitates the identification of information requirements. This chapter is useful both for those who design, implement, and manage information systems and for those who specify information requirements and use the systems. It help system analysts to understand the structure of a management information system and the type of requirements to be included; it can aid information systems executives in planning and management; it can help users to understand how their information requirements fit into the system and how to analyze and formulate those requirements.

2.2. DEFINITION OF A MANAGEMENT INFORMATION SYSTEM

There are so many definitions of management information system. One can prefer alternative terminology such as information processing system, information and decision system, organizational information system, or simply information system to refer to the computer-based information processing system which supports the operations, management, and decision-making functions of an organization.

A definition of a management information system is *an integrated, user-machine system for providing information to support operations, management, and decision-making functions in an organization. The system utilizes computer hardware and software; manual procedures; models for analysis, planning, control and decision making; and a database.*

The management information system has been described as a pyramid structure in which the bottom layer consists of information for transaction processing, the next level consists of information resources in support of day to day operations and control, the third level consists of information system resources to aid in tactical planning and decision making for

management control, and the top level consists of information resources to support strategic planning and policy making by higher levels of management. Each level of information processing may make use of data provided for lower levels, but new data may also be introduced. For example, some of the information to support management and decision making is provided by the data obtained for transaction processing, while some may be new data about activities external to the organization.

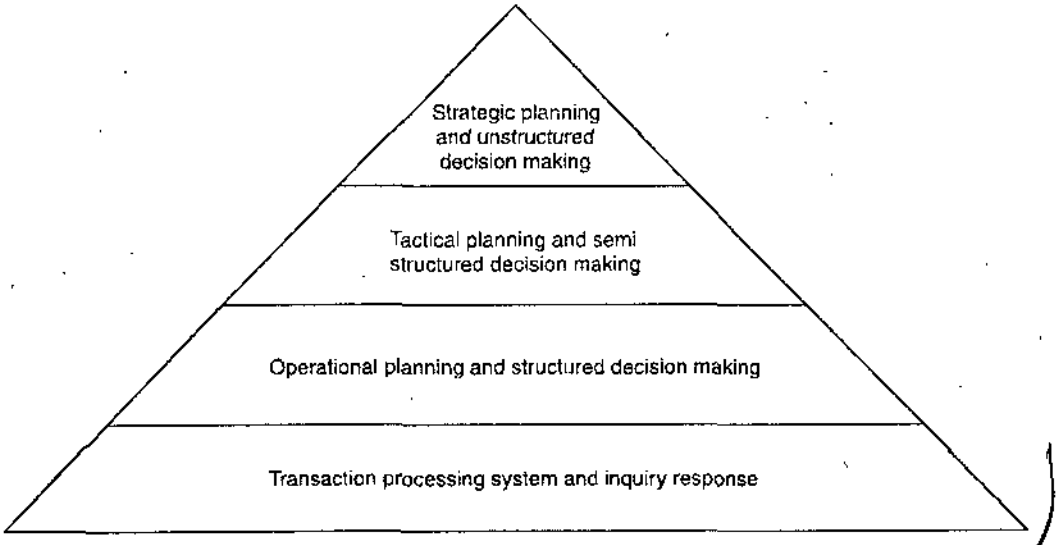

Figure 2.1. *Pyramid of management information system*

MIS as an Evolving Concept

When the concept of MIS was first introduced, many proponents envisioned a single, highly integrated system that would bring together processing for all organizational functions. Others questioned whether it was possible to design adequate computer-based information systems to support management planning and decision making functions, especially strategic planning.

The MIS concept is now that of a federation of subsystems, developed and implemented as needed but conforming to the overall plan, standards, and procedures for the MIS. Thus, rather than a single, global MIS, an organization may have many related information systems which serve managerial needs in various ways. MIS as a concept continues to evolve. It is related to, but not equivalent with, data processing and other information systems-related concepts. Two such concepts that can be considered extensions of the MIS concept are Decision Support Systems (DSS) and Information Resources Management (IRM). An emerging trend consistent with the evolution of the MIS concept is end-user computing.

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2.3. MIS VERSUS DATA PROCESSING

A data processing system processes transactions and produces reports. It represents the automation of fundamental, routine processing to support operations. Prior to computers, data processing was performed manually or with simple machines. MIS is a concept and an orientation toward which an information system design moves rather than an absolute state. Therefore, the significant issue is the extent to which an information system adopts the MIS orientation and supports the management functions of an organization. The answer is usually a matter of degree rather than a simple yes or no.

One important aspect of the difference between MIS and routine data processing is the capability to provide analysis, planning, and decision making support. An MIS orientation means users have access to decision models and methods for querying the database on an ad hoc basis; the database is also, of course, an essential part of routine transaction processing and reporting. Furthermore, an MIS orientation means information resources are utilized so as to improve decision making and achieve improved organizational effectiveness. Information resources are also used as a means of achieving a competitive advantage.

2.4. MIS AND DECISION SUPPORT SYSTEMS

A Decision Support System (DSS) is an information system application that assists decision making. DSS tend to be used in planning, analyzing alternatives, and trial and error search for solutions. They are generally operated through terminal-based interactive dialogs with users. They incorporate a variety of decision models.

2.5. MIS AND INFORMATION RESOURCE MANAGEMENT

Information Resource Management (IRM) is an approach to management based on the concept that information is an organizational resource. The task of the information system executive is to manage the resource. The scope of IRM includes data communications, word processing, and personal computers as well as traditional data processing. The IRM concept tends to emphasize the organizational effectiveness of the information system resource rather than the technical sophistication or efficiency of the hardware and software. The MIS concept, as defined in this text, includes the resource view of information.

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2.6. END-USER COMPUTING

A recent major development affecting the structure and design of MIS is end-user computing. Users are provided with terminals or personal computers and powerful software for accessing data, developing models, and performing information processing directly. This development, made possible by the increasing power and decreasing cost of the technology, is a significant force for change in the way information resources are organized, provided, and used. In many organizations, the MIS function is undergoing a transition from centralized control of information systems resources toward provision of support to users who control their own development and operation of information systems.

2.7. STRUCTURE OF MIS

MIS Structure based on Management Activity

Management information systems support management activity. This means that the structure of an information system can be classified in terms of a hierarchy of management planning and control activities.

Hierarchy of Management Activity

The three levels of management activity can be differentiated on the basis of the planning horizon for each level. Strategic planning deals with long-range considerations. The decisions to be made are concerned with the choice of business direction, market strategy, product mix, etc. Management control and tactical planning has a medium-term planning horizon. It includes acquisition and organization of resources, structuring of work, and acquisition and training of personnel. It is reflected in the capital expenditure budget, the three-year staffing plan, etc. Operational planning and control is related to short-term decisions for current operations. Pricing, production levels, inventory levels, etc., are a result of operational planning and control activities.

Decisions vary as to the degree of structure within each level of management activity, although the majority of decisions at the operational control level are relatively structured and the majority of decisions at the strategic planning level are relatively unstructured. Structured decision systems provide decision rules and exception reports but are relatively inflexible as to content and format. Decision Support Systems (DSS), on the other hand, are characterized by flexible access to the database, a variety of flexible output formats, and a collection of decision models.

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The following three sections summarize the characteristics of information system support for the three levels of the hierarchy of management planning and control.

Information Systems for Operational Control

Operational control is the process of ensuring that operational activities are carried out effectively and efficiently. Operational control makes use of preestablished procedures and decision rules. A large percentage of the decisions are programmable. The procedures to follow are generally quite stable.

Processing support for operational control consists of:

- Transaction processing
- Report processing
- Inquiry processing

These three types of processing contain various decision-making routines which implement prespecified decision rules or provide output describing the decision that will be taken unless the user responsible overrides it. Some examples will illustrate the type of decision procedures that can be designed into operational control systems.

Information Systems for Management Control

Management control information is required by managers of departments, profit centers, etc., to measure performance, decide on control actions, formulate new decision rules to be applied by operational personnel, and allocate resources. Summary information is needed; it must be processed so that trends may be observed, reasons for performance variances may be understood, and solutions may be suggested. The control process requires the following types of information:

- Planned performance (standard, expected, budgeted, etc.)
- Variances from planned performance
- Reasons for variances
- Analysis of possible decisions or courses of action

The database for management control consists of two major elements: (1) the database provided by operations, and (2) the plans, standards, budgets, etc., which define management expectations about performance. The processing requirements to support management control activities are the following:

- Planning and budget models to assist managers in finding problems in direction and preparing and revising plans and budgets. This includes projections of effects of current actions.

- Variance reporting programs to process scheduled reports showing performance and variances from planned performance or other standards such as competitor performance.
- Problem analysis models to analyze data to provide input for decision making.
- Decision models to analyze a problem situation and provide possible solutions for management evaluation.
- Inquiry models to assist in responding to inquiries.

The outputs from the management control information system are plans and budgets, scheduled reports, special reports, analyses of problem situations, decisions for review, and inquiry responses.

Information Systems for Strategic Planning

The purpose of strategic planning is to develop strategies by which an organization will be able to achieve its objectives. The time horizon for strategic planning tends to be fairly long, so that fundamental shifts in the organization may be made. For example:

- A department store chain may decide to diversify into the mail order business.
- A department store chain with stores in the central city may decide to change to a discount type of operation in the suburbs.
- A company manufacturing industrial products may decide to diversify into consumer lines.

Strategic planning activities do not have to occur on a periodic, regular cycle as do management control activities. They can be somewhat irregular, although some strategic planning may be scheduled into the yearly planning and budgeting cycle. Data requirements for strategic planning are generally for processed, summarized data from a variety of sources. There is need for considerable external data.

MIS Structure Based on Organizational Function

The structure of an information system can also be described in terms of the organizational functions which use information. There is no standard classification of functions, but a typical set of functions in a manufacturing organization includes production, sales and marketing, finance and accounting, logistics, personnel, and information systems. Top management can also be considered as a separate function. Each of these functions has unique information needs and each requires information system support designed for it. An organization may not actually be organized along functional lines, but in general the logical information subsystem will follow functional lines.

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Sales and Marketing Subsystems

The sales and marketing function generally includes all activities related to the promotion and sales of products or services. The transactions are *sales* orders, promotion orders, etc. The operational control activities include the hiring and training of the sales force, the day-to-day scheduling of sales and promotion efforts, and periodic analyses of sales volumes by region, product, customer, etc. Managerial control concerns comparisons of overall performance against a marketing plan. Information for managerial control *may include* data on customers, competitors, competitor products, and sales force requirements. Strategic planning for the marketing function involves consideration of new markets and new marketing strategies. The information requirements for strategic planning include customer analyses, competitor analyses, consumer survey information, income projection, *demographic projections, and technology* projections.

Production Subsystem

The responsibilities of the production or manufacturing function include product engineering, planning of production facilities, scheduling and operation of production facilities, employment and training of production personnel, and quality control and inspection. Typical transactions to be processed are production orders, assembly orders, finished parts tickets, scrap tickets, and time-keeping tickets. Operational control requires detailed reports comparing actual performance to the production schedule and highlighting areas where bottlenecks occur. Management control requires summary reports which compare overall planned or standard performance to actual performance for such classifications as cost per unit and labor used. Strategic planning for manufacturing includes alternative manufacturing approaches and alternative approaches to automation.

Logistics Subsystem

The logistics function encompasses such activities as purchasing, receiving, inventory control, and distribution. The transactions to be processed include purchase requisitions, *purchase orders, manufacturing orders, receiving reports, tickets for inventory, shipping* orders, and bills of lading. The operational control function uses information contained in reports such as past-due purchases, past-due shipments to customers, out-of-stock items, overstocked items, inventory turnover reports, vendor performance summaries, and shipper performance analyses. Managerial control information for logistics consists of overall comparisons between planned and actual inventory levels, costs for purchased terns, stock outs, inventory turnover, etc. Strategic planning involves the analysis of new distribution strategies, new policies with regard to vendors, and 'make versus buy'

strategies. Information on new technology, distribution alternatives, etc., is required.

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Personnel Subsystem

The personnel subsystem includes hiring, training, record keeping, payment, and termination of personnel. The transactions result in documents describing employment requisitions, job descriptions, training specifications, personnel data, pay rate changes, hours worked, paychecks, benefits, and termination notices. Operational control for personnel requires decision procedures for action such as hiring, training, termination, changing pay rates, and issuing benefits. Management control of the personnel function is supported by reports and analyses showing the variances resulting from differences between planned and actual performance for such classifications as number of employees hired, cost of recruiting, composition of skills inventory, cost of training, salary paid, distribution of wage rates, and conformance with government equal opportunity requirements. Strategic planning for personnel is involved with evaluating alternative Strategies for recruiting, salary, training, benefits, and building location to ensure that the organization obtains and retains personnel necessary to achieve its objectives. The strategic information required includes analyses of shifting patterns of employment, education, and wage rates by area of the country.

Finance and Accounting Subsystem

Finance and accounting are somewhat separate functions but are sufficiently related to be described together. Finance is responsible for ensuring adequate organizational financing at as low cost as possible. Accounting covers the classification of financial transactions and summarization into the standard financial reports, the preparation of budgets, and classification and analysis of cost data. Operational control over the function itself requires daily error and exception reports, records of processing delays, reports of unprocessed transactions, etc. The managerial control level for accounting and finance utilizes information on budgeted versus actual cost of financial resources, cost of processing accounting data, and error rates. The strategic planning level for accounting and finance involves a long-run strategy to ensure adequate financing, a long-range tax accounting policy to minimize the impact of taxes, and planning of systems for cost accounting and budgeting.

Information Processing Subsystem

Operational control of information processing operations requires information on the daily schedule of jobs, error rates, and equipment failures; for new project development it requires daily or weekly schedules of programmer progress and test time. Managerial control over information

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processing requires data on planned versus actual utilization, equipment costs, overall programmer performance, and progress compared to schedule for projects to develop and implement *new applications.* Strategic *planning* for *information* systems involves the organization of the function, the overall information system plan, selection of strategic uses of information, and the general structure of the hardware and software environment.

Top Management Subsystem

The top management function operates separately from the functional areas, but also includes the functional vice presidents acting in a top management capacity such as in management committees. The transactions processed by top management are primarily inquiries for information and support of decisions. The information for operational control in the top management function includes meeting schedules, correspondence control files, and contact files. Managerial control by top management uses information which summarizes the management control being exercised by other functions to evaluate whether the functions are performing as planned. The strategy determined by top management sets the framework for strategic planning within function and also coordinates planning to remove major inconsistencies. Strategic planning at the top management level requires a wide variety of summarized external and internal data. Information system support for strategic planning may include ad hoc retrieval of data, ad hoc analyses, and decision support systems.

General Structure of Management Information System

MIS structure has been described in terms of support for decision making, management activity, and organizational functions. These three approaches will now be synthesized into a management information system structure. This is essentially a conceptual framework which allows one to describe an existing or planned information stem. There is also a physical structure which defines the way an **MIS** is implemented.

Conceptual Structure

The conceptual structure of a management information system is defined as a federation of functional subsystems, each of which is divided into four major information processing components, transaction processing, operational control information system support, managerial control information system support, and strategic planning information system support. Each of the functional subsystems of the information system has some unique data files which are used only by that subsystem. There are also files which need to be accessed by more than one application and need to be available for general retrieval. These files are organized into a general database managed by a database management system.

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Physical Structure

The physical structure of an MIS would be identical to the conceptual structure if all applications consisted of completely separate programs used by only one function, but this is frequently not the case. Modularity is the design of an information system as a number of small sets of processing instructions called modules. Some modules are used only once in a single application; others are used in a large number of applications. The use of modules even in cases where each has a single purpose is desirable because it improves control over system development and modification. The modules can be written and tested separately, allowing more efficient maintenance by identification of the boundaries of the module being changed. The physical structure of an information system is affected by the use of common modules for many processing operations. For example, a common input data validation routine may be used for all applications. If an application consists of major modules for input, input validation and error control, processing, and output, the use of a common module for input validation and error control means that no application is complete without using this module.

Formal versus Informal Information Systems

The management information system encompasses only part of the total information processing that takes place in an organization. The complete information processing system of an organization consists of both public systems and private systems. "Public" is used in the sense of being known to relevant persons in the organization and available to all who have authority to access the information. Private systems are kept by individuals. These may supplement or duplicate the public systems, and they may be unsanctioned and discouraged or sanctioned and encouraged. There are within the public and private systems both formal and informal information systems. The formal information system is manifested by documents and other records, usually indicating compliance with prespecified rules and procedures. The informal information system may process information that is vital to organizational functioning but without formal records of that process. In addition to these formal and informal public systems, many private information systems tend to exist in organizations. Some of these are quite formal, at least for the individual owner and any support staff who help maintain it.

Some advocates of "total systems" have argued for complete integration of all formal information processing. The experience to date suggests that such a tightly integrated system is impractical. There are too many factors to consider all at once, and maintenance is difficult. For this reason, information systems tend to have a modular design with integration only

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where required. Inconsistencies among subsystems are reduced by the use of standards and the common database. Data integration is accomplished by the use of a common database. A common database does not necessarily eliminate the need for separate files. Some files are significant only to one application and therefore may be designed for and maintained by that application.

The information system structure does not specify online user-machine interaction; it indicates only support for various operational and management activities. Online processing of transactions is often desirable because the transaction is completed immediately. Inquiries are generally more effective if immediate response is available.

The computer system that supports online transaction processing may not be able to support interactive models. However, having an information system does not imply that a single computer system must be used. An organization may use its in-house computer for transaction processing but provide alternatives for interactive models such as providing a small in-house interactive system, renting time on an outside computer through timesharing, or providing personal computers. These approaches encourage managers and staff specialists to develop their own support models, rather than depending on the staff of the information processing, function to provide them.

SUMMARY

- Management information system is an integrated, user-machine system for providing information to support operations, management, and decision-making functions in an organization. The system utilizes computer hardware and software; manual procedures; models for analysis, planning, control and decision making; and a database.
- A data processing system processes transactions and produces reports. It represents the automation of fundamental, routine processing to support operations.
- A Decision Support System (DSS) is an information system application that assists decision making.
- Information Resource Management (IRM) is an approach to management based on the concept that information is an organizational resource.
- The logistics function encompasses such activities as purchasing, receiving, inventory control, and distribution. The transactions to be processed include purchase requisitions, purchase orders, manufacturing orders, receiving reports, tickets for inventory, shipping orders, and bills of lading.

- The personnel subsystem includes hiring, training, record keeping, payment, and termination of personnel.

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REVIEW QUESTIONS

1. Define Management Information System and discuss MIS vs Data Processing.
2. Describe MIS structure based on management activity.
3. Explain about MIS structure based on Organisational Function.
4. Give general structure of Management Information System.
5. Write notes on:
   (1) MIS as an Evolving Concept
   (2) MIS and Decision Support System
   (3) MIS and Information Resource Management.

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CHAPTER 3 CONCEPTS OF PLANNING AND CONTROL

★ STRUCTURE ★

LEARNING OBJECTIVES

After going through this chapter, you will be able to:

- describe concept of organizational planning
- discuss the planning process
- discuss the computational support for planning and characteristics of control process.
- explain the nature of control in organization.

3.1. PLANNING PROCESS

A plan is a predetermined course of action. It represents goals and the activities necessary to achieve those goals. Control is the activity which measures deviations from planned performance and initiates corrective action.

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Organizational Planning

The starting point for MIS planning is general organization planning. No MIS department can decide what they should do or how they should do it without the groundwork provided by objectives and plans for the company they are supporting. Planning is an ongoing organizational function that provides the framework operational activities and decision making. The organizational mission is translating operational objectives through an organizational hierarchy of planning activities. There is planning in organizations even though there may not be a formal organizational plan; however, informal planning is usually inconsistent and incomplete. The reasons for formal organizational planning are to focus the energies and activity the organization on achievement of its objectives. The formal plan not only guides activity provides a basis for evaluating results.

Setting of Goals and Objectives

There is general agreement on the meaning of terms used in planning, but they tend to be used imprecisely and interchangeably.

Mission is broad statement of the purpose of the organization. To provide a high-quality product and convenient customer service.

Goals are general statement of what is to be accomplished. Reduce time to respond to service request without increasing number of service personnel.

Strategies are general approaches to achieving goals. Improve procedures for handling service requests; provide procedures for reducing time required at each site.

Objectives are statement of measurable results to be achieved. Reduce average time from request to completion of service call.

Plans and budgets are schedule of specific activities and actions to achieve objectives. Revise service call request procedures: revise servicing procedures to improve use of diagnostic tools.

Policy is the limits to acceptable behavior express ethical and moral values, decision limits, and standards. System interfaces shall be designed to enhance and enrich the job performed by users.

The Planning Process

Planning is a significant activity for management and many other positions in the organization, but it is frequently neglected. The reasons for the neglect of an activity recognized as very important center around four characteristics of planning as a human activity.

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- Planning is a very difficult cognitive activity. It is hard mental work. Because of the cognitive strain involved in doing planning work, people avoid planning.
- Planning makes evident the uncertainty of future events. By making explicit the various uncertainties, the future may appear more uncertain after planning than before. There is a human tendency to avoid uncertainty, and this may be reflected in planning avoidance.
- Planning reduces perceived freedom of action. When plans are made, individuals are committed to a narrower range of actions than when no formal plans are made.
- Planning is a very intensive effort, and it is difficult, given the nature of managerial work, to take the time for planning. This is one reason that organizations have retreats where all other activities are shut out in order to concentrate on planning.
- Planning is computationally tedious. Each change in planning assumptions affects other figures in the plans. Analysis of past data and current expectations requires significant computational work. The popularity of planning software reflects the need for computational assistance in planning.
- Plans are often made and then ignored. One reason they may be ignored is that they don't represent real agreement. However, if they are ignored people become reluctant to be involved in planning.

The high cost of preparing data for planning and of manually examining alternative plans places severe limitations on planning activities. The plans of an organization reflect expectations about the environment, expectation about the capabilities of the organization and decisions and bargains on such matters a allocation of resources and direction of effort. The quantified expectations are input to models used in planning.

3.2. COMPUTATIONAL SUPPORT FOR PLANNING

There are four types of computational support needed for the analysis preparatory to planning, the preparation of the plans, and the output of the results:

1. An analysis of historical data to obtain relationships useful for projections
2. Various projection and forecasting techniques to estimate future values
3. Computations internal to the plan and computations required for outputs
4. Output of the results in a meaningful planning format

This computational support can range from sophisticated statistical techniques to a fairly simple spread sheet computational procedure.

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Historical Data Analysis Techniques

Historical data is analyzed to discover patterns or relations that will be useful in projecting the future values of significant variables. Even when quantitative relations are not sufficiently stable to use in forecasting, data analysis is useful for input into the judgmental forecast. The major data generation techniques are described as:

1. Time trend or growth rate: Computation of rate of change or growth over a specified period. For example, sales grew at a rate of 19.1 percent during the years 2001 to 2005.
2. Data smoothing: Raw data generally contains random variations or other irregularities which make the normal level difficult to observe. Data smoothing techniques are used to smooth the irregularities.
3. Seasonal analysis: Economic activity varies with the time of year. For example, sales of turkeys are especially high in November and December. Seasonal analysis is used to obtain the seasonal pattern and to adjust for it in the overall pattern.
4. Autocorrelation analysis: Certain variables have a time delay relation with each other. For example, a sale of repair parts in period n is a function of the sales of new units in period *n-1*. Autocorrelation analysis assists in discovering these relations.
5. Cross-correlation analysis: The degree of association between two sets of data is calculated.
6. Data description and dispersion analysis: It is useful to understand data in terms of measures such as mean, median, mode, intervals, and standard deviations. For example, the analysis that identifies daily sales as being 100.000 units with a standard deviation of 12,000 units is useful in understanding the nature of the sales activity being planned. Among the most useful statistics are measures of central tendency (mean, median & mode) and measures of dispersion (standard deviation). Graphs and histograms may be prepared for visual analysis.

Historical Extrapolation Techniques

Historical data describes the past, but planning involves the future. Estimating is generally based on analysis of past history combined with various techniques to generate data for planning purposes. Some of the common estimation techniques for planning are:

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1. Extrapolation of time series or growth rate: Time series and growth rates can be extrapolated from historical data analysis. If the past growth rate has been 10 percent, the rate is assumed to continue.
2. Extrapolation based on regression analysis: Past patterns of activity obtained by regression analysis can be used if they are expected to continue. The patterns may be based on time and a growth rate or on causal relationships among variables.
3. Interpolation: If historical data exists, but not for the values related to planning, the needed value can often be interpolated. If cost is known for 12,000 and 14,000 units, a cost can be interpolated for 13,000 units.
4. Formula or relation: Many planning figures are derived from computations on other figures. For example, sales returns may be computed as a percentage of gross sales. Sales for the month may be computed from yearly sales multiplied by the seasonal factor for the month.

Financial Planning Computations

Models that involve financial plans need to provide for various computations and analyses commonly required for measuring or evaluating profitability. Examples are depreciation computation rate of return analysis, and break-even analysis. Depreciation is a significant computation in most financial planning. It affects profit computations because it is an expense, and it affects cash flow because of its impact on taxes. There are several methods for computing depreciation, all of which should be available to the planner. Rate of return analysis is a method for computing the profitability of an investment, taking into account the timing of the investment and the cash flows stemming from the investment. There are several methods for computing the rate of return which should be a part of the planning model. Break-even analysis is a fairly simple but very useful computation for determining the volume of activity at which there is no loss or profit. In evaluating alternatives, two situations may have identical expected profits, but the one with a lower break-even point is to be preferred.

Output of Planning Results

The output of the planning process will be plans in a format suited to the needs of their various users. It is common to have the major financial plans in the same form as the actual results are reported. They are often termed proforma statements. Other outputs will be prepared in a form suitable for the function, project, organizational unit, etc., receiving their part of the plan. One of the problems of planning is preparing outputs, because each change in any variable has an effect that may ripple through

the entire output. The outputs may not be complex or long, but the constant changes during the planning process cause a substantial clerical cost to redo the outputs, unless there is computer modeling support.

Computer-based planning models provide facilities for developing and validating analytical models, flexible access to data in the database, and facilities for manipulating the model and posing 'What if' questions.

3.3. CHARACTERISTICS OF CONTROL PROCESSES

Control consists of procedures to determine deviations from plans and indicate corrective action. Every major organizational function has a set of controls associated with it.

Control in Systems

The basic model of a system as inputs, process, and outputs did not include regulation and control of the system. For control purposes, a feedback loop is added to the basic model as in figure. In its simplest form outputs from the system are compared with the desired output, and any difference causes an input to be sent to the process to adjust the operations so that output will be closer to the standard.

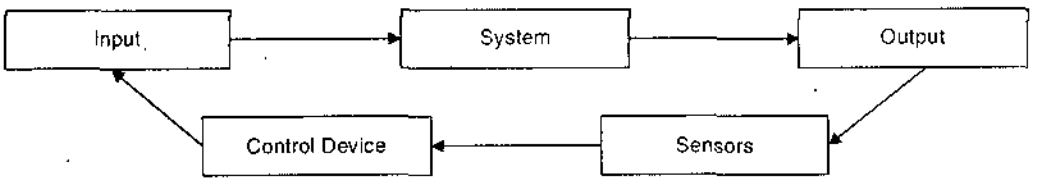

Figure 3.1. *Sensor control for a system*

Feedback which seeks to dampen and reduce fluctuations around the standard is termed *negative feedback*. It is used in feedback control loops. *Positive feedback* reinforces the direction in which the system is moving. In other words, positive feedback causes the system to repeat or amplify an adjustment or action. With proper feedback and control the system said to be a *cybernetic system.*

Feedback in which the system changes its operation is not the only adjustment an organizational system may make. In response to feedback, the organization may change its standards. Since organizations are goal-directed and self-organizing, a change in goals may often lead to changes in the system to achieve the new goals.

Negative Feedback Control

Negative feedback control in a system means keeping the system operating within certain limits of performance. For example, an automated production

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system is in control if inputs of material and energy are converted to output of produced items using a standard amount of material and energy and with the percentage of defective items falling within allowable limits. A system which is out of control functions outside the allowable limits because the regulatory mechanisms are not operative. Control using negative feedback normally involves four elements.

1. A characteristic or condition to be controlled. The characteristic or condition must be measurable from some output.
2. A sensor for measuring the characteristic or condition.
3. A control unit which compares the measurements with a standard for that characteristic or condition.
4. An activating unit which generates a corrective input signal to the process.

Feedback control loops are frequently classified as closed or open. A *closed control loop* is an automated control such as a thermostat or computer-controlled process. In much the same way that a closed system is insulated from disturbances in the environment, a closed feedback loop is insulated from disturbances in the control loop. An *open control loop* is one with random disturbances, such as those associated with human control elements. There are variations between the two extremes. A human machine system is thus an attempt to use the best characteristics of both open and closed controls to make the system as closed as possible.

Law of Requisite Variety

One of the basic notions of system control theory is the *law of requisite variety* to obtain control. This has various rigorous formulations, but a common-sense understanding is that to control each possible state of the system elements, there must be a corresponding control state; to control a hundred states of the system elements, there must be a hundred different states of controls. In human or organizational terms, a manager who wishes to control an inventory of 10,000 stock keeping units needs to have available detailed information on each stock keeping unit and to generate a control response for each possible variation in the state of each stock keeping unit. This is beyond the capabilities of one person-in term of channel capacity to receive and transmit the data and in processing capability to generate the variety of control responses. The manager handles this by assigning standard control procedures that can be applied to all units and furnishing a subordinate with decision rules for generating the variety of responses required to control the inventory assigned.

The law of requisite variety means that for a system to be controlled, every controller (human or machine) must be provided with (1) enough

control responses (what to do in each case) to cover all possible conditions the system may face, (2) decision rules for generating all possible control responses, or (3) the authority to become a self-organizing system in order to generate control responses. Enumerating all responses is possible only in simple cases. Providing decision rules works well, but it is difficult to be all-encompassing when open systems are involved. Computer-controlled open systems are not feasible because of the law of requisite variety. The solution is the use of human machine systems in which the computer applies decision rules to generate control responses for all expected situations and a human decision maker is used to generate control responses for the unexpected.

3.4. THE NATURE OF CONTROL IN ORGANIZATIONS

The control process requires measurement of performance and a standard for comparison. Measurement is basic to human experience; we think, move, and act in terms of measured amounts of time, distance, and value. Performance is expressed as measured units of input, activity, and output. Management evaluates performance, but it requires a standard against which an object, activity, or result may be placed to decide whether performance is satisfactory.

Performance Standards

For control purposes, the standard can be a budget or plan that was previously arrived at following consideration of alternatives and surrounding conditions. The planned performance is usually the best that can realistically be expected rather than what is desired. A loss may be budgeted by a business. If the actual loss is the same as the budgeted loss, performance must be evaluated as acceptable. In other words, it is any deviation from the budget or plan that calls for corrective action. Interpretive comments are often included on control reports to explain deviations from the planned or budget standard. The control report issued to management represents a comparison of actual performance with planned performance. Use of the term control to refer to such a report does not refer to the performance being reported; the activity presented has already taken place. It is no longer subject to control. An activity can be controlled before it takes place or while it is taking place, but it cannot be controlled after it has been completed. A report summarizing past activity is an evaluation report. Only if the report of past performance is the basis for control of future action may it be considered to be a control report.

When the object of a control system is individual performance, it is important that personnel connected with the activity being evaluated should regard the standard or plan as being fair. Experiments indicate that individuals reject standards that are too easy or too hard. The acceptance of goals and their use as a motivator to improve performance are enhanced by their being set within the limits that the individuals involved consider feasible. Therefore, it is considered desirable for the individuals themselves to participate in setting the budget or standard by which they may judge themselves and by which they know they will be judged by others. This is a basic principle of *management by objectives.*

The Avoidance of Uncertainty

The purpose of organization and control is to reduce uncertainty regarding the task to be performed, how it is to be performed, and when it will be performed. The opposite of organization and control is disorganization and entropy. A major purpose of information is to reduce uncertainty. The problem of avoidance of uncertainty with respect to planning and control is that it may manifest itself in an avoidance of planning or in excessive control. As noted earlier in the chapter, the avoidance of planning may be explained in part by an avoidance of explicit recognition of uncertainty. In the case of control, attempts to avoid uncertainty may result in excessive rules and regulations, thereby stifling individual initiative and self-organization. *The* problems of control are especially relevant to information system design since many organizational *systems are designed* to use information acquisition and information processing to achieve control.

The Behavior of Control Personnel

There are a number of control positions in organizations. Their primary function is verification that organizational policies and procedures are being followed. Examples are budget officers, performance review personnel, and auditors. While these control tasks are necessary and useful organizational function, the tendency is to make the reward structure for personnel performing them dependent upon discovering and pointing out errors. In other words, the person in a control position tends to receive organizational rewards for finding the mistakes and failures of other members of the organization. This may lead to a tendency on the part of persons being evaluated to manipulate the information being provided. The integrity of the information system may be affected by data items that are misclassified or otherwise misreported.

3.5. MIS PLANNING : GENERAL

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Now that the groundwork of general business objectives and planning has been laid, we can turn to these same activities narrowed to the MIS scope. Just the larger business, there can be no long-term success with management information systems unless those involved know where they are going and how they will get there. These four special reasons for systems planning are

1. To off set uncertainty
2. To improve economy of operations
3. To focus on objectives
4. To provide a device for control of operations

Planning the overall approach to an integrated system is also economical. The prevailing pattern of design effort in most companies reflects the short-term approach of automating those clerical operations that offer an immediate payoff in terms of reduction of paperwork and staff. However, experience has shown that in the long run this approach is likely to be more costly than is proceeding under a predetermined plan. Once one job or function has been automated, need for the design and automation of contiguous functions frequently becomes obvious. A good plan for systems development also serves to focus on company and systems objectives. Indeed, if we review the fundamental process of planning, we discover that planning cannot proceed any area of endeavor until adequate objectives have first been set. It follows development of a master systems plan forces examination and definition of objectives.

MIS Objectives

It cannot be too strongly stated or too often repeated—the reason for an MIS group's existence is to support line management in whatever business they are engaged. The temptation of every support group is to take on an independent life of its own. The purpose of MIS is to support and assist management in the company's business. As we stated, MIS objectives are derived from the company's objectives. Ideally, these business objectives are clearly stated in writing. If that is not the case these objectives are available from the key executives in the business. Although an executive may not have written objectives, almost certainly he or she can answer the questions:

1. What do you want to achieve in area XYZ ?
2. What is your schedule for this achievement ?

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3. What are the cost and completion criteria ?
4. How can the MIS group assist you ?

- Each company objective should be reflected in at least one MIS objective. The MIS objective calls for a supporting contribution to meet the company's also.

One final point should be made on setting MIS objectives. Each MIS objective must tie back to a company objective (*i.e.,* everything done by the MIS department is in support of the company's business).

Strategic Planning, Project Planning, and MIS

As already mentioned, it is imperative to have a long-range, total MIS plan into which all shorter-range plans and projects fit. This prevents the creation of fragments that are incompatible with other management information systems. The long-range, total MIS plan evolves from reflecting support for the company's overall goals.

The total MIS plan should be checked periodically to verify that it still answers to the needs of the larger business. The total MIS plan is always consulted when a strategic or project plan for a management information system is proposed. The key question asked is, "Does this specific MIS plan fit within the framework of the total MIS plan ?" There should again be a correspondence between business plans and MIS plan, this time at the strategic level. Each business strategy should be supported by an information management strategy. Each information management strategy should tie in to some business strategy. The MIS department must produce an operating plan that meshes with the other operating plans in the company. That operating plan will contain a number of project plans, each of these in support of a project in the business mainline.

Planning Techniques

For very small projects, commonsense techniques for planning and documenting the plans for the MIS project are sufficient. Most of these techniques and tools have been borrowed from engineering project management theory and practice, where they originated. The planning techniques rest on some fundamental management premises. The first is that all work can be planned and controlled. The second is that the greater the difficulty in planning the work, the greater the need for such planning. Techniques exist for a rational approach to planning the design and implementation of large systems. The third premise is that the assignment of project management to a project manager with wide responsibilities is an important factor in increasing the probability of success of a project. The project manager must control all funds required for the project.

However, the project manager may direct the activities of a program without having direct-line command over all persons involved in the program.

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Work Breakdown Structure

A fundamental concept in project management is the work breakdown structure, which starts with the total end result desired and terminates with the individual detailed tasks. The project breakdown structure is a natural decomposition of the project end result. It is created in a level-by-level breakdown from:

1. System to subsystem
2. Subsystem to task
3. Task to subtask
4. Subtask to work package.

The work breakdown structure, referred to as WBS, starts with a word description of the entire project and is then decomposed by word descriptions for each element of each subdivision. The organizational structure should have no influence on the development of the WBS. The classification should be such that natural systems and components are identified and milestone tasks for accomplishing their design are related. Neither gaps nor overlaps must be allowed, yet the structure should interlock all tasks and work packages. The smallest element in the WBS, usually appearing at the lowest level, is work package, a paragraph description of the work that is to be done to achieve an intermediate target. The checklist for work package information:

1. Project identification, title, and number
2. Title and number of work package
3. Responsible organization and manager
4. Interface events and dates
5. Start and end date for work package
6. Dollar and labor estimates. projections of dollars and labor on a weekly or monthly basis, and schedule of actual application of resources maintained as current
7. Contract or funding source identification
8. Account charge number
9. Work order or shop order, to be opened when authorization is obtained to expend a specific amount of money under a particular account number.

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Sequence Planning

The relationships among tasks must be set forth by a chronological ordering, starting with the terminal task of the project and working backward. As each task is set down, it is necessary to determine what immediately preceding tasks must first be completed. When a network of events has been established, estimates of the time required to complete each event, based upon the work package information, may be entered.

Master Program Schedule

The Master Program Schedule (MPS) is a management document giving calendar dates for milestones, providing the control points for management review. The MPS may be in form of a Gantt chart for small MIS projects or in machine or computer print for large projects whose networks have been programmed for reporting. In the latter case, the MPS is derived from the network schedule by establishing a calendar data for the starting event.

Budgeting

The establishment of cost and resource targets for a planned series of periods in advance is project budgeting. Although cost constraints may be applied in a top-down fashion during planning, such constraints must be reconciled with a bottom-up approach through the work breakdown structure. Reconciliation is accomplished by either allocating more funds or narrowing and reducing the scope of the work and redefining the objectives of the project.

Reporting and Controlling

Control of the project means control of performance/cost/time. These elements must be reported in a way that ties them all together, otherwise the report is meaningless. Consider, for instance, a project in which performance and costs are on target. It is possible for such a project to be behind and in trouble from the time standpoint. On the other hand, a project may show overrun of costs as of a particular date, yet if the work performance is ahead of schedule, this is good news instead of bad news.

Reporting Techniques

The reporting system for a project is its own MIS. Some methods of project reporting are

1. Integrated performance/cost/time charts
2. Financial schedules and variance reports
3. Time-scaled network plans and computerized reports based on them
4. Problem analysis and trend charts

5. Progress reports
6. Project control room and computerized graphic systems
7. Design review meetings and reference designs.

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Reporting Problems

Control is difficult if the only reports are written narratives requiring interpretation by management. Managers prefer graphic displays, which reduce large amounts of complex information into easily understood pictorial form. Comparisons and trends of major variables are also effective in communicating. Graphic display must be designed to guard against too gross a level of reporting, however, or else growing problems may be obscured.

Other problems in reporting are the use of complex grammatical structure, high "fog index" of writing; excessive and unexplained abbreviations, codes, and symbols; and too much technical jargon. Projects may fail if the project manager and his or her technical specialists do not make clear to management what is happening and how the money is being spent.

SUMMARY

- A plan is a predetermined course of action. It represents goals and the activities necessary to achieve those goals.
- Mission is broad statement of the purpose of the organization. To provide a high-quality product and convenient customer service.
- Goals are general statement of what is to be accomplished. Reduce time to respond to service request without increasing number of service personnel.
- Strategies are general approaches to achieving goals. Improve procedures for handling service requests; provide procedures for reducing time required at each site.
- Plans and budgets are schedule of specific activities and actions to achieve objectives. Revise service call request procedures: revise servicing procedures to improve use of diagnostic tools.
- Policy is the limits to acceptable behavior express ethical and moral values, decision limits, and standards.
- Planning is a significant activity for management and many other positions in the organization, but it is frequently neglected.
- Historical data is analyzed to discover patterns or relations that will be useful in projecting the future values of significant variables.

NOTES

- The Master Program Schedule (MPS) is a management document giving calendar dates for milestones, providing the control points for management review. The MPS may be in form of a Gantt chart for small MIS projects or in machine or computer print for large projects whose networks have been programmed for reporting.

REVIEW QUESTIONS

1. Explain organizational planning.
2. Describe setting of goals and objectives in an organization.
3. Describe the planning process and its importance in an organization.
4. Discuss computational support needed for the analysis preparatory to planning.
5. Describe the characteristics of Control Processes.
6. Explain the nature of control in an organization.

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CHAPTER 4 BUSINESS APPLICATIONS OF INFORMATION TECHNOLOGY

★ STRUCTURE ★

LEARNING OBJECTIVES

After going through this chapter, you will be able to:

- describe internet and electronic commerce and intranet, extranet
- discuss information systems for business operations
- explain information system for managerial decision support and information system for strategic advantages.

4.1. INTERNET AND ELECTRONICS COMMERCE

Internet

The **Internet** is the largest "network of networks" today, and the closest model we have to the information superhighway of tomorrow. Distinguishing features of the Internet include:

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- The Net does not have a central computer system or telecommunications centre. Instead each message sent on the Internet has a unique address code so any Internet server in the network can forward it to its destination.
- The Net does not have any headquarters or governing body.
- The Internet is growing rapidly.

The applications of Internet are:

- The most popular Internet applications are e-mail, browsing the sites on the World Wide Web, and participating in special interest newsgroups.
- Internet browser software enables millions of users to surf the World Wide Web by clicking their way to the multimedia information resources stored on the hyperlinked pages of businesses, government, and other web sites.
- Web sites are the launch sites for electronic commerce transactions between businesses and their suppliers and customers.
- The Internet provides electronic discussion forums and bulletin board systems formed and managed by thousands of special-interest newsgroups.
- Other applications include downloading software and information files and accessing databases provided by thousands of businesses, governments, and other organizations.
- Hold real-time conversations with other Internet users.
- Gathering information through online services using web browsers and search engines.

Business Use of the Internet

Business use of the Internet is expanding from an electronic information exchange to a broad platform for strategic business applications. Business uses of the Internet include:

- Collaboration among business partners.
- Providing customer and vendor support.
- Buying and selling products and services.
- Marketing, sales and customer service applications.
- Growth of cross-functional business applications.
- Emergence of applications in engineering, manufacturing, human resources and accounting.
- Enterprise communications and collaboration.

- Electronic commerce.
- Strategic business alliances.

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Communications and Collaboration

The Internet, intranets, and extranets support real time global communications and collaboration among employees; customers, suppliers and other business partners. Interactive web sites, e-mail, bulletin board systems, discussion groups, audio and videoconferencing, and other Internet features enable internal and external business information to be researched, solicited, disseminated, and shared. This enables 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.

Electronic Commerce

The Internet, the World Wide Web, and Internet-based technologies such as intranets and extranets provide global links to a company's customers and suppliers. This enables **electronic commerce** applications-the marketing, buying, selling, and support of products and services over these networks. Such applications include interactive order processing at company web sites, electronic data interchange (EDI) of business transaction documents, and secure electronic funds transfer (EFT) payment systems.

Interactive Marketing

Because of the Internet, marketing a company and its products and services has become an interactive process. A company's Web site can now offer more than hyper-linked multimedia product catalogs and promotional material. The Internet and the Web enable companies to create a dialog with customers through online discussion groups, bulletin boards, electronic questionnaires, mailing lists, newsletters, and e-mail exchanges. Interactive marketing process includes push and pulls marketing methods. That is marketing material can be put on customers' or prospects' computer screens using either push or pull technologies. **Pull Marketing** relies on to access the services of the internet or the web using web browsers. **Push Marketing** relies on software called web broadcasters or net broadcasters.

Strategic Alliances

The Internet enables companies to form strategic alliances with customers, suppliers, consultants, subcontractors, and even competitors. Internet and extranet global links to such business partners support network organizational structures and the formation of **virtual companies.**

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The Business Value of Internet

What business value do companies derive from their business applications on the Internet?

- Substantial cost savings can arise because applications that use the Internet and Internet-based technologies (like Intranets and extranets) are typically less expensive to develop, operate, and maintain than traditional systems.
- Attracting new customers with innovative marketing and products.
- Retaining present customers with improved customer service and support.
- Generating revenue through electronic commerce applications is a growing source of business value.

Most companies are building commercial sites on the World Wide Web to achieve six major business values:

1. Generate new revenue from online sales.
2. Reduce costs through online sales and customer support.
3. Attract new customers via web marketing and advertising and online sales.
4. Increase the loyalty of existing customers via improved web customer service and support.
5. Develop new web-based markets and distribution channels for existing products.
6. Develop new information-based products accessible on the web.

The Internet provides a synthesis of computing and communication capabilities that add value to every part of the business. What business value do companies derive from their business applications on the Internet? Substantial cost savings can arise because applications that use the Internet and Internet based technologies (like intranets and extranets) are typically less expensive to develop, operate, and maintain than traditional systems. For example, American Airlines saves money every time customers use their Web Site instead of their (customer support telephone system). Another example is corporate intranet applications, which are typically a lot easier and cheaper to develop and maintain than using traditional mainframe or client/server systems. Most companies are building commercial sites on the World Wide Web to achieve four major business objectives:

1. Attract new customers via web marketing and advertising.
2. Improve service to existing customers via web customer service and support functions.

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3. Develop new web-based markets and distribution channels for existing products.
4. Develop new information-based products accessible on the web..

The internet can be viewed as having six strategic capabilities that support a variety of key applications that can add business value to a company. These capabilities include:

Global Dissemination

Since most countries now have Internet connections, global communications has become a fact of life in business. e-mail, electronic mailing lists, World Wide Web sites, and other Internet services have made international dissemination of information significantly faster, cheaper, and easier. This provides strategic business value in the increased cost savings and efficiency of global communications, and the ability to reach, sell, and provide customer service to new or expanded international markets.

Interaction

Interactive communications is another key capability of the Internet. This may take the form of interactive Web sites; discussion forums and chat groups; interactive forms for customer orders, feedback, and technical support; and immediate E-mail responses to online queries and comments. Fast, efficient feedback from customers and responses from customer support specialists provide multiple opportunities to demonstrate a company's responsiveness to its customers. Thus Internet technologies help a business build customer value and loyalty.

Customization

The ability to automatically provide information and services customized to an individual customer or user is a strategic business capability of the Internet, intranets, and extranets. Information can be accessed and disseminated from network servers on an individual basis, depending on a variety of user factors. For example, you can fill out interest profile or registration forms that give you quick access to selective levels of Web site resources. Or software can remember your visits to a site and provide Web site access keyed to your preferences.

Collaboration

The Internet, intranets and extranets enable easy and efficient access to shared data and other network resources. For example, project information at Web sites can be easily shared using Web browsers. Other groupware tools help coordinate projects and manage the information they store on servers at cross-linked Web sites. This enhances the collaboration process among teams, workgroups, and business partners, and thus provides strategic business value to a company.

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Electronic Commerce

The Internet has become the technology platform for electronic commerce. The Internet, along with intranets and extranets, links companies to their customers and suppliers, and thus, enables them to electronically market, buy, sell, and support products and services. For many companies the business value of the Internet lies in electronic commerce applications, which open up new markets and/or make possible new products and services.

Integration

The internetworked enterprise integrates its external online activities with its internal\business process. For example, a company's Internet websites can be linked by extranets to select operational databases stored on its intranet web servers. This provides more detailed, up-to-date information that can be used to support electronic commerce applications. In addition, intranets promote the integration of cross-functional business processes within a company.

Electronic Commerce

Defining electronic commerce as "doing business over interconnected networks using Web-based technologies." The Internet is redefining the model for electronic commerce to one that supports the complete seller-to-buy relationship. This model includes promoting and communicating company and product information to a global user base, accepting orders and payment for goods and services online, delivering software, and information products online, providing ongoing customer support, and engaging in online collaboration for new product development.

So for internetworked enterprises in the age of the Internet, intranets, and extranets, electronic commerce is more than just buying and selling products online. Instead, it encompasses the entire online process of developing, marketing, selling, delivering, servicing, and paying for products and services purchased by internetworked, global virtual communities of customers, with the support of a worldwide network of business partners.

Applications of Electronic Commerce

The Internet, intranets, and extranets provide vital electronic commerce links between the components of a business and its customers, suppliers, and other business partners. This allows companies to engage in three basic categories of electronic commerce applications, which we will explore in this section: business to consumer, business to business, and internal business processes.

Business to Consumer Commerce

In this form of electronic commerce, businesses must develop attractive electronic marketplaces to entice and sell products and services to consumers. For example, companies may offer multimedia Web sites that provide virtual storefronts and virtual shopping malls, interactive order processing, and secure electronic payment systems. Electronic commerce uses the Internet, intranets, and extranets to accomplish online transactions with consumers, business customers, and business partners.

Electronic commerce on the Internet been businesses and consumers is, accelerating the impact of information technology on consumer behaviour and business processes and markets.

A basic fact of Internet retailing is that all Web sites are created equal as far as the location; imperative for success in retailing is concerned. No site is any closer to its customers. This makes it vital that businesses find ways to keep customers coming back to their stores. The key to this goal is to optimize factors such as performance and service efficiency, personalization, socialization, the look and feel of the site, offering incentives to purchase, and security.

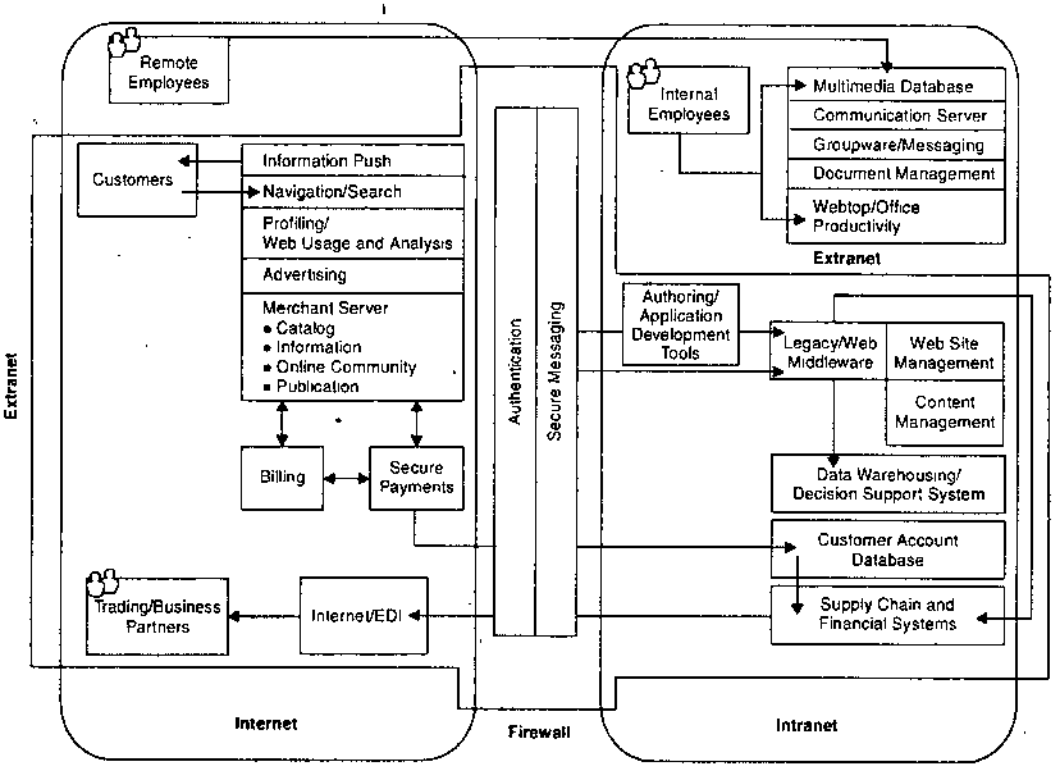

Figure 4.1. *Use of internet, intranet and extranet in e-commerce*

Let's take a look at each of these factors, which help make a retail Web Site success.

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Electronic Data Interchange

Electronic data interchange, or EDI, involves the electronic exchange of business transaction documents over computer networks between trading party. Data representing a variety of business transaction documents (such as purchase orders, invoices, requests for quotations, and shipping notices) are electronically exchanged between computers using standard document message formats. Typically, EDI software is used to convert a company's own document format into standardized formats as specified by various industries and international protocols.

Internal Business Processes

All business, functions and many business processes are affected by electronic commerce activities. For example, many internetworked enterprises are customer-driven and market-driven. They continually monitor and evaluate online information about their customers, suppliers, and competitors from their Web sites and discussion groups. This information is available via intranets to all business functions, and is used to shape, a company's product development, marketing programs, customer service, and competitive strategies.

Technologies of Electronic Commerce

Most information technologies, telecommunications technologies, and Internet technologies are involved in electronic commerce systems. An electronic commerce architecture, proposed by Sun Microsystems and its business partners. This architecture emphasizes that:

- The Internet, intranets and extranets are the network infrastructure or foundation of electronic commerce.
- Customers must be provided with a range of secure information, marketing, transaction processing, and payment services.
- Trading and business partners rely on the internet and extranets to exchange information and accomplish secure transaction using EDI and other supply chain, other financial systems and databases.
- Company employees depend on a variety of internet and internet resources to communicate and collaborate in support of their e-commerce activities.
- IS professionals and end users can use a variety of software tools to develop and manage the contents and operations of web sites and other EC resources of a company.

Electronic Payments

Payment through using e-commerce activities is also possible under high security.

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Electronic Funds Transfer

Electronic funds transfer (EFT) systems are a major form of electronic commerce systems in banking and retailing industries. EFT systems use a variety of information technologies to capture and process money and credit transfers between banks and businesses and their customers.

Secure Electronic Payments on the Internet

One of the most visible and contentious, topics in Internet commerce today is the, security of Internet transactions. When you make an online purchase on the Internet, your credit card information is vulnerable to interception by network sniffers, software that easily recognizes credit card number formats. Several basic security measures are being used to solve this security problem: (1) encrypt (code and scramble) the data passing between the customer and merchant, (2) encrypt the data passing between the customer and the company authorizing the credit card transaction, or (3) take sensitive information offline.

For example, many companies use the **Secure Socket Layer (SSL)** security method developed by Netscape Communications that automatically encrypts data passing between your Web browser and a merchant's server. However, sensitive information is still vulnerable to misuse once it is decrypted (decoded and unscrambled) and stored on a merchant's server. So a digital wallet approach such as the Cyber Cash payment system was developed. In this method, you add security software add-on modules to your Web browser. That enables your browser to encrypt your credit card data in such a way that only the bank that authorizes credit card transactions for the merchant gets to see it. All the merchant is told is whether your credit transaction is approved or not.

The **Secure Electronic Transaction (SET)**, standard for electronic payment security extends the Cyber Cash digital wallet approach. In this method, EC software encrypts a digital envelope of digital certificates specifying the payment details for each transaction. SET has been agreed to by VISA, MasterCard, IBM, Microsoft etc.

4.2. INTRANETS, EXTRANETS AND ENTERPRISE SOLUTIONS

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The Network

The network is connecting two or more devices to communicate. The Internet is the largest "network of networks" today, and the closest model we have to the information superhighway of tomorrow. The explosive growth of the Internet and the use of its enabling technologies have revolutionized computing and telecommunications. The Internet has become the key platform for a rapidly expanding list of information and entertainment services and business applications, including enterprise collaboration and electronic commerce systems. Open systems with unrestricted connectivity using inter-net technologies are the primary telecommunications technology drivers in e-business systems. Their primary goal is to promote easy and secure access by business professionals and consumers to the resources of the internet, enterprise intranets, and interorganizational extranets. Some features of the Internet include:

- The Net does not have a central computer system or telecommunications centre. Instead each message sent on the Internet has a unique address code so any Internet server in the network can forward it to its destination.
- The Net does not have any headquarters or governing body.
- The Internet is growing rapidly.

Intranets

An **intranet** is a network inside an organization that uses internet technologies (such as web browsers and servers, TCP/IP network protocols, HTML hypermedia document publishing and databases, and so on) to provide an Internet-like environment within the enterprise 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. A Company's Intranet can also be accessed through the Intranets of customers, suppliers, and other business partners via extranet links. Intranets have moved beyond merely making hypermedia information available on Web servers, or pushing it to users via net broadcasting. Intranets are also being used as the platform for developing and deploying critical business applications to support business operations and managerial decision making across the internetworked enterprise.

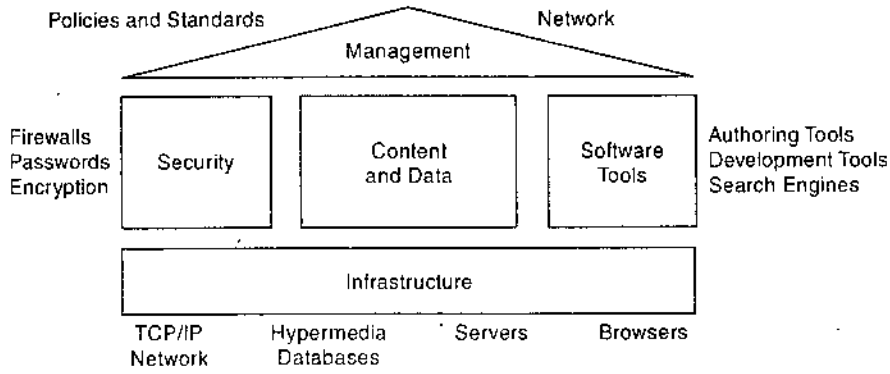

Figure 4.4. *Components of Intranets' IT architecture*

The Business Value of Intranets

Companies are deriving strategic business value from the Internet, which enables them to disseminate information globally, communicate and trade interactively with customized information and services for individual customers, and foster collaboration of people and integration of business processes within the enterprise and with business partners. These capabilities allow them to generate cost savings from using Internet technologies, revenue increases from electronic commerce, and better customer service and relationships through interactive marketing and customer relationship manage-ment. Organisations are implementing a broad range of Intranet uses. Several common functional Intranet business applications include:

- Marketing
- Finance
- Human Resources
- Sales
- Manufacturing
- Training
- Customer Information.

Intranet applications support communications and collaboration, business operations and management, web publishing, and Intranet management. These appli-cations can be integrated with existing IS resources and applications, and extended to customers, suppliers, and business partners.

Applications of Intranets

Intranets applications are as under:

Communications and Collaboration

Intranets can significantly improve communications and collaboration within an enterprise. Intranets can significantly improve communications

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and collaboration within an enterprise. For example, you can use your intranet browser and your PC to send and receive E-mail, voicemail, paging, and faxes to communicate with others within your organization, and externally through the Internet and extranets. You can also use intranet groupware features to improve team and project collaboration with services such as discussion groups, chat rooms, and audio and videoconferencing. Examples include:

- Using an Intranet browser and PC or NC workstation to send and receive e-mail, voicemail, paging, and faxes to communicate with others within your organization, and externally through the Internet and extranets.
- Using Intranet groupware features to improve team and project collaboration with services such as discussion groups, chat rooms, and audio and video-conferencing.

Web Publishing

The advantages of developing and publishing hyperlinked multimedia documents to hypermedia databases accessible on World Wide Web servers have moved to corporate intranets. The comparative ease, attractiveness, and lower cost of publishing and accessing multimedia business information internally via intranet web sites have been one of the primary reasons for the explosive growth in the use of intranets in business. The advantages of developing and publishing hyperlinked multimedia documents to hypermedia databases accessible on World Wide Web servers has moved to corporate intranets. The comparative ease, attractiveness, and lower cost of publishing and accessing multimedia business information internally via intranet Web sites have been the primary reasons for the explosive growth in the use of intranets in business. Examples include:

- Company newsletters, technical drawings, and product catalogs can be published in a variety of ways including hypermedia and web pages, e-mail, net broadcasting, and as part of in-house business applications.
- Intranet software browsers, servers, and search engines can help you easily navigate and locate the business information you need.

Business Operations and Management

Intranets are being used as the platform for developing and deploying critical business applications to support business operations and managerial decision making across the internetworked enterprise. Employees within the company, or external business partners can access and run such applications using web browsers from anywhere on the network whenever needed. The advantages of developing and publishing hyperlinked multimedia documents to hypermedia databases accessible on World Wide Web servers has moved to corporate intranets. The comparative ease,

attractiveness, and lower cost of publishing and accessing multimedia business information internally via intranet Web sites have been the primary reasons for the explosive growth in the use of intranets in business. Examples include:

- Many companies are developing customer applications like order processing, inventory control, sales management, and executive information systems that can be implemented on Intranets, extranets, and the Internet.
- Many applications are designed to interface with, and access, existing company databases and legacy systems. The software for such business uses (sometimes-called applets or cross ware) is then installed on Intranet web servers.
- Employees within a company, or external business partners, can access and run applications using web browsers from anywhere on the network whenever needed.

• **Intranet Benefits**	• **Intranet Limitations**
Global, enterprise-wide in scope	New evolving technology
Easy, intuitive GUI assess via browsers	Lack of security features
Low-cost access	Lack of performance managment
Low-or no-cost software	Minimal user support
Low-cost hardware	May require network upgrades
Runs on all platforms	Browser/server software incompatibilities
Standardized file transfer	between versions
Standardized document creation	May not scale for large enterprises with
Standardized network protocol, TCP/IP	intense interactive applications
Reduces paper/printing cost	Difficult to maintain content over time
Reduces marketing/sales costs	Animation, video and audio are slow
Increases productivity via faster information	Unfiltered information may overwhelm users
access and easier collaboration	Not all employees may have personal computers

Figure 4.5. *Benefits and Limitations of Intranets*

Extranets

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. As businesses continue to use open Internet technologies extranets to improve communication with customers and partners, they can gain many competitive advantages along the way-in product development, cost savings, marketing, distribution, and leveraging their partnership. The primary role of extranets is to link the intranet resources of a company to the intranets of its customers, suppliers, and other business partners. Extranets can also provide access to operational

company databases and legacy systems to business partners. Thus, extranets provide significant business value by facilitating and strengthening the business relationships of a company with customers and suppliers, improving collaboration with its business partners, and enabling the development of new kinds of Web-based service for its customers, suppliers, and others. Companies can:

- Establish direct private network links between themselves, or create private secure Internet links between them called virtual private networks.
- Use the unsecured Internet as the extranet link between its Intranet and consumers and others, but rely on encryption of sensitive data and its own firewall systems to provide adequate security.

Business Value of Extranets

The business value of extranets is derived from several factors:

- The web browser technology of extranets makes customer and supplier access of intranet resources a lot easier and faster than previous business methods.
- Extranets enable a company to offer new kinds of interactive Web-enabled services to their business partners. Thus, extranets are another way that a business can build and strengthen strategic relationships with its customers and suppliers.
- Extranets enable and improve collaboration by a business with its customers and other business partners.
- Extranets facilitate an online, interactive product development, marketing, and customer-focused process that can bring better designed products to market faster.

Enterprise Collaboration Systems

The Internet phenomenon has permanently changed the computing mentality of business people. Today's users expect any computing experience to include on-demand Internet access and tools for collaborating with other people. The goal of enterprise collaboration systems is to enable us to work together more easily and effectively by helping us to communicate, sharing information with each other. Enterprise collaboration systems provide tools to help us collaborate - to communicate ideas, share resources, and coordinate our cooperative work efforts as members of the many formal and informal process and project teams and workgroups that make up many of today's organisations. The goal of enterprise collaboration systems is to enable us to work together more easily and effectively by helping us to:

- **Communicate:** Sharing information with each other.
- **Coordinate:** Coordinating our individual work efforts and use of resources with each other.
- **Collaborate:** Working together cooperatively on joint projects and assignments.

There are many types of teams and workgroups, each with its own work styles, agendas, and computing needs. A workgroup can be defined as two or more people working together on the same task or assignment. A team can be defined as a collaborative workgroup, whose members are committed to collaboration, that is, working with each other in a cooperative way that transcends the coordination of individual work activities found in a typical workgroup. So collaboration is the key to what makes a group of people a team, and what makes a team successful.

Virtual Teams

Teams and workgroups can be as formal and structured as a traditional business office or department or they can be less formal and structured like the members of process teams in a manufacturing environment or they can be as informal, unstructured, and temporary as an ad hoc task force or a project team whose members work for different organizations in different parts of the world. Thus, the members of a team or workgroup don't have to work in the same physical location. They can be members of a virtual team, that is, one whose members are united by the tasks on which they are collaborating, not by geography or membership in a larger organization.

Electronic Communication Tools

These help you to communicate and collaborate with others by electronically sending messages, documents, and files in data, text, voice, or multimedia over the Internet, intranets, extranets, and other computer networks.

Electronic Mail

Widely used to send and receive text messages between networked PCs over telecommunications networks. E-mail can also include data files, software, and multimedia messages and documents as attachments.

Voice Mail

Unanswered telephone messages are digitized, stored, and played back to you by a voice messaging computer.

Faxing

Transmitting and receiving images of documents over telephone or computer networks using PCs or fax machines.

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Web Publishing

Creating, converting, and storing hyperlinked documents and other material on Internet or intranet Web servers so they can easily be shared via Web browsers or netcasting with teams, workgroups, or the enterprise.

Electronic Conferencing Tools

These help networked computer users share information and collaborate while working together on joint assignments, no matter where they are located.

Data Conferencing

Users at networked PCs can view, mark up, revise and save changes to a shared whiteboard of drawings, documents and other materials.

Voice Conferencing

Telephone conversations shared among several participants via speaker phones or networked PCs with internet telephone software.

Videoconferencing

Real time video and audio conferencing (1) among users at networked PCS (desktop video conferencing) or (2) among participants in conference room or auditoriums in different locations (teleconferencing). Video conferencing can also include white boarding and document sharing.

Discussion Forums

Provide a computer network discussion platform to encourage and manage online test discussions over a period of time among members of a special interest groups or project teams.

Chat Systems

Enable two or more users at networked PCs to carry on online, real time text conversation.

Electronic Meeting Systems

Using a meeting room with networked PCs, a large screen projector, and EMS software to facilitate communication, collaboration and group decision making in business meetings.

Collaborative Work Management Tools

These help people accomplish or manage joint work activities.

Calendaring and Scheduling

Using electronic calendar-sand other groupware features to automatically schedule, notify, and remind the computer networked members of teams and workgroups of meetings, appointments, and other events.

Task and Project Management

Managing team and workgroup projects by scheduling; tracking, and charting the completion status of tasks within a project.

Workflow Systems

Help networked knowledge workers collaborate to accomplish and manage the flow of structured work tasks and electronic document processing within a business process.

Knowledge Management

Organizing and sharing the diverse forms of business information created within an organization. Includes managing project and enterprise document libraries, discussion databases, hypermedia Web site databases, and other types of knowledge bases.

4.3. INFORMATION SYSTEMS FOR BUSINESS OPERATIONS

Information Technology in Businesses

e-business is the use of the Internet and other networks and information technologies to support electronic commerce, enterprise communications and collaboration, and Web-enabled business processes both within a networked enterprise, and with its customers and business partners. Information systems can be grouped into business function categories; however, in the real world information systems are typically integrated combinations of functional information systems. Functional business systems are composed of a variety of types of information systems (transaction processing, management information, decision support, etc.) that support the business functions of:

- Accounting
- Finance
- Marketing
- Productions/Operations Management
- Human Resource Management.

There is a strong emphasis in many organizations to develop such composite or cross-functional information systems that cross the boundaries of traditional business functions in order to reengineer and improve vital business processes. These organizations view cross-functional information systems as a strategic way to share information resources and improve the efficiency and effectiveness of a business, thus helping it attain its strategic objectives.

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Business firms are turning to Internet technologies to integrate the flow of information among their internal business functions and their customers and suppliers. Companies are using the World Wide Web and their intranets and extranets as the technology platform for their cross-functional and interorganizational information systems.

Introduction to e-business systems describes how information systems integrate and support enterprise wide business processes and the business functions of marketing, manufacturing, human resource management, accounting, and finance.

Cross-Functional Enterprise Systems

Cross-functional enterprise applications are integrated combinations of information subsystems that share information resources and support business processes across the functional units of the business enterprise and extend beyond to customers, suppliers, and other business partners.

Many organizations are using information technology to develop integrated cross-functional enterprise systems that cross the boundaries of traditional business functions in order to reengineer and improve vital business processes all across the enterprise. These organizations view cross-functional enterprise systems as a strategic way to use IT to share information resources and improve the efficiency and effectiveness of business processes, thus helping an e-business attain its strategic objectives. Functional business information systems support the business functions of marketing, production/operations, accounting, finance, and human resource management through a variety of e-business operational and management information systems.

As a business end user, it is important that you have a specific understanding of how information systems affect particular business function-marketing, for example or a particular industry *(e.g.,* banking) that is directly related to your career objectives. For example, someone whose career objective is a marketing position in banking should have a basic understanding of how information systems are used in banking and how they support the marketing activities of banks and other firms. Information systems can be grouped into business function categories. Thus, information systems in this section will be analyzed according to the business function they support to give you an appreciation of the variety of business information systems that both small and large business firms may use. As we know information systems in the real world typically are integrated combinations of functional information systems. Such systems support business processes, such as product development, production, distribution, order management, customer support, and so on. Many organizations are using information technology to develop cross-

functional information systems that cross the boundaries of traditional business functions in order to reengineer and improve vital business processes. These organizations view cross-functional information systems as a strategic way to use IT to share information resources and improve the efficiency and effectiveness of business processes.

Many e-business applications are integrated cross-functional enterprise applications like enterprise resource planning (ERP), customer relationship management (CRM), and supply chain management (SCM), which also reengineer the business processes involved. Enterprise collaboration systems (ECS) support and enhance communication and collaboration among the teams and workgroups in an organization.

These systems themselves are being interconnected with enterprise application integration (EAI) software so that the business users of these applications can more easily access the information resources they need to support the needs of customers, suppliers, and business partners.

Information systems typically are integrated combinations of cross-functional business systems. Such systems support business processes, such as:

- Product development
- Production
- Distribution
- Order management
- Customer support etc.

It illustrates the interrelationships of the major cross-functional enterprise applications that many companies have or are installing today. This architecture spotlights the roles that e-business systems play in supporting the customers, suppliers, partners, and employees of the business.

Many companies have moved from functional mainframe legacy systems to integrated cross-functional enterprise applications. This typically has involved installing:

- Enterprise resource planning (ERP) software.
- Supply chain management (SCM) software.
- Customer relationship management (CRM) software.

These cross-functional enterprise software applications focus on supporting integrated clusters of business processes involved in the operations of a business.

Enterprise application integration (EAI) software is becoming available, which interconnects these enterprise application clusters. EAI software:

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- Enables users to model the business processes involved in the interactions that should occur between business applications.
- Provides middleware that performs data conversion and coordination, application communication and messaging services, and access to the application interfaces involved.

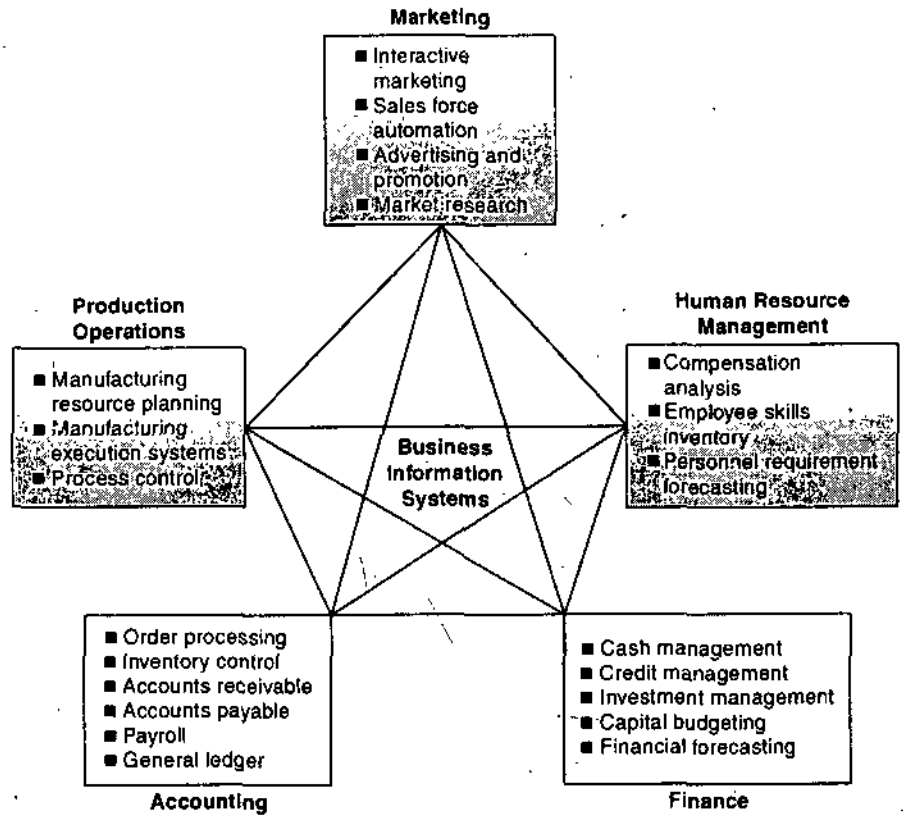

Figure 4.6. *Business Information Systems*

- Integrate a variety of enterprise application clusters by letting them exchange data according to rules derived from the business process models developed by users.
- Integrate the front-office and back-office applications of an e-business, so they work together in a seamless, integrated way. This is a vital capability that provides real business value to an e-business enterprise that must respond quickly and effectively to business events and customer demands.

Marketing Information Systems

Marketing information systems support traditional and e-commerce processes and management of the marketing function. Major types of marketing information systems include interactive marketing at e-commerce websites, sales force automation, customer relationship

management, sales management, product management, targeted marketing, advertising and promotion, and market research. Thus, marketing information systems assist marketing managers in electronic commerce product development and customer relationship decisions, as well as in planning advertising and sales promotion strategies and developing the e-commerce potential of new and present products, and new channels of distribution. 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 present and potential customers.

Marketing information systems support traditional and e-commerce processes and management of the marketing function. Major types of marketing information systems include interactive marketing at e-commerce websites, sales force automation, customer relationship management, sales management, product management, targeted marketing, advertising and promotion, and market research. Thus, marketing information systems assist marketing managers in electronic commerce product development and customer relationship decisions, as well as in planning advertising and sales promotion strategies and developing the e-commerce potential of new and present products, and new channels of distribution.

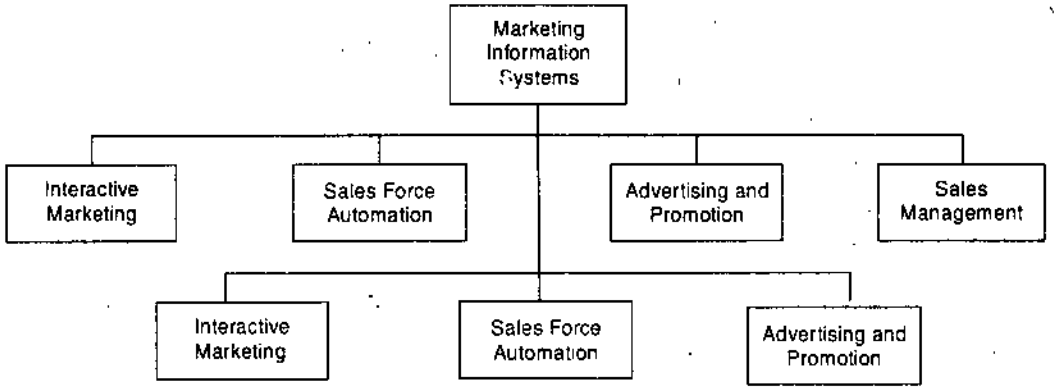

Figure 4.7. *Marketing Information Systems*

Marketing information systems integrate the information flow required by many marketing activities. Marketing information systems provide information for:

- Internet/intranet web sites and services make an interactive marketing process possible where customers can become partners in creating, marketing, purchasing, and improving products and services.
- Sales force automation systems use mobile computing and Internet technologies to automate many information processing activities for sales support and management.

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- Other marketing systems assist marketing managers in product planning, pricing, and other product management decisions, advertising and sales promotion strategies, and market research and forecasting.

Interactive Marketing

The explosive growth of Internet technologies has had a major impact on the marketing function. The term 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 interaction between a business and its customers or potential customers. The goal of interactive marketing is to enable a company to profitably use those networks to attract and keep customers who will become partners with the business in creating, purchasing, and improving products and services.

Interactive marketing:

- Customers are not passive participants, but are actively engaged in a network-enabled proactive and interactive process.
- Encourages customers to become involved in product development, delivery, and service issues.
- Enabled by various Internet technologies, including chat and discussion groups, web forms and questionnaires, and e-mail correspondence.
- Expected outcomes are a rich mixture of vital marketing data, new product ideas, volume sales and strong customer relationships.

Targeted Marketing

Targeted marketing has become an important tool in developing advertising and promotion strategies for a company's electronic commerce websites. Target marketing is an advertising and promotion management concept that includes five targeting components:

- **Community:** Companies can customize their web advertising messages and promotion methods to appeal to people in specific communities. These can be communities of interest, such as virtual communities of online sporting enthusiasts or arts and crafts hobbyists, or geographic communities formed by the websites of a city or local newspaper.
- **Content:** Advertising such as electronic billboards or banners can be placed on various website pages, in addition to a company's home page. These messages reach the targeted audience.
- **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 a company's products.

- **Demographic/Psychographic:** Marketing efforts can be aimed only at specific types or classes of people: unmarried, twenty-something, middle income, and male college graduates.
- **Online behaviour:** Advertising and promotion efforts can be tailored to each visit to a site by an individual. This strategy is based on "web cookie" files recorded on the visitor's disk drive from previous visits. Cookie files enable a company to track a person's online behaviour at a website so marketing efforts can be instantly developed and targeted to that individual at each visit to their website.

Sales and Product Management

Sales managers must plan, monitor, and support the performance of the salespeople in their organizations. So in most firms, computer-based systems produce sales analysis reports that analyze sales by product, product line, customer, type of customer, salesperson, and sales territory. Such reports help marketing managers monitor the sales performance of products and salespeople and help them develop sales support programs to improve sales results.

Sales Force Automation

Increasingly, computers and networks are providing the basis for sales force automation. In many companies, the sales force is being outfitted with notebook computers that connect them to Web browsers, and sales contact management software that connect them to marketing websites on the Internet, extranets, and their company intranets. Characteristics of sales force automation include:

- Increases the personal productivity of salespeople.
- Dramatically speeds up the capture and analysis of sales data from the field to marketing managers at company headquarters.
- Allows marketing and sales management to improve the delivery of information and the support they provide to their salespeople.
- Many companies view sales force automation as a way to gain a strategic advantage in sales productivity and marketing responsiveness.

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:

- select media and promotional methods.
- allocate financial resources.
- control and evaluate results of various advertising and promotion campaigns.

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Market Research and Forecasting

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. Market, economic, and demographic trends are also analyzed. Data can be gathered from many sources. Then, a variety of statistical software tools can help managers analyze market research data and forecast sales and other important market trends.

Manufacturing Systems

Manufacturing information systems support the production/operations function, which includes all activities concerned with the planning and control of the processes that produce goods or services. The production/operations function is concerned with the management of the operational systems of all business firms. Information systems used for operations management and transaction processing support all firms that must plan, monitor, and control inventories, purchases, and the flow of goods and services. Computer-based manufacturing information systems help a company achieve computer-integrated manufacturing (CIM), and thus simplify, automate, and integrate many of the activities needed to quickly produce high-quality products to meet changing customer demands. For

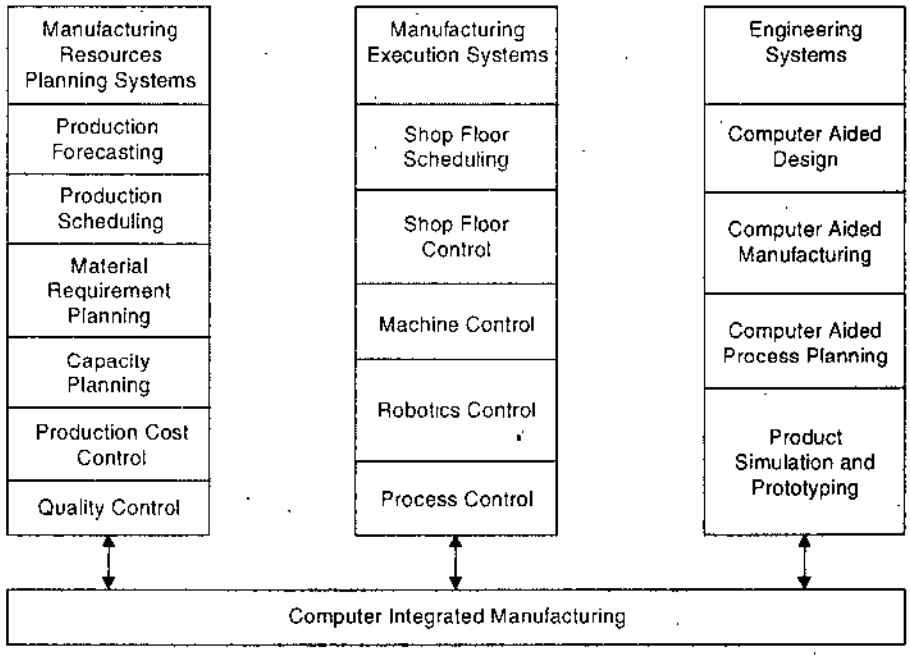

Figure 4.8. *Manufacturing Information Systems*

example, computer-aided design using collaborative manufacturing networks helps engineers collaborate on the design of new products and processes. Then manufacturing resource planning systems help plan the types of resources needed in the production process. Finally, manufacturing execution systems monitor and control the manufacture of products on the factory floor through shop floor scheduling and control systems, controlling a physical process (process control), a machine tool (numerical control), or machines with some humanlike work capabilities (robots).

Computer Integrated Manufacturing (CIM)

Computer-based manufacturing information systems use several major techniques to support computer-integrated manufacturing (CIM). CIM is an overall concept that stresses that the goals of computer use in factory automation must be to:

- **Simplify:** (Reengineer) production processes, product designs, and factory organization as a vital foundation to automation and integration.
- **Automate:** Production processes and the business functions that support them with computers, machines, and robots.
- **Integrate:** All production and support processes using computers, telecommuni-cations networks, and other information technologies.

Overall goal of CIM: Is to create flexible, agile, manufacturing processes that efficiently produce products of the highest quality. Thus, CIM supports the concepts of:

- Flexible manufacturing systems.
- Agile manufacturing.
- Total quality management.

Results of CIM: Implementing such manufacturing concepts enables a company to quickly respond to and fulfill customer requirements with high-quality products and services.

Uses of computers in manufacturing include:

- Computer-aided engineering (CAE).
- Computer-aided design (CAD).
- Computer-aided process planning (CAPP).
- Material requirements planning (MRP).
- Manufacturing resource planning (MRP-II).
- Computer-aided manufacturing (CAM).

Some of the benefits of CIM are:

- Increased efficiency through:
  - work simplification and automation.

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- better production schedule planning.
- better balancing of production workloads in production capacity.

- Improved utilization of facilities, higher productivity, better quality control through:
  - continuous monitoring.
  - feedback and control of factory operations, equipment and robots.
  - reduced investments in production inventories and facilities.
  - work simplification.
  - just-in-time inventory policies.
  - better planning and control of production.
  - better planning and control of finished goods requirements.
  - improved customer service.
  - reducing out-of-stock situations.
  - producing high-quality products that better meet customer requirements.

Computer-Aided Manufacturing (CAM)

Systems are those that automate the production process. For example, this could be accomplished by monitoring and controlling the production process in a factory (manufacturing execution systems) or by directly controlling a physical process (process control), a machine tool (machine control), or machines with some humanlike work capabilities (robots).

Manufacturing Execution Systems (MES)

MES are performance monitoring information systems for factory floor operations. They monitor, track, and control the five essential components involved in a production process:

- Materials
- Equipment
- Personnel
- Instructions and specifications
- Production facilities.

MES includes:

- Shop floor scheduling and control systems.
- Machine control systems.
- Robotics control systems.
- Process control systems.

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Process Control

The use of computers to control an ongoing physical process. Process control computers are used to control physical processes in such areas as:

- Petroleum refineries.
- Food product manufacturing plants.
- Cement plants.
- Pulp and paper mills.
- Steel mills.
- Electrical power plants.
- Chemical plants.

Machine Control

The use of a computer to control the actions of a machine. This is also popularly called numerical control. The control of machine tools in factories is a typical numerical control application, though it also refers to the control of typesetting machines, weaving machines, and other industrial machinery. Machine control computers are used in such areas as:

- Factories
- *Industrial shops*
- Machine tooling shops.

Collaborative Manufacturing Networks

Manufacturing processes like computer aided engineering and design, production control, production scheduling, and procurement management typically involve a collaborative process. Increasingly, this involves using the Internet, intranets, extranets, and other networks to link the workstations of engineers and other specialists with their colleagues at other sites. These collaborative manufacturing networks may link employees within a company, or include representatives from a company's suppliers or customers wherever they may be located.

Robotics

An important development in machine control and computer-aided manufacturing is the creation of smart machines and robots. These devices directly control their own activities with the aid of microcomputers. Robotics is the technology of building and using machines (robots) with computer intelligence and computer controlled human like physical capabilities (dexterity, movement, vision, etc.). Robotics has also become a major thrust of research, and development efforts in the field of artificial intelligence.

Computer-Aided Engineering

Manufacturing engineers use **computer-aided engineering** (CAE) to simulate, analyze, and evaluate the models of product designs that they have developed using **computer aided design** (CAD) methods. Networks of powerful engineering workstations with enhanced graphics and computational capabilities and CAD software help them analyze and design products and manufacturing processes and facilities. CAD packages refine an engineer's initial drawings and provide three-dimensional computer graphics that can be rotated to display all sides of-the object being designed. The engineer can *zoom* in for close-up views of a specific part and even make parts of the product appear to move as they would in normal operation. The design can then be converted into a finished mathematical model of the product. This is used as the basis for production specifications and machine tool programs.

Human Resource Information Systems (HRIS)

Human resource information systems support human resource management in organizations. They include information systems for staffing the organization, training and development, and compensation administration. HRM websites on the Internet or corporate intranets have become important tools for providing HR services to present and prospective employees.

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

- Planning to meet the personnel needs of the business.
- Development of employees to their full potential.
- Control of all personnel policies and programs.
- Traditionally, businesses used computer-based information systems to:
  - Produce paychecks and payroll reports.
  - Maintain personnel records.
  - Analyze the use of personnel in business operations.

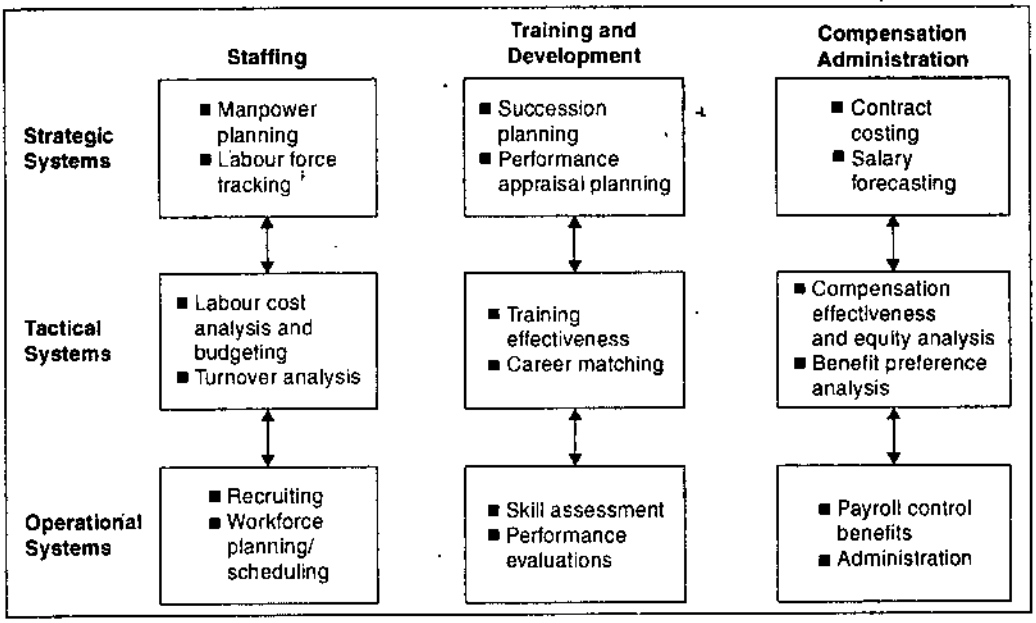

Figure 4.9. *Human Resource Information Systems*

Many firms have gone beyond these traditional personnel management functions and have developed human resource information systems (HRIS) that also support:

- Recruitment, selection and hiring.
- Job placement.
- Performance appraisals.
- Employee benefit analysis.
- Training and development.
- Health, safety, and security.

HRM and the Internet

The Internet has become a major force for change in human resource management. For example, companies are:

- Recruiting for employees through recruitment sections of their corporate web sites.
- Using commercial recruiting services and databases on the World Wide Web, posting messages in selected Internet newsgroups, and communicating with job applicants by Internet e-mail.

HRM and the Corporate Intranet

Intranet technologies allow companies to process most common HRM applications over their corporate intranets. *For example:*

- Intranets allow the HRM department to provide around-the-clock services to their customers the employees.

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- Intranets allow for the dissemination of valuable information faster than through previous company channels.
- Intranets can collect information online from employees for input to their HRM files.
- Intranets enable employees to perform HRM tasks with little intervention by the HRM department.
- Intranets can serve as a superior training tool.
- Intranets enable employees to produce automated paychecks, the online alternative to timecards.

Staffing the Organization

The staffing function must be supported by information systems that record and track human resources within a company to maximize their use. These systems are used in personnel record keeping systems, employee skills inventory systems, and personnel requirements forecasting systems. *For examples:*

- 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 terminations.
- Employee skills inventory system that uses the employee skill data from a personnel database to locate employees within a company who have the skills required for specific assignments and projects.
- Forecasting personnel requirements to assure a business an adequate supply of high-quality human resources.

Training and Development

Information systems help human resource managers:

- Plan and monitor employee recruitment, training, performance appraisals, and career development by analyzing the success history of present programs.
- Analyze the career development status of each employee to determine whether development methods such as training programs and periodic performance appraisals should be recommended.

Compensation Analysis

IS can help analyze the range and distribution of employee compensation (wages, salaries, incentives and other benefits) within the company and make comparision with compensation paid by similar firms.

Governmental Reporting

Organizations use computer based information systems to keep track of the statistics and produce reports required by a variety of government laws and regulations.

Accounting Information Systems

Accounting information systems are the oldest and most widely used information systems in business. Accounting information systems record, report, and analyze business transactions and events for the management of the business enterprise. Examples of common accounting information systems include order processing, inventory control, accounts receivable, accounts payable, payroll, and general ledger systems. Information systems in finance support financial manager in decisions regarding the financing of a business and the allocation of financial resources within a business. Financial information systems include cash management, online investment management, capital budgeting, and financial forecasting and planning.

The accounting function is responsible for maintaining and managing the firm's financial records receipts, disbursements, depreciation, payroll–to account for the flow of funds in a firm. Finance and accounting share related problems–how to keep track of a firm's financial assets and fund flows. They provide answers to questions such as these: What is the current inventory of financial assets? What records exist for disbursements, receipts, payroll, and other fund flows?

Operational accounting systems focus on transaction processing systems. They emphasize legal and historical record-keeping and the production of accurate financial statements. Typically, operational accounting systems include:

1. Order processing
2. Inventory control
3. Accounts receivable
4. Accounts payable
5. Accounts payroll
6. General ledger systems.

Management accounting systems focus on the planning and control of business operations. They emphasize:

- Cost accounting reports.
- Development of financial budgets and projected financial statements.
- Analytical reports comparing actual to forecasted performance.

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Online Accounting Systems

Accounting information systems are being affected by Internet and client/server technologies. Using the Internet, intranets, extranets, and other network changes how accounting information systems monitor and track business activity. The online, interactive nature of such networks calls for new forms of transaction documents, procedures, and controls. Many companies are using or developing network links to their trading partners through the use of the Internet or other networks for applications such as order processing, inventory control, accounts receivable, accounts payable, payroll and general ledger.

Order Processing

Order processing, or sales order processing, is an important transaction processing system that captures and processes customer orders and produces data needed for sales analysis and inventory control. In many firms, it also keeps track of the status of customer orders until goods are delivered. Computer-based sales order processing systems:

- Provide a fast, accurate, and efficient method of recording and screening customer orders and sales transactions.
- Provide inventory control systems with information on accepted orders so they can be filled as quickly as possible.

Inventory Control

Inventory control systems process data reflecting changes to items in inventory. A computer-based inventory control system:

- Record changes to inventory levels and prepares appropriate shipping documents.
- May notify managers about items that need reordering and provide them with a variety of inventory status reports.
- Helps a business provide high-quality service to customers while minimizing investment in inventory and inventory carrying costs.

Accounts Receivable

Accounts receivable systems keep records of amounts owed by customers from data generated by customer purchases and payments. Accounts receivable systems:

- Produce invoices to customers, monthly customer statements and credit management reports.
- Stimulate prompt customer payments by preparing accurate and timely invoices and monthly statements to credit customers.

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- Provide managers with reports to help them control the amount of credit extended and the collection of money owed.
- Help to maximize profitable credit sales while minimizing losses from bad debts.

Accounts Payable

Accounts payable systems keep track of data concerning purchases from and payments to suppliers. Accounts payable systems:

- Prepare checks in payment of outstanding invoices and produce cash management reports.
- Help ensure prompt and accurate payment of suppliers to maintain good relationships, ensure a good credit standing, and secure any discounts offered for prompt payment.
- Provide tight financial control over all cash disbursements of the business.
- Provide management with information needed for the analysis of payments, expenses, purchases, employee expense accounts, and cash requirements.

Payroll

Payroll systems receive and maintain data from employee time cards and other work records. Accounts payable systems:

- Produce paychecks and other documents such as earning statements, payroll reports, and labor analysis reports.
- Product reports for management and government agencies.
- Help businesses make prompt and accurate payments to their employees, as well as reports to management, employees, and government agencies concerning earnings, taxes, and other deductions.
- Provide management with reports analyzing labor costs and productivity.

General Ledger

General ledger systems consolidate data from accounts receivable, accounts payable, payroll, and other accounting information systems. General ledger systems:

- At the end of each accounting period, these systems produce the general ledger trial balance, the income statement and balance sheet of the firm, and various income and expense reports for management.
- Help businesses accomplish accounting tasks in an accurate and timely manner.

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- Typically provide better financial controls and management reports and involves fewer personnel and lower costs than manual accounting methods

Financial Management Systems

Information systems in finance support financial manager in decisions regarding the financing of a business and the allocation of financial resources within a business. Financial information systems include cash management, online investment management, capital budgeting, and financial forecasting and planning. Computer-based financial management systems support financial managers in decisions concerning:

- The financing of a business.
- The allocation and control of financial resources within a business.

Major financial information system categories include.

- Cash and investment management.
- Capital budgeting.
- *Financial forecasting.*
- Financial planning.

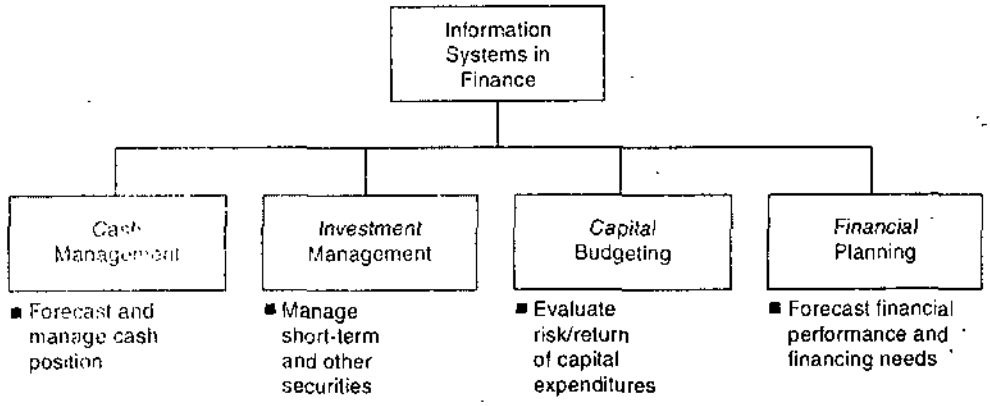

Figure 4.10. *Financial Management Systems*

Cash Management

Cash management systems collect information on all cash receipts and disbursements within a company on a real time or periodic basis. Cash management systems:

- Allow businesses to deposit or invest excess funds more quickly, and thus increase the income generated by deposited or invested funds.
- Produce daily, weekly, or monthly forecasts of cash receipts or disbursements (cash flow forecast) 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

Many businesses invest their excess cash in short-term low-risk marketable securities or in higher return/higher risk alternatives, so that investment income may be earned until the funds are required. Portfolio of securities can be managed with the help of portfolio management software packages. Online investment management services:

- Are available from hundreds of online sources on the Internet and other networks.
- Help a financial manager make buying, selling, or holding decisions for each type of security so that an optimum mix of securities is developed that minimizes risk and maximizes investment income for the business.

Capital Budgeting

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. This application 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 a business.

Financial Forecasting and Planning

A variety of financial forecasting packages provide analytical techniques that result in economic or financial forecasts of national and local economic conditions, wage levels, price levels, and interest rates. Financial Planning systems use financial planning models to evaluate the present and projected financial performance of a business or of one of its divisions or subsidiaries. Financial planning systems:

- Help determine the financial needs of a business and analyze alternative methods of financing the business.
- Use financial forecasts concerning the economic situation, business operations, types of financing available, interest rates, and stock and bond prices to develop an optimal financing plan for the business.
- Frequently use electronic spreadsheet packages and DSS generators to build and manipulate models.
- Are used to answer what-if and goal-seeking questions in order to evaluate financial and investment alternatives.

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Transaction Processing Systems

Transaction processing systems (TPS) are cross-functional 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. Transaction processing activities are needed to capture and process data, or the operations of a business would grind to a halt. Online transaction processing systems play a vital role in e-commerce.

Many firms are using the Internet, intranets, extranets, and other networks for online transaction processing to provide superior service to their customers and suppliers.

Online transaction processing systems play a strategic role in electronic commerce.

- Many firms are using the Internet, extranets, and other networks that tie them electronically to their customers or suppliers for online transaction processing (OLTP).
- These real-time systems, which capture and process transactions immediately, can help them provide superior service to customers and other trading partners.
- OLTP systems add value to a company's products and services, and thus give them an important way to differentiate themselves from their competitors.

The Transaction Processing Cycle

Transaction processing systems capture and process data describing business transactions. Then they update organizational files and databases, and produce a variety of information products for internal and external use. A transaction processing cycle consists of several basic activities, which involve:

1. Data entry activities.
2. Transaction processing activities.
3. Database maintenance activities.
4. Document and report generation.
5. Inquiry processing activities.

Data Entry

The input activity in TPS involves a data entry process. In this process, data is captured or collected by recording, coding, and editing activities. Move from traditional (manual) data entry systems toward source data automation (automated systems). The reason for this trend is that direct

methods are more efficient and reliable than manual systems. Examples of devices used in data automation include:

- Point-of-sale (POS) transaction terminals.
- ATM (Automated Teller Machine) terminals.
- Optical character recognition (OCR) scanners and wands.
- PCs and network computers with cash drawers as intelligent POS terminals.
- Portable digital radio terminals and pen-based tablet PCs for remote date entry.
- PCs equipped with touch screens and voice recognition systems for data entry.
- Bar coded tags.
- Magnetic stripe cards.
- Electronic website on the Internet.

Transaction Processing Activities

Transaction processing systems process data in two basic ways:

Batch Processing: Transaction data are accumulated over a period of time and processed periodically. Batch Processing is an economical method when large volume of data must be updated.

Real-time Processing: (Online Processing) Where data are processed immediately after a transaction occurs. All online transaction processing (OLTP) systems incorporate real-time processing capabilities. Many online systems also depend on the capabilities of fault tolerant systems that can continue to operate even if parts of the system fail. It provides immediate updating of database and immediate responses to user inquiries

Database Maintenance

An organization's data must be maintained by its transaction processing systems so that they are always correct and up-to-date. Therefore, transaction processing systems update the corporate database of any organization to reflect changes resulting from day-to-day business transactions.

Document and Report Generation

Transaction processing systems produce a variety of documents and reports. Examples of transaction documents include purchase orders, paychecks, sales receipts, invoices, and customer statements. Transaction reports might take the form of a transaction listing such as a payroll register, or edit reports that describe errors detected during processing. There are so many types of documents:

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1. **Action documents:** These are documents that initiate actions or transactions on the part of their recipient. *For example,* a paycheck authorizes a bank to pay an employee.
2. **Information documents:** These documents relate, confirm prove to their recipients that transactions have occurred.
3. **Turnaround documents:** Some types of transaction documents are designed to be read by magnetic or optical scanning equipments. Forms produced in this manner are called turnaround documents because they are designed to be returned to the sender.

Inquiry Processing

Many transaction processing systems allow you to use the Internet, intranets, extranets, and web browsers or database management query languages to make inquiries and receive responses concerning the results of transaction processing activity. Typically, responses are displayed in a variety of pre-specified formats or screens. Examples of queries include:

- Checking on the status of a sales order.
- Checking on the balance in an account.
- Checking on the amount of stock in inventory.

Enterprise Collaboration Systems

Enterprise collaboration systems provide tools to help us collaborate to commu-nicate ideas, share resources, and coordinate our cooperative work efforts as members of the many formal and informal processes and project teams and workgroups that make up many of today's organizations. The goal of enterprise collaboration systems is to enable us to work together more easily and effectively by helping us to:

- Communicate–sharing information with each other.
- Coordinate–coordinating our individual work efforts and use of resources with each other.
- Collaborate–working together cooperatively on joint projects and assignments.

4.4. INFORMATION SYSTEMS FOR MANAGERIAL DECISION SUPPORT

Information systems can support the intelligence, design, and choice activities of the decision making process. To do this, information systems should:

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- scan the internal organization and the external environment to produce information that helps identifying problems and opportunities;
- help generate and evaluate decision alternatives;
- provide information products that emphasis and prioritize alternatives and provide feedback on implemented decisions.

Decision support is still largely a concept, the reason being the lack of commercially available systems for the purpose, improve human effectiveness. Therefore, the objective of DSS is not to replace judgments but to support it in such a manner that the strengths of both man and machine process are utilized to the fullest.

A decision support system can be defined simply as a system that provides information for making semi-structured and unstructured decisions. However, this simple definition of DSS is not fully illustrative because when information systems were first developed for semi-structured and unstructured decisions, emphasis was placed on finding the structure and programming of the decision as much as possible. The results were often inefficient and inflexible systems that were ignored or sabotaged by decision makers because of their ineffectiveness. Thus, in order to make decision support systems effective, a different approach to information systems should be taken. This approach is not to structure and automate decision making process; it is to provide support for decision making. Particularly semi-structured and unstructured decisions. Based on this approach Keen and Scott Morton have defined DSS as follows:

Decision support systems (DSS) represent a different approach to information system support for semi-structured and unstructured decisions. They support a variety of unstructured decision processes.

Laudon and Laudon have defined DSS in terms of computer systems that combine data, analytical models, and user-friendly software. Accordingly:

A decision support system is a computer system at the management level of an organization that combines data, sophisticated analytical tools, and user-friendly software to support semi-structured and unstructured decision making.

Features of Decision Support Systems

There are several features of decision support systems that distinguish them from other information systems of an organization. These features are as follows:

1. The philosophy of decision support systems is to give users the tools necessary to analyze important blocks of data, using easily controlled sophisticated models in a flexible manner. DSS are designed to deliver capabilities, not simply to respond to information needs.

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2. DSS are tightly focused on a specific decision or set of decisions, such as routing, queuing, evaluating, and so on. Thus they are not used for general purpose.
3. DSS are aimed at higher-middle and top management with emphasis on change, flexibility, and quick response, and there is less emphasis on to link users to structured information flows and a correspondingly greater emphasis is placed on models graphics and assumptions.
4. The design of DSS applies a different set of skills than the design of structured, operational systems. DSS designers must not only be technically competent but also be able to observe, understand, and identify with the decision-makers' world.
5. The technology required for DSS is based on the need for flexible access. Reliable communication networks, availability of computer terminals, and even stand-alone microcomputers are more important than large-scale data processing systems.
6. DSS are developed through evolutionary process that requires extensive parti-cipation by the end users. More emphasis is placed on prototyping and end-user system development rather than using system development life cycle approach.

Decisions

It is a process of choosing one alternative among several available alternatives for decision making and for deciding the course of action.

Level of Decision Making

The three-tiered management pyramid Transactional planning at the lower end, Operational planning at the middle level and Policy planning of the top level all need to use computers for different purposes.

People at transactional planning level collect routine data generated within the organization and process it in a well-defined, structured and static fashion to be converted to routine reports. Here one is bothered only about 'what happens' on a particular time-frame.

The middle level management does operational planning by retrieving data collected by the lower level people. They operate on the, information obtained by processing the data already collected. People at this level normally think of 'why and how' things happened.

The top level management largely depends on external data, knowledge in the field, intuition and judgment. The Top management extracts very little organizational data and relies more on external and personal data. People at this level think of in terms of what if situations.

Type of Decisions

The decisions are characterized on the bases of organizational problems and on the basis of ability of individual to pre-plan the process of decision making.

Structured Decisions (Programmed Decision)

These are those for which a set of rules and procedures for the decision making process can be determined and utilized in subsequent decisions. Although structured decisions imply that the decision situations occur repetitively under the same sets of conditions, this is not necessarily true. These largely involve situations where no choice or very little choice or alternative is possible. Managers make these decisions chiefly in areas of strategic planning. *e.g.,* Payroll production, Accounts receivable, Budget analysis, Taking leave.

Unstructured Decisions (Non-programmed)

These are those for which preplanned rules and procedures cannot be completely specified. Even though decisions must be made regularly to deal with a recurring problem, the conditions are so different each time that no structured rules can be specified. They represent decisions based entirely on a manager's intuition and judgment. It is used in area of company strategic planning. Line managers face unstructured decisions chiefly in dealing with the people, workers and other managers. *e.g.,* one time decision to terminate an organization, changing schedules for production based on changing economy.

Semi-structured Decision

It may not be possible to specify all conditions surrounding a decision situation, but it may be possible to specify a general set of guidelines to assist a decision maker. Such decision situations may be considered semi-structured, depending on the level of detail to how much the process can be pre-specified. These involve both data and a manager's intuition and judgment. *e.g.,* in operations control, decisions on expediting; in management controls, decisions on master scheduling; In strategic planning, decisions on optimum plant size and location.

Phases in Decision Making Process

According to Herbert A. Simon's model, there are three phases in decision.

Intelligence Phase

In this phase decision maker searches the environment and finds out the conditions that demand decision making. For this, he obtains the information from various sources, analyses it and identifies the problem or opportunities: Intelligence activities result in dissatisfaction with the

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current state of affairs and call for modification in present way of working. *e.g.*, Manager may ask for regular production reports, Targets industry standards, National standards etc.

Decision Phase

During this phase course of actions are invented, developed and analyzed .For this manager tries to understand the course of the problem and finds a possible solution and tests the solution for feasibility.

Choice Phase

During this phase one alternative or course of action is selected from all the possible alternatives known and implemented.

Approach Towards Decision Making

Decision under certainty: In this approach when the decision maker chooses an alternative he has complete and accurate knowledge of the outcome of each alternative.

Decision under risk: In such type of decisions, decision maker is aware of possible outcomes associated with each alternative, but he is not very sure of its occu-rrence but each alternative has some probability attached to it which he is aware of.

Decision under uncertainty: In such type of decisions, decision maker has multiple alternatives and associated outcomes but has no knowledge of probabilities attached to each. For such type decisions decision maker tries to search subjective and use his judgment and take decision.

Decision Making Process

The first element is information, which is either supplied to the decision maker or he/she searches for the information himself. Second element is the decision maker, who uses multiple systems for decision making. These systems are:

Filtering system: When the decision maker collects the information, it is possible that all the information may not be of use to him. Filtering system restricts only relevant information to be passed which is of no use to the decision maker.

Predictor system: It is used for forecasting the future projection for varying the inputs, so that the effect of change can be studied.

Decision constraint: When the decision maker has to make a decision then he is guided by certain constraints. These constraints have to be applied to the outcomes and final decision has to be viewed.

Once the decision maker has several alternatives in front of him, he has to choose one out of them, which has to be followed. When the decision has been made then in order to carry it out effectively, a plan is made. This plan illustrates how the objectives will be achieved and to achieve the objective what resources will be required and in what time fame it will be completed. After the plan has been made ideas are put to work *i.e.,* performance phase starts.

Factors that Shape the Decision Process

Managers often say : Give me the facts and I will make the decision. This implies that once they get the information, they will be able to make well reasoned objective decisions. In reality the decisions by managers are influenced by wide variety of factors. These factors are:

Rational factors: These are the factors that a manager consciously applies at the time of decision making. The factors could be cost, time, management principles, and forecasts.

Psychological factors: These are the factors that individual applies to the decision process based on his experience, knowledge and capabilities. Involved factors are his personality, participation, his values aspiration and his perceived role.

Social influence: Decision in an organization must be made with due regards to acceptance by the members of the organization; otherwise implementation will suffer. The decision maker must therefore consider not only his goal and values but the values and goals of the individuals affected.

Cultural factors: These factors are learned behaviour patterns. These are:

- Culture of the organization;
- Culture of the geographical region in which the organization is located;
- Culture of the people of that country or region.

Key Aspects of DSS

The Decision Support Systems (DSS) are interactive computer based systems that provide the user with easy access to decision models and data in order to support semi- structured decision task. The key aspects of DSS are:

- This is sort of decision making occurs at all levels of management;
- It should be able to help groups making decisions rather than just individuals working on independent tasks;

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- It should assist in all stages of decision making including identifying problems analyzing alternatives and choosing a solution;
- It should be flexible, fitting the style of a particular manager and adaptable in accommodating changes in the environment. It is very important type of language to be able to work with the DSS;
- DSS are information systems whose focus is on decision making. In this sense they differ from EDP and MIS which focus on data and information respectively;
- It should be easy to use. A user should not be required to be a computer programmer to generate reports, answer to queries or graphics;
- They rely on man and the machine working together for solving decision problems;
- They are support tools under the control of managers. They do not attempt to automate decision making, predefine objectives, or impose solutions;
- Their functional capabilities are oriented more towards supporting decision making activities rather than solving decision problems;
- Their impact is on decisions where the manager's judgment is essential and there is sufficient structure for computers and analytical aids to be of value;
- They emphasize flexibility and adaptability to accommodate changes in decision making;
- They can be used for structured problems;
- They are usually ad hoc systems *i.e.*, designed for specific non-recurring decision problems;
- They are generally user friendly;
- They tend to be extensible and evolve overtime;
- DSSs are used as much as for decision making as for communicating decisions and for training purposes.

Key Differences between Expert Systems and DSSs

Objective: Expert system's objective is to enhance human decision making, replicate experts, replace human-decision makers while that of DSS's objective is to enhance decision making, provide intellectual support.

Control: In Expert system the system dominates. It determines the problem solving process. In DSS the human dominates. The human determines the overall problem solving process.

Machine: In Expert system the machine is more knowledgeable than user It carries problem solving capabilities. It plays a high cognitive role.

Whereas in DSS, it shared expertise and labor. It supplements human expertise capabilities.

Human: In Experts system human is less knowledgeable than the machine. He supports the problem solving of machine by answering questions. He plays a lower level cognitive role. The DSS shared expertise and roles. Human may not be the expert but quit capable of solving problems on his own.

Types of Decision Support System

The decision support system can be either data oriented or model oriented. Decision support system uses (1) analytical models, (2) specialized databases, (3) a decision maker's own insights and judgements, and (4) an interactive, computer-based modelling process to support the making of semi-structured and unstructured decisions by individual managers. Therefore, they are designed to ad hoc, quick-response systems that are initiated and controlled by managerial end users. Decision support system are thus able to directly support the specific types of decisions and the personal decision making styles and needs of individual managers.

Data Oriented System

They are specializing in retrieving or analyzing data. They are:

1. **Data retrieval:** File Drawer Systems and Data Analysis Systems.
2. **Data analysis:** Analysis Information Systems and Data Analysis Systems.

Model Oriented System

Models are an important component of decision support systems. A model can be defined as a simplified abstraction of reality that illustrates the fundamental components and relationships of a system or other phenomenon. Models can be physical models such as aeroplane, verbal model such as written description of a system graphics models such as the flowchart of an information system, and mathematical models, which can represent the relationships among the components of a system by means of mathematical equations and expressions. Mathematical models have been developed to analyze the performances of electronic circuits, highway systems, spacecraft, biological systems, etc. Mathematical models have also been widely used in business applications because they have proven to be a concise, simple, and flexible way to analyze and computerize business problems. Mathematical models are frequently used to express the decision rules utilized by business information systems. They provide powerful facilities for using models for simulation of business situations and suggestion of possible choices. They are:

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1. **Simulation:** Accounting Models and Representational Models.
2. **Suggestion:** Optimization Models and Suggestion Models.

File Drawer Systems

They give users immediate access to data in a database. *For example,* A manager who wants information on inventory levels of certain items.

Data Analyses Systems

They allow managers to work with the data in a single data file. This is used to analyse current or historical data.

Analysis Information System

They give managers access to many databases and small models. *For example,* sales analysis system.

Accounting Models

They help managers to see the effects of various activities on the company's income statements, balance sheets.

Representational Models

They help the managers predict the results of alternative decisions by analyzing the decision along with financial data.

Optimizing Models

They tell the managers the optimal solution to a problem. The solution is based on mathematical data about costs, sales volume, sales revenues and other financial factors that have been entered into mathematical equations. *e.g.,* a system that indicates how many of each a company's products to be manufactured to achieve the greatest profit for that company.

Suggestion Models

They suggest decisions for fairly routine problems faced by the company. *e.g.,* A suggestion model may calculate postal rates for packages of certain weights and dimensions.

The ideal DSS would offer all of these functions describe above. Most of the systems in current use tend to offer only a few of the functions, but newer, more powerful systems offering all of them have been introduced lately. It is becoming more and more common to see organizations building DSS that contain all the functions they need to solve their specific problems.

Building Decision Support System

When building a DSS, designers must consider many factors including what technology is available and what the DSS will be used. The components of the DSS consists of following:

Hardware Resources

Executive workstations, connected by telecommunications networks to other computers and devices in the organization, provide the preliminary hardware resources for a DSS. Personal computers can be used on a stand alone basis, or they can be connected by telecommunications networks to larger computer systems for access to other DSS software, model, and data resources.

Software Resources

DSS software packages are called DSS generators. They contain modules for database, model, and dialogue management. A Database Management module provides for the creation, interrogation, and maintenance of the DSS database using capabilities typically found in database management packages. A Model Base Management module provides the ability to create, maintain, and manipulate the mathematical models in the models base using capabilities provided by modelling packages, electronic spread-sheet packages, and user-written programs. A Dialogue Generation and Management module provides an attractive user interface that supports interactive input and output by managers. The types of software are:

The specific DSS: It is the system that actually accomplishes the work. It is similar to application software; a specific DSS is what the user needs to perform the task.

A DSS generator: A DSS generator is general DSS-type software that can be adapted to be used in different situations. It integrates the management and use of the model bases, database, and dialogue generation capabilities of a decision support system. They range from special-purpose packages and custom programs, to full-featured DSS generators to more modest electronic spreadsheet and integrated packages. The generator can manipulate models and data that relate to a particular problem. Without learning how to write computer programs, users of DSS generators may enter and manipulate these models and data to come up with their solutions. Some DSS generators used are IFPS/plus (Interactive Financial Planning System Plus) and FOCUS. A FOCUS is a database management system package having capabilities for financial modelling and statistical analysis. The major components of FOCUS are:

Report generator: Creates simple or complex reports using nonprocedural English like language and an interactive window-driven process.

Dialogue manager: Develops menu-given interactive dialogue procedures with appropriate prompts.

Full-screen editor: Help build and edit command and data files.

Screen manager: Develops formatted screens and windows.

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Graphics generator: Produces pie charts, bar charts, line graphs, etc.

Database management: Manages the creation and maintenance of the DSS database.

Communications packages: Allow micro computer to mainframe communications.

Data security package: Provides four levels of data security, plus encryption capability.

Financial modeling language: Creates electronic spreadsheets and allows What-if analysis, goal seeking, and other types of financial analysis.

Statistical analysis library: Provide a library of statistical functions, including time series descriptive statistics, regression analysis etc.

Several other DSS software packages are available from independent consulting firms and computer manufacturers. Many are available in mainframe versions. In addition, statistical software packages are used as DSS generators for decision support that requires extensive statistical analysis. However don't forget that electronic spreadsheet packages (such as Lotus 123, EXCEL) and integrated packages (such as Microsoft Works) are limited DSS generators. They provide some of the model building (spreadsheet models), model manipulation ("What if" analysis), database management, and dialogue management (menus, prompts etc.) functions offered by more powerful DSS generators.

DSS tools are used to build both specific DSS and DSS generators. The tools include programming languages data manipulation software special graphics software and so on.

DSS Components:

- User working with computer hardware and software.
- Software system that includes both data and models handling programs.
- A database that contains internal and external information from all areas in the company.
- A model base that contains strategic, tactical and operational models as well as tools to build additional models. The data model approach is the most popular approach for the developing practical DSS. It recognizes two kinds of critical resources data and models. Data fulfils the basic information needs of the decision maker and models provide various analytical schemes for analyzing the decision problem making conclusions from the data.

Problem in Building Decision Support System

The decision makers seldom know what information they need because they lack an adequate model of each decision situation they encounter. As

a result decision makers are unable to specify verbally their requirements, even to themselves, let alone to system designers and implementers.

There is inadequate communication of decision maker requirements to designers and implementers. Thus the designers are likely to utilize their own interpretation of the terms to specify requirements. Because of discrepancy between what is needed and what is provided by the systems, decision makers must expend time and effort to acquire information and decision support they need but cannot get from their system. The result is additional costs, in terms of lost time and on the part of decision makers to operate these private information systems.

Impact of Decision Support System

The impact of a DSS can be hard to measure, since they support managers and aim at helping to improve effectiveness. They facilitate but do not cause the improvement; managers do that. In general therefore DSS cannot be justified in terms of cost and benefits. The benefits are often qualitative and not easily measured.

It can change communication patterns the way the manager views his job and spends his time and even the type of individual to be hired for the position. The more effective the DSS the more likely it is to stimulate changes.

Why Do Managers Need DSS

1. The declining cost of computers hardware has made computer processing and computer storage relatively inexpensive.
2. The advent of data base management system provides means for storage and management of large amounts of detailed data. These data are now relatively easy to retrieve for use in a DSS.
3. There has been large increase in number of software packages that incorporate the functions of a DSS. These packages can be used directly to implement DSS applications.
4. Many college graduates trained in analytic techniques are now reaching the middle and upper levels of management. These individuals know how to use the tools that decision support systems provide.

Applications of DSS

- Portfolio Management.
- Merger and Acquisition Analysis.
- Ski-Area Design.
- Redesign of School Districts.

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- Design of Police Force Beats.
- Market Planning.
- Corporate Planning.
- Manpower Planning.
- Policy Analysis in State Government.
- R & D Management.
- Product Planning.
- Media Selection.
- Energy Management and Budgeting.

Examples of DSS

1. AIMS (An Analytical Information Management System)

American airlines developed this system to support planning, finance, marketing and operations functions. The system manages a large amount of historical data on the entire airline industry and provides managers with the ability to access, analyze, compute, and display historical future data interactively. It is used to facilitate studies and forecast of load factors markets share, aircraft utilization, productivity, measurement and revenue yield, among other things.

2. EIS (Executive Service Information System)

Boeing computer services has developed this system as one of the services on their time sharing network, depicted as a set of six interrelated subsystems; report writing, graphics; financial applications forecasting and statistics; modeling; What if and simulation and database management.

3. GADS (Geo-Data Analysis and Display System)

This interactive graphics system assists users in solving problems where the relevant data can be related to geographical areas. It has been used by local government in solving problems of police personnel deployment, land use planning and school redistricting. GADS consists of a variety of analysis and display functions that user can invoke in any order, thus following their own problem solving process.

4. GODDESS (Goal Directed Decision Structuring System)

It is based on a novel, goal directed structure for representing decision problems. The structure allows the user to state relations among aspects, effects, conditions and goals, in addition to actions and states which are the basic components of the traditional decision-tree approach. The program interacts with the user in English like dialogue. The structure is more

compatible with the way people encode knowledge about problems and actions.

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5. GPLAN (Generalized Planning System)

This system was developed at Purdue University, USA. It is tailored to support decision making in any of a variety of areas, such as inventory management and water quality planning. It is an easy to use Language system; a flexible knowledge system and a problem processing system that could automatically interface a model with some data to perform a desired analysis.

6. PAMPS (Plan Analysis and Modeling System)

Getty Oil developed this system for use in supporting capital investment decision making. It allows managers to interrogate and analyze historical data with English like language, displaying the result in tabular or graphics form. The system also provides access to a large repertory of financial routines and models for generating future plans which are analyzed and displayed to aid in data decision making.

4.5. INFORMATION SYSTEMS FOR STRATEGIC ADVANTAGES

Strategic Information Technology

Information technologies can support many competitive strategies. They can help a business cut costs, differentiate and innovate in its products and services, promote growth, develop alliances, lock in customers and suppliers, create switching costs, raise barriers to entry, and leverage its investment in IT resources. Thus, information technology can help a business gain a competitive advantage in its relationships with customers, suppliers, competitors, new entrants, and producers of substitute products. Information systems must be viewed as more than a set of technologies that support efficient business operations, workgroup and enterprise collaboration, or effective business decision-making. For this reason, you should view information systems strategically, that is, as vital competitive networks, as a means of organizational renewal, and as a necessary investment in technologies that help a company adopt strategies and business processes that enable it to reengineer or reinvent itself in order to survive and succeed in today's dynamic e-business environment.

Competitive Strategy Concepts

The strategic role of information systems involves using information technology to develop products, services, and capabilities that give company

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major advantages over the competitive forces it faces in the global marketplace. This creates strategic information systems, information systems that support or shape the competitive position and strategies of an e-business enterprise. So a strategic information system can be any kind of information system (TPS, MIS, DSS, etc.) that helps an organization:

- Gain a competitive advantage.
- Reduce a competitive disadvantage.
- Meet other strategic enterprise objectives.

According to Michael Porter, a firm can survive and succeed in the long run if it successfully develops strategies to confront five competitive forces that shape the structure of competition in its industry. These include:

- Rivalry of competitors within its industry.
- Threat of new entrants.
- Threat of substitutes.
- Bargaining power of customers.
- Bargaining power of suppliers.

A variety of competitive strategies can be developed to help a firm confront these competitive forces. A foundation of Information in Business presents an overview of the five basic areas of information systems knowledge needed by business professionals, including the conceptual system components and major types of information systems.

Cost Leadership Strategy

- Become a low-cost producer of products and services.
- Find ways to help suppliers or customers reduce their costs.
- Increase the costs of competitors.

Differentiation Strategy

- Developing new ways to differentiate a form's products and services from its competitors.
- Reduce the differentiation advantages of competitors.

Innovation Strategy

- Find new ways of doing business.
- Development of unique products and services.
- Enter into unique markets or marketing niches.
- Establish new business alliances.
- Find new ways of producing products/services.
- Find new ways of distributing products/services.

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Growth Strategies

- Significantly expand the company's capacity to produce goods and services.
- Expand into global markets.
- Diversify into new products and services.
- Integrate into related products and services.

Alliance Strategies

- Establish new business linkages and alliances with customers, suppliers, competitors, consultants and other companies (mergers, acquisitions, joint ventures, forming virtual companies, etc.).

Strategic Uses of Information Systems

How can the preceding competitive strategy concepts be applied to the strategic role of information systems? Information technology can be used to implement a variety of competitive strategies. These include the five basic competitive strategies (differen-tiation, cost, innovation, growth, and alliance), as well as other ways that companies can use information systems strategically to gain a competitive edge. For example:

- Lower costs.
- Differentiate.
- Innovate.
- Promote growth.
- Develop alliances.
- Improving quality and efficiency.
- Build an IT platform.

Other competitive strategies: Several key strategies that are implemented with information technology include:

Locking in customers or suppliers: Building valuable relationships with customers and suppliers, which deter them from abandoning a firm for its competitors or intimidating it into accepting less profitable relationships.

Building switching costs: The costs in time, money, effort, and inconvenience that it would take a customer or supplier to switch its business to a firm's competitors.

Raising barriers to entry: Technological, financial, or legal requirements that deter firms from entering an industry.

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Leveraging investment in information technology: Developing new products and services that would not be possible without a strong IT capability.

Breaking Business Barriers

Computers and telecommunications networks break time barriers and geographic barriers. Information Technology can break cost barriers and structural barriers.

IT can break traditional barriers to strategic business success. This includes time and geographic barriers broken by speed and reach of global telecommunication networks. IT can also break cost barriers by significantly increasing the efficiency of business operations, and structural barriers by electronically linking a business to its customers, suppliers and business partners.

The Value Chain and Strategic Information System

An important concept that can help a manager identify opportunities for strategic information systems is the value chain concept as developed by Michael Porter. This concept:

- Views a firm as a series or chain of basic activities that add value to its products and services and thus, add a margin of value to the firm;
- Some business activities are viewed as primary activities, and others are support activities. This framework can highlight where competitive strategies can best be applied in a business;
- Managers and business professionals should try to develop a variety of strategic uses of Internet and other technologies for those activities that add the most value to a company's product or services, and thus to the overall business value of the company.

Value chain examples: Collaborative workflow internet-based systems can increase the communications and collaboration needed to dramatically improve administrative coordination and support services. Examples of support processes:

- Career development intranet can help the human resources management function and provide employees with professional development training programs;
- Computer-aided engineering and design extranets enable a company and its business partners to jointly design products and processes;
- Extranets can dramatically improve procurement of resources by providing an online e-commerce web site for a firm's suppliers.

Examples of primary processes:

- Automated just-in-time warehousing systems to support inbound logistic processes involving storage of inventory, computer-aided flexible manufacturing (CAM) systems for manufacturing operations, and online point-of-sale and order processing systems to improve outbound logistics processes that process customer orders;
- Support of marketing and sales processes by developing an interactive targeted marketing capability on the Internet and its World Wide Web;
- Customer service can be dramatically improved by a coordinated and integrated customer relationship management system.

Strategic Uses of IT

Companies may use information systems strategically, or may use them in defensive or controlled ways. More and more businesses are beginning to use information systems strategically for competitive advantage.

Building a Customer-Focused e-Business

A key strategic use of Internet technologies is to build a company that develops its business value by making customer value its strategic focus. Customer-focused companies use Internet, intranet, and extranet e-commerce websites and services to keep track of their customers' preferences; supply products, services, and information anytime, anywhere; and provide services tailored to the individual needs of their customers. For many companies, the chief business value of becoming a customer-focused e-business lies in its ability to help them:

- Keep customers loyal;
- Anticipate customers. future needs;
- Respond to customer concerns;
- Provide top quality customer service.

The concept of customer-focused e-business focuses on customer value. This strategy recognizes that quality, rather than prices, has become the primary determinant in a customer's perception of value. From a customer's point of view, companies that consistently offer the best value are able to:

- Keep track of their customers' individual preferences;
- Keep up with market trends;
- Supply products, services and information anytime and anywhere;
- Provide customer services tailored to individual needs.

Increasingly, businesses are serving many of their customers and prospective customers via the Internet. This large and fast-growing group

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of customers wants and expects companies to communicate with them and service their needs at e-commerce websites. The Internet has become a strategic opportunity for companies large and small to offer fast, responsive, high-quality products and services tailored to individual customer preferences.

SUMMARY

- The Internet is the largest "network of networks" today, and the closest model we have to the information superhighway of tomorrow.
- Supply Chain Management is Network of facilities for procuring materials, transforming raw materials into finished products, and distributing finished products to customers.
- EFT systems use a variety of information technologies to capture and process money and credit transfers between banks and businesses and their customers.
- An intranet is a network inside an organization that uses internet technologies to provide an Internet-like environment within the enterprise for information sharing, communications, collaboration, and the support of business processes.
- 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.
- Targeted marketing has become an important tool in developing advertising and promotion strategies for a company's electronic commerce websites.
- Computer-based manufacturing information systems use several major techniques to support computer-integrated manufacturing (CIM).
- MES are performance monitoring information systems for factory floor operations.
- Payroll systems receive and maintain data from employee time cards and other work records.
- A decision support system is a computer system at the management level of an organization that combines data, sophisticated analytical tools, and user-friendly software to support semi-structured and unstructured decision making.

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REVIEW QUESTIONS

1. What is internet? Discuss business use of the Internet.
2. What do you mean by Electronic Commerce give application of Electronic Commerce.
3. What is Electronic Payment? Discuss its importance.
4. What do you mean by term "Network"?
5. Define Intranet explain business value of Intranets and discuss applications of Intranet.
6. What is extranet? Explain business value of extranet.
7. Explain importance of information technology in business.
8. Discuss the role of accounting information systems in an organization.
9. Explain financial management system role in organization.
10. Write down features of decision support systems.
11. What do you mean by decision? Describe the types of decision taken in an organization.
12. Enumerate the phases of decision making process.
13. What are the problem in building decision support system?
14. Explain competitive strategy concepts and strategic uses of information systems.

FURTHER READINGS

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CHAPTER 5 MANAGING INFORMATION TECHNOLOGY AND ADVANCED CONCEPTS IN INFORMATION SYSTEMS

★ STRUCTURE ★

LEARNING OBJECTIVES

After going through this chapter, you will be able to:

- describe enterprise and global management
- explain Information Resource Management (IRM)
- discuss characteristics of information at different managerial levels
- define the global company and global business
- explain security and ethical challenges
- discuss planning process and implementation activities
- describe what is enterprise resource planning?

- discuss the supply chain management, its principles and implementation.
- explain about customer relationship management
- describe the features of procurement management system.

PART I: MANAGING INFORMATION TECHNOLOGY

5.1. ENTERPRISE AND GLOBAL MANAGEMENT

Managers and Information Technology

The competitive pressures of today's business and technology environment are forcing companies to rethink their use and management of information technology. Many business executives now see information technology as an enabling technology for managing the cross-functional and interorganizational processes that business unit must have to successfully confront the competitive measures they face. For example, the Internet, intranets, extranets, and more cost effective hardware and software are enabling individuals, teams, workgroups, business units, and organizations to be "wired together" in close business relationships that can provide the communication, coordination, and collaboration needed in today's competitive global marketplace. Thus, information technology has become a major force for precipitating or enabling organizational and managerial change. Thanks to the Internet, intranets, extranets, and client/server networks, computing power and information resources are now more readily available to more managers than ever before. In fact, these and other information technologies are already promoting innovative changes in managerial decision making, organizational structures, and managerial work activities in companies around the world.

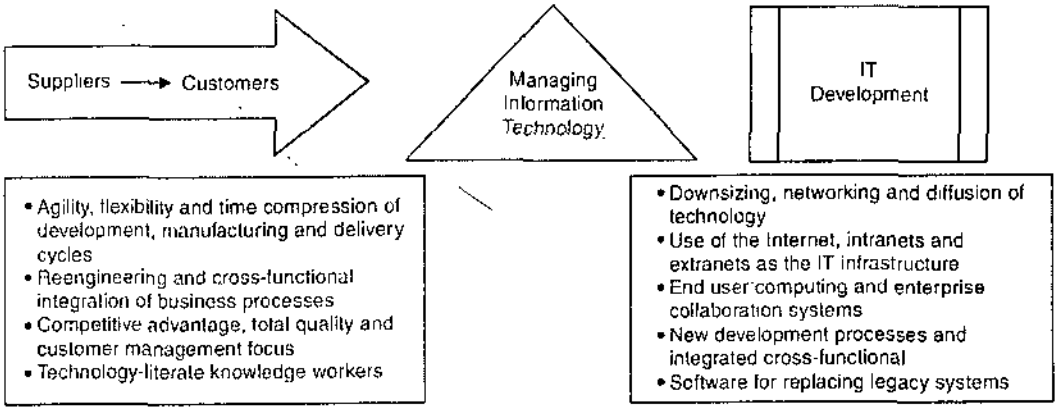

Figure 5.1. *IT must be managed to meet the challenges*

For example, the decision support capability provided by information systems technology is changing the focus of managerial decision making. Managers freed from number-crunching chores must now face tougher

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strategic policy questions in order to develop realistic alternatives for today's dynamic competitive environment. The use of the Internet, intranets, and enterprise collaboration systems to coordinate work activity is another example of the impact of information technology on management. Finally, information technology presents managers with a major managerial challenge. Managing the information system resources of a business is no longer the sole province of information systems specialists. Instead information resource management (IRM) has become a major responsibility of all managers. That is, data and information, computer hardware and software, telecommunications networks, and IS personnel should be viewed as valuable resources that must be managed by every business manager to ensure the effective use of information technology for the operational and strategic benefit of a business.

Performance of Poor Information Systems

Managing information technology is not an easy task. The information systems function has performance problems in many organizations. The promised benefits of information technology have not occurred in many documented cases. Studies by management consulting firms, computer user groups, and university researchers have shown that many businesses have not been successful in managing their computer resources and information services departments. It is evident that in many organizations information technology is not being used effectively, efficiently or economically.

Information technology is not being used effectively by companies that Use IT primarily to computerize traditional business processes instead of using it for decision support and innovative processes and products to gain competitive advantages. Information technology is not being used efficiently by information services groups that provide poor response times frequent downtimes, incompatible systems, unintegrated data, and applications development backlogs. Information technology is not being used economically in many cases. Information technology costs have risen faster than other costs in many businesses even though the cost of processing each unit of data is decreasing due to dramatic price reductions and improvements in hardware and software technology.

Organizations and Information Technology

The organizational impact of information technology is to view an organization as a sociotechnical system. In this context, people, tasks, technology, culture, and structure are the basic components of an organization. This concept emphasizes that to improve an organization's performance. Managers must:

1. Change one or more of these components, and
2. Take into account the relationships among these interdependent components.

This is especially important for the proper use of information technology. A major managerial challenge of information technology is to develop information systems that promote strategic improvements in how an organization supports its people, tasks, technology, culture, and structure.

People

Managers and knowledge workers are individuals with a variety of preferences for information and diverse capabilities for effectively using information provided to them. Information systems must produce information products tailored to meet managers' individual needs, as management information, decision support, and executive information systems can do.

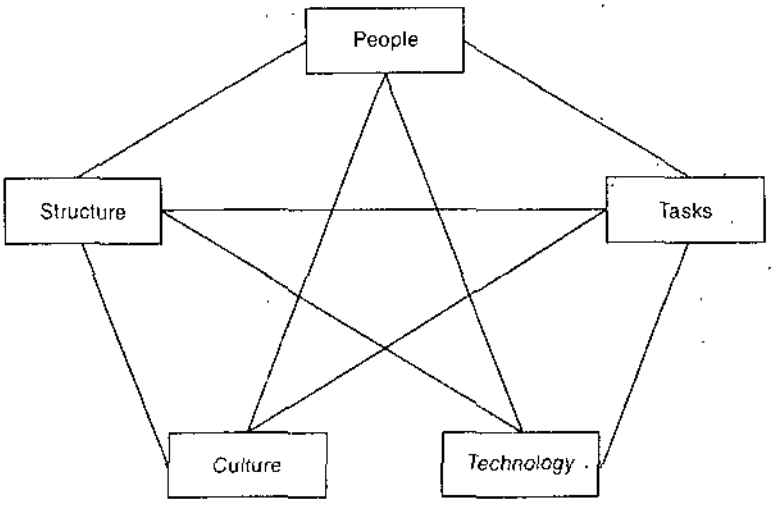

Figure 5.2. *Components of Information Systems are interrelated to each other*

Tasks

The tasks of many organizations have become quite complex and inefficient over time. In many cases, information technology has been used to do the same old thing, only faster. IT can play a major role in fighting organizational complexity by supporting the reengineering of business processes. For example, IT developments such as electronic data interchange dramatically reduce the need for several departments to be involved in preparing, authorizing checking, and sending paper business documents. This can eliminate many manual tasks and required procedures, and significantly improve communication and strategic cooperation between, organizations.

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Technology

The technology of computer-based information systems continues to grow more sophisticated and complex. However, this technology should not dictate the information needs of end users in the performance of their organizational tasks. It should accommodate the management culture and structure of each organization. For example, executive information systems overcame many of the objections of top executives to the lack of individual and task flexibility of previous types of management information systems. Internet and intranet-based business systems have also gained end user acceptance because of their easy-to-use browser-based graphical interfaces.

Culture

Organizations and their subunits have a culture that is shared by managers and other employees. That is, they have a unique set of organizational values and styles. For example, managers at some organizations share an informal, collegial, entrepreneurial spirit that stresses initiative, collaboration and risk taking. Managers at other organizations may stress a more formal "do it by the book", "go through the chain of command", or "don't risk the stockholders' money" approach. Naturally, the designs of information systems and information products must accommodate such differences. For example, managers in a corporate culture that encourages entrepre-neurial risk taking and collaboration with probably favor executive information systems that give them quick access to forecasts about competitors and customers, and E-mail and internet and intranet systems that makes it easy to communicate with colleagues anywhere.

Structure

Organizations structure their management, employees, and job tasks into a variety of organizational sub units. IS function must no longer assume a hierarchical, centralized, organizational structure that it supports by centralizing processing power, databases, and, systems development. This type of structure emphasizes gathering data into centralized databases and producing reports to meet the information needs of functional executives. Instead, IT must be able to support a more decentralized, collaborative type of organizational, structure, which needs more interconnected intranets or client server networks, distributed databases, downsized computers, and systems development resources distributed to business unit and workgroup levels. Thus, information technology must emphasize quick and easy communication and collaboration among individuals, business units, and other organization workgroups, using electronics instead of paper. For example, information technologies such as the Internet, intranets, and extranets enable the development of

interorganizational information systems and network organizational structures that are vital to the formation of the virtual companies.

Information Resource Management (IRM)

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IT has become the fourth major resource available to executives to shape and operate an organization. Companies have managed the other three major resources: people, money, and machines. Information resource management (IRM) is an IS management concept that organizes the management and mission of the information systems function into five major dimensions.

1. Strategic Management.
2. Operational Management.
3. Resource Management.
4. Technology Management.
5. Distributed Management.

Strategic Management

Information technology must be managed to contribute to a firm's strategic objectives and competitive advantages, not just for operational efficiency or decision support.

Operational Management

Information technology and information systems can be managed by functional and process-based organizational structures and managerial techniques commonly used throughout other business units.

Resource Management

Data and information, hardware and software, telecommunications networks, and IS personnel are vital organizational resources that must be managed like other business assets.

Technology Management

All technologies that process, store, and communicate data and information throughout the enterprise should be managed as integrated systems of organizational resources.

Distributed Management

Managing the use of information technology and information system resources in business units or workgroups is a key responsibility or their managers, no matter what their function or level in the organization.

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Managers and Information

Generally speaking, managers at different levels of an organizational hierarchy make different types of decisions, control different types of processes, and therefore have different information needs. While companies have many different organizational structures we will discuss the most common: a generic pyramid-shaped hierarchy with a few leaders at the top and an increasing number of workers at each subsequent managerial and operational level. There has long been a fairly close correlation between the level of work a person does in an organization and the type of IS he or she uses.

But today, with computers on every desk, that relationship is no longer as clear. The availability of increasingly flexible and powerful information systems throughout all organizational levels has had a profound effect on organizational structure. For instance, in the past, companies had specialized staff whose main task was to process data and generate information to meet managers' requests. Now, the ability to generate information has been placed directly in managers' hands, which has contributed to the downsizing of middle management. Technology aside, the politics of information within an organization can undermine optimal business decision making. Trying to retain power in their hands, and realizing that information is power, managers sometimes oppose the trend of making both data and processing tools available throughout a company. Problems often arise when the potential politics are not considered when developing systems and deciding how people will support those systems.

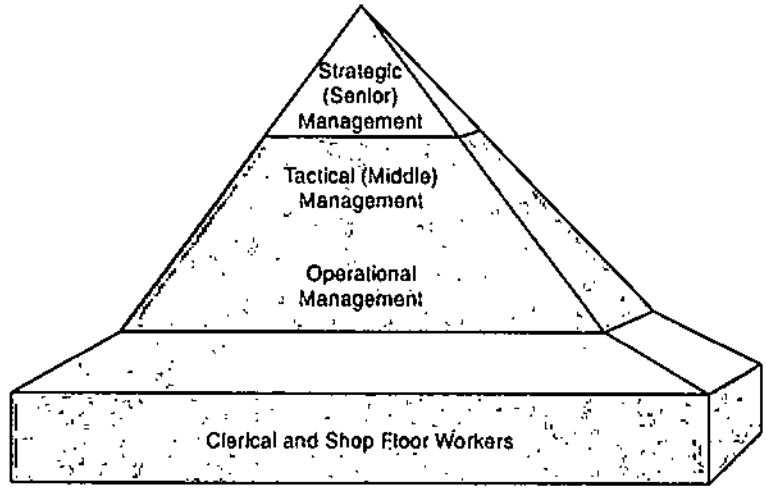

Figure 5.3. *The Management Pyramid*

The Traditional Organizational Pyramid

Every organization needs leadership. The top level leaders of an organization are a small group of people responsible for running the

organization and reporting to one person in the group, who usually pears the title Chief Executive Officer (CEO). Some small, knowledge-intensive companies use matrix organizational structure. A matrix structure distributes leadership among several people, varying by project, product, or discipline. However, the management of most organizations still follows a pyramid model.

In general, at the bottom of the organizational pyramid are clerical and shop floor workers. In the next layer up are operational managers who are responsible for overseeing the day-to-day operations of company. Next up is a much narrower layer of middle managers and at the top are a few senior managers. Due to the nature of their decisions managers in the top two layers are often referred to as tactical (middle) and strategic (senior) management. Strategic managers are expected to establish corporate strategies with a long term view, and tactical managers are expected to figure out how to achieve the strategies. Variation in this structure exists among organizations, not every organization lies exactly three layers and there are often sub layers in the management levels.

Clerical and Shop Floor Workers

In many organizations, clerical and shop floor, workers make up the largest group of employees. Included in this group are all types of service workers, such as tellers in banks, receptionists in hospitals, and sales associates and cashiers in retail stores, as well as traditional production employees in manufacturing organizations. The main characteristic common to workers at this level is that they are not managers. Although they may have high levels of expertise in a particular technology, equipment, or process, the scope of their decisions is typically narrower and focused on the work at hand. However, they are not required and are not expected to make management level judgment.

Operational Management

Operational managers are in charge of small groups of front-line workers. Examples include the foreperson on a shop floor, a department manager in a department store, and a manager in a bank or insurance company who is in charge of a small unit and authorized to obligate the company for small amounts of money. The people in these positions typically follow general policies handed down by their superiors. Within these policies, they make decisions that affect their units in the short term, that is, within days. For instance if a subordinate calls in sick, an operational manager in a manufacturing setting is empowered to decide whether to call another employee in from home, in which case the person will probably report late, or to ask another worker to stay for another shift, in which case the company must pay time and a half. In a service industry such as

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an airline, an operational manager might help ticket agents solve a problem that has cropped up with a passenger's luggage.

Tactical Management

Tactical managers, also called middle managers, receive general directions and goals from their superiors and, within those guidelines; they make decisions for their subordinates, affecting the near and somewhat more distant future. Usually, they are in charge of several operational managers. Tactical managers are so-called because they are responsible for finding the best means (tactics) to accomplish their superiors' strategic decisions. A strategic decision focuses on what to do, while a tactical decision concentrates on how to do it. For example, corporate management may make the strategic decision to provide more of a bank's services electronically over the telephone and online via personal computers. This broad goal leaves the tactical managers to determine how to provide those services. Should the bank develop the necessary computer software in-house? Should it hire a consulting firm? Which services should be offered first? How should the bank educate staff and customers about the new offerings? Tactical managers are expected to provide the best solutions to these problems and refer issues to the strategic level only if their decisions may affect the general strategy outlined.

Strategic Management

It is easier to determine which managers make up the strategic level than it is to discern who belongs to the other two levels. The reason is simple: these people are the highest-ranking officers of the organization. In many companies, the president and vice-presidents make up the strategic management. When members of the board of directors play an active role in the company's business, they, too, contribute their share to strategic decision making. However, do not be misled by titles. Some corporations, such as banks, grant vice-presidential titles to thousands of their managers. Title alone does not place those people in the strategic level of their organizations. Strategic managers make decisions that affect the entire organization, or large parts of it, and leave an impact in the long run. *For example,* such decisions may include merging with and acquiring other companies, opening branches overseas, developing a completely new product or service, moving operations to the Internet, or recommending a major restructuring of an organization.

Characteristics of Information at Different Managerial Levels

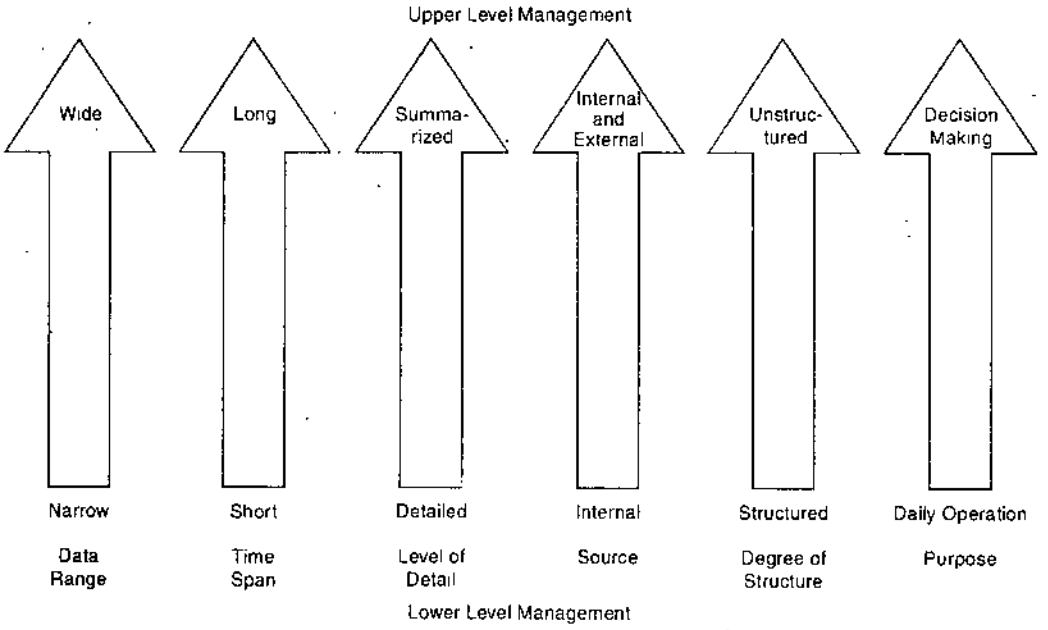

Figure 5.4. *Characteristics of data and information for different levels of management*

People in different management levels have different information needs. The information needed by different managerial and operational levels varies in the time span covered, level of detail, source, and other characteristics over a broad spectrum. Clerical workers need data that allow them to fulfill daily operations but not necessarily make decisions. To serve customers and other workers, they must have access to information such as how many units of a certain item are available for sale, how much a certain customer service costs, and how much overtime a certain employee worked last week. Usually, these people make ad hoc inquiries to satisfy immediate information needs.

On the other hand, most of the information that managers require is used to make decisions. Operational managers need information based on data that are generally narrow in scope, gathered over a short period of time, and useful for decisions that have an impact in the short run, that is, hours, days, and weeks. The decisions middle managers make affect a greater number of organizational units for longer periods of time, and they require information extracted from data that are broader in scope and time, and that information may come from outside their departments.

The decision-making process of middle managers and above is less structured than that of operational managers despite the broader scope of the data-and sometimes because of it there are no proven methods for selecting a course of action that guarantees a predicted outcome. The decisions that senior managers make affect whole divisions or the entire

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organization and have long-standing impact. Their decision making is much unstructured. Senior managers need information gleaned from vast amounts of raw data that have been collected over long periods of time from many or all of an organization's units. The original data for the information come from internal organizational sources as well as external sources, such as the mass media, the Web, national and international trade bulletins, and consulting firms.

Data Range

Data range refers to the amount of data from which information is extracted, in terms of the number of organizational units supplying data or the length of time the data covers.

Data range is different from level of detail. When a lot of data is summarized into a few figures, such as totals and averages, the level of detail is low; however, the data range may be high if the data are about numerous people, departments, or events. Data range refers to the number of individuals, departments, or events about which data were collected.

Time Span

The time span of data refers to how long a period of time the data cover. Data that cover hours or days (the time span usually needed by lower-level managers) are said to have a short time span relative to data that cover months, years, or decades, which are said to have a long time span.

Level of Detail

The level of detail is the degree to which the information generated is specific. When a department manager looks at the number of shoes sold every day of the week broken down by style, the information is, obviously, very detailed. Operational managers usually consider highly detailed information. Senior managers, in contrast, typically consider information that is highly summarized. This type of information includes totals and averages for categories of products (rather than individual products) over long periods of time. These different levels of detail serve the different operational purposes.

Source: Internal *versus* External

Internal data are collected within the organization, usually by transaction processing systems, but also through employee and customer surveys. External data are collected from a wide array of sources outside the organization, including mass communications media such, as television, radio, and newspapers; specialized newsletters published by private organizations; government agencies; and the vast sources of news and statistics on the Web. Multinational corporations rely on even more

external data; the data they use come from many different parts of the world, from many different sources, and often in many different formats.

In some industries, almost all the information comes from external sources. For example, managers of mutual funds and pension funds must track changes in the prices of stocks and other securities daily (sometimes even hourly) to be able to optimize the capital gains of the funds.

Structured and Unstructured Data

Structured data are numbers and facts that can be conveniently stored and retrieved in an orderly manner for operations and decision making. The sources of such data are primarily internal files and databases that capture transactions. Data warehouses also provide highly structured data, such as numbers of units in inventory, number of units sold, and the like. Unstructured data are drawn from meeting discussions, private conversations, textual documents, graphical representations, and other nonuniform sources.

Challenges to Global Information Systems

While the web offers great opportunities for establishing international Information Systems, global Information Systems are not without their problems, both for B2B and B2C e-commerce. The major challenges to Global Information Systems are:

Technological Challenges

Not all countries have adequate information technology infrastructures to allow resident companies to build international ISs. International ISs, especially those using the Web, often incorporate graphics to convey technical or business information, are those applications, as well as interactive software, require increasingly fast communication lines. Thus, companies may have to offer two versions of their sites, one for wide-bandwidth and another for narrow bandwidth lines.

Another technological challenge has to do with language. Each byte is represented by a standard group of eight electrical circuits. This setup is fine of languages with up to 256 (2^8) characters, such as English and other languages whose alphabetic root is Latin. But eight-bit bytes are not sufficient for languages with larger numbers of characters, such as Chinese, Japanese, and Korean. The solution for this obstacle is to program computers to use double-byte characters-allowing for up to 65,536 (216) characters. Other points that may sound trivial may also break havoc in international ISs. For example, fields such as telephone numbers should be set for variable length, because the number of digits in telephone numbers varies by country. Many sites still offer forms that limit telephone

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numbers to ten digits and do not accept shorter or longer numbers even when they are meant for audiences outside the U.S. and Canada.

Differences in Payment Mechanisms

One of the greatest expectations of e-commerce is easy payment methods for what we buy. Credit cards are very common in North America and are the way businesses prefer to be paid. However, this practice is not widespread in other regions of the world. The high rate of stolen credit cards, especially in Eastern Europe, attaches risk to such payments and deters potential online customers. Americans are more willing to give credit-card details via the Web than any other nation. Until citizens of other countries become as willing to do so, payment through the Web, and therefore B2C trade will not reach its full potential.

Language Differences

To communicate internationally, parties must agree on one acceptable language, and that can create problems. For instance, data may not be transmittable internationally in real time because the information must first be translated (usually by human beings). Although some computer applications can translate on the fly, they are far from perfect. Another hurdle is that national laws usually forbid businesses to run accounting and other systems in a foreign language, leading to an awkward and expensive solution: running these systems in two languages, the local one and English.

Cultural Differences

Cultural differences refer in general to the many ways in which people from different countries vary in their tastes, gestures, and preferred colours, treatment of people of certain gender or age, attitudes about work, opinions about different ethical issues, and the like. ISs may challenge cultural traditions by imposing the culture of one nation upon another. Conservative groups in some countries have complained about the Americanization of their young generations. Governments may be inclined to forbid the reception of some information for reasons of undesirable cultural influence. An example of such fear is the French directive against use of foreign words in government-supported mass media and official communications. These fears have intensified with growth of the Internet and use of the Web. Because the Web was invented in the United States and is still used by Americans more than by any other single nation, its predominant culture is American.

Conflicting Economic, Scientific and Security Interests

The goal of corporate management is to seize a large market share and maximize its organization's profits. The goal of a national government is

to protect the economic, scientific, and security interests of its people. Scientific information is an important national resource for a country and a great source of income for corporations, so occasionally those interests conflict. For instance, companies that design and manufacture weapons have technical drawings and specifications that are financially valuable to the company but also valuable to the security of their country. Hence, many governments, including the U.S. federal government, do not allow the exchange of weapon designs. Transfer of military information to another country, even if the receiving party is part of an American business, is prohibited. Another problem that arises with international information interchange is that countries treat trade secrets, patents, and copyrights differently. Sometimes business partners are reluctant to transfer documents when one partner is in a country that restricts intellectual property rights, while another is in a country that has more relaxed laws to protect intellectual property. On the other hand the employees of a division of a multinational corporation may be able to divulge information locally with impunity.

Political Challenges

As we have known that information is power and some countries fear that a policy of free access to all information may threaten their sovereignty. For instance, a nation's government may believe that access to certain data, such as the location and quantity of natural resources, may give other nations an opportunity to control an indigenous resource, thereby gaining a business advantage that would adversely affect the resource-rich country's political interests.

Governments are also increasingly recognizing software as an important economic resource, leading some countries to dictate that companies operating within their borders must purchase software from within their borders.

Lack of Standards

Differences in standards must be considered when integrating 1Ss internationally, even within the same company. Because nations use different standards and rules in their daily business operations, sometimes records within one company are compatible. For instance, the bookkeeping records of one division of a multinational company may be incompatible with the records of other divisions and headquarters. As another example, the U.S. still uses the English system of weights and measures (inches, feet, miles, quarts, pounds, and so on), while the rest of the world (including England) officially uses the metric system (centimeters, meters, liters, kilograms, and the like). There are also different standards for communicating dates, times, temperatures, and addresses. The U.S. uses

the format of mouth, day, year, while the rest of the world records dates in the format of day, month, year. A date recorded as 10/12/03 may be misinterpreted. The U.S. uses a 12 number time notation with the addition of a.m. or p.m., while the rest of the world uses a 24 number notation (called "military time" in the U.S. because the U.S. military does use this notation). America uses Fahrenheit temperatures, while other countries use Celsius temperatures.

Legal Barriers

Although many of the challenges involved in cross border data transfers have been resolved through international agreements, one remains unsolved—respect for individual privacy in the conduct of international business.

Countries differ in their approaches to the issue of privacy, as reflected in their laws. Data protection laws from various countries can be generally described by three different criteria:

1. Whether the law applies, to the collection and treatment of data by the private sector, the public sector (governments), or by both.
2. Whether the laws apply to manual data, to automated data, or to both.
3. Whether data protected under the law are only those concerning human or those concerning both human and legal entities (*i.e.*, organizations).

Global IT Management

All Global IT activities must be adjusted to take into account the cultural, political and geoeconomic challenges that exist in the international business community. Developing appropriate business and IT strategies for the global marketplace should be the first step in global IT management. Once that is done, end user and IS managers can move on to developing the portfolio of applications needed to support business/IT strategies, the hardware, software, and network technology platforms to support those applications; the data management methods to provide necessary databases; and finally the systems development projects that will produce the global information systems required.

Cultural, Political and Geoeconomic Challenges

'Business as usual' is not good enough in global business operations. The same holds true for global IT management. There are too many cultural, political, and geoeconomic (geographic and economic) realities that must be confronted in order for a business to succeed in global markets. Global IT management must focus on developing global business IT strategies and managing global application portfolios, technologies, platforms, databases and systems development projects. But managers must also

accomplish that from a perspective and through methods that take into account the cultural, political, and geoeconomic differences that exist when doing business internationally.

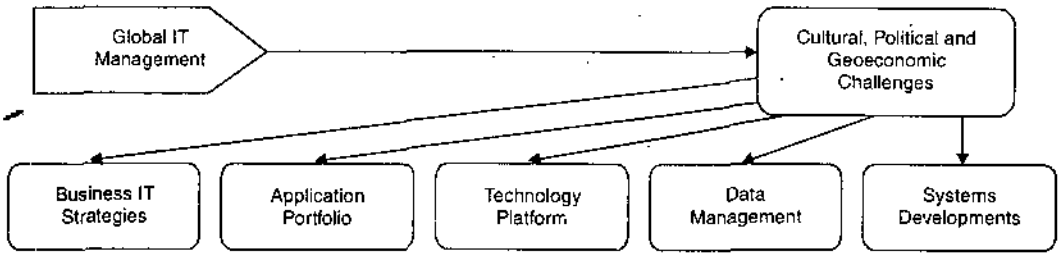

Figure 5.5. *Dimensions of Global IT Management*

A major **political challenge** is that many countries have rules regulating or prohibiting transfer of data across their national boundaries, especially personal information such as personnel records. **Geoeconomic challenges** in global business and IT refer to the effects of geography on the economic realities of international business activities. **Cultural challenges** facing global business and IT managers include differences in languages, cultural interests, religions, customs, social attitudes, and political philosophies. Obviously, global IT managers must be trained and sensitized to such cultural differences before they are sent abroad or brought into a corporation's home country. Other cultural challenges include differences in work styles and business relationships.

The Global Company

A global company is a business that is driven by global strategy, which enables it to plan and treat all of its activities in the context of a whole world system, and therefore serve its local and global customers with excellence.

Figure 5.6 illustrates this view of a global company. It emphasizes that a global company balances its strategies and activities to ensure serving customers in each locality with sensitivity and excellence, while still implementing a whole-world strategy that serves its global customers with excellence. Becoming a global company is a major undertaking, a process requiring fundamental business transformation. Becoming a global company is a multiyear process, driven by the vision of achieving a fundamentally different state than the current one and involving simultaneous changes in just about every aspect of the business.

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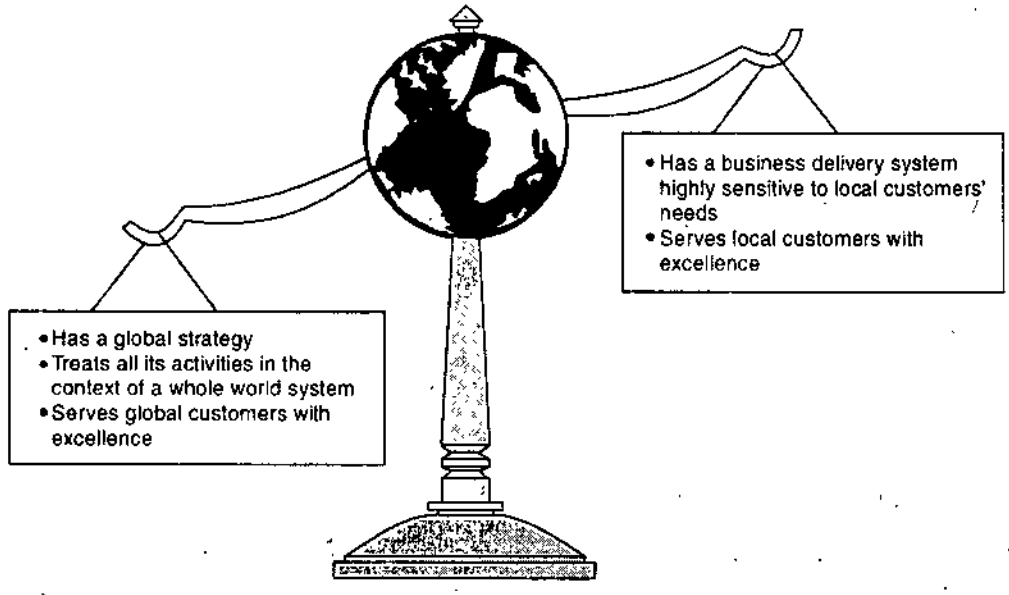

Figure 5.6. *A Global Company*

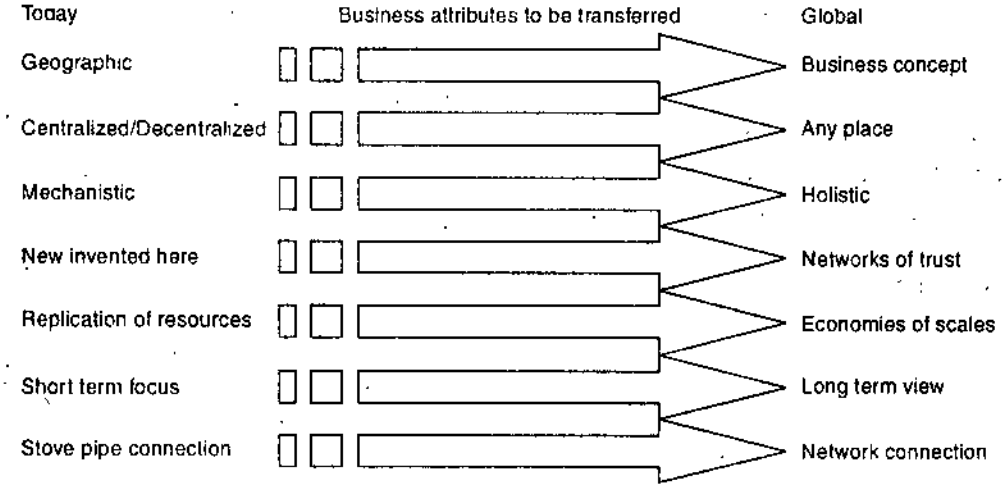

Figure 5.7. *Components to be taken to become a Global Company*

Global Business and IT Applications

The applications of information technology developed by global companies depend on their business and IT strategies and their expertise and experience in IT. However, their IT applications also depend on a variety of **global business drivers**, that is, business requirements caused by the nature of the industry and its competitive or environmental forces. One example would be companies like airlines or hotel chains that have global customers, *i.e.,* customers who travel widely or have global operations. Such companies will need global IT capabilities for online transaction processing so they can provide fast, convenient service to their customers or face losing them to their competitors. The economies of scale provided

by global business operations are another business driver that requires the support of global IT applications.

Companies whose products are available worldwide would be another example of how business needs can shape global IT. *For example,* Coca-Cola or Pepsi might use teleconferencing to make worldwide product announcements, and use computer based marketing systems to coordinate global marketing campaigns. Other companies with global operations have used IT to move parts of their operations to lower-cost sites. For example, Citibank moved its credit card processing operations to Sioux Falls, South Dakota; American Airlines moved much of its data entry work to Barbados; and other firms have looked to Ireland and India as sources of low cost software development. However, as global operations expand and global competition heats up, there is increasing pressure for companies to install global transaction processing applications for their customers and suppliers. Examples include global point-of-sale (POS) and customer service systems for customers and global electronic data interchange (EDI) systems for suppliers.

• **Global customers.** Customers are people who may travel anywhere or companies with global operations. Global IT can help provide fast, convenient service.
• **Global products.** Products are the same throughout the world or are assembled by subsidiaries throughout the world. Global IT can help manage worldwide marketing and quality control
• **Global operations.** Parts of a production or assembly process are assigned to subsidiaries based on changing economic or other conditions. Only global IT can support such geographic flexibility.
• **Global resources.** The use and cost of common equipment, facilities, and people are shared by subsidiaries of a global company. Global IT can keep track of such shared resources.
• **Global collaboration.** The knowledge and expertise of colleagues in a global company can be quickly accessed, shared, and organized to support individual or group efforts. Only global IT can support such enterprise collaboration.

Figure 5.8. *Business reasons behind Global IT Applications*

Global IT Platforms

The choice of technology is another major dimension of global IT management. That is, what hardware, software, telecommunications networks, and computing facilities will be needed to support our global business operations? Answering this-question is a major challenge of global IT management. The choice of a global IT platform is not only technically complex but also has major political and cultural implications. *For example,* hardware choices are difficult in some countries because of high prices, high tariffs; import restrictions, long lead times for government approvals,

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lack of local service or spare parts, and lack of documentation tailored to local conditions. Software choices can also present unique problems. Software packages developed in Europe may be incompatible with American or Asian version, even when purchased from the same hardware vendor. Establishing computing facilities internationally is another global challenge. Companies with global business operations usually establish or contract with systems integrators for additional data centres in their subsidiaries in other countries.

We and Global IT Management

Most companies fail to have in place a coherent information technology strategy. Their IT infrastructure does not match or facilitate their emerging global business strategy. Few multinationals have discovered the potential of computers and communications technology to transform their operations on a global basis. A company may have a single product sold globally, but no globally rationalized product database. Now that we have covered the basic dimensions of global IT management, it is time to acknowledge that much work remains to be done to implement global IT strategies. As a future business user of IT, the global business success of your company or business unit will be in your hands. But now at least you know the dimensions of the problems and opportunities that arise from the use of information technology to support global business operations. First, you must discover if your company has a global business strategy and a strategy for how information technology can support global business operations. If not, you can begin to play a role, however small, in developing such strategies. Then you must discover or help develop the IT applications to support your global business activities. This includes providing your ideas for the hardware, software, and telecommunications platform and databases you need to do business globally. This process can be a gradual one.

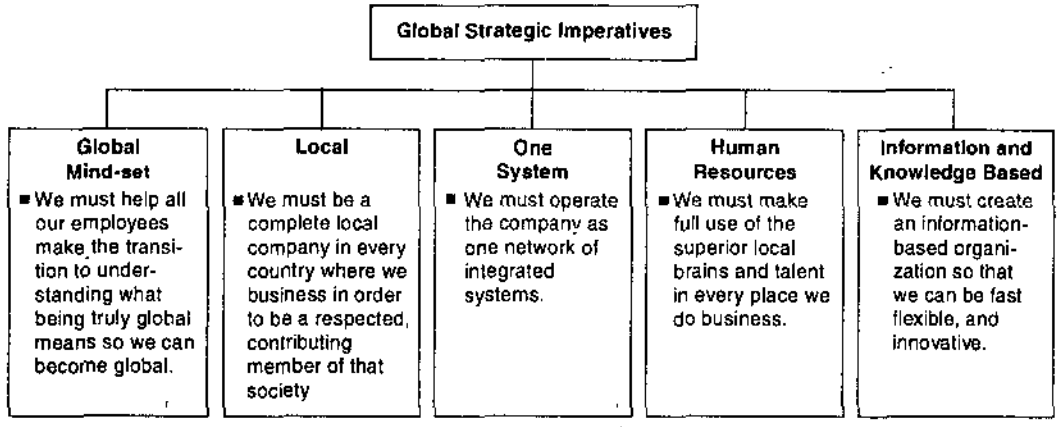

Figure 5.9. *Basic steps towards becoming a Global Company*

5.2. SECURITY AND ETHIC CHALLENGES

What Controls are Needed?

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 internetworked information systems that interconnect today's end users and organizations. Effective controls also provide quality assurance for information systems. That is, 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. However, much work needs to be done before adequate controls are implemented in many companies. Three major types of controls must be developed to ensure the quality and security of information systems. These control categories are:

- Information system controls.
- Procedural controls.
- Facility controls.

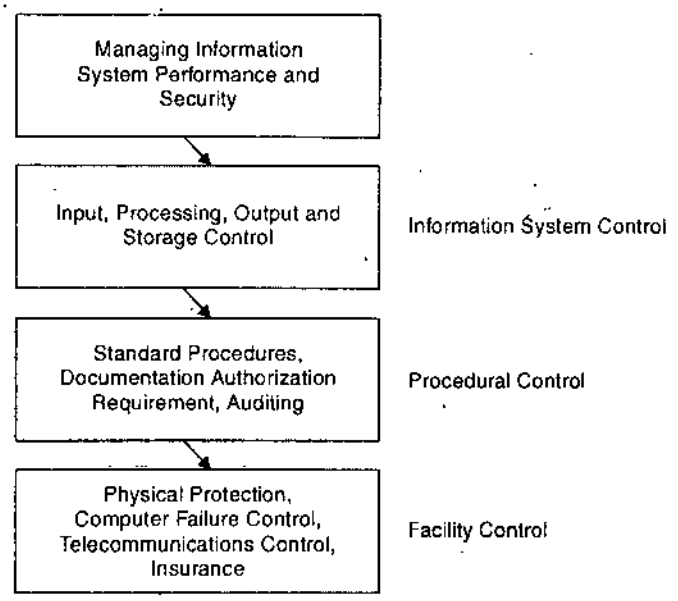

Figure 5.10. *Types of Control*

Information System Controls

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

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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.

Input Controls

When we enter data into computer for processing, it gives result accordingly. But if we enter wrong data, computer can not provide the right result, *i.e.,* Garbage in Garbage out (GIGO). Computer software can include instructions to identify incorrect, invalid, or improper input data as it enters the computer system.

Processing Control

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. Processing controls can include hardware controls and software controls.

Hardware controls: Hardware controls are special checks built into the hardware to verify the accuracy of computer processing.

Software controls: Some software controls ensure that the right data are being processed. The major software control is the establishment of checkpoints during the processing of a program. Check points are intermediate points within a program being processed where intermediate totals, listings, or dumps of data are written on magnetic tape or disk or listed on a printer.

Output Controls

How can we control the quality of the information products produced by an information system? Output controls are developed to ensure that information products are correct and complete and are available to authorized users in a timely manner. Several types of output controls are similar to input control methods. 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.

Storage Controls

How can we protect our data resources? First, control responsibilities for files of computer programs and organizational databases may be assigned to data centre specialists and database administrators. These employees are responsible for maintaining and controlling access to the program libraries and databases of the organization. Second, many databases and files are protected from unauthorized or accidental use by security programs that require proper identification before they can be used. Typically, operating systems or security monitors protect the databases of

realtime processing systems from unauthorized use or processing accidents. Many firms also use backup files, which, are duplicate files of data or programs. Such files may be stored off-premises, that is, in a location away from the computer centre, sometimes in special storage vaults in remote locations.

Facility Control

Facility controls are methods that protect an organization's computing and network facilities and their contents from loss or destruction. Computer networks and computer centres are subject to such hazards as accident, natural disasters, sabotage, vandalism, unauthorized use, industrial espionage, destruction, and theft of resources. Therefore, various safeguards and control procedures are necessary to protect the hardware, software, network, and vital data resources of a company.

Network Security

Security of a network may be provided by specialized system software packages known as system security monitors. System security monitors are programs that monitor the use of computer systems and networks and protect them from unauthorized use, fraud and destruction.

Encryption

When communicating sensitive information via a public network such as the Internet, the parties must authenticate each other and keep the message secret. Authentication is a process of ensuring that the person who sends a message to or receives a message from you is indeed that person. Authentication can be accomplished by sender and receivers exchanging codes known only to them. Once authentication is established, keeping a message secret too can be accomplished by transforming it into a form that cannot be read by anyone who intercepts it. Coding a message into a form unreadable to an interceptor is called encryption.

Firewalls

As we discussed earlier the great increase in the number of people and organizations using the internet and especially Web sites, has provided fertile ground for unauthorized and destructive activity. The best defense against unauthorized access to systems over the Internet is a firewall, which is software whose purpose is to block access to computing resources. (Early firewalls used combinations of hardware and software.) Firewall software screens the activities of a person who logs on to a Web site; it allows retrieval and viewing of certain material but blocks attempts to change the information or to access other resources that reside on the same computer or computers connected, to it.

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A firewall controls communication between a trusted network and the untrusted internet. The firewall is installed between the organization's internal network and a router. A router is a communication device that forwards communications data from one network to another, in this case from the organization's network to the Internet and *vice-versa.*

Physical Protection Controls

Providing maximum security and protection for an organization's computer and network resources requires many types of controls. *For example,* computer centres and end user work areas are protected through such techniques as identification badges, electronic door locks, burglar alarms, security police, closed circuit TV, and other detection systems.

Biometric Controls

Biometric controls are a fast-growing area of computer security. A biometric is a physical, measurable characteristic of human being that is used to identify a person. Characteristics such as finger prints, retinal pictures or voice prints can be used as biometric. These are security measures provided by computer devices that measure physical traits that make each individual unique. This includes voice verification, fingerprints, hand geometry, signature dynamics, keystroke analysis, retina scanning, face recognition etc. Biometric control devices use special-purpose sensors to measure and digitize a biometric profile of an individual's fingerprints, voice, or other physical trait. The digitized signal is processed and compared to a previously processed profile of the individual stored on magnetic disk.

Procedural Controls

Procedural controls are methods that specify how an organization's computer and network resources should be operated for maximum security. They help to ensure the accuracy and integrity of computer arid network operations and systems development activities.

Standard Procedures and Documentation

Typically, an IS, organization develops and follows standard procedures for the operation of information systems. Using standard procedures promotes quality and minimizes the chances of errors and fraud. It helps both end users and IS specialists known what is expected of them in operating procedures and system quality. 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.

Authorization Requirements

Requests for systems development and program changes are frequently subjected to a review process before authorization is given. For example program changes requested by end users or generated by maintenance programmers must typically be approved by a systems development manager after consultation with the affected business unit.

Audit Trail

In spite of the many steps taken to prevent system abuse, it nonetheless occurs. Consequently, further steps are needed to track transactions so that,

1. when abuses are found, they can be traced and
2. fear of detection will indirectly discourage abuse.

One popular tracking tool is the audit trail: a series of documented facts that help detect who recorded which transactions, at what time, and under whose approval. Whenever an employee records a transaction, such a system prompts the employee to provide certain information an invoice number, account number, salesperson ID number, and the like. Sometimes an audit trail is automatically created by using data, such as the date and time of a transaction or the name or password of the user updating the file. These data are recorded directly from the computer often unknown to the user and attached to the record of the transaction.

Audit trail information helps uncover undesirable acts, from innocent mistakes to premeditated fraud. The information helps determine who authorized and/or made the entries, the date and time of the transactions, and other identifying data that are essential in correcting mistakes or recovering losses. The audit trail is the most important tool of the information systems auditor (formerly known as the electronic data processing auditor).

Ethical Foundations

People may use ethical philosophies or hold ethical values that guide them in ethical decision making. For example four basic ethical philosophies are: egoism, natural law, utilitarianism, and respect for persons.

Egoism: What is best for a given individual is right.

Natural law: Humans should promote their own health and life, propagate, pursue knowledge of the world and God, pursue close relationships with other people, and submit to legitimate authority.

Utilitarianism: Those actions are right that produce the greatest good for the greatest number of people.

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Respect for persons: People should he treated as an end and not as a means to an end; and actions are right if everyone adopts the moral rule presupposed by the action.

Ethical values are more specific ethical concepts that people hold, and are heavily influenced by one's cultural, background.

Business Ethics

Business ethics can be subdivided into two separate areas. The first is concerned with the illegal, unethical, or questionable practices of managers or organizations, their causes and their possible remedies. The second is concerned with the numerous ethical questions that managers must confront as part of their daily business decision making.

Ethical and Societal Dimensions of IT

It emphasizes that the use of information technology in business has major impacts on society, and thus raises serious ethical considerations in areas such as privacy, crime, health, working conditions, individuality, employment, and the search for societal solutions through IT. However, you should realize that information technology can have a beneficial effect as well as a negative effect in each of these areas. For example, computerizing a production process may have the adverse effect of eliminating jobs, and the beneficial effect of improving the working conditions and job satisfaction of employees that remain, while producing products of higher quality at less cost. So your job as a managerial end user should involve managing your work activities and those of others to try to minimize the negative effects of IT and maximize its beneficial effects. That would represent an ethically responsible use of information technology.

Information Ethics

Another way to understand the ethical dimensions of IT is to consider the basic ethical, issues that arise from its use to gather, process, store, and distribute information.

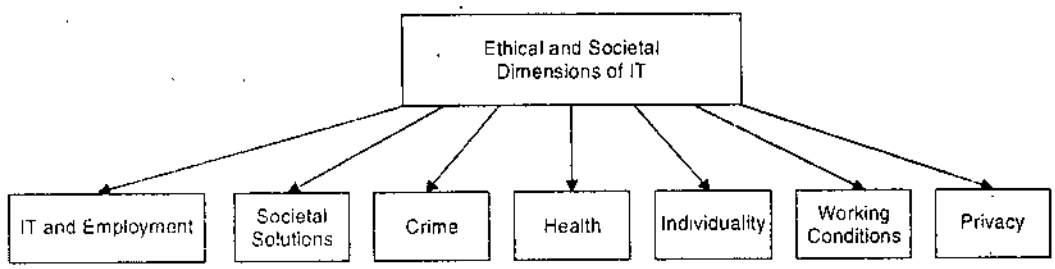

Figure 5.11. *Aspects of Ethical and Societal Dimensions of IT*

The widespread use of the Internet by businesses and consumers has brought many of these issues to the forefront. Here we summarize four

ethical issues with the acronym PAPA (privacy, accuracy, property, and accessibility).

Privacy: What information about one's self or one's associations must a person reveal to others, under what conditions, and with what safeguards? What things can people keep to themselves and not be forced to reveal to others?

Accuracy: Who is responsible for the authenticity, fidelity, and accuracy of information? Similarly, who is to be held accountable for errors in information and how is the injured party to be made whole?

Property: Who owns information? What are the just and fair prices for its exchange? Who owns the channels, especially the airways, through which information is transmitted? How should access to this scarce resource be allocated?

Accessibility: What information does a person or an organization have, a right or a privilege to obtain, under what conditions, and with what safeguards?

In answering these questions, the solution is that the developments of a new social contract, where information technology will help ensure everyone's right to fulfill his or her human potential. Some ideas could serve as the basis for many proposals being debated concerning privacy, censorship, and accessibility of the Internet. In this new social contract, information systems should be designed to ensure accuracy and not invade a person's privacy. Information systems should be designed to protect an individual's intellectual capital from unauthorized exposure, loss, or damage

IT and Employment

The impact of information technology on employment is a major ethical concern and is directly related to the use of computers to achieve automation. The use of information technology has created new jobs and increased productivity. Computers used for office information processing or for the numerical control of machine tools are accomplishing tasks formerly performed by many clerks and machinists. Information technology has created a host of new job opportunities for the manufacture, sale, and maintenance of computer hardware and software, and for other information system services. Many new jobs, including Internet webmasters, systems analysts, computer programmers, and user consultants, have been created in computer using organizations.

IT and Individuality

A frequent criticism of information technology concerns its negative effect on the individuality of people. It is more efficient for an information system to deal with an individual as a number than as a name, many people feel

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a loss of identity when they seem to be just another number. The negative impact of IT on individuality is reinforced by horror stories that describe how inflexible and uncaring computer based systems are when it comes to rectifying their own mistakes. However, computer-based systems can be **ergonomically** engineered to accommodate human factors that minimize depersonalization and regimentation.

IT and Working Conditions

Information technology has eliminated monotonous or obnoxious tasks in the office and the factory that formerly had to be performed by people. For example, word processing and desktop publishing make producing office documents a lot easier to do, while robots have taken over repetitive welding and spray painting jobs in the automotive industry. Information technology can be said to upgrade the quality of work because it can upgrade the quality of working conditions and the content of work activities. Many automated operations are also criticized for relegating people to a, do-nothing standby role, where workers spend most of their time waiting for infrequent opportunities to push some buttons.

One of the most explosive ethical issues concerning the quality of work is computer monitoring. That is, computers are being used to monitor the productivity and behaviour of millions of employees while they work. Computer monitoring has been criticized as unethical because it monitors individuals, not just work, and is done continually, thus violating workers privacy and personal freedom. Since computer monitoring increases the stress on employees who must work under constant electronic surveillance, it has also been blamed for causing health problems among monitored workers. Computer monitoring has been blamed for robbing workers of the dignity of their work. In effect, computer monitoring creates an electronic sweatshop, where workers are forced to work at a hectic pace under poor working conditions.

Privacy Issues

Information technology makes it technically and economically feasible to collect, store, integrate, interchange, and retrieve data and information quickly and easily. This characteristic has an important beneficial effect on the efficiency and effectiveness of computer-based information systems. The power of information technology to store and retrieve information can have a negative effect on the right to privacy of every individual. Confidential information on individuals, contained in centralized computer databases by credit bureaus, government agencies, and private business firms, has been stolen or misused, resulting in the invasion of privacy, fraud, and other injustices. The unauthorized use of such information has seriously damaged the privacy of individuals.

Computer Crime

Computer crime is the threat caused by the criminal or irresponsible actions of computer users who are taking advantage of the widespread use of computer networks in our society. It thus presents a major challenge to the ethical use of IT. Computer crime poses serious threats to the integrity, safety, and quality of most business information systems, and thus makes the development of effective security methods a top priority.

Computer Crime Laws

One way to understand computer crime is to see how current laws view such criminal offenses. A good example of this is the U.S. Computer Fraud and Abuse Act of 1986. In a nutshell, this law says that computer crime involves access of federal interest computers (used by the federal government) or operating in interstate or foreign commerce (1) with intent to defraud, (2) resulting in more than a $1,000 loss, or (3) to gain access to certain medical computer systems. Trafficking in computer access passwords is also prohibited. Penalties, for violations of this law are severe. They include 1 to 5 years in prison for a first offense, 10 years for a second offense, and 20 years for three or more offenses. Fines could range up to $250,000 or twice the value of the stolen data.

The Association of Information Technology Professionals (AITP) has worked with federal and state agencies to develop computer crime laws. In its Model Computer Crime Act, the AITP defines computer crime as including:

1. the unauthorized use, access, modification, and destruction of hardware, software, data, or network resources.
2. the unauthorized release of information.
3. the unauthorized copying of software.
4. denying an end user access to his or her own hardware, software, data, or network resources.
5. using or conspiring to use computer resources to illegally obtain information or tangible property.

Health Issues

The use of information technology in the workplace raises a variety of health issues. Heavy use of computers is reportedly causing health problems like job stress, damaged arm and neck muscles, eye strain, radiation exposure, and even death by computer caused accidents. For example, computer monitoring is blamed as a major cause of computer related job stress. Workers, unions, and government officials criticize computer monitoring as putting so much stress on employees that it leads to health problems.

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Solutions to some of these health problems are based on the science of **ergonomics**, sometimes called human factors engineering. The goal of ergonomics is to design healthy work environments that are safe, comfortable, and pleasant for people to work in, thus increasing employee morale and productivity. Other health issues may require ergonomic solutions emphasizing job design, rather than workplace design.

Societal Solutions

It would be good to emphasize that information technology can have many beneficial effects on society. We can use information technology to solve human and social problems through societal solutions such as medical diagnosis, computer assisted instruction, governmental program planning, environmental quality control, and law enforcement. Computers have been used to monitor the level of pollution in the air and in bodies of water, to detect the sources of pollution, and to issue early warnings when dangerous levels are reached. Computers are also used for the program planning of many government agencies in such areas as urban planning, population density and land use studies, highway planning, and urban transit studies. These and other applications illustrate that information technology can be used to help solve the problems of society.

Concept of Information Security

Information security relates to the protection of assets against loss, damage or disclosure of information. While securing valuable assets from threats, sabotage or natural disasters with physical safeguards, such as locks, perimeter fences, insurance etc., is common and is followed by most of the organizations, information security should also include logical and other technical safeguards, such as user identifiers, passwords firewalls etc. The basic objective of information security is the protection of the interests of those who rely on information from harm resulting from failure of availability confidentiality and integrity. Information security objective is met when:

1. information systems are available and usable whenever required (availability objective);
2. information is disclosed only to those who have right to know it (confidentiality objective);
3. information is protected against unauthorized modification (integrity objective).

Information security faces a number of threats both from internal sources as well as external sources as discussed later in this chapter. The amount of threats is increasing day by day from these sources. Since information is a valuable asset its security is important so that it achieves its objectives.

Principles of Information Security

For effective information security, it is essential that certain principles are followed. These principles are accountability, awareness, multidisciplinary, integration, timeliness, reassessment, cost effectiveness, land societal factors. These principles are known as core principles of information security. Each of these principles focuses on different aspects of information security.

Accountability principle: Accountability principle denotes that someone should be made accountable for relevant aspects of information security. Accountability creates an obligation on a person who is responsible for information security maintenance. While prescribing accountability, following issues should be considered:

1. Specification of ownership of data and information.
2. Identification of users who access the system in a unique way.
3. Assignment of responsibility for maintenance of data and information.
4. Recording of system activities through the provision of audit trails.
5. Institution of investigative and other remedial procedures when a breach or an attempted breach of information security occurs.

Awareness principle: Awareness principle indicates that awareness of risks and information security measures must be disseminated. Information security measures are effective only when the concerned persons are aware about what these measures are and how they operate. While applying awareness principle, the following issues must be taken into consideration:

1. The level of details disclosed should be consistent with information security requirements.
2. Appropriate knowledge should be available to all parties concerned who have legitimate right to gain such knowledge.
3. Information security awareness is not one shot action but is an on going process so that it becomes part of the organizational culture.
4. Security awareness being an on going process, is applicable to all employees, whether old or new recruits as information technology changes fast and risks for security breaches even faster.

Multidisciplinary principle: Multidisciplinary principle states that information security must be addressed taking into account both technological and non-technological issues because information security is not purely a technological issue. The issues that must be tackled in this context are as follows:

1. Business value of the information being protected.
2. Technology that is available to meet the information security objectives.

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3. Impact of technological and organizational changes on the administration of information security.
4. Requirements of legal and industry norms.
5. Requirements of managing advanced technology for information security.

Integration principle: Integration principle states that information security measures should be well integrated and coordinated. Various policies procedures and practices related to information security measures should be integrated and coordinated so that each of them contributes positively to others and a coherent information security system emerges. This requires that all levels of information cycle gathering, recording, processing, storing, transmitting, retrieving and deleting are covered. The issues that should be addressed are as follows:

1. Information security policy and administration to be included as an integral part of the overall management of the organization.
2. Information development and information security to be consistent with each other.
3. Review of interrelatedness between information system development and information security.
4. Risks relating to third parties on whom the organization's business processes depend.

Timeliness principle: Timeliness principle states that security procedures must provide for monitoring and timely response. An organization must establish procedures to monitor and respond to real or attempted breaches in security in a timely manner in proportion to risk Involved. The increasing threat potential to information security requires that the organization reacts swiftly. The issues that should be taken care of in this context are as follows:

1. Instantaneous and irrevocable nature of business transactions.
2. Volume of information generated from the increasingly interconnected and complex information systems.
3. Automated tools to support real-time and after-the-fact monitoring.
4. Expediency of reporting security breaches to appropriate decision making level.

Reassessment principle: Reassessment principle states that various measures and their operations related to information security should be reassessed periodically as information systems and, consequently, their security needs change rapidly. The issues that should be addressed are as follows:

1. Increase in upgradation of information systems according to business needs.

2. Changes in information systems and, their infrastructure.
3. New threats that emerge over the period of time requiring extra safeguard.
4. New information security technology that has emerged or is emerging.

Cost effectiveness principle: Cost effectiveness principle suggests that Information security measures must be cost-effective. In fact, many organizations do not opt for high-tech information security measures because these are quite costly. Therefore, cost of information security must be in relation to the value of information. The relevant issues in this context are as follows:

1. Value to and dependence of the organization on a particular information asset.
2. The amount of security and confidentiality required to various types of information.
3. The nature of threats that exist for information security.
4. Safeguards that are likely to eliminate or minimize the threats and costs of such safeguards.
5. Costs and benefits of incremental increases to security level.
6. Optimum level beyond which costs of security measures to be prohibitive.

Societal factors principle: Societal factors principle states that ethics must be promoted keeping in view the rights and interests of others, Information security does not mean that those who have right to access particular information are denied such an access. The issues that are important in this context are as follows:

1. Fair presentation of data and information to legitimate users.
2. Secured destruction of data that have been sensitive but no longer required.
3. Ethical use and disclosure of information obtained from others.

Computer Viruses

Virus in the context of medical science is referred to a pathogenic agent not visible by ordinary microscopic, that transmits infection from one person to another. In the context of computer science, a virus is a rogue software program that is difficult to detect and spreads rapidly through computer systems, destroying data or disrupting processing and memory systems. There are more than 2000 known viruses and many more viruses are added to these numbers every month. Viruses result into loss of productivity, interference lockup, corrupted files, lost data, unreliable

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applications, corrupted e-malls, etc. Viruses generally affect the following types of files:

1. An .EXE or .COM file.
2. The .OVL (overlay) program file.
3. The boot sector of a disk.
4. A device driver program.

A virus affects computer systems in a number of ways. One of the techniques that is most commonly used is the development of a program that replicates itself numerous times in the main memory of the computer system, destroying whatever data or programs are resident there. When a virus-infected program is executed, the virus searches the system for unaffected programs and copies itself into these programs. The virus, thus, infects the whole system. Virus can be spread either through computer networks or through infected diskettes procured from outside. However, spreading viruses through computer networks, particularly the Internet is more common as the Internet is the least secured for committing computer crimes.

Cyber Laws

One of the major problems in settling disputes including computer frauds and other information security violation activities is the absence of commensurate cyber laws. Cyber laws, by their implications, regulate the legal framework related to computer-based information systems. The absence of cyber laws is a world-wide phenomenon including India. However, in India an Act has been proposed in 2000 which is known as Information Technology Act, 2000. Prior to enactment of this Act, problems arising out of electronic dealings, particularly electronic commerce used to be dealt with under the provisions of the Indian Evidence Act 1872. The application of these provisions used to create two types of problems-requirement of physical written documents and signature for legal recognition. In order to overcome these problems, Government of India prepared Information Technology bill 1999 which was passed by both houses of parliament in May 2000 and received President's assent in August 2000. This document is known as Information Technology Act 2000.

Information Technology Act

Information Technology Act (IT Act) has provided legal recognition to electronic records and digital signatures which are expected to facilitate electronic commerce and creation of legal rights and obligations through the electronic communication like Internet. The objectives of the IT Act are as follows:

1. To grant legal recognition for transactions carried out by means of electronic data interchange and other means of electronic communication, commonly known as electronic commerce in place of paper-based methods of communication.
2. To give legal recognition to digital signature for authentication of any information or matter this requires authentication under any law.
3. To facilitate electronic filing of documents with Government departments.
4. To facilitate electronic storage of data.
5. To facilitate and give legal sanction to electronic fund transfers between banks and financial institutions.
6. To give legal recognition for keeping books of account by bankers in electronic form.
7. To amend the Indian Penal Code the Indian Evidence Act 1872 the Bankers' Book Evidence Act 1891, and the Reserve Bank of India Act 1934.

The Act contains 94 sections spread over thirteen chapters and four schedules. Each of these chapter deals with a specific issue of the Act and the four schedules deal with amendments required in Indian Penal Code, the Indian Evidence Act, the Bankers' Book Evidence Act and the Reserve Bank of India Act. The thirteen chapters deal with the following issues:

1. Chapter I: Objectives and definitions.
2. Chapter II: Authentication of electronic records using digital signatures.
3. Chapter III: Electronic governance.
4. Chapter IV: Attribution receipt and dispatch of electronic records.
5. Chapter V: Secure electronic records and secure digital signatures.
6. Chapter VI: Regulation of certifying authorities.
7. Chapter VII: Digital signature certification.
8. Chapter VIII: Duties of subscribers.
9. Chapter IX: Penalties and adjudication.
10. Chapter X: Cyber regulations appellate tribunal.
11. Chapter XI: Offences.
12. Chapter XII: Network service providers.
13. Chapter XIII: Miscellaneous.

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Major provisions of the IT Act are as follows:

Electronic Records

Provisions regarding electronic records have been provided in Chapter II which contains only section 3. According to section 2 electronic record means data record or data generated image or sound stored or sent in an electronic form or micro film. Section 3 provides the conditions subject to which an electronic record may be authenticated by means of affixing digital signature. Digital signature means authentication of any electronic record by a subscriber by means of an electronic method or procedure in accordance with the provisions of section 3.

Digital signature can be created in two distinct steps. First the electronic record is converted into a message digest using a mathematical function, known as hash function which digitally freezes the electronic record, thus, ensuring the integrity of the content of the intended communication contained in the electronic record. Any tempering with the contents of electronic record will immediately invalid the digital signature. Second, the identity of the person affixing the digital signature is authenticated through the use of private key which attaches itself to the message digest and which can be verified by anybody who has the public key corresponding to such private key. This enables anybody to verify whether the electronic record is retained intact or has been tampered with since it was so fixed with the digital signature. It also enables a person who has a public key to identify the originator of the message.

Electronic Governance

Electronic governance includes how electronic records are to be maintained and authenticated with digital signature. The major provisions relating to electronic governance are:

Legal Recognition of Electronic Records: Section 4 provides that where any law requires that any information or matter should be in the typewritten or printed form such requirement shall be deemed to be satisfied if it is in an electronic form. Similarly, section 5 provides that where any law requires that any information or matter should be authenticated by affixing the signature of any person, such requirement shall be satisfied if it is authenticated by means of digital signature affixed in such manner as may be prescribed by the Central Government.

Foundation of Electronic Governance: Foundation of electronic governance deals with filing and retaining electronic records. Section 6 provides that filing of any form application or any other documents, creation, retention for preservation of records or grant of any license or receipt of payment in Government offices and its agencies may be done

through the means of electronic form. Section 7 provides that the documents records or information to be retained for any specified period shall be deemed to have been retained if the same are retained in electronic form provided the following conditions are satisfied:

1. the information therein remains accessible so as to be usable subsequently.
2. the electronic record is retained in its original format or in a format which accurately represents the information contained.
3. the details, which will facilitate the identification of the origin, destination, dates, and time of dispatch or receipt of such electronic record, are available therein.

Section 8 provides that where any law requires the publication of any rule, regulation, order, bye-law, notification of any other matter in the Official Gazette, such requirement shall be deemed to be satisfied if the same is published in electronic form. This section further provides that where the Official Gazette is published both in the printed as well as in the electronic form, the date of publication shall be the date of the Official Gazette which was first published in any form.

Power to Central Government to Make Rules: Section 10 provides powers to Central Government to prescribe rules relating to digital signature. The rules that may be prescribed include:

- the type of digital signature;
- the manner and format in which the digital signature shall be affixed;
- the manner or procedure which facilitates identification of the person affixing the digital signature;
- control processes and procedures to ensure adequate integrity, security, and confidentiality of electronic records or payments;
- any other matter which is necessary to give legal effect to digital signatures.

Dispatch and Security of Electronic Records

Chapter IV deals with receipt and dispatch of electronic records while Chapter V deals with security of electronic records and digital signatures. Section 11 provides how an electronic record is to be attributed to the person who originated it. Section 12 provides the manner in which receipt of an electronic record is acknowledged. Section 13 provides the manner in which the time and place of dispatch and receipt of electronic record sent by the originator shall be identified. It has been provided that, in general, an electronic record is deemed to be dispatched at the place where the originator has his place of business and received where the addressee has his place of business.

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Chapter V sets out the conditions that would apply to qualify electronic records and digital signatures as being secure. Section 16 empowers the Central Government to prescribe the security procedure in respect of secured electronic records and digital signatures. In doing so, the Government shall take into account various factors like nature of the transaction, level of the sophistication of the technological capacity of parties, availability and cost of alternative procedures, volume of similar transactions entered into by other parties, etc.

Digital Signature Certification

Chapters VI, VII, VIII deal with various aspects of digital signature certification. Chapter VI contains provisions relating to the appointment and powers of the Controller and Certifying Authorities. Section 17 provides the provisions of appointment of controller and other officers to regulate the Certifying Authorities.

Duties of Certifying Authorities: Section 30 provides that every Certifying Authority shall follow certain procedures in respect of digital signatures as given below :

1. Make use of hardware, software, and procedures that are secure from intrusion and misuse.
2. Provide reasonable level of reliability in its services which are reasonably suited to the performance of intended functions.
3. Adhere to security procedures to ensure that the security and privacy of the digital signatures are assured.
4. Observe such other standards as may be specified by regulations.

Procedure for Digital Signature Certification: Chapter VII deals with procedural matters of digital signature certification. Section 35 provides that application for digital signature certificate shall be made in the prescribed form and shall be accompanied by a fee as prescribed by the Central Government. The section also provides that no digital signature certificate shall be granted unless the Certifying Authority is satisfied that:

1. the applicant holds the private key corresponding to the public key to be listed in the digital signature certificate;
2. the applicant holds a private key which is capable of creating a digital signature; and
3. the public key to be listed in the certificate can be used to verify a digital signature affixed by the key held by the applicant.

Duties of Subscribers: Chapter VII provides provisions about duties of subscribers in relation to digital signature certification. Accordingly, the duties of a subscriber are as follows:

1. On acceptance of the digital signature certificate, the subscriber shall generate a key pair using a secured system. By accepting the certification, the subscriber certifies to the public the following facts: (*a*) that he holds the private key corresponding to the public key listed in the digital signature certificate and (*b*) that all the information contained in the certificate as well as materials relevant are true.
2. The subscriber shall exercise all reasonable care to retain control of his private key corresponding to the public key.

Computer Offences

Chapter XI containing sections 65 to 78 deals with computer offences and provides penal provisions for these offences. Penal provisions exist for the following types of offences:

Tampering with Documents: Section 65 provides the penal provisions for tampering with computer source documents. The section provides for punishment with imprisonment up to three years or a fine of up to ₹ 2 lakhs or both to whomsoever knowingly or intentionally tampers with the computer code source documents. Computer source code means the listing of programs, computer commands design and layout, and program analysis of computer resource in any form. Computer resource includes computer, computer system, computer network, data, computer database or software.

Hacking with Computer System: Hacking is the act of destroying, deleting or altering any information in a computer resource or diminishing its value or affecting it injuriously, inspite of knowing that such action is likely to cause wrongful loss or damage to the public or the person. Section 66 provides that a person who commits hacking shall be punished with a fine upto ₹ 2 lakhs or imprisonment upto 3 years or both 3.

Publication of Obscene Information: Section 67 provides punishment to any person who transmits, publishes or causes to be transmitted or published any material which is obscene in electronic form with imprisonment for a term upto five years and a fine upto ₹ 1 lakh on first conviction. In the case of second or subsequent conviction imprisonment upto ten years and fine upto ₹ 2 lakhs can be imposed.

Misrepresentation: Section 71 provides that any person found misrepresenting or suppressing any material fact from the Controller or the Certifying Authority shall be punished with imprisonment for a term upto two years or a fine upto ₹ 1 lakh or both.

Breach of Confidentiality: Section 72 provides punishment for breach of confidentiality and privacy of electronic records, books, information etc., by a person who accesses to them without the consent of the person to whom these belong. The punishment may be in the form of imprisonment upto a term of two years or a fine upto ₹ 1 lakh or both.

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Publishing False Digital Signature Certificate: Section 73 provides punishment for publishing a digital signature certificate, false in material particulars or otherwise making it available to any other person with imprisonment upto two years or a fine upto ₹ 1 lakh or both.

Fraudulent Publication: Section 74 provides penalty for fraudulent publication which includes imprisonment upto two years or fine upto ₹ 1 lakh or both.

Offence Committed Outside India: Section 75 provides punishment for commission of any offence or contravention by a person outside India irrespective of his nationality if the act or conduct constituting the offence or contravention involves a computer, computer system, or computer network located in India.

Confiscation: Section 76 provides provisions of confiscation of any computer, computer system, floppies, compact disks, tape drives, or any other accessories in respect of contravention of any provision of the Act, rules, regulations, or orders made therein. Section 77 provides that penalty and confiscation provided under the Information Technology Act shall not interfere with other punishments provided under any other law for the time being in force. Section 78 provides power to investigate the offences under this Act by a police officer not below the rank of Deputy Superintendent of Police.

Compensation for Computer Frauds

Chapter IX, consisting of sections 43 to 47, provides provisions for compensation for the loss arising out from computer frauds and Chapter X provides provisions for making appeals against such compensation. Section 43 deals with penalty for damage to computer, computer system, etc., by any of the following methods:

1. Securing access to the computer, computer system, or computer network.
2. Downloading or extracting any data, computer database, or information from such computer system or those stored in any removable storage medium.
3. Introducing any computer contaminant or computer virus into any computer, computer system or network.
4. Damaging any computer, computer system or network or any computer data, database, or program.
5. Disrupting any computer, computer system, and network.
6. Denying access to any person authorized to access any computer, computer system, or network.

7. Providing assistance to any person to access any computer, computer system, or network in contravention of any provision of this Act or its rules.
8. Changing the services availed of by any person to the account of another person by tampering with or manipulating any computer, computer system, or network.

Section 46 confers power/to adjudicate contravention under this Act to an officer not below the rank of a Director to the Government of India or an equivalent officer of a State Government. The adjudicating officer shall hold an enquiry in the prescribed manner after giving reasonable opportunity of being heard and, thereafter, impose penalty where required. Section 47 provides that while deciding upon the quantum of compensation, the adjudicating officer shall have due regard to the amount of gain of unfair advantage and the amount of loss caused to any person as well as the respective nature of the default. Chapter X provides provisions for constituting Cyber Regulations Appellate Tribunal which has appellate power in respect of orders passed by any adjudicating officer. Civil courts have been barred from entertaining any suit or proceeding in respect of any matter which an adjudicating officer or Tribunal is empowered to handle. Section 62 provides for an appeal to the High Court by an aggrieved person from the decision of the Tribunal.

Positive and Negative Aspects of IT Act

Various provisions of the Information Technology Act, 2000 are quite relevant for dealing with the problems arising out of computer-based information systems. These provisions have provided legal framework for tackling the following issues related to electronic commerce:

1. Requirement of documents in writing.
2. Requirement of signature.
3. Requirement of legal recognition for electronic messages records and documents to be admitted in evidence in a court of law.

Besides facilitating e-commerce the provisions of the Act specifically provide for punishment for computer crimes and compensation for loss arising due to computer frauds. However the Act lacks comprehensiveness in dealing with the entire problems of security of CBIS and the businesses that can be conducted through the use of these. For example the Act has not addressed the following issues:

1. Protection of domain names.
2. Infringement of copyright laws.
3. Jurisdictional aspect of electronic contracts like jurisdiction of courts of law, income tax authority etc.

4. Taxation of goods and services traded through e-commerce.
5. Requirement of stamp duty on electronic contracts.

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5.3. PLANNING AND IMPLEMENTING CHANGES

Organizational Planning

Planning means deciding what to do before you do it. Most of us would agree planning is an important ingredient of success. If you spend time and effort thinking about the best way to reach a goal before you begin to reach for it, you are planning, and your chances of accomplishing your goal should be enhanced. That's why organizations and their management teams make plans.

Let's review briefly some of the terms used in the organizational planning. A shared vision is a commonsense of purpose and values shared by the members of a team or organization. A **mission** is an organization's reason for being. It is a statement of the basic purpose or purposes for which the organization exists. *For example, the mission of a utility company could be* to supply energy to consumers. **Goals** are broad statements of the ends the organization intends to accomplish in order to fulfill its-mission. **Objectives** are more specific, measurable elements of a goal. *For example, the utility company might have increased profitability and energy utilization* as goals measured by objectives such as specific increases in earnings per share and kilowatt hours used. **Strategies** are general approaches that show how goals should be achieved. And tactics are more specific guides to actions that would implement strategies. *For example,* a company's strategy of becoming the low cost producer in its industry would probably require a tactic such as increasing investments in automation. **Policies** are general guidelines that direct and constrain decision making within an organization. *For example,* many organizations have a policy of promoting from within that guides managers in filling job openings that occur. Policies are implemented by **rules** and **procedures**; which are more specific statements that direct decision making. *For example,* procedures to follow in hiring employees and rules protecting employee job rights would help implement a policy of promoting from within an organization.

Organizational Planning Process

Many companies now go through an organizational planning process of:

1. Team building, Modeling and consensus.
2. Evaluating what they have accomplished and the resources they have acquired.

3. Analyzing their business, economic, political, and societal environment.
4. Anticipating and evaluating the impact of future developments.
5. Building a shared vision and deciding on what goals they want to achieve.
6. Deciding what actions to take to achieve their goals.

The result of this planning process is called a plan, which formally articulates the actions we feel are necessary to achieve our goals. Thus, a plan is an action statement. Plans lead to actions, actions produce results, and part of planning is learning from results. In this context, the planning process should be followed by implementation, which should be followed by control measures, which provide feedback for planning.

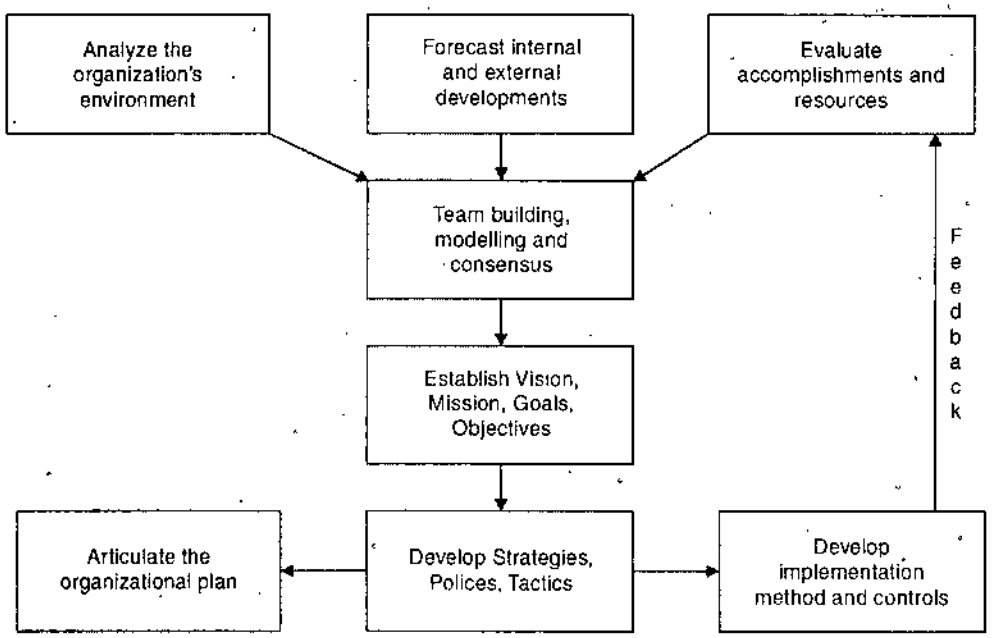

Figure 5.12. *Process of Planning*

Types of Planning

Planning is discussed, typically in terms of the level of planning (strategic, tactical, and operational) and the planning time frame. Strategic planning deals with the development of an organization's mission, goal, strategies, and policies. Corporations may begin 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. 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

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years (or more) into the future. However, many organizations have a continual planning process that reviews and modifies their long-range plans on a regular basis such as every six months to a year. Short range planning can range from daily, weekly, or monthly planning to a one-year or two year time frame. All operational planning and much 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 horizon. However, if unforeseen developments with major strategic implications occur, an organization would use strategic planning methods within a short time frame in order to confront a crisis.

Strategic Information Systems Planning

Information system planning is an important component of organizational planning. It emphasizes the activities and outputs of strategic business planning, and the role of business vision, business drivers, arid the IT architecture in the IS planning processes. Companies do strategic IS planning with four main objectives in mind:

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

A 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 IT architecture for the company be designed.

- Technology platform Computer systems, system and application software and telecommunications networks provide a computing and communications infrastructure, or platform that supports the use of information technology in the business.
- **Data resources:** Many types of operational and specialized databases, including data warehouses, analytical databases, and external data banks store and provide data and information for business processes and managerial decision support.

- **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 applications portfolio should include support for interorganizational business linkages, managerial decision making, end user computing and collaboration, and strategic initiatives for competitive advantage.
- **IT organizational:** The organizational structure of the IS function within a company and the distribution of IS specialists among corporate headquarters and business units can be designed or redesigned to meet the changing strategies of a business.

Tactical and Operational Planning

Tactical information systems planning is built on the business/IT strategies developed in the strategic IS planning stages. Tactical planning is the last stage of the planning process. Tactical IS planning produces project proposal for the development of new or improved information systems that implement the IT architecture created during strategic IS planning. Finally, a resource allocation plan is developed to specify the IS resource financial, commitments, and organizational changes needed to implement the strategic IT development plan of the company.

Operational planning involves detailed planning for the accomplishment of new information systems developments projects including the preparation of operating budgets Project Planning is an important operational planning function. It involves the development of plans, procedures and schedules for an information systems development projects. Such planning is an important part of a project management.

Planning for Competitive Advantage

It is important for complex IT environment. So strategic IS planning involves an evaluation of the potential benefits and risks a company faces when using IT for competitive advantage.

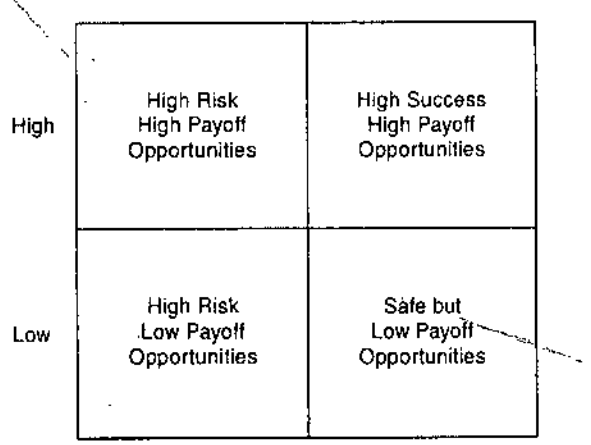

Figure 5.13. *A strategic opportunities matrix*

Also popular in strategic IS planning is the use of a strategic opportunities matrix, as illustrated in figure 24.2. SWOT analysis (strengths, weaknesses, opportunities, and threats) is used to evaluate the impact that each possible strategic opportunity can have on the business and its use of information technology. Management planning teams must ask and answer many key questions to uncover and evaluate potential business IT opportunities for competitive advantage.

Examples include:

- How might a business or technological development or trend represent a competitive opportunity? Does it change the core business drivers of our company? Our industry?
- What are the main risks associated with this opportunity: market risk or technical, implementation, financial, regulatory, or organizational risk?
- Are there any indicators that this combination of business and technology will become a competitive necessity within a few years?
- Is the necessary IT platform in place? Do any competitors have an equivalent platform? Will the innovation require major changes to our IT platform? What is the required lead time to make such changes?
- Can this opportunity be pursued alone, or should we look for business partners? Should there be industry partners or partners from other industries (*e.g.,* suppliers, customers)?

Business Systems Planning

Business systems planning (BSP) is a structured approach that assists an organization in developing information systems plans to satisfy its short and long term information requirements. One of the basic premises of BSP methodology is that an organization's information systems should be planned from the top down and implemented piece by piece from the bottom up.

Top Down Planning

It requires that a planning team of top executives layout the strategic mission and objectives of the organization. Then planning teams of managers throughout the organization propose how these objectives should be implemented in the basic functions (marketing, manufacturing, etc.) and processes (order entry, shipping, receiving, etc.) of the business. Next, teams of managers and IS specialists suggest the IT capabilities that might be needed to support these basic processes. Finally, an IT architecture is developed that designs the technology platform (computer systems, software and networks) and the organizational databases that can provide the capabilities needed by the business.

Bottom Up Planning

It involves application development activities that are performed by teams of end users and information systems professionals. Their goal is to develop specific business application (such as electronic data interchange) that rely on a technology platform whose design was determined by the hardware, software, databases, and networks of the IT architecture. Each application should therefore serve a business function that supports the mission and objectives of the organization.

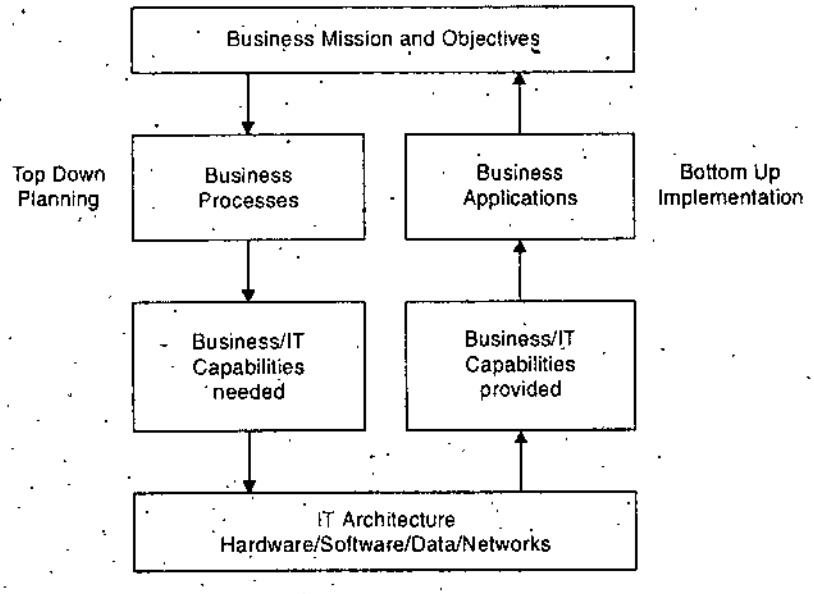

Figure 5.14. *Business system planning approach*

Computer Aided Planning Tools

A variety of computer aided planning tools are available for strategic planning. For example, business simulation software is frequently used in the scenario approach for teams to experiment with plans to successfully confront a variety of business situations. Personal computers are making it possible to integrate learning about complex team interactions with learning about complex business interactions. These new micro worlds allow groups to reflect on, expose, test, and improve the mental models upon which they rely in facing difficult problems. Other computer aided planning software provides generic planning features that can support other planning methodologies such as the BSP and CSF methodologies. They are used to define a planning environment (strategic, tactical, etc.) and planning structures such as critical success factors, organizational units, business processes, data structures, and so-on.

The software helps planners identify and experiment with ways to improve the planning process relationships between planning structures. This planning process results in an enterprise model of the business. An

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enterprise model defines the structures and relationships of business processes (process models) and data elements (data models); as well as other planning structures. The enterprise model helps managers and planners to understand the relationships between planning structures. Also, a manager can create what-if scenarioes to analyze the effects of changes to selected structures and relationships. This type of analysis helps planners formulate plans for use of information technology that support an organization's critical success factors.

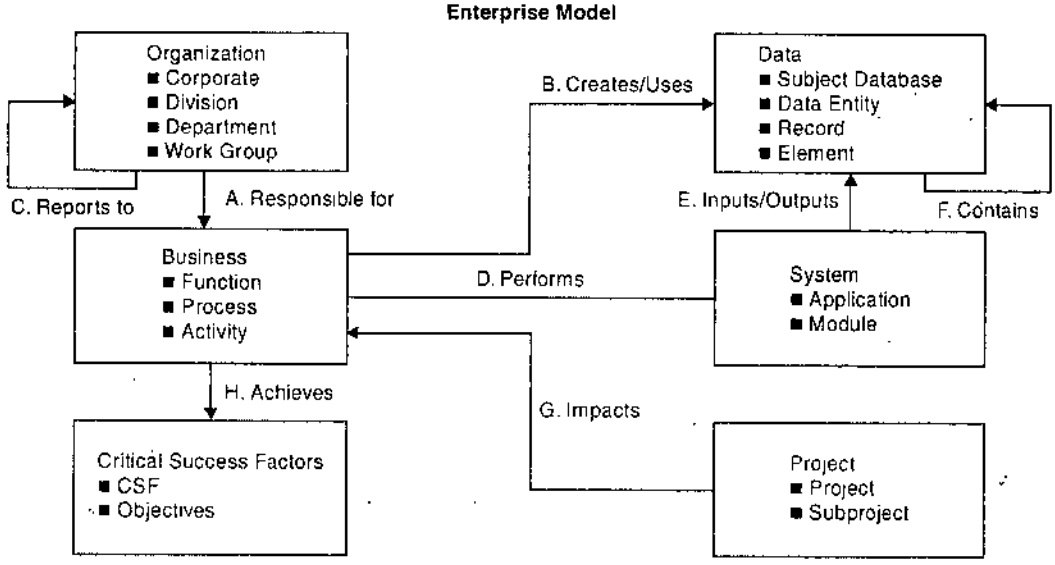

Figure 5.15. *Computer aided planning tool*

Implementing Business Change with IT

Implementation is an important managerial responsibility. Implementation means doing what you planned to do. You can view implementation as a process that carries out the plans for changes in the business use of information technology developed in the planning process. The implementation process can also be viewed as a major stage that follows the investigation, analysis, and design stages of the systems development process. Therefore, implementation is an important activity in the deployment of information technology to support the business changes planned by an organization and its end users.

Managing Organizational Change

IT increasingly changes jobs, skill needs, work, and relationships. Technical change has become synonymous with organizational change. Such change can be complex, painful, and disruptive. Typically, implementing changes in information technology is only part of a larger process of managing major changes in business processes, organizational structures, managerial roles, and employee work assignments. Organizations must implement a

variety of management initiatives to help manage business change. *For example,* change management requires the involvement and commitment of top management and a formal process of organizational design. This supports changes in business and technology generated by the reengineering of business processes and other work redesign activities. Any new way of doing things generates some resistance by the people affected.

Thus, the implementation of new computer-based work support; technologies can generate fear and resistance to change by employees. End user resistance to sharing knowledge is the biggest obstacle to the implementation of knowledge management programs. Human resource management is thus a major focus of organizational change management activities. This includes activities such as developing innovative ways to measure, motivate, and reward performance. So is designing programs to recruit and train employees in the core competencies required in a changing workplace. Finally, change management involves analyzing and defining all changes facing the organization, and developing programs to reduce the risks and costs and to maximize the benefits of change.

To summarize, change experts recommend:

- Involve as many people as possible in reengineering and other change programs.
- Make constant change part of the culture.
- Tell everyone as much as possible about everything as often as possible, preferably in person.
- Make liberal use of financial incentives and recognition.
- Work within the company culture, not around it.

Process of Implementing New Systems

Implementing a new system involves investigation, analysis, design testing and other factors. Here we discuss the points of implementation process:

Acquisition: Evaluate and acquire necessary hardware and software resources and information systems services.

Software development: Develop any computer program that will not be acquired externally as software packages. Make any necessary modification to software packages that are acquired.

Training: Educate and train management and end users.

Testing: Test and make necessary corrections to the programs, procedures and hardware used by a new system.

Documentation: Record and communicate detailed system specifications, including procedures for end users and IS personnel.

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Conversation: Convert from the use of present system to the operation of a new or improved system.

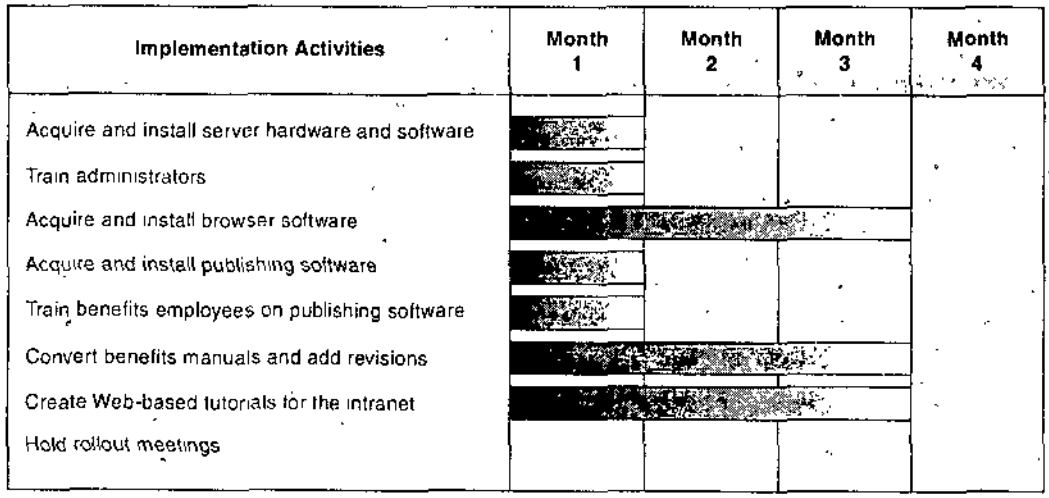

Figure 5.16. *Example of implementation process*

Hardware Evaluation Factors

Performance: What are the speed, capacity and throughput?

Cost: What is its lease or purchase price? What will be its cost of operations and maintenance?

Reliability: What are the risks of malfunction and its maintenance requirements? What are its error control and diagnostic features?

Availability: When is the firm delivery date?

Compatibility: Is it compatible with existing hardware and software? Is it compatible with hardware and software provided by competing suppliers?

Modularity: Can it be expanded and upgraded by acquiring modular "add on" units?

Technology: In year of its product life cycle is it? Does it use a new untested technology or does it run the risk obsolescence?

Ergonomics: Has it been human factor engineered with the user in mind? Is it user-friendly, designed to be safe, comfortable and easy to use?

Connectivity: Can it be easily connected to wide area and local area networks of different types of computers and peripherals?

Scalability: Can it handle processing demands of a wide range of end users, transactions, queries and other information processing requirements?

Software: Is system and application software available that can best use this hardware?

Support: Are the services required to support and maintain it available?

Software Evaluation Factors

Efficiency: Is the software a well developed system of computer instructions or objects that does not use much memory capacity or CPU time?

Flexibility: Can it handle its processing assignments easily without major modifications?

Security: Does it provide control procedures for errors, malfunctions and improper use?

Connectivity: Is it network enabled so it can be easily access the internet, intranet and extranet and other networks on its own or by working with network browsers or other network software?

Language: Is it written in a programming language that is used by our own computer programmers?

Documentations: Is the software well documented? Does it include helpful user instructions?

Hardware: Does existing hardware have the features required to best use this software?

Other factors: What are its performance, cost, reliability, availability, compatibility, modularity, technology, ergonomics, scalability and support characteristics?

Services Evaluation Factors

Performance: What has been their past performance in view of their past promises?

Systems developments: Are systems analysis and programming consultants available? What are their qualities and cost?

Maintenance: Is equipment maintenance provided? What are its quality and cost?

Conversion: What systems developments, programming and hardware installation services will they provide during the conversion period?

Training: Is the necessary training personnel provided? What are its quality and cost?

Backup: Are several similar computer facilities available for emergence backup purposes?

Accessibility: Does the vendor have a local or regional office that offers sales, systems developments and hardware maintenance services? Is a customer hotline provided?

Business positions: Is the vendor financially strong, with good industry market prospects?

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Hardware: Do they have a wide selection of compatible hardware devices and accessories?

Software: Do they offer a variety of useful system software and application packages?

Other Implementation Activities

Testing, documentation, and training are keys to successful implementation of a new system. The testing of a newly developed system is an important implementation activity.

Testing

System testing involves testing hardware devices, testing and debugging computer programs, and testing information processing procedures. Programs are tested using test data that attempt to simulate all conditions that may arise during processing. In good programming practice (structured programming), programs are subdivided into levels of modules to assist their development, testing, and maintenance. Program testing usually proceeds from higher to lower levels of program module until the entire program is tested as a unit. The program is then tested along with other related programs in a final systems test. If computer-aided software engineering (CASE) methodologies are used, such program testing is minimized because any automatically generated program code is more likely to be error free.

An important part of testing is the production of prototypes of displays, reports; and other output. These should be reviewed by end users of the proposed systems for possible errors. Of course, testing should not occur only during the system's implementation stage, but throughout the system's development process.

Documentation

Developing good user documentation is an important part of the implementation process. When computer-aided systems engineering methods are used, documentation can be created and changed easily since they are stored in a CASE system repository. Documentation serves as a method of communication among the people responsible for developing, implementing, and maintaining a computer-based system. Installing and operating a newly designed system or modifying an established application requires a detailed record of that system's design, Documentation is extremely important in diagnosing errors and making changes, especially if the end users or systems analysts who developed a system are no longer with the organization.

Training

Training is a vital implementation activity. IS personnel, such as user consultants, must be sure that end users are trained to operate a new system or its implementation will fail. Training may involve only activities like data entry, or it may also involve all aspects of the proper use of a new system. In addition, managers and end users must be educated in how the new technology impacts the company's business operations and management. This knowledge should be supplemented by training programs for any new hardware device, software packages, and their use for specific work activities.

IS Maintenance

Once a system is fully implemented and being operated by end users, the maintenance function begins. Systems maintenance is the monitoring, evaluating, and modifying of operational information systems to make desirable or necessary improvements: *For example,* the implementation of a new system usually results in the phenomenon known as the learning curve. Personnel who operate and use the system will make mistakes simply because they are not familiar with it. Though such errors usually diminish as experience is gained with a new system, they do point out areas where a system may be improved. Maintenance is also necessary for other failures and problems that arise during the operation of a system. End users and information systems personnel then perform a troubleshooting function to determine the causes of and solutions to such problems.

The maintenance activity includes a post implementation review process to ensure that newly implemented systems meet the systems development objectives established for, them. Errors in the development or use of a System must be corrected by the maintenance process. This includes a periodic review or audit of a system to ensure that it is operating properly and meeting its objectives. This audit is in addition to continually monitoring a new system for potential problems or necessary changes. Maintenance includes making modifications to a system due to changes in the business organization or the business environment. *For example,* new tax legislation, company reorganizations, and new business ventures usually require making a variety of changes to current business information systems.

PART II: ADANCED CONCEPTS IN INFORMATION SYSTEMS

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5.4. ENTERPRISE RESOURCE PLANNING

As the topic of the paper suggests, we shall study how various organizations in different Industries and functions can manage Information Technology (IT) in the 21st century. The purpose of any organization to incorporate IT into its business processes is essentially focused on the customer, and then on profits. In this paper, we shall see how organizations can focus on benefiting society at large, by using the latest technology available in the field of IT to drive their businesses.

Information Technology is revolutionizing the way in which we live and work. The digital revolution has given mankind and the ability to treat information with mathematical precision to transmit it with very high accuracy and to manipulate it at will.

One of the latest technologies existing in the IT field is (ERP) Enterprise Resource Planning. The main idea of this technology is to weave IT through the whole enterprise, and thereby have various resources put together to give a common integrated output. Let us see what this statement means.

An enterprise consists of the various functional departments, some vertical-like product line departments, and some horizontal—like HR, finance, etc. For any financial year or plan period, each department has its own way of functioning and self-defined processes, its own objectives and targets. Thus, although, at the top management level, there would be one single corporate vision, the broken down objectives at Strategic Business Units and lower levels tend to be isolated and disconnected. This leads to:

- Departments taking decisions, irrespective of how it affects the other departments and their customers.
- Less than optimal use of various resources present in the different functions.
- The original corporate vision getting diluted, as each department pursues its own priorities and processes, which might sometimes even be at tangent to those of another department.

Therefore, we need some way of integrating the various functions and processes to form a single cycle or chain, thus providing an overall benefit for top management and customers. With data of the whole organization at their fingertip, top management can now take decisions in real time. For the customer, this helps to reduce time and cost of owning a product or service. Thus, we have seen how ERP has traditionally helped

organizations and customers. Its focus till now was more directed towards Business Process Reengineering (BPR), or even simple process cleaning and automation, thus leading to increased productivity and reduced costs. ERB along with its standard modules and ability to interoperate with legacy or customized independent solutions has started looking at what other benefits the customers can get, like Customer Relationship Management (CRM), Data Mining, etc. Apart from standard modules, ERP vendors are now supplying function and industry specific modules, which are tailored to those specific organizations. ERP is also able to interoperate with certain legacy systems. ERP is being used as the backbone for various applications that help to give different service offerings to the customer.

The software vendors would only find themselves getting extinct. And at the rate, at which IT industry moves, it is now or never for the technology and the software vendors. Today we find the concept of Application Service Provider (ASP) taking the market by rage. ASP is a concept where all IT infrastructure including the data centre, hardware, software, application, network bandwidth, and support personnel are provided on rent by a service provider to any customer, based on requirement. Hence ERP with its increased functions and customizations, can be delivered through an ASP to so many customers, who have till now had a desire to use ERP, but could not due to the cost and implementation constraints.

Enterprise resource planning software, or ERP, doesn't live up to its acronym. Forget about planning—it doesn't do much of that—and forget about resource, a throwaway term. But remember the enterprise part. This is ERP's true ambition. It attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments' particular needs.

That is a tall order, building a single software program that serves the needs of people in finance as well as it does the people in human resources and in the warehouse. Each of those departments typically has its own computer system optimized for the particular ways that the department does its work. But ERP combines them all together into a single, integrated software program that runs off a single database so that the various departments can more easily share information and communicate with each other. That integrated approach can have a tremendous payback if companies install the software correctly.

Take a customer order, for example. Typically, when a customer places an order, that order begins a mostly paper-based journey from in-basket to in-basket around the company, often being keyed and rekeyed into different departments' computer systems along the way. All that lounging around in in-baskets causes delays and lost orders, and all the keying into different computer systems invites errors. Meanwhile, no one in the company truly

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knows what the status of the order is at any given point because there is no way for the finance department, *for example,* to get into the warehouse's computer system to see whether the item has been shipped. "You'll have to call the warehouse" is the familiar refrain heard by frustrated customers.

ERP vanquishes the old standalone computer systems in finance, HR, manufacturing and the warehouse, and replaces them with a single unified software program divided into software modules that roughly approximate the old standalone systems. Finance, manufacturing and the warehouse all still get their own software, except now the software is linked together so that someone in finance can look into the warehouse software to see if an order has been shipped. Most vendors' ERP software is flexible enough that you can install some modules without buying the whole package.

Technologies of ERP

We find that over the years, most organizations have developed from being a small group of people, functions and products, to big conglomerates having many employees, functions and departments, products and services. Simultaneously, as IT developed and new technology evolved, each department and function implemented its own IT solution to help automate or improve its existing business processes. When each department starts working in an isolated manner, the original, common, corporate vision gets diluted. For top management, it is a difficult task to integrate and analyze reports from various functions, and then make strategic decisions for the organizations in real time. Hence the, ERP technology came into existence. This helps automate all business processes of each function, such that information of each function is seamlessly integrated with the others. The term ERP does not just imply hardware and software, but also implies the whole idea, architecture, deployment and sustenance, of an enterprise wide system of running an organization or business, towards the common goals of profits and customer delight. ERP has migrated from being an idea from the manufacturing perspective alone, to a solution for all sorts of products and service functions.

In other words, ERP is an idea, technology and system to manage effectively the different resources across the enterprise, through business process automation and integration, thereby improving the efficiency of the enterprise and increasing customer satisfaction.

It is essential to understand that ERP is the core technology, on which other technology ideas and systems can piggyback; *e.g.,* supply chain management (SCM), data warehousing, customer relationship management (CRM). This is because organizations' expectations from IT are rapidly moving from a focus on cost cutting, efficiency and productivity to customer value, effectiveness, and competitive advantage. It is critical to understand

the complementary roles that an ERP backbone and other applications play in orchestrating a digital nervous system. Successful information architecture predicates a symbiotic relationship between an ERP application and several other solutions–which include workflow and web-based applications.

The standard ERP vendors in the market offer some standard packages, apart from some industry specific packages. Some vendors in the market are Oracle, SAP, BaaN, JDEdwards, and Peoplesoft. Some of the standard modules on offer are as follows :

ERP Benefits

There are five major reasons why companies undertake ERP.

Integrate Financial Information

As the CEO tries to understand the company's overall performance, he may find many different versions of the truth. Finance has its own set of revenue numbers, sales has another version, and the different business units may each have their own version of how much they contributed to revenues. ERP creates a single version of the truth that cannot be questioned because everyone is using the same system.

Integrate Customer Order Information

ERP systems can become the place where the customer order lives from the time a customer service representative receives it until the loading dock ships the merchandise and finance sends an invoice. By having this information in one software system, rather than scattered among many different systems that can't communicate with one another, companies can keep track of orders more easily, and coordinate manufacturing, inventory and shipping among many different locations at the same time.

Standardize and Speed Up Manufacturing Processes

Manufacturing companies especially those with an appetite for mergers and acquisitions often find that multiple business units across the company make the same widget using different methods and computer systems. ERP systems come with standard methods for automating some of the steps of a manufacturing process. Standardizing those processes and using a single, integrated computer system can save time, increase productivity and reduce head count.

Reduce Inventory

ERP helps the manufacturing process flow more smoothly, and it improves visibility of the order fulfillment process inside the company. That can lead to reduced inventories of the stuff used to make products (work-in-

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progress inventory), and it can help users better plan deliveries to customers, reducing the finished good inventory at the warehouses and shipping docks. To really improve the flow of your supply chain, you need supply chain software, but ERP helps too.

Standardize HR Information

Especially in companies with multiple business units, HR may not have a unified, simple method for tracking employees' time and communicating with them about benefits and services. ERP can fix that. In the race to fix these problems, companies often lose sight of the fact that ERP packages are nothing more than generic representations of the ways a typical company does business. While most packages are exhaustively comprehensive, each industry has its quirks that make it unique. Most ERP systems were designed to be used by discrete manufacturing companies (that make physical things that can be counted), which immediately left all the process manufacturers (oil, chemical and utility companies that measure their products by flow rather than individual units) out in the cold. Each of these industries has struggled with the different ERP vendors to modify core ERP programs to their needs.

Other ERP benefits are:

- Increased efficiency.
- Decrease in lead-times and cycle-times of order fulfillment.
- Better capacity and resource utilization.
- Integration of more accurate information of various functions, to enable better real-time decision making.
- Increased customer responsiveness and service Increase in brand equity.
- Reduction in hidden costs.
- Flexibility and agility through all the functions in the chain of workflow.

ERP can Improve a Company's Business Performance

ERP's best hope for demonstrating value is as a sort of speeding up for improving the way your company takes a customer order and processes it into an invoice and revenue—otherwise known as the order fulfillment process. That is why ERP is often referred to as back-office software. It doesn't handle the up-front selling process (although most ERP vendors have recently developed CRM software to do this); rather, ERP takes a customer's order and provides a software road map for automating the different steps along the path to fulfil it. When a customer service representative enters a customer's order into an ERP system, he has all the information necessary to complete the order (the customer's credit rating and order history from the finance module, the company's inventory

levels from the warehouse module and the shipping dock's trucking schedule from the logistics module).

People in these different departments all see the same information and can update it. When one department finishes with the order it is automatically routed via the ERP system to the next department. To find out where the order is at any point, you need only log in to the ERP system and track it down. With luck, the order process moves like a bolt of lightning through the organization, and customers get their orders faster and with fewer errors than before. ERP can apply that same magic to the other major business processes, such as employee benefits or financial reporting. That, at least, is the dream of ERP. The reality is much harsher.

Let's go back to those inboxes for a minute. That process may not have been efficient, but it was simple. Finance did its job, the warehouse did its job, and if anything went wrong outside of the department's walls, it was somebody else's problem. Not anymore. With ERP, the customer service representatives are no longer just typists entering someone's name into a computer and hitting the return key. The ERP screen makes them businesspeople. It flickers with the customer's credit rating from the finance department and the product inventory levels from the warehouse. Will the customer pay on time? Will we be able to ship the order on time? These are decisions that customer service representatives have never had to make before, and the answers affect the customer and every other department in the company. But it's not just the customer service representatives who have to wake up. People in the warehouse who used to keep inventory in their heads or on scraps of paper now need to put that information online. If they don't, customer service representatives will see low inventory levels on their screens and tell customers that their requested item is not in stock. Accountability, responsibility and communication have never been tested like this before.

People don't like to change, and ERP asks them to change how they do their jobs. That is why the value of ERP is so hard to pin down. The software is less important than the changes companies make in the ways they do business. If you use ERP to improve the ways your people take orders, manufacture goods, ship them and bill for them, you will see value from the software. If you simply install the software without changing the ways people do their jobs, you may not see any value at all—indeed, the new software could slow you down by simply replacing the old software that everyone knew with new software that no one does.

Time Taken by ERP Projects

Companies that install ERP do not have an easy time of it. Don't be fooled when ERP vendors tell you about a three or six month average

implementation time. Those short (that's right, six months is short) implementations all have a catch of one kind or another: The company was small, or the implementation was limited to a small area of the company, or the company used only the financial pieces of the ERP system (in which case the ERP system is nothing more than a very expensive accounting system).

To do ERP right, the ways you do business will need to change and the ways people do their jobs will need to change too. And that kind of change doesn't come without pain. Unless, of course, your ways of doing business are working extremely well (orders all shipped on time, productivity higher than all your competitors, customers completely satisfied), in which case there is no reason to even consider ERP.

The important thing is not to focus on how long it will take—real transformational ERP efforts usually run between one and three years, on average—but rather to understand why you need it and how you will use it to improve your business.

Why Do ERP Projects Fail So Often

At its simplest level, ERP is a set of best practices for performing different duties in your company, including finance, manufacturing and the warehouse. To get the most from the software, you have to get people inside your company to adopt the work methods outlined in the software. If the people in the different departments that will use ERP don't agree that the work methods embedded in the software are better than the ones they currently use, they will resist using the software or will want IT to change the software to match the ways they currently do things. This is where ERP projects break down. Political fights break out over how—or even whether—the software will be installed. IT gets bogged down in long, expensive customization efforts to modify the ERP software to fit with powerful business barons wishes. Customizations make the software more unstable and harder to maintain when it finally does come to life. The horror stories you hear in the press about ERP can usually be traced to the changes the company made in the core ERP software to fit its own work methods. Because ERP covers so much of what a business does, a failure in the software can bring a company to a halt, literally.

But IT can fix the bugs pretty quickly in most cases, and besides, few big companies can avoid customizing ERP in some fashion—every business is different and is bound to have unique work methods that a vendor cannot account for when developing its software. The mistake companies make is assuming that changing people's habits will be easier than customizing the software. But it is not so. Getting people inside your company to use the software to improve the ways they do their jobs is by far the harde

challenge. If your company is resistant to change, then your ERP project is more likely to fail.

ERP packages, if chosen correctly, implemented judiciously and used efficiently, will raise the productivity and profits of companies dramatically. But many a company fails in this because of a wrong product, incompetent and haphazard implementation and inefficient or ineffective usage.

To work successfully, the ERP solutions need a lot of factors to click. There should be good people who know the business. The vendor should be good and his package should be the one best suited for the company's needs. The ERP consultants should be good. The implementation should be planned well and executed perfectly. The end-user training should be done so that the people understand the system, and the effect of their efforts on the overall success of the program.

The introduction of the ERP system will dramatically change the job descriptions and functions of many employees. Employees who were earlier doing the work of recording information will, overnight, be transformed into decision-makers. *For example,* in the past an order entry clerks job was to enter the orders that came to him. With the implementation of good ERP systems the order entry clerk becomes an action initiator. As soon as he enters the order into the system, the information is passed on to the sales, distribution and finance modules. The distribution module checks whether the item is in stock and if available, the item is dispatched and the information is sent to the finance module. If the items are not in stock, then the manufacturing module is given the information, so that production can start. The customer is informed about the status of his order. If the items are shipped, the finance module prepares the invoice and sends it to the customer. All these actions take place automatically as soon as the order entry clerk enters the information regarding the order into the system. Thus the order entry clerk is transformed from a data entry operator to a decision maker whose actions can trigger a chain of actions.

Many employees find this transformation difficult to accept. If the employees are not given proper training, well in advance, then the systems will fail. Another factor is the fear of unemployment. When procedures become automated, the people who were doing those jobs become redundant. So it is quite natural to have resistance from the employees. But the same employees can be trained in the new system and can work in more challenging and stimulating environments. For this also, the employees have to be told, in advance, as to what will happen and should be given ample time and training to make the transformation.

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Configuration of ERP Software

Even if a company installs ERP software for the so-called right reasons and everyone can agree on the optimal definition of a customer, the inherent difficulties of implementing something as complex as ERP is like, well, teaching an elephant to do the hootchy-kootchy. The packages are built from database tables, thousands of them, that IS programmers and end users must set to match their business processes; each table has a decision switch that leads the software down one decision path or another. By presenting only one way for the company to do each task, say run the payroll or close the books a company's individual operating units and far-flung divisions are integrated under one system. But figuring out precisely how to set all the switches in the tables requires a deep understanding of the existing processes being used to operate the business. As the table settings are decided, these business processes are reengineered, ERP's way. Most ERP systems are not shipped as a shell system in which customers must determine at the minutia level how all the functional procedures should be set, making thousands of decisions that affect how their system behaves in line with their own business activities. Most ERP systems are preconfigured, allowing just hundreds—rather than thousands—of procedural settings to be made by the customer.

ERP Fits with e-Commerce

ERP vendors were not prepared for the onslaught of e-commerce. ERP is complex and not intended for public consumption. It assumes that the only people handling order information will be your employees, who are highly trained and comfortable with the tech jargon embedded in the software. But now customers and suppliers are demanding access to the same information your employees get through the ERP system—things like order status, inventory levels and invoice reconciliation—except they want to get all this information simply, without all the ERP software jargon, through your website.

E-commerce means IT departments need to build two new channels of access in to ERP systems—one for customers (otherwise known as business-to-consumer) and one for suppliers and partners (business-to-business). These two audiences want two different types of information from your ERP system. Consumers want order status and billing information, and suppliers and partners want just about everything else.

Traditional ERP vendors are having a hard time building the links between the Web and their software, though they certainly all realize that they must do it and have been working hard at it for years. The bottom line, however, is those companies with e-commerce ambitions face a lot of hard integration work to make their ERP systems available over the Web. For

those companies that were smart—or lucky—enough to have bought their ERP systems from a vendor experienced in developing e-commerce wares, adding easily integrated applications from that same vendor can be a money-saving option. For those companies whose ERP systems came from vendors that are less experienced with e-commerce development, the best—and possibly only—option might be to have a combination of internal staff and consultants hack through a custom integration.

But no matter what the details are, solving the difficult problem of integrating ERP and e-commerce requires careful planning, which is key to getting integration on the right track.

One of the most difficult aspects of ERP and e-commerce integration is that the Internet never stops. ERP applications are big and complex and require maintenance. The choice is stark if ERP is linked directly to the Web—take down your ERP system for maintenance and you take down your website. Most e-commerce veterans will build flexibility into the ERP and e-commerce links so that they can keep the new e-commerce applications running on the Web while they shut down ERP for upgrades and fixes.

The difficulty of getting ERP and e-commerce applications to work together—not to mention the other applications that demand ERP information such as supply chain and CRM software—has led companies to consider software known alternately as middleware and EAI software. These applications act as software translators that take information from ERP and convert it into a format that e-commerce and other applications can understand. Middleware has improved dramatically in recent years, and though it is difficult to sell and prove ROI on the software with business leaders—it is invisible to computer users—it can help solve many of the biggest integration woes that plague IT these days.

ERP Modules

All ERP packages contain so many modules. The features and modules may differ according to demand. Here we discuss some major modules (but it can vary organization to organization).

Finance

IT as a concept is used to provide relevant information to the right people at the right time. This data needs to be an integrated view of all the financial functionalities across the organization, irrespective of individual departmental function and geographic location. This is provided thorough ERP. ERP enables data to be entered once only, and the software itself automatically understands various departments' modules and provides the relevant information. Some of the sub-systems in the Finance module are as follows:

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Financial Accounting

This helps to provide organization wide control and integration of financial info, essential for strategic decision making. It helps to centrally track financial accounting data within an international framework of multiple companies, languages, currencies, legal aspects and standards.

The general ledger provides the real time snapshot of the financial data. ERP helps to then provide customized queries and reports to tailor the view to each organization as per their requirements. It provides flexible structuring of the chart of accounts at the group and company level, distributed application scenarios, real time, simultaneous update of all sub ledgers, elimination of time-consuming reconciliation, and parallel views of data. It also provides an integrated, financial calendar for automating periodic activities.

The accounts receivable and payable part helps to use standard business rules for transaction processing, whenever there is a debit or credit, or cash movement. It includes Internet integration, document management, and full support for EDI processing, and automatic integration with cash management. It also assists in giving credit management with workflow integration, payment automation with EFT and check processing, and document parking with various approval procedures.

Asset accounting assists in managing the companies' fixed assets. Some important features include country specific charts of depreciation complying with local legal requirements, full support through the asset life cycle from acquisition to retirement, depreciation simulation and interest calculation, and integration with project management and order accounting for capital asset management. It also gives integration with plant maintenance for management of machinery and equipment, leased assets, assets under construction, and interactive reporting.

Legal consolidation subsystem provides direct data transfer, from individual statements into the consolidated report, thus reducing staff workload and data entry errors. It allows creating multiple views of the consolidated data, based on legal procedures and entities in the organization.

Controlling

This helps to gather the functions required for effective internal cost accounting. It provides standard reports and analysis paths. Sub-modules are:

Overhead cost controlling subsystem focuses on the monitoring and allocation of overheads. It helps to give transparency in overhead cost areas, especially in cost monitoring and optimization in production areas, where indirect costs cannot be directly assigned to products or services.

Cost centre accounting analyses where overheads occur within an organization. Costs are assigned to sub-areas of the company where they originated.

Overhead orders sub system collects and analyses costs, based on individual internal measures. It can monitor and automatically check budgets assigned to each measure.

Activity based costing, which is one of the current trends, helps to monitor and control cross-departmental business processes, along with products and functions. This subsystem automatically determines the utilization of business processes by products, customers, and other cost objects based on cost drivers taken from the integrated accounting environment.

Product cost controlling module determines the cost arising from manufacturing a product or providing a service. Plan and standard values serve in evaluating warehouse stock and for contrasting revenues received with costs. It determines lowest price limit for which a product is profitable. Simulations show the effects of changes in production methods on the cost of goods manufactured.

Cost object controlling helps to monitor manufacturing orders. Integration with logistics components result in a logistic quantity flow that provides instant information on actual object costs, allowing ongoing calculations at any time. Follow-up calculations determine and analyze the variances between manufacturing costs, and the plan costs resulting from product cost planning.

Profitability analysis module examines the sources of returns. It helps to take important decisions in determining prices, selecting customers, developing conditions and choosing distribution channels.

Investment Management

It provides modular support for investment processes from planning to settlement. One can use it to define an investment program hierarchy, to distribute budgets, monitor and control budget overruns. It provides tools, to plan and manage capital spending projects from the earliest stage. Settlement is flexible and fully automatic, thereby enabling a complete integration with business planning and control, and provides consistent up-to-date values.

Treasury module helps to manage short, medium arid long-term payment flows and hence the risk exposure. It assists in facilities management and control of cash flows, and risk positions across-all the divisions of the company. Sub-modules include:

Cash management allows analyzing financial transactions for a given period. It identifies and records future developments for purpose of

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financial budgeting. It provides information on the sources and uses of funds to secure liquidity in order to meet payment obligations when they become due.

Treasury management helps to take results of current liquidity, currency, and risk positions and consider the conditions prevailing on the money and capital markets, before implementing concrete decisions in the form of financial instruments.

Market risk management module acts as an integrated, central risk control station with monitoring and management functions. By simulating market data, the company can determine the risk structure of certain cash scenarios.

Funds management sub-module supports the fund management process from budgeting to payments, including monitoring expenditures, activities, resources and revenues. It enables to control various funds commitments and determine how much budget has already been utilized by availability checking.

Enterprise Controlling

It comprises of those functions that will optimize shareholder value, while meeting internal objectives for growth and investment. Sub-modules are:

Executive information system integrates data from other ERP components, and non-ERP data sources, both inside and outside the enterprise. Drill down reporting and report portfolio, are available to evaluate and present data.

Business planning and budgeting module supports the management teams of business units and groups in the calculation of business targets, such as return on investment. It also helps support central investment planning, budget release and tracking.

Profit centre accounting analyses the profitability of internal responsibility centres. It helps in the planning of certain strategies.

Manufacturing

In today's business world, manufacturers are measured by their ability to react quickly to sudden, often unpredictable change in customer demand for their products and services. Companies must be able to deliver customer-specific products with the lead-time of standard, off-the-shelf products. To help manage product and market shifts; the manufacturing module provides the freedom to change manufacturing and planning methods, as and when they need a change. The main module comprises of the following sub-modules:

Material and capacity planning sub-modules are used to simulate alternative plans, to provide the responsiveness to meet customer delivery

requirements. This simulation helps to gain the information that a company needs to determine, which parts and assemblies to make, which to buy and when to manufacture or purchase. Most packages have features to generate recommendations for purchases and production, and where required, recommend changes to current plans to prevent over or under utilization of work centres.

Shop Floor Control

This module allows the shop scheduler to reprint the shop packet and to reflect new material allocations that correct previous shortages. All systems provide a full function shop order maintenance capability, allowing the user to evaluate and adjust operation steps and components.

Quality Management

This module supports the benchmarking and use of optimal product design, process engineering and quality assurance data by all functional departments within the manufacturing enterprise, thereby facilitating definition of repeatable processes, root cause analysis and the continuous improvement of manufacturing methods. The material procurement subsystem provides tools for implementing TQM programs within an organization. Material inspection subsystem offers a wide range of capabilities for process supervision and control. Product quality metrics are collected and archived in a manner that offers full support for statistical process techniques. Material disposition is a feature that offers advanced material review and disposition functions ensure that the right quality control decisions are made and leave an audit trail of decisions for compliance purposes.

Engineering Data Management

This module is designed to help a company trim data transfer time, reduce errors and increase design productivity by providing an automated link between engineering and production information.

Engineering Change Control

This module assists in gaining effective control over engineering change orders. The company can define the authorization steps for approving and implementing an engineering change order. Once these steps are completed, the system automatically implements file change in the production database.

Configuration Management

This module helps to reduce order cycle time by eliminating the lengthy engineering review, typically associated with determining feasibility and the costs associated with the configured end time. This reduction is achieved by creating a flexible user defined knowledge base that is accessed by a powerful analytic engine.

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Serialization/Lot Control

This module comes in handy. This serialization is applicable to commercial aviation, defense industry suppliers and capital equipment manufacturers who provide service over the life of the products unit by unit basis. The lot control system provides pre-allocation of lot numbers. This feature is available throughout the product offering and includes MRP, shop floor control, order processing and JIT. Many systems allow production orders to be pre-assigned with lot numbers from the parent item.

Tooling Module

This helps to ensure that tools and materials arrive together at scheduled operations by storing tools in inventory and planning and allocating the required tools as part of the production order. They also provide visibility of tool use, calculate the remaining useful life of a tool and automatically route tools for maintenance, based on usage.

Human Resources

Human resources management is an essential factor of any successful business. HR managers need to continually review and optimize their business processes. HR modules of ERP provide a versatile Job of managing the HR processes of an organization. The various contents of this module are:

Personnel Management

This module has sub-modules that allow a company to deal with human resources tasks more quickly, accurately and efficiently. These are:

- A personnel administration module helps eliminate duplicate entries, reduce chance for error and improves data accuracy. The HR modules provide a global, fully integrated data structure for the enterprise, without compromising control over individual segments of the operations.
- Employee master data module provides tools to save time and help tailor the system to suit a company's needs. The system can produce charts and reports, both standard and customer defined. It even displays graphical information.
- Recruitment management module helps in hiring the right people with the right skills, thus helping to reduce the cost of recruiting and hiring new people. This component includes processes for managing open positions/requisitions, applicant screening, and selection, correspondence, reporting and cost analysis. It provides tools to analyze costs incurred during advertising and interviewing for each open position.

- Travel management module helps in processing the travel expenses effortlessly, in several currencies and formats. It assists in processing a business trip from start to finish. All processing is electronic, and paperwork is reduced.
- Benefits administration module provides a company with the capabilities and flexibility to effectively manage benefit programs for diverse employee population. The company can maintain an unlimited amount of savings plans for the employees to consider. It gives the capability to maintain both deferred and non-deferred options, as well as employee matched and unmatched contributions. It tracks employee changes and investment histories.
- Salary administration module assists in disbursement of salary efficiently and effectively. It also helps in the salary review process by taking into account standard salary changes within the company, as well as individual compensation exceptions.

Organizational Management

- This module assists in maintaining an accurate picture of the organization structure, no matter how fast it changes. The sub-modules are:
- Payroll accounting module helps to fulfill changing needs of an organization in this area as well as addresses the issue from a global perspective.
- Time management module assists in simplifying-the administration and evaluation of time data. It relates to the time employees spend working. It helps to set flexible working hours and process work notices as times are recorded.
- Shift planning module helps to plan workforce requirement quickly and accurately. It assists in planning shifts as per requirement, taking into consideration all criteria, including absences due to leave or sickness, as well as skill level availability. It keeps the company informed of staff excess or deficit.
- Personnel development helps in selecting the best employees and enhancing their careers effectively. It helps determine the areas where employees need further training for employee potential and performance matching.

5.5. SUPPLY CHAIN MANAGEMENT: AN INTRODUCTION

Supply Chain Management is a network of facilities for procuring materials, transforming raw materials into finished products, and distributing

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finished products to customers. To deliver the product more rapidly to the customer at lower cost, firms are also trying to streamline their business processes for supply chain management. **Supply chain management** is the close linkage of activities involved in buying, making, and moving a product. It integrates supplier, distributor, and customer logistics requirements into one cohesive process to reduce time, redundant effort, and inventory costs. The **supply chain** is a network of facilities for procuring materials, transforming raw materials into intermediate and finished products, and distributing the finished products to customers. It links manufacturing plants, distribution centres, conveyances, retail outlets, people, and information through processes such as procurement or logistics to supply goods and services from source through consumption. Goods or services start out as raw materials and move through the company's logistics and production systems until they reach customers. To manage the supply chain, a company tries to eliminate redundant steps, delays, and the amount of resources tied up along the way.

Companies that skillfully manage their supply chains get the right amount of their products from their source to their point of consumption with the least amount of time and the lowest cost. Information systems make supply chain management more efficient by helping companies coordinate, schedule, and control procurement, production, inventory management, and delivery of products and services to customers. Information systems can integrate demand planning, production forecasting, materials requisition, order processing, inventory allocation, order fulfillment, transportation services, receiving, invoicing, and payment.

Supply chain management systems can be built by using intranets, extranets, or special supply chain management software.

The concept of SCM is not new. It starts with the customer's end and it ends with the customer. Through the loop flow all the materials and finished goods, all information, even all transactions. It requires looking at your business as one continuous process. The process absorbs such traditionally distinct functions as forecasting purchasing, manufacturing, distribution and sales and marketing into a continuous flow of business

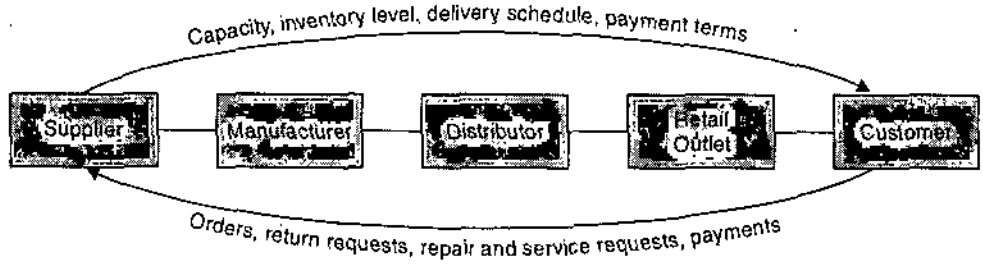

Figure 5.17. *Supply Chain Management*

interaction. Gone are the functional stove pipes of corporate activity, instead departments are situated as a pipeline that stretches between a company's suppliers and its customers.

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. Supply chains exist in both service and manufacturing organizations, although the complexity of the chain may vary greatly from industry to industry and firm to firm.

IT makes it possible to have more information, more accurately, more frequently, from more sources, from all over the globe. And IT makes it possible to digest, to understand, and to act on this growing abundance of information by giving us even more sophisticated analysis, modeling, and decision-support capabilities. In short, advances in communications and computerized decision-support systems are making it possible to deal with the supply chains growing complexity, to incorporate more factors and more people in the decision-making, and to communicate the decisions and learn faster about the results.

The rise of systems thinking in business management has fostered the development of SCM. Engineers are trained to consider all the parts of an entity in examining how they interact with one another. Total quality management (TQM) and business process reengineering (BPR) also has made important contributions. Both of these disciplines, in their own way, teach the power of understanding process interactions in order to design more efficient and more productive processes.

Since the pace of change never slows but only grows faster, supply chain professionals need to keep focused on some key success factors. Here is list:

- Always keep foremost the needs and desires of the end customer;
- Measure, measure, and measure to make quantitatively based decisions;
- Communicate, communicate, and communicate all through the total supply chain;
- Design flexibility into the supply chain for rapid response to changing conditions;
- And most of all: Enjoy the challenge.

Supply Chain Decisions

We classify the decisions for supply chain management into two broad categories: strategic and operational. As the term implies, strategic decisions are made typically over a longer time horizon. These are closely

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linked to the corporate strategy and guide supply chain policies from a design perspective. On the other hand, operational decisions are short term, and focus on activities over a day-to-day basis. The effort in these types of decisions is to effectively and efficiently manage the product flow in the strategically planned supply chain.

There are four major decision areas in supply chain management:

1. Location.
2. Production.
3. Inventory.
4. Transportation (distribution).

There are both strategic and operational elements in each of these decision areas.

Location Decisions

The geographic placement of production facilities, stocking points, and sourcing points is the natural first step in creating a supply chain. The location of facilities involves a commitment of resources to a long term plan. Once the size, number, and location of these are determined, so are the possible paths by which the product flows through to the final customer. These decisions are of great significance to a firm since they represent the basic strategy for accessing customer markets, and will have a considerable impact on revenue, cost, and level of service.

Production Decisions

The strategic decisions include what products to produce and which plants to produce them in, allocation of suppliers to plants. These decisions assume the existence of the facilities, but determine the exact path(s) through which a product flows to and from these facilities. Another critical issue is the capacity of the manufacturing facilities. Operational decisions focus- on detailed production scheduling. These decisions include the construction of the master production schedules, scheduling production on machines, and equipment maintenance. Other considerations include workload balancing, and quality control measures at a production facility.

Inventory Decisions

These refer to the means by which inventories are managed. Inventories exist at every stage of the supply chain as either raw material, semi-finished or finished goods. They can also be in process between locations. Their primary purpose is to buffer against any uncertainty that might exist in the supply chain. It is strategic in the sense that the top management sets goals. However, most researchers have approached the management of inventory from an operational perspective.

Transportation Decisions

The mode choice aspects of these decisions are the most strategic ones. These are closely linked to the inventory decisions, since the best choice of mode is often found by trading-off the cost of using the particular mode of transport with the indirect cost of inventory associated with that mode. While air shipments may be fast, reliable and warrant lesser safety stocks, they are expensive. Meanwhile shipping by sea or rail may be much cheaper, but they necessitate holding relatively large amounts of inventory to buffer against the inherent uncertainty associated with them. Therefore customer service levels-and geographic location play vital roles in such decisions. Since transportation is more than 30 per cent of the logistics costs, operating efficiently makes good economic sense.

Supply Chain Modeling

Clearly, each of the above two levels of decisions requires a different perspective. The strategic decisions are, for the most part, global or all encompassing in that they try to integrate various aspects of the supply chain. Consequently, the models that describe these decisions are huge, and require a considerable amount of data.

We divide the modeling approaches into three areas:

1. Network Design.
2. Rough Cut Methods.
3. Simulation Based Methods.

Network Design Methods

The network design methods, for the most part, provide normative models for the more strategic decisions. These models typically cover the four major decision areas described earlier, and focus more on the design aspect of the supply chain, the establishment of the network and the associated flows on them. As the very name suggests, these methods determine the location of production, stocking, and sourcing facilities, and paths the product(s) take, through them. Such methods tend to be of a large scale, and are used generally at the inception of the supply chain. Clearly these network design based methods add value to the firm in that they lay down the manufacturing and distribution strategies far into the future. It is imperative that firms at one time or another make such integrated decisions, encompassing production, location, inventory, and transportation, and such models are therefore indispensable.

Rough Cut Methods

Rough cut method; on the other hand give guiding policies for the operational decisions. These models typically assume a "single site" (*i.e.*,

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ignore the network) and add supply chain characteristics to it, such as explicitly considering the site's relation to the others in the network.

These models form the bulk of the supply chain literature, and typically deal with the more operational or tactical decisions. Most of the integrative research in the literature seems to take on an inventory management perspective. In fact, the term Supply Chain first appears in the literature as an inventory management approach. The thrust of the rough cut models is the development of inventory control policies, considering several levels or echelons together. These models have come to be known as multi-level inventory control models.

Simulation Based Methods

A simulation method is a method by which a comprehensive supply chain model can be analyzed, considering both strategic and operational elements.

Integrated Supply Chain Management (ISCM)

Integrated Supply Chain Management (ISCM) is a process-oriented, integrated approach to procuring, producing, and delivering products and services to customers. ISCM has a broad scope that includes sub suppliers, suppliers, internal operations, trade customers, retail customers, and end users. ISCM covers the management of material, information, and funds flow.

Supply chains come in different varieties of increasing complexity. Single-stage supply chain incorporates the material flow functions of receiving raw material or sub-assemblies, manufacturing, distributing, and delivering. It has many information-processing and decision-making functions, reflected in the many information-flow lines. This single stage supply chain, typically found in a single company, has been the primary focus of supply chain management to date.

The multi-stage supply chain more fully embodies our SCM definition above. These are typically multi-company supply chains, but they are essentially multiple replications of the single-stage supply chain.

Seven Principles of Supply Chain Management

The principles of Supply Chain Management are as under:

1. Segment customers based on service needs.
2. Customize the logistics network.
3. Listen to signals of market demand and plan accordingly.
4. Differentiate product closer to the customer.
5. Source strategically.

6. Develop a supply chained technology strategy.

7. Adopt channel spanning performance measures.

Principle 1: Segmented customers are based on the service needs of distinct groups and adapt the supply chain to serve these segments profitably.

Segmentation has traditionally grouped customers by industry, product, or trade channel and then taken a one-size-fits-all approach to serving them, averaging costs and profitability within and across segments. The typical result, as one manager admits: "We don't fully understand the relative value customers place on our service offerings." But segmenting customers by their particular needs equips a company to develop a portfolio of services tailored to various segments. Surveys, interviews, and industry research have been the traditional tools for defining key segmentation criteria. Today, progressive manufacturers are turning to such advanced analytical techniques as cluster and conjoint analysis to measure customer tradeoffs and predict the marginal profitability of each segment. Some manufacturers of home improvement and building products base segmentation on sales and merchandising needs and order fulfillment requirements. Others are finding that criteria such as technical support and account planning activities drive segmentation.

Principle 2: Customize the logistics network to the service requirements and profitabiliy of customer segments.

Companies have traditionally taken a monolithic approach to logistics network design in organizing their inventory, warehouse, and transportation activities to meet a single standard. For some, the logistics network has been designed to meet the average service requirements of all customers; for others, to satisfy the toughest requirements of a single customer segment. Neither approach can achieve superior asset utilization or accommodate the segment-specific logistics necessary for excellent supply chain management. In many industries, especially such commodity industries as fine paper, tailoring distribution assets to meet individual logistics requirements is a greater source of differentiation for a manufacturer than the actual products, which are largely undifferentiated.

Principle 3: Listen to market signals and align demand planning accordingly across the supply chain, ensuring consistent forecasts and optimal resource allocation.

Forecasting has historically proceeded silo by silo, with multiple departments independently creating forecasts for the same products all using their own assumptions, measures and level of detail. Many consult the marketplace only informally, and few involve their major suppliers in the process. The functional orientation of many companies has just made

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things worse, allowing sales forecasts to envision growing demand while manufacturing second-guesses how many products the market actually wants.

Principle 4: Differentiate the product closer to the customer and speed conversion across the supply chain.

Manufacturers have traditionally based production goals on projections of the demand for finished goods and have stockpiled inventory to offset forecasting errors. These manufacturers tend to view lead times in the system as fixed, with only a finite window of time in which to convert materials into products that meet the customer requirements. While even such traditionalists can make progress in cutting costs through set-up reduction, cellular manufacturing, and just-in-time techniques, great potential remains in less traditional strategies such as mass customization.

Principle 5: Manage sources of supply strategically to reduce the total cost of owning materials and services.

Determined to pay as low a price as possible for materials, manufacturers have not traditionally cultivated warm relationships with suppliers. In the words of one general manager: If the best approach to supply is to have as many players as possible fighting for their piece of the pie-that's when you get the best pricing.

Excellent supply chain management requires a more enlightened mindset-recognizing, as a more progressive manufacturer did. If our supplier's costs are in effect our costs. If we force our supplier to provide 90 days of consigned material when 30 days are sufficient, the cost of that inventory will find its way back into the supplier's price to us since it increases his cost structure. While manufacturers should place high demands on suppliers, they should also realize that partners must share the goal of reducing costs across the supply chain in order to lower prices in the market place and enhance margins. The logical extension of this thinking is to gain sharing arrangements to reward everyone who contributes to the greater profitability.

Principle 6: Develop a supply chain-wide technology strategy that supports multiple levels of decision-making and gives a clear view of the flow of products, services, and information.

The manager needs to build an information technology system that integrates capabilities of three essential kinds. For the short term, the system must be able to handle day-to-day transactions and electronic commerce across the supply chain and thus help align supply and demand by sharing information on orders and daily scheduling. From a mid-term perspective, the system must facilitate planning and decision-making,

supporting the demand and shipment planning and master production scheduling needed to allocate resources efficiently. To add long term value, the system must enable strategic analysis by providing tools, such as an integrated network model, that synthesizes data for use in high-level what-if scenario planning to help managers evaluate plants, distribution centres, suppliers, and third-party service alternatives.

Despite making huge investments in technology, few companies are acquiring-this full complement of capabilities. Today's enterprise wide systems remain enterprise-bound, unable to share across the supply chain the information that channel partners must have to achieve mutual success.

Principle 7: Adopt channel-spanning performance measures to gauge collective success in reaching the end-user effectively and efficiently.

To answer the question, How are we doing? most companies look inward and apply any number of functionally oriented measures. But excellent supply chain managers take a broader view, adopting measures that apply to every link in the supply chain and include both service and financial metrics.

First, they measure service in terms of the perfect order—the order that arrives when promised, complete, priced and billed correctly, and undamaged. The perfect order not only spans the supply chain, as a progressive performance measure should, but also views performance from the proper perspective, that of the customer. Second, excellent supply chain managers determine their true profitability of service by identifying the actual costs and revenues of the activities required to serve an account, especially a key account. For many, this amounts to a revelation, since traditional cost measures rely on corporate accounting systems that allocate overhead evenly across accounts. Such measures do not differentiate, *for example,* an account that requires a multi-functional account team, small daily shipments, or special packaging. Traditional accounting tends to mask the real costs of the supply chain-focusing on cost type rather than the cost of activities and ignoring the degree of control anyone has (or lacks) over the cost drivers.

Supply Chain Implementation

Once the internal integration is underway companies can set their sights on the next challenge executing the supply chain strategy and building the bridges to the external partners. This is not an easy task, even for the best run organizations. It takes a dedicated effort and committed people who know the meaning of persistence.

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Here is a framework for setting and then implementing a strategic supply chain agenda. Under the team's guidance, the agenda-setting process would proceed along four steps.

1. Assess the Organization's Supply-Chain Competitiveness

The evaluation begins by comparing business objectives to existing capabilities and performance. This exercise typically reveals where the existing supply chain can achieve immediate competitive advantage and where inefficiencies may be leaving the company vulnerable to the competition.

2. Create a Vision of the Desired Supply Chain

Through a series of "visioneering" sessions that include key customers and suppliers, the team considers how such trends as globalization, channel shifts, and new technology will affect the desired supply chain configuration. It addresses such questions as, what supply chain factors and performance levels drive customer buying decisions? What would make one supply chain a winner over others?

3. Define those Actions Required to Close the Gap between Tomorrow's Vision and Todays' Reality

The team identifies possible re-engineering, restructuring, or other actions that could help narrow any gaps. At this stage, the team also works closely with management to assess the organization's readiness to pursue needed changes.

4. Prioritize the Action Items Identified and then Commit the Appropriate Resources

The end result of this task should be a unified commitment to a supply chain strategy and a clear agenda to achieve that strategy.

Advantage of Supply Chain Management

These are some advantage of using SCM:

Advanced use of IT

Data and information flow readily to all parts of the supply chain. Web enabled ordering use this complex information to enable better, faster decisions that then are quickly communicated throughout the supply chain.

Quantitatively based Performance Management

Measurements of multiple performance factors occur frequently at each stage in the supply chain. Time and cost are key measures, but others are used as appropriate to the specific supply chain. All measures relate to the ultimate supply chain goals.

Use of Cross-Functional Teams

Teams of people from the interrelated functional operations working closely together can cut through the normal organizational barriers to find local and distributed improvements that benefit the overall supply chain performance.

Attention to Human Factors and Organization Dynamics

Use of the best human and organization coordination/cooperation/measurement/reward techniques facilitates supply chain innovation and implementation. This level of attention is needed to offset the tendency of individual accountability and work-unit accountability to create barriers to supply chain cooperation.

By simultaneously enhancing customer satisfaction and profitability, SCM can modify these warring objectives into a formula for sustainable competitive advantage.

5.6. CUSTOMER RELATIONSHIP MANAGEMENT

Instead of treating customers as exploitable sources of income, businesses are now viewing them as long-term asserts to be nurtured through customer relationship management (CRM). **Customer relationship management (CRM)** focuses on managing all of the ways that a firm deals with its existing and potential new customers. CRM is both a business and technology discipline that uses information systems to coordinate all of the business processes surrounding the firm's interactions with its customers in sales, marketing, and service. The ideal CRM system provides end-to-end customer care from receipt of an order acquisition through product delivery. In the past, a firm's processes for sales, service, and marketing were highly compartmentalized and did not share much essential customer information. Some information on a specific customer might be stored and organized in terms of that person's account with the company. Other pieces of information about the same customer might be organized by products that were purchased. There was no way to consolidate all of this information to provide a unified view of a customer across the company. CRM tools try to solve this problem by integrating the firm's customer-related processes and consolidating customer information from multiple communication channels–the telephone, e-mail, wireless devices, or the Web so that the firm can put one coherent face to the customer. Good CRM systems consolidate customer data from multiple sources and provide analytical tools for answering questions such as: What is the value of a particular customer to the firm over his or her lifetime?

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Who are our most loyal customers? (It costs six times more to sell to a new customer than to an existing customer). Who are our most profitable customers? (Typically 80–90% of a firm's profits are generated by 10–20% of its customers.) What do these profitable customers want to buy? Firms can then use the answers to acquire new customers, provide better service and support, customize their offerings more precisely to customer preferences, and provide ongoing value to retain profitable customers.

Customer Relationship Management is an information industry term for methodologies, software, and usually Internet capabilities that help an enterprise manage customer relationships in an organized way. *For example,* an enterprise might build a database about its customers that described relationships in sufficient detail. Therefore, management, salespeople, people providing service, and perhaps the customer directly could access information, match customer needs with product plans and offerings, remind customers of service requirements, and know what other products a customer had purchased.

CRM consists of: Helping an enterprise to enable its marketing departments to identify and target their best customers, manage marketing campaigns with clear goals and objectives, and generate quality leads for the sales team.

Providing employees with the information and processes necessary to know their customers, understand their needs, and effectively build relationships between the company, its customer base, and distribution partners.

CRM is a comprehensive approach that provides seamless coordination between sales, customer service, marketing, field support and other customer-touching functions. CRM integrates people, process and technology to maximize relationships with all your customers including eCustomers, distribution channel members, internal customers and suppliers. CRM increasingly leverages the Internet.

Components of CRM

The definition of CRM will evolve and change over time. However, CRM will consist of the following 13 components, at least for the near future. This means that our initial CRM system will consist of one or more of these components, and is likely to grow over time to include additional components from this list, as well as new components that will emerge as the CRM industry matures.

1. Sales functionality.
2. Sales management functionality.
3. Telemarketing/ telesales functionality.

4. Time management functionality.
5. Customer service and support functionality.
6. Marketing functionality.
7. Executive information functionality.
8. Field service support functionality.
9. Enterprise portals.
10. E-commerce functionality.
11. ERP integration functionality.
12. Data synchronization functionality.
13. Multi-modal access.

History of CRM

With the advent of e-commerce, comes the e-customer. The e-customer expects constant access to a company, through e-mails; call centres, faxes and Web sites. They demand immediate response and a personalized touch. Meeting their needs places new demands on the enterprise. Since traditional enterprise resource planning applications did not include a customer management aspect, CRM was the logical next step.

Two trends have brought CRM to the forefront. First, as global competition has increased and products have become harder to differentiate, companies have begun moving from a product-centric view of the world to a customer-centric one.

Second, technology has ripened to the point where it's possible to put customer information from all over the enterprise into a single system. Until recently, we didn't have the ability to manage the complex information about customers, because information was stored in 20 different systems. But as network and Internet technology has matured, CRM software has found its place in the world.

Necessity of CRM

Many companies are turning to customer-relationship management systems to better understand customer wants and needs. CRM applications, often used in combination with data warehousing, E-commerce applications and call centres allow companies to gather and access information about customer's buying histories; preferences, complaints and other data so they can better anticipate what customers will want. The goal is to instill greater customer loyalty.

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Other benefits of CRM are:

1. The ability to provide faster response to customer inquiries.
2. Increased efficiency through automation.
3. Having a deeper knowledge of customers.
4. Getting more marketing or cross-selling opportunities.
5. Identifying the most profitable customers.
6. Receiving customer feedback that leads to new and improved products or services.
7. Doing more one-to-one marketing.
8. Obtaining information that can be shared with the company's business partners.

eCRM

Conventional Customer Relationship Marketing done electronically is eCRM. Companies understand that Electronic Customer Relationship Marketing (eCRM) has significant potential; but they face the challenge of building the required technology infrastructure quickly and cost effectively. A more sound approach is to install a comprehensive software platform of five engines that together enable the eCRM business process. These five engines are:

1. The Customer-centric Information Store

To consolidate information about millions of customers together with preferences, permissions, and information that may be useful to them. A Customer centric Information Store integrates data from disparate information sources such as web sites, transactional systems, operational databases, call centres, enterprise resource planning systems, and third party data. This engine enables companies to recognize and respond accurately to customers, whether they purchase products through a physical store; telephone a call centre; or browse a web site. Three factors are critical to its success:

Scalability: Companies tend to underestimate the volume of data that is required for developing a comprehensive 360 degree view of customers and visitors.

Flexibility: The Customer-centric Information Store must accommodate multiple data models and database architectures and allow for integration with other back-end information systems. Without this flexibility, the usefulness of this engine will diminish over time. Customer information stores are dynamic, growing entities that have to keep up with every customer's interaction with the company.

High performance: Speed and accuracy of access to customer-centric information is essential for enabling a true value exchange with customers.

2. The Analysis and Segmentation Engine

To leverage this customer information, to build a business campaign strategy and evaluate its success. Building trusted customer relationships depends on accurate customer segmentation. The Analysis and Segmentation Engine performs business analysis, segmentation, and prediction so that customer interactions take place in an appropriate and personalized manner. Without this engine eCRM lacks the intelligence to be effective even if it has massive volumes of customer centric information.

There are three major categories of analysis and segmentation techniques: Online Analytical Processing (OLAP), Data Mining, and Statistics. Briefly, OLAP tools perform complex queries on a database, Data Mining tools discover unforeseen associations using pattern matching algorithms, and Statistical tools perform complex mathematical operations on sets of data. Each technique has its strengths.

3. The Personalization Engine

To personalize the entire customer experience, configuring unique sets of messages and offers to each customer. New technology makes it possible to personalize products and services for large numbers of customers in a cost effective manner by lowering the marginal cost of personalization. Until now, personalized attention and service were labor intensive and not scalable to serve a large customer base without high costs.

4. The Broadcast Engine

To proactively deliver information and offers to every customer via the media of his or her choice. Growing appetite for non web communication is not just a consumer phenomenon, but a business shift, as well. Corporate use of wireless technology is increasing dramatically. Successful eCRM requires an engine that reaches millions of customers wherever they are: at home, via phone, or TV set-top box; at work; via e-mail; or on the road, via WAP phone or pager. A scalable Broadcast Engine that is built on an open architecture and supports all communication devices enables this level of customer interaction.

5. The Transaction Engine

To facilitate the interactions between customer and the company, either exchanging information or driving transactions. An effective Transaction Engine promotes information exchange between every customer and the enterprise. Like the small town shopkeeper who often conversed with his customers and remembered significant details, the Transaction Engine maintains customer contact and transmits information to the Customer-

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centric Information Store for later use. Leveraging the other four eCRM Engines, the Transaction Engine develops informed lifelong customer relationships.

The Transaction Engine facilitates the value exchange and provides a single interface to any set of information sources. The Transaction Engine also acts as a third-party purchase facilitator for the consumer. The consumer provides relevant preferences via any device and the Transaction Engine vends the relevant information. Smart consumers want trustworthy product information before every potential purchase. To gain confidence in their product purchases, customers will interact with many vendors to gather information, conduct comparative analysis, and then decide which products to buy. The Transaction Engine promotes and ultimately brokers customer transactions.

The Transaction Engine manages the flow of information and services through each customer device and provides appropriate value-added features and functionality. This is achieved by integrating closely with the Broadcasting and Personalization Engines.

Properly configured, these five engines collectively form a robust, scalable, and flexible platform for eCRM. Prefabricated and custom made software can be seamlessly integrated into the platform to provide a virtual shopkeeper to millions of customers. Equipped with such infrastructure, companies can continually create significant customer value at Internet speed, automating the who, what, when, where, and how of sales and marketing.

Types of CRM Systems

Let's take a closer look at some of the many flavors of CRM systems. What data do they provide and which functions do they support? What is the current position of the sales, marketing and service software industry? We find that CRM systems cover one or several of the customer facing areas of sales, marketing and service.

Operational Oriented CRM Systems

It can hold transactional level data on individual products, customers and transactions. They provide support for customer facing processes done by direct mail, phone, the Internet, third party agents, field sales. These operational CRM applications are part of what is also called front-office applications.

Analytical CRM Systems

It will hold aggregated data where the unit of analysis is the campaign, market segment, key account, and market or product group. They provide support for strategic planning processes.

Collaborative CRM

It is the use of new and traditional GroupWare web technologies to facilitate customer, staff and business partner communications.

CRM Implementation

Seven steps to pick the right CRM solution. There are so many options in the market, how do you pick the right solution? Don't panic. Adapted this methodology, here are seven steps to help you figure it out.

1. Remember you can't automate your way to CRM. CRM starts with a customer-centric business strategy, usually requires some changes to processes and organization, and yes, needs good technology too.
2. With senior management sponsorship, develop a short list of business objectives for your CRM project. Be precise "Sharing information" doesn't count.
3. With these objectives in mind, develop a working list of up to 10 CRM vendors that seem like reasonable candidates due to their functionality, market focus, price point, reputation, etc.
4. Cut the list to three by evaluating responses to a short Request For Information (RFI) that you design. Don't worry about pricing. If you get a proposal not in your format, throw it away.
5. Develop a real-world scenario that hits the features, users want most, and deliver the business benefits you need. Ask your shortlist vendors to prepare a presentation and demonstration that follows this scenario, and invite a cross-function team to rate the results.
6. Pick the best one based on quantitative (*e.g.*, demonstration score) and other factors such as vendor strength, technology platform, and customer references. Negotiate the best price you can. Don't like the deal? Work with #2.
7. Take a break, then go back to read step #1 again. Your CRM journey of a thousand miles has just started with one step. Enjoy the rest of the trip.

Steps to Ensure a Successful Implementation

- **Define your business plan:** Before you think about customer relationship management (CRM) solutions; identify the specific business objectives that you want to achieve with the new system, such as increasing customer satisfaction, reducing sales cycles, and increasing close rates. Understand the value of having an automated system.
- **Build a team:** Support and commitment throughout an organization are crucial to a successful implementation, so develop a team that will carry the project through. A representative from each department who

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will use the sales system should be part of the team. *For example,* a team may include a vice president of sales, sales managers, sales representatives, a sales administrator, an IT manager, a finance person, and a database administrator. At the start, establish a project manager who has project management skills and keep your sales force involved in the system's planning and design.

- **Evaluate your sales process:** Make sure you take time to plan and understand your business processes before evaluating possible solutions. To perform your workflow analysis, interview members of your organization to see how they define the sales process. Get your top sales people involved and decide what the best practice is. Examine your process and try to eliminate unnecessary steps.
- **Define your requirements:** Once you understand how your business works, define which functions are required from a business perspective and from a salesperson's perspective. Involve-the end-users to find out what helps them and what they would use. There are two main user groups: managers and salespeople. Managers will be interested in features for forecasting, funnel management, and reporting. Salespeople will want to quickly generate accurate quotes and proposals, product catalogs, and customer histories.
- **Vendor selection:** Make sure vendors understand the specific problems that you are trying to solve. Understand what the vendor's solution can offer YQU and ask how the vendor uses it. Make sure to obtain everything in writing including schedules, time lines, and who is responsible for what. Don't stop there: Interview customers about their experience, costs, and the implementation process.
- **Development and deployment:** The design of a CRM solution should be a joint effort between customer and vendor. To focus, only deploy what is needed immediately and add functionality in phases. Prioritize the rollout to user groups and define a pilot user group.

Step by Step Approach to CRM Implementation

The phase approach allows you to adjust the system as necessary without disrupting end-users. Implement a solution in phases by implementing only the necessary features at any given time.

Phase 1	Define your business process and requirements.
Phase 2	Develop a front-end system.
Phase 3	Deploy hardware and software to pilot division region.
Phase 4	Train staff and end-users.
Phase 5	Evaluate results and make adjustments.

Phase 6	Deploy software to the next division, then another, then to the rest of the company.
Phase 7	Train, train, and retrain.
Phase 8	Start integration with other applications.

Use of Technology in CRM

The Internet has dramatically changed the way your customers expect to interact with your sales force. But how do you quickly implement a customer relationship management (CRM) solution that will provide sales and customer service assistance without breaking the bank? This Test Centre Comparison looks at three midmarket leaders that seek to cut back the customization and deployment costs associated with high-end CRM, yet provide enough substance and flexibility to make a difference in your sales success.

Companies That Have Implemented CRM

American Express

After finally coming up with a great TV ad campaign, American Express decided to get serious about CRM. Anne Grim, the senior vice president and general manager of American Express Company's Customer Information Management group, is the result of that. Grim's group at Amex is charged with making sure each business unit delivers the right combination of products and services to a diverse mix of personal and professional clients and ensuring that each business unit complies with the company's stringent privacy protection policies. Grim's job, in essence, is to unify the company by helping it keep, on top of what customers want.

The group has made some changes, according to a case study in a issue of eWeek. Amex customers can already review credit card statements and pay bills online, as well as tally frequent traveller membership awards. They can receive personalized services on My American Express, a Web site that brings together all of a customer's services into one easy-to-manage interface. And a new pilot program allows customers to interact with an Amex representative via live chat on the Web site.

DuPont

Chemicals giant DuPont is developing a CRM system to collect customer information from all points of interaction-phone, fax, Internet, and even face-to-face discussions and to quickly distribute it to all relevant personnel, according to a case study in a recent issue of Chemical Week. This will allow us to substantially improve our interactions with specific customers and an entire customer segment says Cinda Hallman, senior vice president

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of information technology at DuPont. The key, as is true in any serious CRM implementation, is to make it as easy as possible for customers to do business with DuPont. The goal is straightforward, and is being pursued by a number of other leading chemical companies, but it will not be easy to achieve, particularly given the substantial organizational and supply chain challenges associated with improving customer relationships.

This is difficult in what has been, up to now, such a product-focused industry as chemical products. "[CRM] will be one of the e-business applications driving our company and the entire chemical industry toward some very fundamental changes." Hallman says. Those include a dramatic shift in the industry's traditional focus on products. Although manufacturing excellence will always be important to chemical companies, e-business will lead to an increasing focus on customer satisfaction. In the future we will have to do more than manufacture and sell products, because e-business is generating fundamentally new value propositions. "We are now at the point where value needs to be defined in terms of end-to-end customer experiences, instead of being based largely on products, says Hallman.

5.7. PROCUREMENT MANAGEMENT SYSTEM

Procurement Management System provides you a solution to conduct centralized purchase based on the demands individually submitted and approved by competent authorities. It also provides an interface to initiate the demands are approved electronically after which combine purchases are made which includes automatic receipt of approval, generation of comparative statements (CST), generation of FAX for multiple demands, preparation of purchase orders. Store receipts on computer and issue of delivery challans to store- section is also accomplished electronically.

Procurement Management System is a system that provides a place for those small businesses-to purchase their inventories at a reasonable price. The idea of this system is to combine those orders that are purchasing the same product in order to gain the benefit of economic of scale when negotiating the selling price with supplier. Procurement Management System plays the role of a middleman that manages the process of purchasing transaction. So, this system will deal with two types of clients, one is consumer, and the other one is supplier. Each of them will enjoy different kinds of services and functions.

Features of Procurement Management System

The procurement function in any organization can have various dimensions; direct or indirect procurement and transactional or strategic procurement based on the types of materials being bought or the procurement process involved. The system procurement management must address these challenges to meet the requirements of various materials and the processes for different industries. In the modern era of IT, the Internet is being exploited as an effective medium for communication and collaboration between buyers, supplies and trading partners to efficiently conduct procurement practices. The various dimensions of procurement can be represented as below:

Transactional and Strategic Procurement

Transactional procurement represent the activities involved in procurement process in exchanging the purchase documents such as Request For Quotations (RFQ), purchase orders, invoices, shipping documents, payment documents etc., between the buyers, suppliers and the trading partners.

The procurement salary for transactional document must have an effective workflow engine to replicate the existing procurement process-and must be easily customizable to address the changing needs of the business processes with internal and external partners. The PMS must provide an excellent collaboration platform between buyers, suppliers and trading partners. In addition, the procurement solution must be able to integrate with the existing systems on both the buyer and the supplier side.

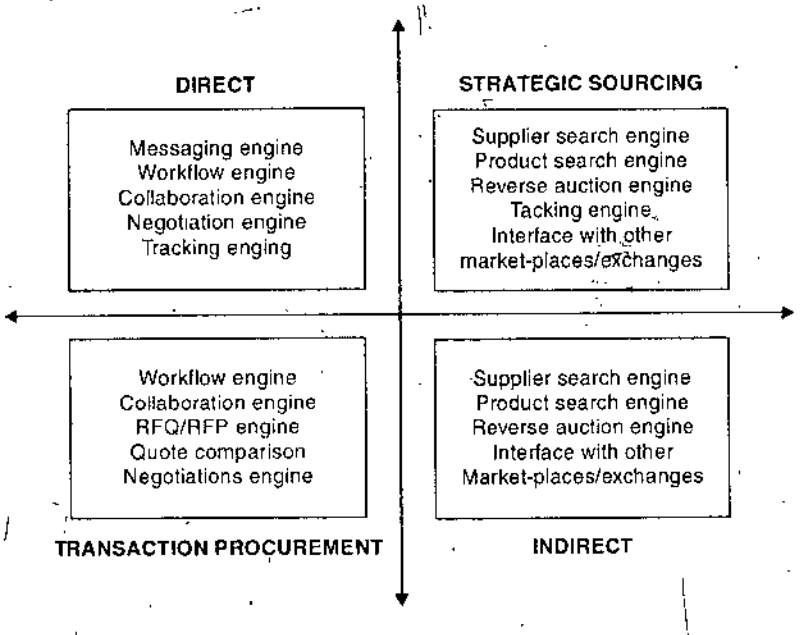

Figure 5.18. *Various dimensions of procurement management system*

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Strategic Procurement

Whereas strategic procurement involves supplier search, supplier evaluation, supplier qualification, contract negotiations, monitoring vendor performance and rating. The need for extensive collaboration between various departments in buyer and supplier organizations at all levels cannot be overstated. To address these needs of strategic procurement, the PMS application must have state-of-the-art search capabilities of suppliers and products, and interfaces to other vertical exchanges and market places.

Direct Procurement

Direct procurement are for items that go into the Bill of Materials (BOM) for production, whereas indirect procurement are support items required enabling the production. The requirements of procurement of direct and indirect materials are totally different, as they have to satisfy different conditions based on the suppliers. Direct procurement must assure large volume of items with high consistent quality just-in-time. The suppliers of direct materials have had longstanding relationship with the buyers and the procurement process has been developed over years of best business practices. Any change in suppliers is very complex long drawn process. Direct materials are bought repeatedly for production from approved suppliers. Price is not the only factor in direct material procurement. Quality, supply, consistency, JIT are also of paramount importance. The transactional automation of business processes such as purchase order placement, invoicing, shipping, tracking, goods receipt and payment between buyers and suppliers, improving efficiency and collaboration between trading partners are the main focus in e-procurement solutions for direct materials. Effective messaging engine and dynamic workflow engine are critical to meet these requirements.

Indirect Procurement

Whereas the procurement of indirect material involves MRO (Maintenance, Repair and Operational) items required to support the production. Indirect materials are mostly one-time purchase in limited quantities as and when there is need. Indirect materials can be bought from multiple suppliers based on price performance. The suppliers or the products can be easily changed or substituted. Continuous new supplier search, new product search, request for quotations, quote comparisons, negotiations engine, reducing negotiation time by using effective reverse auction engines are, the prime focus of e-procurement solutions for indirect materials.

Procurement Performance Planning Model

- PMS combines complex sales forecasting with comprehensive procurement planning for efficient inventory management.
- Provides for: Multi Company/Divisional Hierarchy Multi Level Product Structure Comprehensive analysis by Value (Sales and Cost).
- The system is robust and capable of handling large volumes of data. System overheads are relatively small because data is stored-in compiled matrixes.
- Units and Contribution User defined (as well as system defined) Units Bill of Materials.
- Each business unit to analyze forecast and report its own products/ categories Drill Down.
- Forecasts to be linked to inventory Rolling Forecasts Multiple Currencies Access to information restricted to authorized users Flexible "What-if" Comparison Rapid "What-if" Scenario Simulations Comprehensive Reporting (on-screen, printed or graphic format).
- PMS is built around a modeling engine, ensuring fast accurate processing of numerical data.
- PMS is built around a modeling engine, ensuring fast accurate processing of numerical data. The system is robust and capable of handling large volumes of data. System overheads are relatively small because data is stored in compiled matrices.

SUMMARY

- Tactical managers, also called middle managers, receive general directions and goals from their superiors and, within those guidelines; they make decisions for their subordinates, affecting the near and somewhat more distant future.
- Data range refers to the amount of data from which information is extracted, in terms of the number of organizational units supplying data or the length of time the data covers.
- A major political challenge is that many countries have rules regulating or prohibiting transfer of data across their national boundaries, especially personal information such as personnel records. Geoeconomic challenges in global business and IT refer to the effects of geography on the economic realities of international business activities. Cultural challenges facing global business and IT managers include differences in languages, cultural interests, religions, customs, social attitudes, and political philosophies.