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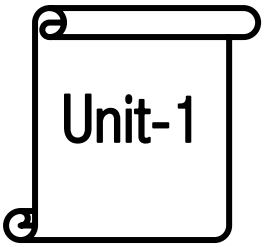


Information systems in Global business today

1.1 Definition of Information system

An **information system** can be defined technically as a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization. In addition to supporting decision making, coordination, and control, information systems may also help managers and workers analyse problems, visualize complex subjects, and create new products.

Information system contain information about significant people, places, and things within the organization or in the environment surrounding it. By **information** we mean data that have been shaped into a form that is meaningful and useful to human beings. **Data**, in contrast, are streams of raw facts representing events occurring in organizations or the physical environment before they have been organized and arranged into a form that people can understand and use.

Three activities in an information system produce the information that organizations need to make decisions, control operations, analyse problems, and create new products or services. These activities are:

a. Input
b. Process
c. Output

Input : Input captures or collects raw data from within the organization or from its external environment.

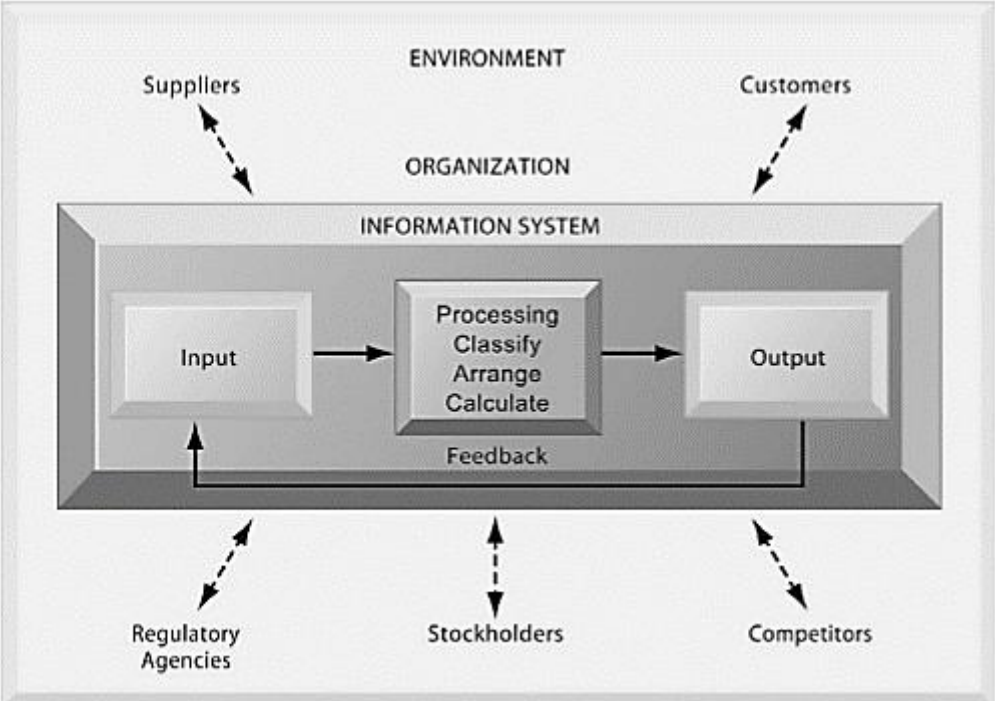
Process: Processing converts this raw input into a meaningful form.

Output: Output transfers the processed information to the people who will use it or to the activities for which it will be used.

Information system also require **feedback**, which is output that is returned to appropriate members of the organization to help them evaluate or correct the input stage.

Computer based information systems use computer technology to process raw data into meaningful information, there is a sharp distinction between a computer and a computer program on the one hand, and an information system on the other. Electronic computers are related software programs are the technical foundation, the tools and materials, of modern information systems. Computers provide the equipment for storing and processing information. Computer programs, or software, are sets of operating instructions that direct and control computer processing. Knowing how computers and computer programs work is important in designing solutions to organizational problems, but computers are only part of an information system.

Functions of an information system:



Points to remember:

An information system contains information about an organization and its surrounding environment. Three basic activities—input, processing, and output—produce the information organizations need. Feedback is output returned to appropriate people or activities in the organization to evaluate and refine the input. Environmental actors, such as customers, suppliers, competitors, stockholders, and regulatory agencies, interact with the organization and its information systems.

Dimensions of Information Systems

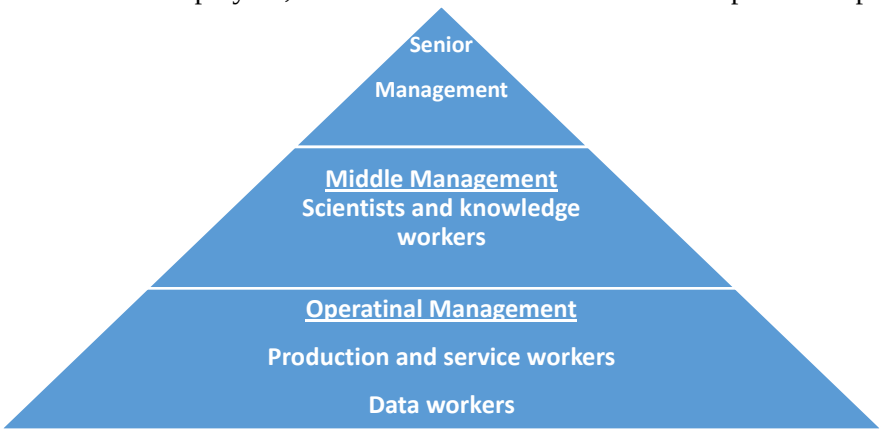
To fully understand information systems, we must understand the broader organization, management, and information technology dimensions of systems and their power to provide solutions to challenges and problems in the business environment.

1. **Organizations:**

Information system are integral part of organizations. Indeed, for some companies, such as credit reporting firms, there would be no business without an information system. The key elements of an organization are its people, structure, business processes, politics, and culture.

Organizations have a structure that is composed of different levels and specialties. Their structures reveal a clear-cut division of labor. Authority and responsibility in a business firm are organized as a

hierarchy, or a pyramid structure. The upper levels of the hierarchy consist of managerial, professional, and technical employees, whereas the lower levels consist of operational personnel.



Senior Management: Senior management makes long-range strategic decisions about products and services as well as ensures financial performance of the firm.

Middle management: Middle management carries out the programs and plans of senior management.

Operational management: Operational management is responsible for monitoring the daily activities of the business.

Knowledge workers, such as engineers, scientists, or architects, design products or services and create new knowledge for the firm, whereas data workers, such as secretaries or clerks, assist with scheduling and communications at all levels of the firm. Production or service workers actually produce the product and deliver the service.

Experts are employed and trained for different business functions. The major business functions, or specialized tasks performed by business organizations, consist of sales and marketing, manufacturing and production, finance and accounting, and human resources.

Major business functions:

Function	Purpose
Sales and marketing	Selling the organization's products and services
Manufacturing and production	Producing and delivering products and services
Finance and accounting	Managing the organization's financial assets and maintaining the organization's financial records.
Human resources	Attracting, developing, and maintaining the organization's labor force, maintaining employee records.

2. Management

Management's job is to make sense out of the many situations faced by organizations, make decisions, and formulate action plans to solve organizational problems. Managers perceive business challenges in the environment; they set the organizational strategy for responding to those challenges; and they allocate the human and financial resources to coordinate the work and achieve success. Throughout, they must exercise responsible leadership. But managers must do more than manage what already exists. They must also create new products and services and even re-create the organization from time to time. A substantial part of management responsibility is creative work driven by new knowledge and information. Information technology can play a powerful role in helping managers design and deliver new products and services and redirecting and redesigning their organizations.

3. Information Technology

Information technology is one of many tools managers use to cope with change.

Computer hardware is the physical equipment used for input, processing, and output activities in an information system. It consists of computers of various sizes and shapes (including mobile handheld devices); various input, output and storage devices; and telecommunications devices that link computers together.

Computer software consists of the detailed, pre-programmed instructions that control and coordinate the computer hardware components in an information system.

Data management technology consists of the software governing the organization of data on physical storage media.

Networking and telecommunications technology consisting of both physical devices and software, links the various pieces of hardware and transfers data from one physical location to another.

- **Internet:** The world's largest and most widely used network is the Internet. The internet is a global "network of networks" that uses universal standards to connect millions of different networks with more than 1.4 billion users in over 230 countries around the world.
- **Intranet:** Internal corporate networks based on internet technology are called intranets.
- **Extranet:** Private intranets extended to authorized users outside the organization are called extranets. The firms use such networks to coordinate their activities with other firms for making purchases, collaborating on design, and other inter organizational work.

1.2 Definition of management information system

Management Information System is an old management tool, which has been long used by people for superior management and scientific decision making. Management Information System is primarily dependent upon information, which is a vital ingredient of any Management Information System. Information is the most critical resource of Management Information System. We all know that information is a vital factor for our existence. Just as our body needs air, water and clothes, we are as much dependent upon information.

Definitions of MIS:

- Management Information System is an integrated, user-machine system for providing information to support operation, management and decision-making functions in an organization.
- A Management Information System aims at meeting the information needs of managers, particularly with regard to the current and past operations of the enterprise.
- Management Information System is a system which provides accurate, timely and meaningful data for management planning, analysis and control to optimize the growth of the organization.
- Management Information System also defined as a system that aids management in making, carrying out and controlling decisions. Here Management Information System is a system that aids management in performing its job.

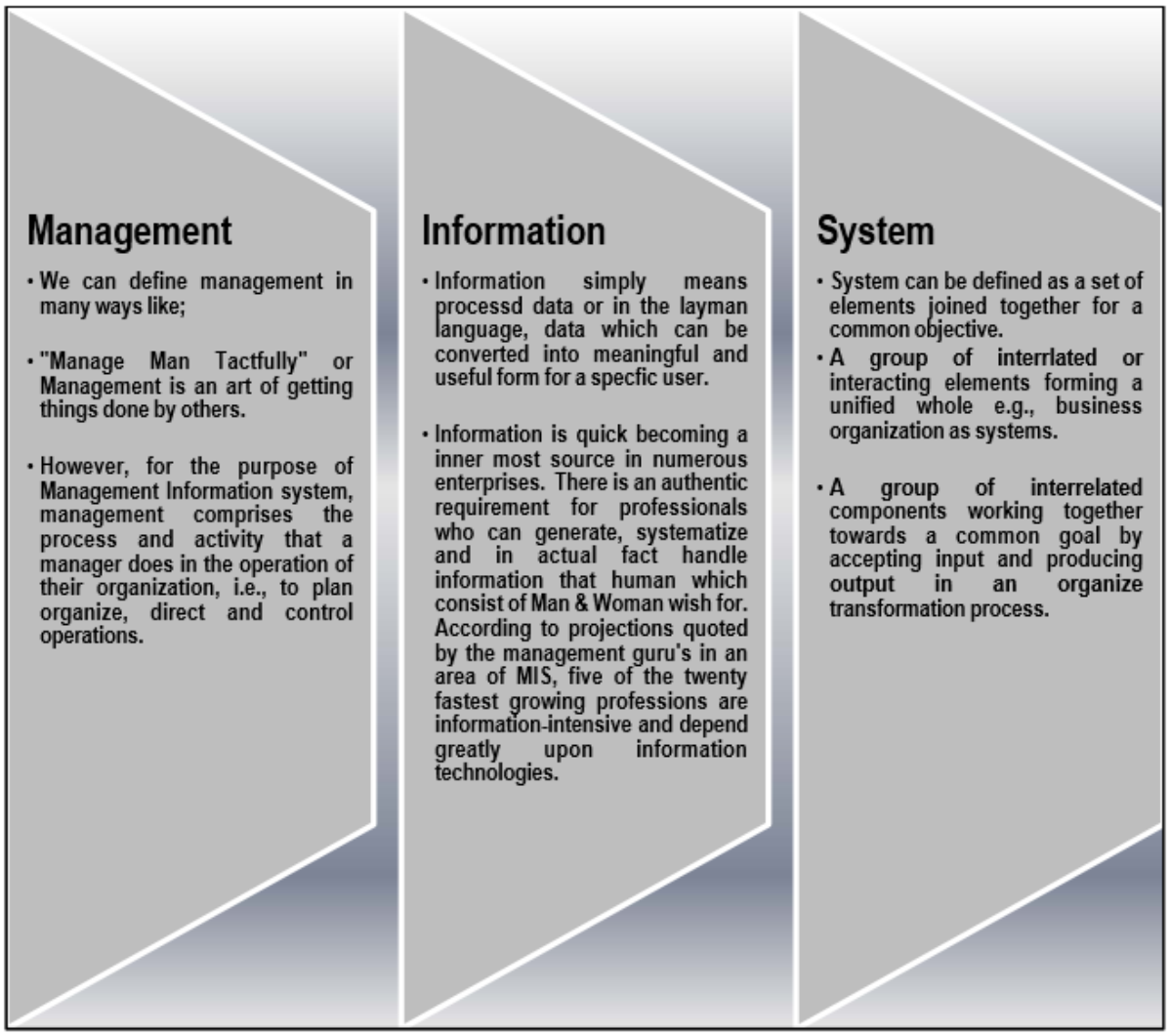


Fig: Exploratory thought on MIS

Developing MIS – Do's and Don'ts

Once we are in the process of developing MIS or rather makeup our mind to implement MIS, the best way is to accomplish some homework which can facilitate in finding out what is right and what is wrong.

S.N.	Particular	Do's	Don't
1	Layman	Have simpler and manageable system	Be ambitious
2	Bridging	Develop common understanding between consultant and the organization	Be unrealistic in developing action plan
3	Contribution in Totality	Involve programmer in needs assessment	Delay decisions on hiring application developers
4	Tailor-made	Customize off-the-shelf software	Depend heavily on the consultant
5	Interpretation	Have simple software for users to handle	Invest heavily in in-house application development
6	Synchronization	Extensively involve users in MIS development	Let vendors determine hardware needs for LAN
7	Application	Adopt modular approach for s/w development	Go for large applications

Some examples of MIS:

- Airline reservations (seat, booking, payment, schedules, boarding list, special needs etc.)
- Bank operations (deposit, transfer, withdrawal) electronically with a distinguish payment gateways.
- Integration of department with the help of contemporary software's like ERP
- Logistics management application to streamline the transportation system.
- Train reservation system etc.

So, management information system provide decision-makers with preselected types of information. MIS is generally in the form of computer-generated reports and usually generated from data obtained from transaction processing systems.

1.3 Role of information systems in business today

We can see the results of this massive spending around us every day by observing how people conduct business. More wireless cell phone accounts were opened than land lines installed. Cell phones, BlackBerrys, iPhones, e-mail and online conferencing over the Internet have all become essential tools for business. Most of the people nowadays access the Internet using mobile devices. Everyday millions of people go online to research a product or service.

iPhones, iPads, BlackBerrys, and web-surfing netbooks are not just gadgets or entertainment outlets. They represent new emerging computing platforms based on an array of new hardware and software technologies. More and more business computing is moving from PCs and desktop machines to these mobile devices. Managers are increasingly using these devices to coordinate work, communicate with employees, and provide information for decision making. We call these developments the "emerging mobile digital platform".

Change	Business Impact
Technology	
Cloud computing platform emerges as a major business area of innovation	A flexible collection of computers on the internet begin to perform tasks traditionally performed on corporate computers.
Growth in software as a service (SaaS)	Major business applications are now delivered online as an internet service rather than as boxed software or custom systems.
A mobile digital platform emerges to compete with the PC as a business system	Apple opens its iPhone software to developers, and then opens an applications store on iTunes where business users can download hundreds of applications to support collaboration, location-based services, and communication with colleagues. Small portable lightweight, low cost, net centric subnotebook computers are a major segment of the laptop marketplace. The iPad is the first successful tablet sized computing device with tools for both entertainment and business productivity.
Management	
Managers adopt online collaboration and social networking software to improve coordination, collaboration, and knowledge sharing.	Google Apps, Google Sites, Microsoft's Windows SharePoint services, and IBM's Lotus connections are used by over 100 million business professionals worldwide to support blogs, project management, online meetings, personal profiles, social bookmarks, and online communities.
Business intelligence applications accelerate	More powerful data analytics and interactive dashboards provide real time performance

	information to managers to enhance decision making.
Virtual meeting proliferates	Managers adopt telepresence video conferencing and web conferencing technologies to reduce travel time, and cost, while improving collaboration and decision making.
Organizations	
Web 2.0 applications are widely adopted by firms	Web-based services enable employees to interact as online communities using blogs, wikis, e-mail, and instant messaging services. Facebook and MySpace create new opportunities for business to collaborate with customers and vendors.
Telework gains momentum in the workplace	The internet, netbooks, iPads, iPhones, and BlackBerrys make it possible for growing number of people to work away from the traditional office.
Co-creation of business value	Sources of business value shift from products to solutions and experiences and from internal sources to networks of suppliers and collaboration with customers. Supply chains and product development are more global and collaborative than in the past; customers help firms define new products and services.

1.4 Globalization challenges and opportunities

- In 1492, Columbus reaffirmed what astronomers were long saying: the world was round and the seas could be safely sailed. As it turned out, the world was populated by peoples and languages living in isolation from one another, with great disparities in economic and scientific development. The world trade that ensued after Columbus's voyages has brought these peoples and cultures closer. The "industrial revolution" was really a world-wide phenomenon energized by expansion of trade among nations.
- In 2005, journalist Thomas Friedman wrote an influential book declaring the world was now "flat," by which he meant that the Internet and global communications had greatly reduced the economic and cultural advantages of developed countries. Friedman argued that the U.S. and European countries were in a fight for their economic lives, competing for jobs, markets, resources, and even ideas with highly educated, motivated populations in low-wage areas in the less developed world (Friedman, 2007). This "globalization" presents both challenges and opportunities for business firms.
- A growing percentage of the economy of the United States and other advanced industrial countries in Europe and Asia depends on imports and exports. In 2010, more than 33 percent of the U.S. economy resulted from foreign trade, both imports and exports. In Europe and Asia, the number exceeded 50 percent. Many Fortune 500 U.S. firms derive half their revenues from foreign operations. For instance, more than half of Intel's revenues in 2010 came from overseas sales of its microprocessors. Eighty percent of the toys sold in the U.S. are manufactured in China, while about 90 percent of the PCs manufactured in China use American-made Intel or Advanced Micro Design (AMD) chips.
- It's not just goods that move across borders. So too do jobs, some of them high-level jobs that pay well and require a college degree. In the past decade, the United States lost several million manufacturing jobs to offshore, low-wage producers. But manufacturing is now a very small part of U.S. employment (less than 12 percent and declining). In a normal year, about 300,000 service jobs move offshore to lower wage countries, many of them in less-skilled information system occupations, but also including "tradable service" jobs in architecture, financial services, customer call centers, consulting, engineering, and even radiology.

The challenge for us as a business student is to develop high-level skills through education and on-the-job experience that cannot be outsourced.

The challenge for our business is to avoid markets for goods and services that can be produced offshore much less expensively.

- The emergence of the Internet into a full-blown international communications system has drastically reduced the costs of operating and transacting on a global scale.
- Communication between a factory floor in Shanghai and a distribution center in Rapid Falls, South Dakota, is now instant and virtually free.
- Customers now can shop in a worldwide marketplace, obtaining price and quality information reliably 24 hours a day.
- Firms producing goods and services on a global scale achieve extraordinary cost reductions by finding low-cost suppliers and managing production facilities in other countries.
- Internet service firms, such as Google and eBay, are able to replicate their business models and services in multiple countries without having to redesign their expensive fixed-cost information systems infrastructure.

1.5 The emerging digital firm

A digital firm can be defined along several dimensions. A digital firm is one in which nearly all of the organization's significant business relationships with customers, suppliers, and employees are digitally enabled and mediated. Core business processes are accomplished through digital networks spanning the entire organization or linking multiple organizations.

Business processes refer to the set of logically related tasks and behaviours that organizations develop over time to produce specific business results and the unique manner in which these activities are organized and coordinated. Developing a new product, generating and fulfilling an order, creating a marketing plan, and hiring an employee are examples of business processes, and the ways organizations accomplish their business processes can be a source of competitive strength.

Key corporate assets—intellectual property, core competencies, and financial and human assets—are managed through digital means. In a digital firm, any piece of information required to support key business decisions is available at anytime and anywhere in the firm.

Digital firms sense and respond to their environments far more rapidly than traditional firms, giving them more flexibility to survive in turbulent times. Digital firms offer extraordinary opportunities for more flexible global organization and management. In digital firms, both time shifting and space shifting are the norm.

Time shifting refers to business being conducted continuously, 24/7, rather than in narrow "work day" time bands of 9 A.M. to 5 P.M.

Space shifting means that work takes place in a global workshop, as well as within national boundaries. Work is accomplished physically wherever in the world it is best accomplished.
Many firms, such as Cisco Systems. 3M, and IBM, are close to becoming digital firms, using the Internet to drive every aspect of their business. Most other companies are not fully digital, but they are moving toward close digital integration with suppliers, customers, and employees. Many firms, for example, are replacing traditional face-to-face meetings with "virtual" meetings using videoconferencing and Web conferencing technology.

1.6 Strategic business objectives of information systems

Entire sectors of the economy are nearly inconceivable without substantial investments in information systems. E-commerce firms such as Amazon, eBay, Google, and E-Trade simply would not exist. Today's service industries—finance, insurance, and real estate, as well as personal services such as travel, medicine, and education—could not operate without information systems. Similarly, retail firms

such as Walmart and Sears and manufacturing firms such as General Motors and General Electric require information systems to survive and prosper. Just as offices, telephones, filing cabinets, and efficient tall buildings with elevators were once the foundations of business in the twentieth century, information technology is a foundation for business in the twenty-first century.

There is a growing interdependence between a firm's ability to use information technology and its ability to implement corporate strategies and achieve corporate goals. What a business would like to do in five years often depends on what its systems will be able to do. Increasing market share, becoming the high-quality or low-cost producer, developing new products, and increasing employee productivity depend more and more on the kinds and quality of information systems in the organization. The more you understand about this relationship, the more valuable you will be as a manager.

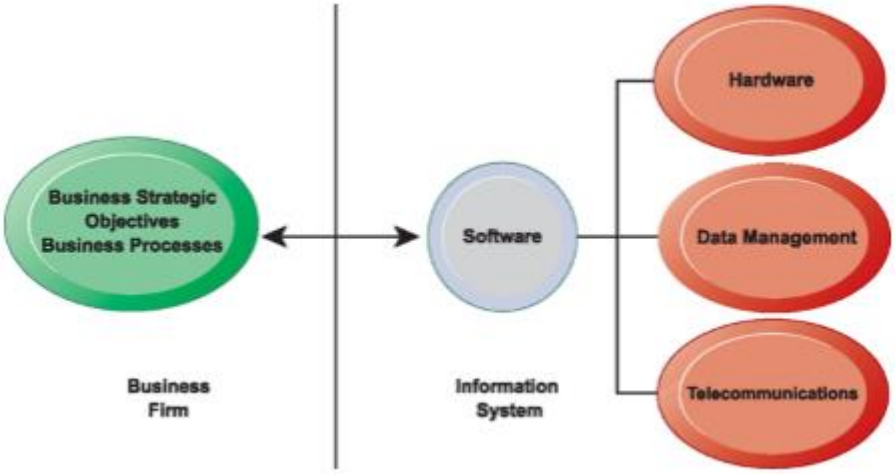


Fig: The interdependence between organizations and information systems

Points to Remember

In contemporary systems there is a growing interdependence between a firm's information systems and its business capabilities. Changes in strategy, rules, and business processes increasingly require changes in hardware, software, databases, and telecommunications. Often, what the organization would like to do depends on what its systems will permit it to do.

Specifically, business firms invest heavily in information systems to achieve six strategic business objectives: operational excellence; new products, services, and business models; customer and supplier intimacy; improved decision making; competitive advantage; and survival.

1. Operational Excellence

Businesses continuously seek to improve the efficiency of their operations in order to achieve higher profitability. Information systems and technologies are some of the most important tools available to managers for achieving higher levels of efficiency and productivity in business operations, especially when coupled with changes in business practices and management behavior.

2. New Products, Service, and Business Models

Information systems and technologies are a major enabling tool for firms to create new products and services, as well as entirely new business models. A business model describes how a company produces, delivers, and sells a product or service to create wealth.

3. Customer and Supplier Intimacy

When a business really knows its customers, and serves them well, the customers generally respond by returning and purchasing more. This raises revenues and profits. Likewise with suppliers: the more a business engages its suppliers, the better the suppliers can provide vital inputs. This lowers costs. How to really know your customers, or suppliers, is a central problem for businesses with millions of offline and online customers.

4. Improved Decision Making

Many business managers operate in an information fog bank, never really having the right information at the right time to make an informed decision. Instead, managers rely on forecasts, best guesses, and luck. The result is over or underproduction of goods and services, misallocation of resources, and poor response times. These poor outcomes raise costs and lose customers. In the past decade, information systems and technologies have made it possible for managers to use real-time data from the marketplace when making decisions.

5. Competitive Advantage

When firms achieve one or more of these business objectives—operational excellence; new products, services, and business models; customer/supplier intimacy; and improved decision making—chances are they have already achieved a competitive advantage. Doing things better than your competitors, charging less for superior products, and responding to customers and suppliers in real time all add up to higher sales and higher profits that your competitors cannot match.

6. Survival

Business firms also invest in information systems and technologies because they are necessities of doing business. Sometimes these "necessities" are driven by industry-level changes. For instance, after Citibank introduced the first automated teller machines (ATMs) in the New York region in 1977 to attract customers through higher service levels, its competitors rushed to provide ATMs to their customers to keep up with Citibank. Today, virtually all banks have regional ATMs and link to national and international ATM networks.

1.7 Business perspective of information system

Managers and business firms invest in information technology and systems because they provide real economic value to the business. The decision to build or maintain an information system assumes that the returns on this investment will be superior to other investments in buildings, machines, or other assets. These superior returns will be expressed as increases in productivity, as increases in revenues (which will increase the firm's stock market value), or perhaps as superior long-term strategic positioning of the firm in certain markets (which produce superior revenues in the future).

We can see that from a business perspective, an information system is an important instrument for creating value for the firm. Information systems enable the firm to increase its revenue or decrease its costs by providing information that helps managers make better decisions or that improves the execution of business processes. For example, the information system for analysing supermarket checkout data can increase firm profitability by helping managers make better decision on which products to stock and promote in retail supermarkets.

Every business has an information value chain, as illustrated in figure, in which raw information is systematically acquired and then transformed through various stages that add value to that information. The value of an information system to a business, as well as the decision to invest in any new information system, is in large part, determined by the extent to which the system will lead to better management decisions, more efficient business processes, and higher firm profitability. Although there are other reasons why systems are built, their primary purpose is to contribute to corporate value.

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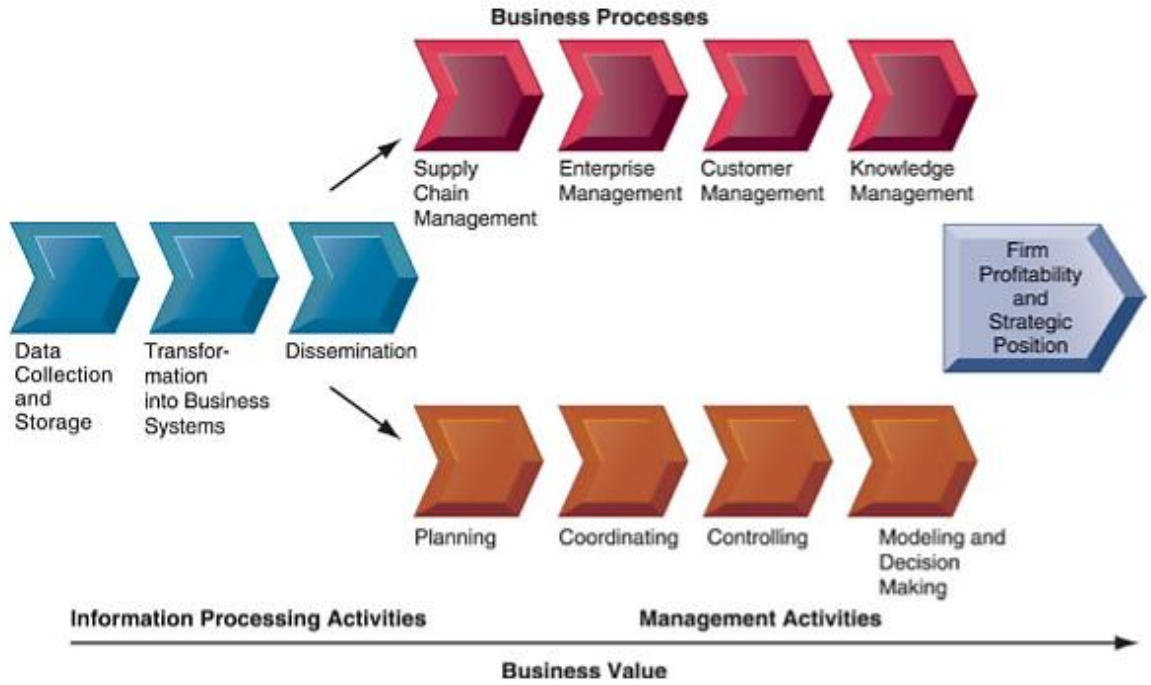


Fig: The business information value chain

Points to Remember
From a business perspective, information systems are part of a series of value-adding activities for acquiring, transforming, and distributing information that managers can use to improve decision making, enhance organizational performance, and, ultimately, increase firm profitability.

From a business perspective, information systems are part of a series of value-adding activities for acquiring, transforming, and distributing information that managers can use to improve decision making, enhance organizational performance, and, ultimately, increase firm profitability.

The business perspective calls attention to the organizational and managerial nature of information systems. An information system represents an organizational and management solution, based on information technology, to a challenge or problem posed by the environment.

Complementary social, managerial and organizational assets required to optimize returns from information technology investments:

Organizational assets	• Supportive organizational culture that values efficiency and effectiveness • Appropriate business model • Efficient business processes • Decentralized authority • Distributed decision-making rights • Strong IS development team
Managerial assets	• Strong senior management support for technology investment and change • Incentives for management innovation • Teamwork and collaborative work environments • Training programs to enhance management decision skills • Management culture that values flexibility and knowledge-based decision making.
Social assets	• The internet and telecommunications infrastructure

	• IT-enriched educational programs raising labor force computer literacy. • Standards (both government and private sector) • Laws and regulations creating fair, stable market environments • Technology and service firms in adjacent markets to assist implementation.

Contemporary approaches to Information Systems

The study of information systems is a multidisciplinary field. No single theory or perspective dominates. Following figure illustrates the major disciplines that contribute problems, issues, and solutions in the study of information systems. In general, the field can be divided into technical and behavioural approaches.

Technical Approach:

The technical approach to information system emphasizes mathematically based models to study information systems, as well as the physical technology and formal capabilities of these systems. The disciplines that contribute to the technical approach are computer science, management science, and operations research.

Computer science is concerned with establishing theories of computability, methods of computation, and methods of efficient data storage and access. Management science emphasizes the development of models for decision making and management practices. Operations research focuses on mathematical techniques for optimizing selected parameters of organizations, such as transportation, inventory control, and transaction costs.

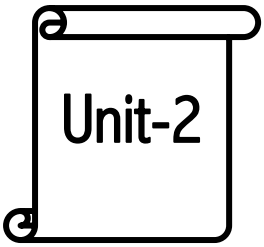
Behavioral approach:

An important part of the information systems field is concerned with behavioral issues that arise in the development and long-term maintenance of information systems. Issues such as strategic business integration, design, implementation, utilization, and management cannot be explored usefully with the models used in the technical approach. Other behavioral disciplines contribute important concepts and methods.

For instance, sociologists study information systems with an eye toward how groups and organizations shape the development of systems and also how systems affect individuals, groups, and organizations. Psychologists study information systems with an interest in how human decision makers perceive and use formal information.

Economists study information systems with an interest in understanding the production of digital goods, the dynamics of digital markets, and how new information systems change the control and cost structures within the firm.

The behavioral approach does not ignore technology. Indeed, information systems technology is often the stimulus for a behavioral problem or issue. But the focus of this approach is generally not on technical solutions. Instead, it concentrates on changes in attitudes, management and organizational policy, and behavior.



Global E-business and Collaborations

2.1 Business Process and Information Systems

In order to operate, businesses must deal with many different pieces of information about suppliers, customers, employees, invoices and payments, and of course their products and services. They must organize work activities that use this information to operate efficiently and enhance the overall performance of the firm. Information systems make it possible for firms to manage all their information, make better decisions, and improve the execution of their business processes.

Business Processes:

Business process refer to the manner in which work is organized, coordinated, and focused to produce a valuable product or service. Business processes are the collection of activities required to produce a product or service. These activities are supported by flows of material, information, and knowledge among the participants in business processes. Business processes also refer to the unique ways in which organizations coordinate work, information, and knowledge, and the ways in which management chooses to coordinate work.

Examples of functional business processes:

Functional Area	Business Process
Manufacturing and production	• Assembling the product • Checking for quality • Producing bills of materials
Sales and marketing	• Identifying customers • Making customers aware of the product • Selling the product
Finance and accounting	• Paying creditors • Creating financial statements • Managing cash accounts
Human resources	• Hiring employees • Evaluating employees' job performance • Enrolling employees in benefits plans

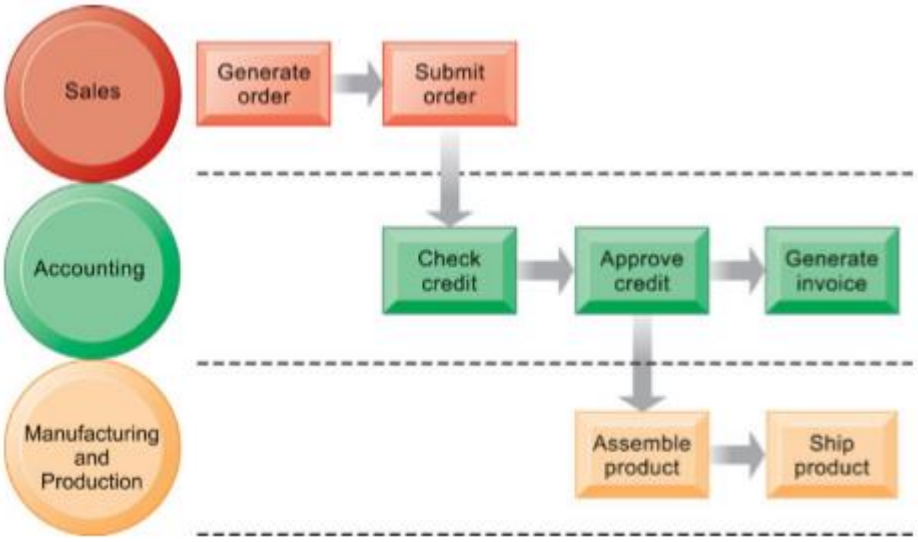
What at first appears to be a simple process, fulfilling an order, turns out to be a very complicated series of business processes that require the close coordination of major functional groups in a firm. Moreover, to efficiently perform all these steps in the order fulfilment process requires a great deal of information. The required information must flow rapidly both within the firm from one decision maker to another; with business partners, such as delivery firms; and with the customer. Computer-based information systems make this possible.

How information technology improves business processes:

Information systems automate many steps in business processes that were formerly performed manually, such as checking a client's credit, or generating an invoice and shipping order. But today, information technology can do much more. New technology can actually change the flow of information, making it possible for many more people to access and share information, replacing sequential steps with tasks that can be performed simultaneously, and eliminating delays in decision making. New information technology frequently changes the way a business works and supports entirely new business models. Downloading a Kindle e-book from Amazon, buying a computer online

at Best Buy, and downloading a music track from iTunes are entirely new business processes based on new business models that would be inconceivable without today's information technology.
That's why it's so important to pay close attention to business processes, both in your information systems course and in your future career. By analyzing business processes, you can achieve a very clear understanding of how a business actually works. Moreover, by conducting a business process analysis, you will also begin to understand how to change the business by improving its processes to make it more efficient or effective. Throughout this book, we examine business processes with a view to understanding how they might be improved by using information technology to achieve greater efficiency, innovation, and customer service.

The order fulfilment process:



Points to Remember

Fulfilling a customer order involves a complex set of steps that requires the close coordination of the sales, accounting, and manufacturing functions.

2.2 Types of information systems

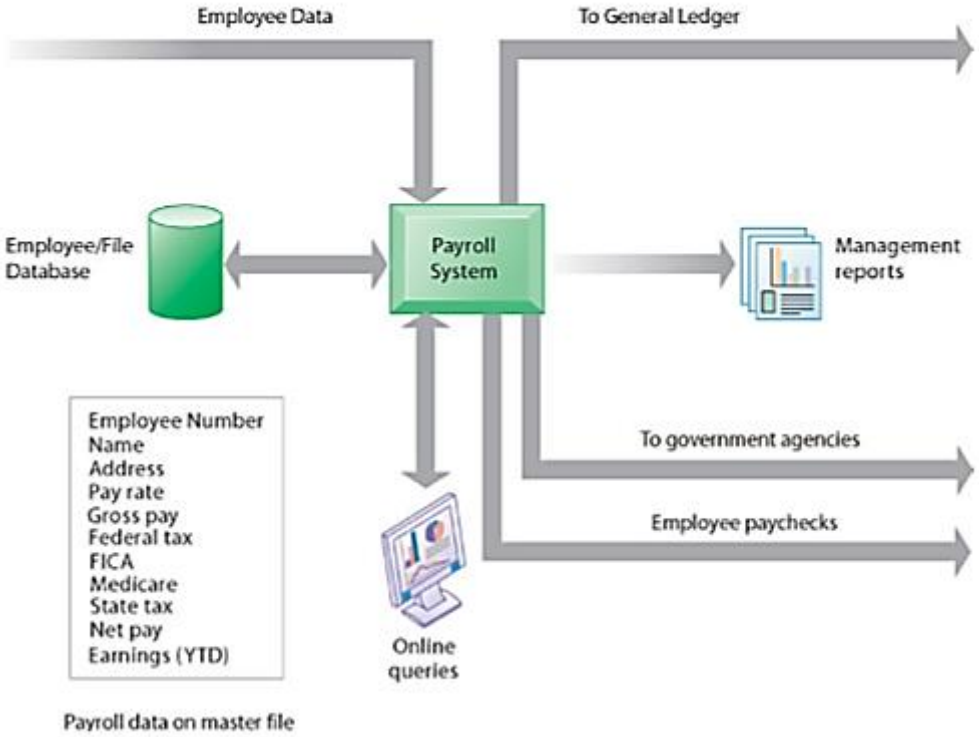
A business firm has systems to support different groups or levels of management. These systems include transaction processing systems, management information systems, decision-support systems, and systems for business intelligence.

1. Transaction Processing System (TPS):
A transaction processing system is a computerized system that performs and records the daily routine transactions necessary to conduct business, such as sales order entry, hotel reservations, payroll, employee record keeping, and shipping.

The principal purpose of systems at this level is to answer routine questions and to track the flow of transactions through the organization. How many parts are in inventory? What happened to Mr. Sarbu's payment? To answer these kinds of questions, information generally must be easily available, current, and accurate.

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.

A payroll TPS



Points to Remember

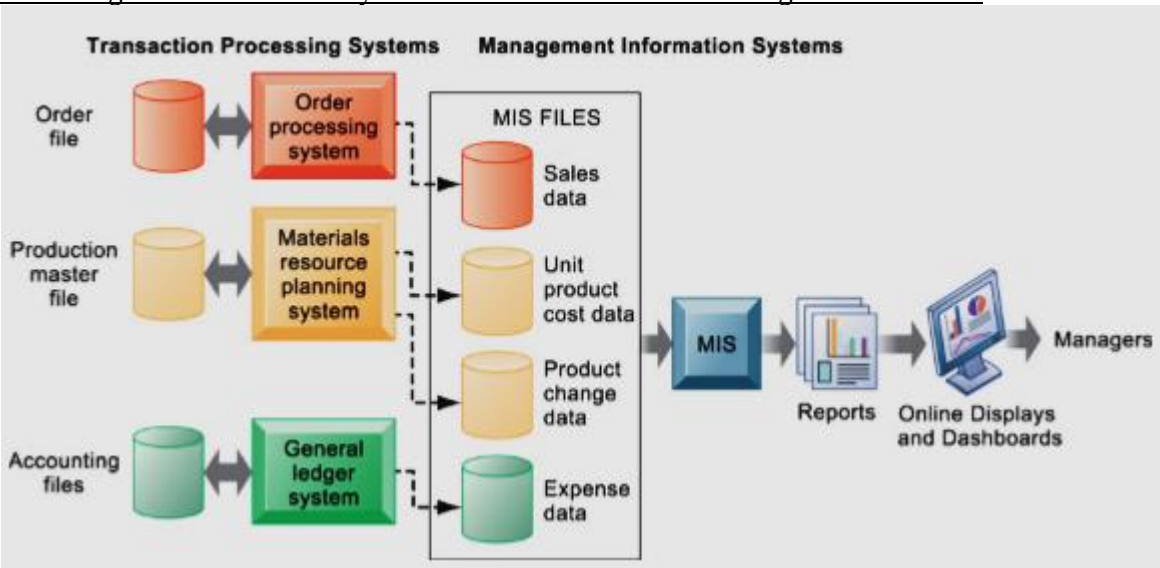
A TPS for payroll processing captures employee payment transaction data (such as a time card). System outputs include online and hard-copy reports for management and employee paychecks.

Managers need TPS to monitor the status of internal operations and the firm's relations with the external environment. TPS are also major producers of information for the other systems and business functions. For example, the payroll system illustrated in Figure, along with other accounting TPS, supplies data to the company's general ledger system, which is responsible for maintaining records of the firm's income and expenses and for producing reports such as income statements and balance sheets. It also supplies employee payment history data for insurance, pension, and other benefits calculations to the firm's human resources function and employee payment data to government agencies.

2. Management Information System (MIS)

Management information systems as the study of information systems in business and management. The term management information systems (MIS) also designates a specific category of information systems serving middle management. MIS provide middle managers with reports on the organization's current performance. This information is used to monitor and control the business and predict future performance. MIS summarize and report on the company's basic operations using data supplied by transaction processing systems. The basic transaction data from TPS are compressed and usually presented in reports that are produced on a regular schedule. Today, many of these reports are delivered online. Following figure shows how a typical MIS transforms transaction-level data from order processing, production, and accounting into MIS files that are used to provide managers with reports.

How management information system obtains their data form the organization's TPS:



In the system illustrated by this diagram, three TPS supply summarized transaction data to the MIS reporting system at the end of the time period. Managers gain access to the organizational data through the MIS, which provides them with the appropriate reports.

3. Decision Support System (DSS):

Decision-support systems (DSS) support more non-routine decision making. They focus on problems that are unique and rapidly changing, for which the procedure for arriving at a solution may not be fully predefined in advance. They try to answer questions such as these: What would be the impact on production schedules if we were to double sales in the month of December? What would happen to our return on investment if a factory schedule were delayed for six months?

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. These systems use a variety of models to analyze the data and are designed so that users can work with them directly.

4. Business Intelligence (BI):

Business intelligence is a contemporary term for data and software tools for organizing, analyzing, and providing access to data to help managers and other enterprise users make more informed decisions.

Business intelligence applications are not limited to middle managers, and can be found at all levels of the organization, including systems for senior management. Senior managers need systems that address strategic issues and long-term trends, both in the firm and in the external environment. They are concerned with questions such as these: What will employment levels be in five years? What are the long-term industry cost trends, and where does our firm fit in? What products should we be making in five years? What new acquisitions would protect us from cyclical business swings?

5. Executive Support System (ESS):

Executive support systems (ESS) help senior management make these decisions. They address non-routine decisions requiring judgment, evaluation, and insight because there is no agreed-on procedure for arriving at a solution. ESS present graphs and data from many sources through an interface that is easy for senior managers to use. Often the information is delivered to senior executives through a portal, which uses a Web interface to present integrated personalized business content.

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, displaying the data of greatest importance to senior managers. Increasingly, such systems

include business intelligence analytics for analyzing trends, forecasting, and "drilling down" to data at greater levels of detail.

2.3 Systems for linking the enterprise

Reviewing all the different types of systems we have just described, you might wonder how a business can manage all the information in these different systems. You might also wonder how costly it is to maintain so many different systems. And you might wonder how all these different systems can share information and how managers and employees are able to coordinate their work. In fact, these are all important questions for businesses today.

Enterprise Applications:
Getting all the different kinds of systems in a company to work together has proven a major challenge. Typically, corporations are put together both through normal "organic" growth and through acquisition of smaller firms. Over a period of time, corporations end up with a collection of systems, most of them older, and face the challenge of getting them all to "talk" with one another and work together as one corporate system. There are several solutions to this problem.

One solution is to implement enterprise applications, which are systems that span functional areas, focus on executing business processes across the business firm, and include all levels of management. Enterprise applications help businesses become more flexible and productive by coordinating their business processes more closely and integrating groups of processes so they focus on efficient management of resources and customer service.

There are four major enterprise applications: enterprise systems, supply chain management systems, customer relationship management systems, and knowledge management systems. Each of these enterprise applications integrates a related set of functions and business processes to enhance the performance of the organization as a whole.

Enterprise Systems:
Firms use enterprise systems, also known as enterprise resource planning (ERP) systems, to integrate business processes in manufacturing and production, finance and accounting, sales and marketing, and human resources into a single software system. Information that was previously fragmented in many different systems is stored in a single comprehensive data repository where it can be used by many different parts of the business.

For example, when a customer places an order, the order data flow automatically to other parts of the company that are affected by them. The order transaction triggers the warehouse to pick the ordered products and schedule shipment. The warehouse informs the factory to replenish whatever has been depleted. The accounting department is notified to send the customer an invoice. Customer service representatives track the progress of the order through every step to inform customers about the status of their orders. Managers are able to use firm-wide information to make more precise and timely decisions about daily operations and longer-term planning.

Supply Chain Management Systems (SCM):
Firms use supply chain management (SCM) systems to help manage relationships with their suppliers. These systems help suppliers, purchasing firms, distributors, and logistics companies share information about orders, production, inventory levels, and delivery of products and services so that they can source, produce, and deliver goods and services efficiently. The ultimate objective is to get the right amount of their products from their source to their point of consumption in the least amount of time and at the lowest cost. These systems increase firm profitability by lowering the costs of moving and making products and by enabling managers to make better decisions about how to organize and schedule sourcing, production, and distribution. Supply chain management systems are one type of interorganizational system because they automate the flow of information across organizational boundaries. You will find examples of other types of interorganizational information systems

throughout this text because such systems make it possible for firms to link electronically to customers and to outsource their work to other companies.

Customer Relationship Management Systems:
Firms use customer relationship management (CRM) systems to help manage their relationships with their customers. CRM systems provide information to coordinate all of the business processes that deal with customers in sales, marketing, and service to optimize revenue, customer satisfaction, and customer retention. This information helps firms identify, attract, and retain the most profitable customers; provide better service to existing customers; and increase sales.
Enterprise Application Architecture:

Knowledge Management Systems:
Some firms perform better than others because they have better knowledge about how to create, produce, and deliver products and services. This firm knowledge is difficult to imitate, unique, and can be leveraged into long-term strategic benefits. Knowledge management systems (KMS) enable organizations to better manage processes for capturing and applying knowledge and expertise. These systems collect all relevant knowledge and experience in the firm, and make it available wherever and whenever it is needed to improve business processes and management decisions. They also link the firm to external sources of knowledge.

Intranets and Extranets:
Enterprise applications create deep-seated changes in the way the firm conducts its business, offering many opportunities to integrate important business data into a single system. They are often costly and difficult to implement. Intranets and extranets deserve mention here as alternative tools for increasing integration and expediting the flow of information within the firm, and with customers and suppliers.
Intranets are simply internal company Web sites that are accessible only by employees. The term "intranet" refers to the fact that it is an internal network, in contrast to the Internet, which is a public network linking organizations and other external networks. Intranets use the same technologies and techniques as the larger Internet, and they often are simply a private access area in a larger company Web site. Likewise with extranets. Extranets are company Web sites that are accessible to authorized vendors and suppliers, and often used to coordinate the movement of supplies to the firm's production apparatus.

E-Business, E-Commerce and E-Government:

E-Business:

Electronic business, or e-business, refers to the use of digital technology and the Internet to execute the major business processes in the enterprise. E-business includes activities for the internal management of the firm and for coordination with suppliers and other business partners.

E-commerce:

E-commerce is the part of e-business that deals with the buying and selling of goods and services over the Internet. It also encompasses activities supporting those market transactions, such as advertising, marketing, customer support, security, delivery, and payment.

E-government:

E-government refers to the application of the Internet and networking technologies to digitally enable government and public sector agencies' relationships with citizens, businesses, and other arms of government.

2.4 Systems for collaboration and team work

Collaboration:

Collaboration is working with others to achieve shared and explicit goals. Collaboration focuses on task or mission accomplishment and usually takes place in a business, or other organization, and between businesses.

Collaboration can be short-lived, lasting a few minutes, or longer term, depending on the nature of the task and the relationship among participants. Collaboration can be one-to-one or many-to-many.

Employees may collaborate in informal groups that are not a formal part of the business firm's organizational structure or they may be organized into formal teams. Teams are part of the organization's business structure for getting things done. Teams have a specific mission that someone in the business assigned to them. They have a job to complete. The members of the team need to collaborate on the accomplishment of specific tasks and collectively achieve the team mission. The team mission might be to "win the game," or "increase online sales by 10%," or "prevent insulating foam from falling off a space shuttle." Teams are often short-lived, depending on the problems they tackle and the length of time needed to find a solution and accomplish the mission.

Collaboration and teamwork are more important today than ever for a variety of reasons.

1. Changing nature of work: The nature of work has changed from factory manufacturing and pre-computer office work where each stage in the production process occurred independently of one another, and was coordinated by supervisors. Work was organized into silos. Within a silo, work passed from one machine tool station to another, from one desktop to another, until the finished product was completed. Today, the kinds of jobs we have require much closer coordination and interaction among the parties involved in producing the service or product. A recent report from the consulting firm McKinsey and Company argued that 41 percent of the U.S. labor force is now composed of jobs where interaction (talking, e-mailing, presenting, and persuading) is the primary value-adding activity. Even in factories, workers today often work in production groups, or pods.

2. Growth of professional work. "Interaction" jobs tend to be professional jobs in the service sector that require close coordination, and collaboration. Professional jobs require substantial education, and the sharing of information and opinions to get work done. Each actor on the job brings specialized expertise to the problem, and all the actors need to take one another into account in order to accomplish the job.

3. Changing organization of the firm: For most of the industrial age, managers organized work in a hierarchical fashion. Orders came down the hierarchy, and responses moved back up the hierarchy.

Today, work is organized into groups and teams, who are expected to develop their own methods for accomplishing the task. Senior managers observe and measure results, but are much less likely to issue detailed orders or operating procedures. In part this is because expertise has been pushed down in the organization, as have decision-making powers.

4. Changing scope of the firm: The work of the firm has changed from a single location to multiple locations—offices or factories throughout a region, a nation, or even around the globe. For instance, Henry Ford developed the first mass-production automobile plant at a single Dearborn, Michigan factory. In 2010, Ford expected to produce about 3 million automobiles and employ over 200,000 employees at 90 plants and facilities worldwide. With this kind of global presence, the need for close coordination of design, production, marketing, distribution, and service obviously takes on new importance and scale. Large global companies need to have teams working on a global basis.

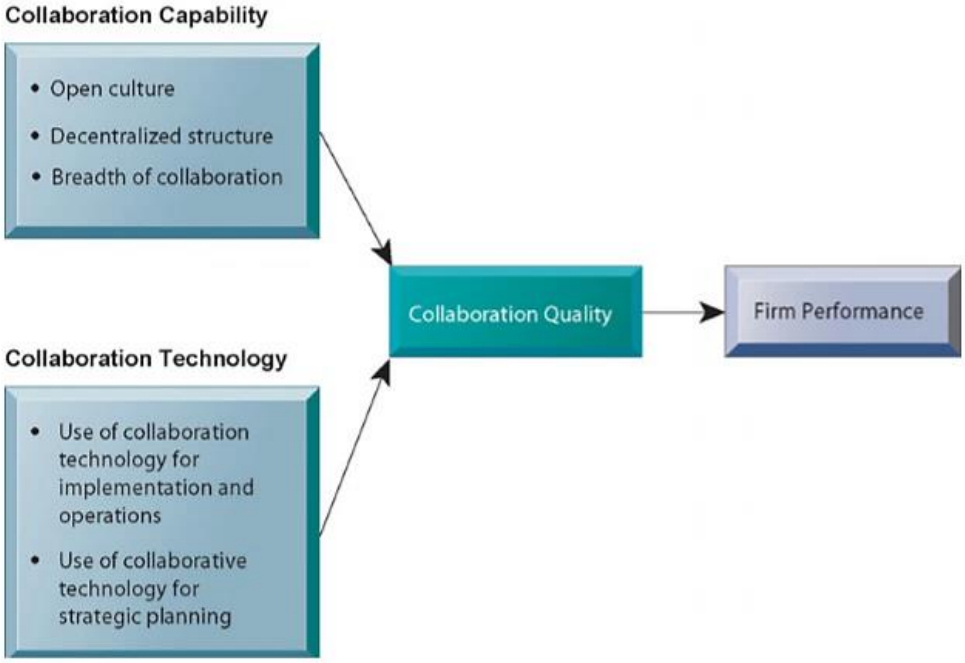
5. Emphasis on innovation: Although we tend to attribute innovations in business and science to great individuals, these great individuals are most likely working with a team of brilliant colleagues, and all have been preceded by a long line of earlier innovators and innovations. Think of Bill Gates and Steve Jobs (founders of Microsoft and Apple), both of whom are highly regarded innovators, and both of whom built strong collaborative teams to nurture and support innovation in their firms. Their initial innovations derived from close collaboration with colleagues and partners. Innovation, in other words, is a group and social process, and most innovations derive from collaboration among individuals in a lab, a business, or government agencies. Strong collaborative practices and technologies are believed to increase the rate and quality of innovation.

6. Changing culture of work and business: Most research on collaboration supports the notion that diverse teams produce better outputs, faster, than individuals working on their own. Popular notions of the crowd ("crowdsourcing," and the "wisdom of crowds") also provide cultural support for collaboration and teamwork.

Business Benefits of collaboration and teamwork:
While there are many presumed benefits to collaboration, you really need a supportive business firm culture and the right business processes before you can achieve meaningful collaboration. You also need a healthy investment in collaborative technologies.

Benefit	Rationale
Productivity	People working together can complete a complex task faster than the same number of people working in isolation from one another. There will be fewer errors.
Quality	People working collaboratively can communicate errors,and correct actions faster, when they work together than if they work in isolation. Can lead to a reduction in buffers and time delay among production units.
Innovation	People working collaboratively in groups can come up with more innovative ideas for products, services, and administration than the same number working in isolation from one another.
Customer Service	People working together in teams can solve customer complaints and issues faster and more effectively than if they were working in isolation from one another.
Financial performance (profitability, sales, and sales growth)	As a result of all of the above, collaborative firms have superior sales growth and financial performance.

Requirement for collaboration:



Tools and technologies for collaboration and teamwork.

A collaborative, team-oriented culture won't produce benefits if there are no information systems in place to enable collaboration. Currently there are hundreds of tools designed to deal with the fact that, in order to succeed in our jobs, we are all dependent on one another, our fellow employees, customers, suppliers, and managers. Some high-end tools like IBM Lotus Notes are expensive, but powerful enough for global firms. Others are available online for free (or with premium versions for a modest fee) and are suitable for small businesses.

Fifteen categories of collaborative software tools:

1. E-mail and instant messaging
2. Collaborative writing
3. Collaborative reviewing/editing
4. Event scheduling
5. File sharing
6. Screen sharing
7. Audio conferencing
8. Video conferencing
9. White boarding
10. Web presenting
11. Work scheduling
12. Document sharing
13. Mind mapping
14. Large audience webinars
15. Co-browsing

E-mail and Instant Messaging (IM): E-mail and instant messaging have been embraced by corporations as a major communication and collaboration tool supporting interaction jobs. Their software operates on computers, cell phones, and other wireless handheld devices and includes features for sharing files as well as transmitting messages. Many instant messaging systems allow users to engage in real-time conversations with multiple participants simultaneously. Gartner technology consultants predict that within a few years, instant messaging will be the "de facto tool" for voice, video, and text chat for 95 percent of employees in big companies.

Social Networking: Social networking tools are quickly becoming a corporate tool for sharing ideas and collaborating among interaction-based jobs in the firm. Social networking sites such as Linkedin.com provide networking services to business professionals, while other niche sites have sprung up to serve lawyers, doctors, engineers, and even dentists. IBM built a Community Tools component into its Lotus Notes collaboration software to add social networking features. Users are able to submit questions to others in the company and receive answers via instant messaging.

Wikis : Wikis are a type of Web site that makes it easy for users to contribute and edit text content and graphics without any knowledge of Web page development or programming techniques. The most well-known wiki is Wikipedia, the largest collaboratively edited reference project in the world. It relies on volunteers, makes no money, and accepts no advertising. Wikis are ideal tools for storing and sharing company knowledge and insights.

Virtual worlds: Virtual worlds, such as Second Life, are online 3-D environments populated by "residents" who have built graphical representations of themselves known as avatars. Organizations such as IBM and INSEAD, an international business school with campuses in France and Singapore, are using this virtual world to house online meetings, training sessions, and "lounges." Real-world people represented by avatars meet, interact, and exchange ideas at these virtual locations. Communication takes place in the form of text messages similar to instant messages.

Google apps/Google sites collaboration features:

Google apps/Google sites capability	Description
Google Calendar	Private and shared calendars; multiple calendars
Google Gmail	Google's free online e-mail service with mobile access capabilities
Google Talk	Instant messaging, text and voice chat
Google Docs	Online word processing, presentation, spreadsheet, and drawing software; online editing and sharing
Google Sites	Team collaboration sites for sharing documents, schedules, calendars; searching documents and creating group wikis
Google Video	Private hosted video sharing
Google Groups	User-created groups with mailing lists, shared calendars, documents, sites, and video; searchable archives

2.5 The information systems function in business

We've seen that businesses need information systems to operate today and that they use many different kinds of systems. But who is responsible for running these systems? Who is responsible for making sure the hardware, software, and other technologies used by these systems are running properly and are up to date? End users manage their systems from a business standpoint, but managing the technology requires a special information systems function. In all but the smallest of firms, the information systems department is the formal organizational unit responsible for information technology services. The information systems department is responsible for maintaining the hardware, software, data storage, and networks that comprise the firm's IT infrastructure.

The information system department:

The information systems department consists of specialists, such as programmers, systems analysts, project leaders, and information systems managers.

1. Programmers: Programmers are highly trained technical specialists who write the software instructions for computers.

2. System analyst: System analysts constitute the principal liaisons between the information systems groups and the rest of the organization. It is the systems analyst's job to translate business problems and requirements into information requirements and systems.

3. Information systems managers: Information systems managers are leaders of teams of programmers and analysts, project managers, physical facility managers, telecommunications managers, or database specialists. They are also managers of computer operations and data entry staff. Also, external specialists, such as hardware vendors and manufacturers, software firms, and consultants, frequently participate in the day-to-day operations and long-term planning of information systems.

4. Chief information officer (CIO): The CIO is a senior manager who oversees the use of information technology in the firm. Today's CIOs are expected to have a strong business background as well as information systems expertise and to play a leadership role in integrating technology into the firm's business strategy.

5. Chief security officer (CSO): The chief security officer (CSO) is in charge of information systems security for the firm and is responsible for enforcing the firm's information security policy. (Sometimes this position is called the chief information security officer [CISO] where information systems security is separated from physical security.) The CSO is responsible for educating and training users and information systems specialists about security, keeping management aware of security threats and breakdowns, and maintaining the tools and policies chosen to implement security.

6. Chief Privacy Officer (CPO): Information systems security and the need to safeguard personal data have become so important that corporations collecting vast quantities of personal data have established positions for a chief privacy officer (CPO). The CPO is responsible for ensuring that the company complies with existing data privacy laws.

7. Chief knowledge officer (CKO): The chief knowledge officer (CKO) is responsible for the firm's knowledge management program. The CKO helps design programs and systems to find new sources of knowledge or to make better use of existing knowledge in organizational and management processes.

8. End users: End users are representatives of departments outside of the information systems group for whom applications are developed. These users are playing an increasingly large role in the design and development of information systems.

Organizing the information systems function:

There are many types of business firms, and there are many ways in which the IT function is organized within the firm. A very small company will not have a formal information systems group. It might have one employee who is responsible for keeping its networks and applications running, or it might use consultants for these services. Larger companies will have a separate information systems department, which may be organized along several different lines, depending on the nature and interests of the firm. The question of how the information systems department should be organized is part of the larger issue of IT governance. IT governance includes the strategy and policies for using information technology within an organization. It specifies the decision rights and framework for accountability to ensure that the use of information technology supports the organization's strategies and objectives. How much should the information systems function be centralized? What decisions must be made to ensure effective management and use of information technology, including the return on IT investments? Who should make these decisions? How will these decisions be made and monitored? Firms with superior IT governance will have clearly thought out the answers.

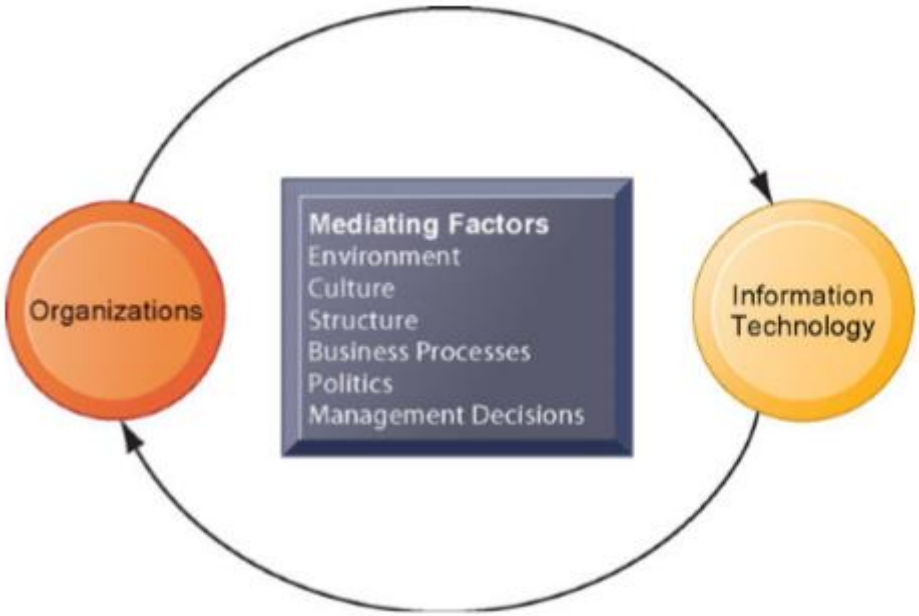
Unit-3

Information system organization and strategy

3.1 Organizations and information systems

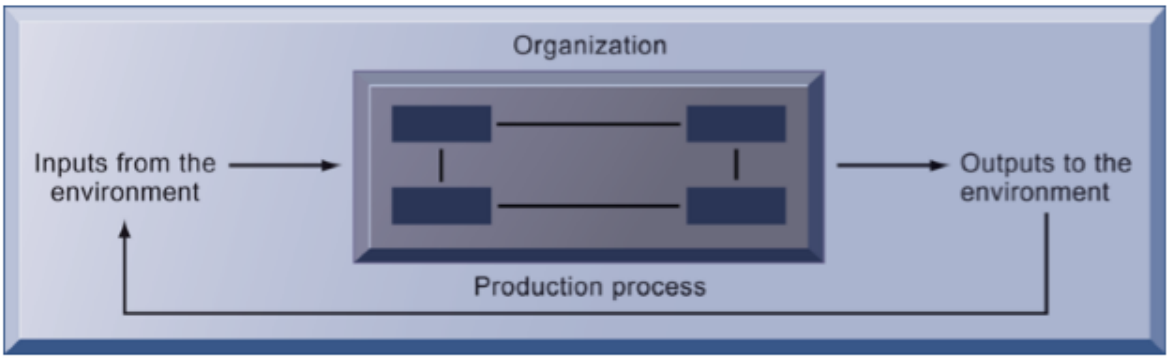
Information systems and organizations influence one another. Information systems are built by managers to serve the interests of the business firm. At the same time, the organization must be aware of and open to the influences of information systems to benefit from new technologies. The interaction between information technology and organizations is complex and is influenced by many mediating factors, including the organization's structure, business processes, politics, culture, surrounding environment, and management decisions.

The two-way relationship between organizations and information technology:



This complex two-way relationship is mediated by many factors, not the least of which are the decisions made—or not made—by managers. Other factors mediating the relationship include the organizational culture, structure, politics, business processes, and environment.

The technical microeconomic definition of the organization:



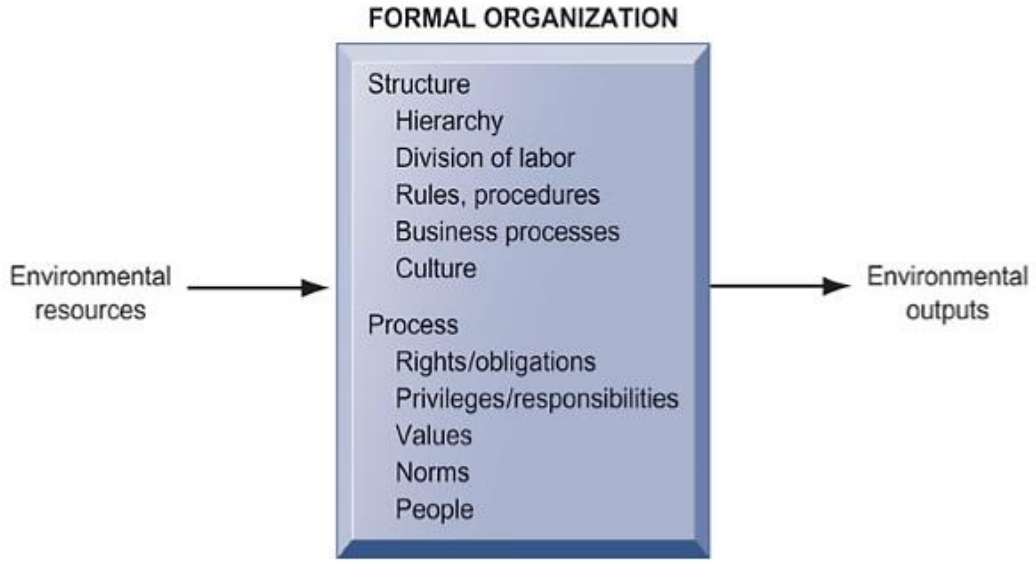
In the microeconomic definition of organizations, capital and labor (the primary production factors provided by the environment) are transformed by the firm through the production process into products

and services (outputs to the environment). The products and services are consumed by the environment, which supplies additional capital and labor as inputs in the feedback loop.

What is organization?
An organization is a stable, formal social structure that takes resources from the environment and processes them to produce outputs. This technical definition focuses on three elements of an organization. Capital and labor are primary production factors provided by the environment. The organization (the firm) transforms these inputs into products and services in a production function. The products and services are consumed by environments in return for supply inputs.

An organization is more stable than an informal group (such as a group of friends that meets every Friday for lunch) in terms of longevity and routineness. Organizations are formal legal entities with internal rules and procedures that must abide by laws. Organizations are also social structures because they are a collection of social elements, much as a machine has a structure—a particular arrangement of valves, cams, shafts, and other parts.

The behavioural view of organizations:



The behavioral view of organizations emphasizes group relationships, values, and structures.

In this behavioral view of the firm, people who work in organizations develop customary ways of working; they gain attachments to existing relationships; and they make arrangements with subordinates and superiors about how work will be done, the amount of work that will be done, and under what conditions work will be done. Most of these arrangements and feelings are not discussed in any formal rulebook.

Features of organizations:
All modern organizations have certain characteristics. They are bureaucracies with clear-cut divisions of labor and specialization. Organizations arrange specialists in a hierarchy of authority in which everyone is accountable to someone and authority is limited to specific actions governed by abstract rules or procedures. These rules create a system of impartial and universal decision making. Organizations try to hire and promote employees on the basis of technical qualifications and professionalism (not personal connections). The organization is devoted to the principle of efficiency: maximizing output using limited inputs. Other features of organizations include their business processes, organizational culture, organizational politics, surrounding environments, structure, goals, constituencies, and leadership styles. All of these features affect the kinds of information systems used by organizations.

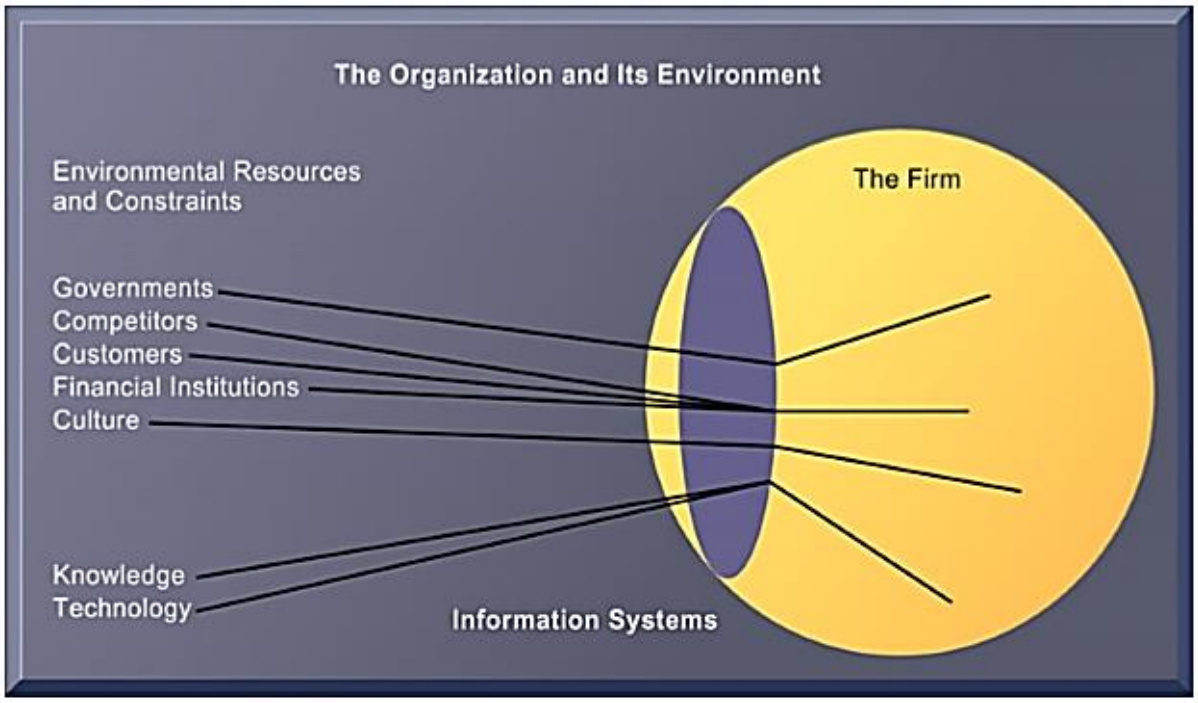
1. Routines and Business processes: All organizations, including business firms, become very efficient over time because individuals in the firm develop routines for producing goods and services. Routines—sometimes called standard operating procedures—are precise rules, procedures, and practices that have been developed to cope with virtually all expected situations. As employees learn these routines, they become highly productive and efficient, and the firm is able to reduce its costs over time as efficiency increases. For instance, when you visit a doctor's office, receptionists have a well-developed set of routines for gathering basic information from you; nurses have a different set of routines for preparing you for an interview with a doctor; and the doctor has a well-developed set of routines for diagnosing you.

2. Organizational Politics: People in organizations occupy different positions with different specialties, concerns, and perspectives. As a result, they naturally have divergent viewpoints about how resources, rewards, and punishments should be distributed. These differences matter to both managers and employees, and they result in political struggle for resources, competition, and conflict within every organization. Political resistance is one of the great difficulties of bringing about organizational change—especially the development of new information systems. Virtually all large information systems investments by a firm that bring about significant changes in strategy, business objectives, business processes, and procedures become politically charged events. Managers that know how to work with the politics of an organization will be more successful than less-skilled managers in implementing new information systems. Throughout this book, you will find many examples of where internal politics defeated the best-laid plans for an information system.

3. Organizational Culture: All organizations have bedrock, unassailable, unquestioned (by the members) assumptions that define their goals and products. Organizational culture encompasses this set of assumptions about what products the organization should produce, how it should produce them, where, and for whom. Generally, these cultural assumptions are taken totally for granted and are rarely publicly announced or spoken about. Business processes—the actual way business firms produce value—are usually ensconced in the organization's culture.

4. Organizational Environments: Organizations reside in environments from which they draw resources and to which they supply goods and services. Organizations and environments have a reciprocal relationship. On the one hand, organizations are open to, and dependent on, the social and physical environment that surrounds them. Without financial and human resources—people willing to work reliably and consistently for a set wage or revenue from customers—organizations could not exist. Organizations must respond to legislative and other requirements imposed by government, as well as the actions of customers and competitors. On the other hand, organizations can influence their environments. For example, business firms form alliances with other businesses to influence the political process; they advertise to influence customer acceptance of their products.

Organization and its environment:



Environments shape what organizations can do, but organizations can influence their environments and decide to change environments altogether. Information technology plays a critical role in helping organizations perceive environmental change and in helping organizations act on their environment.

Organizational Structure:

Organizational Type	Description	Example
Entrepreneurial structure	Young,small firm in a fast-changing environment.It has a Small start-up business simple structure and is managed by an entrepreneur serving as its single chief executive officer.	Small start-up business
Machine bureaucracy	Large bureaucracy existing in a slowly changing environment, Midsize manufacturing firm producing standard products.It is dominated by a centralized management team and centralized decision making.	Midsize manufacturing firm
Divisionalized bureaucracy	Combination of multiple machine bureaucracies, each Fortune 500 firms, such as General producing a different product or service, all topped by one Motors central headquarters.	Fortune 500 firms, such as General Motors
Professional bureaucracy	Knowledge-based organization where goods and services Law firms, school systems, hospitals depend on the expertise and knowledge of professionals. Dominated by department heads with weak centralized authority.	Law firms, school systems, hospitals
Adhocracy	Task force organization that must respond to rapidly changing Consulting firms, such as the Rand	Consulting firms, such as the Rand corporation

	environments. Consists of large groups of specialists organized Corporation into short-lived multidisciplinary teams and has weak central management.	

3.2 Impacts of information systems on organizations and business firms

Information systems have become integral, online, interactive tools deeply involved in the minute-to-minute operations and decision making of large organizations. Over the last decade, information systems have fundamentally altered the economics of organizations and greatly increased the possibilities for organizing work. Theories and concepts from economics and sociology help us understand the changes brought about by IT.

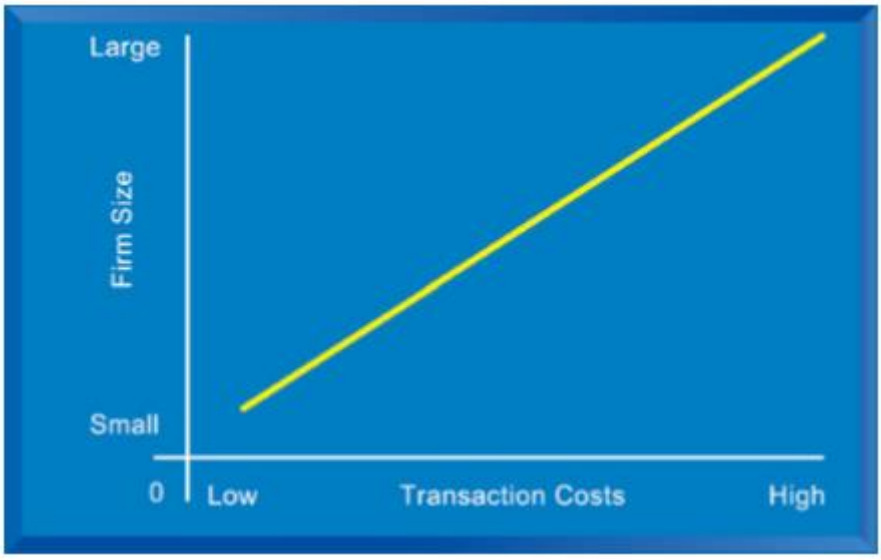
1. Economic Impacts: From the point of view of economics, IT changes both the relative costs of capital and the costs of information. Information systems technology can be viewed as a factor of production that can be substituted for traditional capital and labor. As the cost of information technology decreases, it is substituted for labor, which historically has been a rising cost. Hence, information technology should result in a decline in the number of middle managers and clerical workers as information technology substitutes for their labor.

As the cost of information technology decreases, it also substitutes for other forms of capital such as buildings and machinery, which remain relatively expensive. Hence, over time we should expect managers to increase their investments in IT because of its declining cost relative to other capital investments.

According to transaction cost theory, firms and individuals seek to economize on transaction costs, much as they do on production costs. Using markets is expensive because of costs such as locating and communicating with distant suppliers, monitoring contract compliance, buying insurance, obtaining information on products, and so forth (Coase, 1937; Williamson, 1985). Traditionally, firms have tried to reduce transaction costs through vertical integration, by getting bigger, hiring more employees, and buying their own suppliers and distributors.

Information technology also can reduce internal management costs. According to agency theory, the firm is viewed as a "nexus of contracts" among self-interested individuals rather than as a unified, profit-maximizing entity (Jensen and Meckling, 1976). A principal (owner) employs "agents" (employees) to perform work on his or her behalf. However, agents need constant supervision and management; otherwise, they will tend to pursue their own interests rather than those of the owners. As firms grow in size and scope, agency costs or coordination costs rise because owners must expend more and more effort supervising and managing employees.

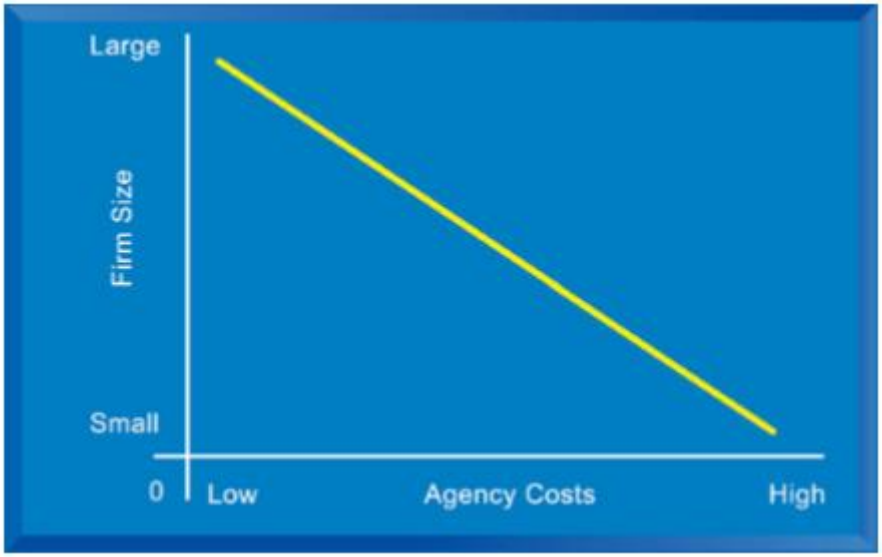
The transaction cost theory of the impact of information technology on the organization:



Points to remember

When the costs of participating in markets (transaction costs) were high, it made sense to build large firms and do everything inside the firm. But IT reduces the firm's market transaction costs. This means firms can outsource work using the market, reduce their employee head count, and still grow revenues, relying more on outsourcing firms and external contractors.

The agency cost theory of the impact of information technology on the organization:



Agency costs are the costs of managing a firm's employees. IT reduces agency costs making management more efficient. Fewer managers are needed to manage employees. IT makes it possible to build very large global firms and to run them efficiently without greatly expanding management. Without IT, very large global firms would be difficult to operate because they would be very expensive to manage.

2. Organizational and behavioural impacts: Theories based in the sociology of complex organizations also provide some understanding about how and why firms change with the implementation of new IT applications.

i) IT fattens organizations: Large, bureaucratic organizations, which primarily developed before the computer age, are often inefficient, slow to change, and less competitive than newly created organizations. Some of these large organizations have downsized, reducing the number of employees and the number of levels in their organizational hierarchies. Behavioral researchers have theorized that

information technology facilitates flattening of hierarchies by broadening the distribution of information to empower lower-level employees and increase management efficiency. IT pushes decision-making rights lower in the organization because lower-level employees receive the information they need to make decisions without supervision. (This empowerment is also possible because of higher educational levels among the workforce, which give employees the capabilities to make intelligent decisions.) Because managers now receive so much more accurate information on time, they become much faster at making decisions, so fewer managers are required. Management costs decline as a percentage of revenues, and the hierarchy becomes much more efficient.

ii) Postindustrial Organizations: Postindustrial theories based more on history and sociology than economics also support the notion that IT should flatten hierarchies. In postindustrial societies, authority increasingly relies on knowledge and competence, and not merely on formal positions. Hence, the shape of organizations flattens because professional workers tend to be self-managing, and decision making should become more decentralized as knowledge and information become more widespread throughout the firm (Drucker, 1988). Information technology may encourage task force-networked organizations in which groups of professionals come together—face to face or electronically— for short periods of time to accomplish a specific task (e.g., designing a new automobile); once the task is accomplished, the individuals join other task forces.

Understanding Organizational Resistance to Change

Information systems inevitably become bound up in organizational politics because they influence access to a key resource—namely, information. Information systems can affect who does what to whom, when, where, and how in an organization. Many new information systems require changes in personal, individual routines that can be painful for those involved and require retraining and additional effort that may or may not be compensated. Because information systems potentially change an organization's structure, culture, business processes, and strategy, there is often considerable resistance to them when they are introduced.

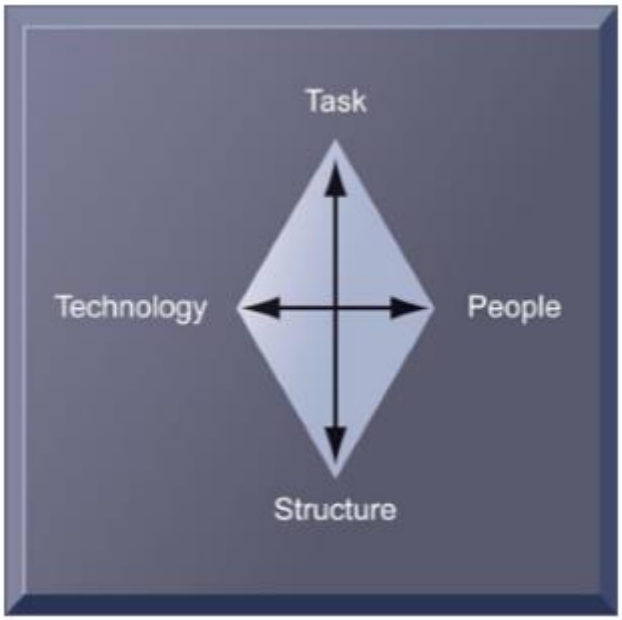


Fig: Organizational resistance and the mutually adjusting relationship between technology and the organization

Implications for the design and understanding of information systems:

To deliver genuine benefits, information systems must be built with a clear understanding of the organization in which they will be used. In our experience, the central organizational factors to consider when planning a new system are the following:

- The environment in which the organization must function
- The structure of the organization: hierarchy, specialization, routines, and business processes

- The organization's culture and politics
- The type of organization and its style of leadership
- The principal interest groups affected by the system and the attitudes of workers who will be using the system
- The kinds of tasks, decisions, and business processes that the information system is designed to assist.

3.3 Using information systems to achieve competitive advantage

Firms that "do better" than others are said to have a competitive advantage over others: They either have access to special resources that others do not, or they are able to use commonly available resources more efficiently—usually because of superior knowledge and information assets. In any event, they do better in terms of revenue growth, profitability, or productivity growth (efficiency), all of which ultimately in the long run translate into higher stock market valuations than their competitors. But why do some firms do better than others and how do they achieve competitive advantage? How can you analyze a business and identify its strategic advantages? How can you develop a strategic advantage for your own business? And how do information systems contribute to strategic advantages? One answer to that question is Michael Porter's competitive forces model.

PORTER'S COMPETITIVE FORCES MODEL:

Arguably, the most widely used model for understanding competitive advantage is Michael Porter's competitive forces model. This model provides a general view of the firm, its competitors, and the firm's environment. Earlier in this chapter, we described the importance of a firm's environment and the dependence of firms on environments. Porter's model is all about the firm's general business environment. In this model, five competitive forces shape the fate of the firm.

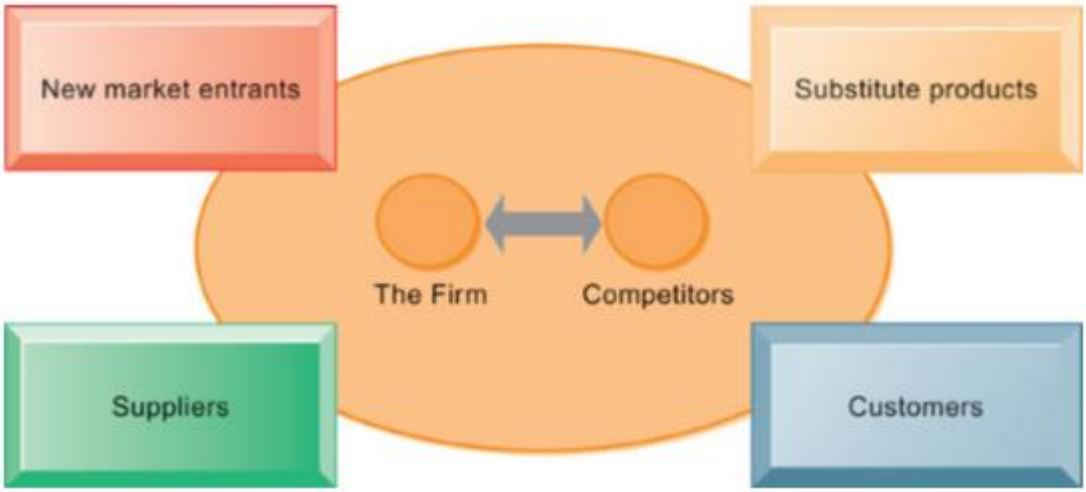


Fig: Porter's competitive forces model

Traditional Competitors: All firms share market space with other competitors who are continuously devising new, more efficient ways to produce by introducing new products and services, and attempting to attract customers by developing their brands and imposing switching costs on their customers.

New Market Entrants: In a free economy with mobile labor and financial resources, new companies are always entering the marketplace. In some industries, there are very low barriers to entry, whereas in other industries, entry is very difficult. For instance, it is fairly easy to start a pizza business or just about any small retail business, but it is much more expensive and difficult to enter the computer chip business, which has very high capital costs and requires significant expertise and knowledge that is hard to obtain.

Substitute Products and Services: In just about every industry, there are substitutes that your customers might use if your prices become too high. New technologies create new substitutes all the

time. Even oil has substitutes: Ethanol can substitute for gasoline in cars; vegetable oil for diesel fuel in trucks; and wind, solar, coal, and hydro power for industrial electricity generation. Likewise, the Internet telephone service can substitute for traditional telephone service, and fiber-optic telephone lines to the home can substitute for cable TV lines.

Customers: A profitable company depends in large measure on its ability to attract and retain customers (while denying them to competitors), and charge high prices. The power of customers grows if they can easily switch to a competitor's products and services, or if they can force a business and its competitors to compete on price alone in a transparent marketplace where there is little product differentiation, and all prices are known instantly (such as on the Internet). For instance, in the used college textbook market on the Internet, students (customers) can find multiple suppliers of just about any current college textbook. In this case, online customers have extraordinary power over used-book firms.

Suppliers: The market power of suppliers can have a significant impact on firm profits, especially when the firm cannot raise prices as fast as can suppliers. The more different suppliers a firm has, the greater control it can exercise over suppliers in terms of price, quality, and delivery schedules. For instance, manufacturers of laptop PCs almost always have multiple competing suppliers of key components, such as keyboards, hard drives, and display screens.

Information system strategies for dealing with competitive forces:
There are four generic strategies, each of which often is enabled by using information technology and systems: low-cost leadership, product differentiation, focus on market niche, and strengthening customer and supplier intimacy.

1. Low cost leadership: Use information systems to achieve the lowest operational costs and the lowest prices. By keeping prices low and shelves well an efficient customer response system directly links consumer behavior to distribution and production and supply chains which continuous replenishment system provides such an efficient customer response.

2. Product Differentiation: Use information systems to enable new products and services, or greatly change the customer convenience in using your existing products and services. Manufacturers and retailers are using information systems to create products and services that are customized and personalized to fit the precise specifications of individual customers.

3. Focus on Market Niche: Use information systems to enable a specific market focus, and serve this narrow target market better than competitors. Information systems support this strategy by producing and analyzing data for finely tuned sales and marketing techniques. Information systems enable companies to analyze customer buying patterns, tastes, and preferences closely so that they efficiently pitch advertising and marketing campaigns to smaller and smaller target markets.

4. Strengthen Customer and Supplier Intimacy: Use information systems to tighten linkages with suppliers and develop intimacy with customers. Strong linkages to customers and suppliers increase switching costs (the cost of switching from one product to a competing product), and loyalty to your firm.

Four basic competitive strategies:

Strategy	Description	Example
Low-cost leadership	Use information systems to produce products and services at a lower price than competitors while enhancing quality and level of service.	Walmart
Product differentiation	Use information systems to differentiate products, and enable new services and products.	Google, eBay, Apple
Focus on market niche	Use information system to enable a focused strategy on a single market niche; specialize	Hilton Hotels

Customer and supplier intimacy	Use information systems to develop strong ties and loyalty with customers and suppliers	Amazon.com

The internet's impact on competitive advantage:
Because of the Internet, the traditional competitive forces are still at work, but competitive rivalry has become much more intense. Internet technology is based on universal standards that any company can use, making it easy for rivals to compete on price alone and for new competitors to enter the market. Because information is available to everyone, the Internet raises the bargaining power of customers, who can quickly find the lowest-cost provider on the Web. Profits have been dampened. Following Table summarizes some of the potentially negative impacts of the Internet on business firms.

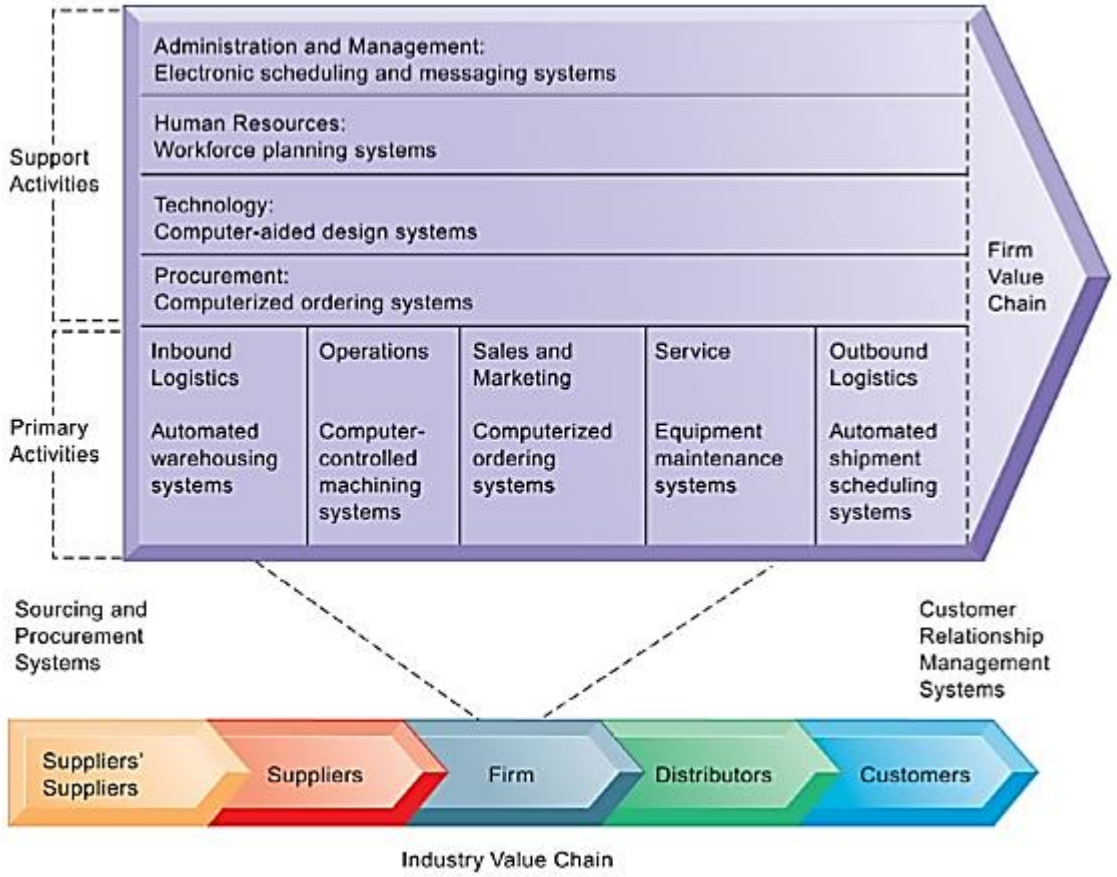
Impact of the internet on competitive forces and industry structure:

Competitive force	**Impact of the internet**
Substitute products or services	Enables new substitutes to emerge with new approaches to meeting needs and performing functions.
Customers' bargaining power	Availability of global price and product information shifts bargaining power to customers.
Suppliers' bargaining power	Procurement over the Internet tends to raise bargaining power over suppliers; suppliers can also benefit from reduced barriers to entry and from the elimination of distributors and other intermediaries standing between them and their users.
Threat of new entrants	The Internet reduces barriers to entry, such as the need for a sales force, access to channels, and physical assets; it provides a technology for driving business processes that makes other things easier to do
Positioning and rivalry among existing competitors.	Widens the geographic market, increasing the number of competitors, and reducing differences among existing competitors; makes it more difficult to sustain operational advantages; puts pressure to compete on price.

3.4 Business value chain model

Although the Porter model is very helpful for identifying competitive forces and suggesting generic strategies, it is not very specific about what exactly to do, and it does not provide a methodology to follow for achieving competitive advantages.

The value chain model highlights specific activities in the business where competitive strategies can best be applied (Porter, 1985) and where information systems are most likely to have a strategic impact. This model identifies specific, critical leverage points where a firm can use information technology most effectively to enhance its competitive position. The value chain model views the firm as a series or chain of basic activities that add a margin of value to a firm's products or services. These activities can be categorized as either primary activities or support activities.



Primary activities are most directly related to the production and distribution of the firm's products and services, which create value for the customer. Primary activities include inbound logistics, operations, outbound logistics, sales and marketing, and service. Inbound logistics includes receiving and storing materials for distribution to production. Operations transforms inputs into finished products. Outbound logistics entails storing and distributing finished products. Sales and marketing includes promoting and selling the firm's products. The service activity includes maintenance and repair of the firm's goods and services.

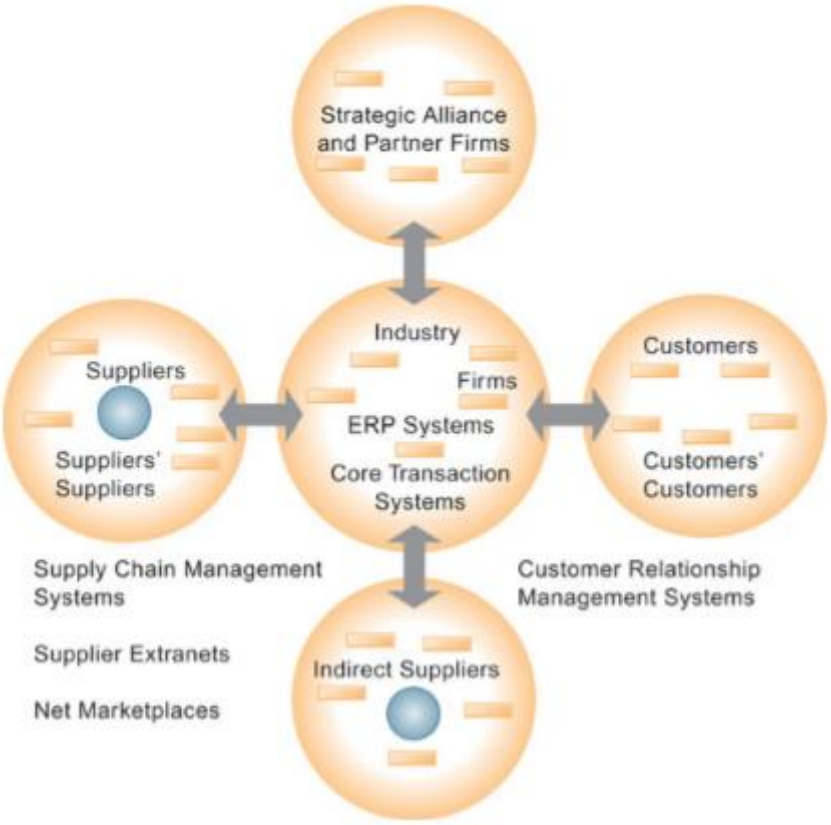
Support activities make the delivery of the primary activities possible and consist of organization infrastructure (administration and management), human resources (employee recruiting, hiring, and training), technology (improving products and the production process), and procurement (purchasing input).

Using the business value chain model will also cause you to consider benchmarking your business processes against your competitors or others in related industries, and identifying industry best practices. Benchmarking involves comparing the efficiency and effectiveness of your business processes against strict standards and then measuring performance against those standards. Industry best practices are usually identified by consulting companies, research organizations, government agencies, and industry associations as the most successful solutions or problem-solving methods for consistently and effectively achieving a business objective.

Once you have analyzed the various stages in the value chain at your business, you can come up with candidate applications of information systems. Then, once you have a list of candidate applications, you can decide which to develop first. By making improvements in your own business value chain that your competitors might miss, you can achieve competitive advantage by attaining operational excellence, lowering costs, improving profit margins, and forging a closer relationship with customers and suppliers.

Synergies, Core competencies, and Network based strategies:
A large corporation is typically a collection of businesses. Often, the firm is organized financially as a collection of strategic business units and the returns to the firm are directly tied to the performance of all the strategic business units. Information systems can improve the overall performance of these business units by promoting synergies and core competencies.

The value web:



The value web is a networked system that can synchronize the value chains of business partners within an industry to respond rapidly to changes in supply and demand.

Synergies:
The idea of synergies is that when the output of some units can be used as inputs to other units, or two organizations pool markets and expertise, these relationships lower costs and generate profits. One use of information technology in these synergy situations is to tie together the operations of disparate business units so that they can act as a whole. Information systems would help the merged companies consolidate operations, lower retailing costs, and increase cross-marketing of financial products.

Enhancing Core Competencies:
Yet another way to use information systems for competitive advantage is to think about ways that systems can enhance core competencies. The argument is that the performance of all business units will increase insofar as these business units develop, or create, a central core of competencies. A core competency is an activity for which a firm is a world-class leader. Core competencies may involve being the world's best miniature parts designer, the best package delivery service, or the best thin-film manufacturer. In general, a core competency relies on knowledge that is gained over many years of practical field experience with a technology. This practical knowledge is typically supplemented with a long-term research effort and committed employees.

Case study

Will TV Succumb to the Internet?

The Internet has transformed the music industry. Sales of CDs in retail music stores have been steadily declining while sales of songs downloaded through the Internet to iPods and other portable music players are skyrocketing. Moreover, the music industry is still contending with millions of people illegally downloading songs for free. Will the television industry experience a similar fate?

Widespread use of high-speed Internet access, powerful PCs with high-resolution display screens, iPhones, iPads, other mobile handhelds, and leading edge file-sharing services have made downloading of video content from movies and television shows faster and easier than ever. Free and often illegal downloads of some TV shows are abundant. But the Internet is also providing new ways for television studios to distribute and sell their content, and they are trying to take advantage of that opportunity.

YouTube, which started up in February 2005, quickly became the most popular video-sharing Web site in the world. Even though YouTube's original mission was to provide an outlet for amateur filmmakers, clips of copyrighted Hollywood movies and television shows soon proliferated on the YouTube Web site. It is difficult to gauge how much proprietary content from TV shows winds up on YouTube without the studios' permission. Viacom claimed in a 2008 lawsuit that over 150,000 unauthorized clips of its copyrighted television programs had appeared on YouTube.

YouTube tries to discourage its users from posting illegal clips by limiting the length of videos to 10 minutes each and by removing videos when requested by their copyright owner. YouTube has also implemented Video ID filtering and digital fingerprinting technology that allows copyright owners to compare the digital fingerprints of their videos with material on YouTube and then flag infringing material. Using this technology, it is able to filter many unauthorized videos before they appear on the YouTube Web site. If infringing videos do make it online, they can be tracked using Video ID.

The television industry is also striking back by embracing the Internet as another delivery system for its content. Television broadcast networks such as NBC Universal, Fox, and CNN have put television shows on their own Web sites. In March 2007, NBC Universal, News Corp (the owner of Fox Broadcasting), and ABC Inc. formed Hulu.com, a Web site offering streaming video of television shows and movies from NBC, Fox, ABC, Comedy Central, PBS, USA Network, Bravo, FX, Speed, Sundance, Oxygen, Onion News Network, and other networks. Hulu also syndicates its hosting to other sites, including AOL, MSN, Facebook, MySpace, Yahoo!, and Fancast.com, and allows users to embed Hulu clips in their Web site. The site is supported by advertising commercials, and much of its content is free to viewers. CBS's TV.com and Joost are other popular Web television sites.

Content from all of these sites is viewable over iPhones. Hulu has blocked services such as Boxee that try to bring Hulu to TV screens, because that would draw subscribers away from cable and satellite companies, diminishing their revenue.

According to Hulu CEO Jason Kilar, Hulu has successfully brought online TV into the mainstream. It dominates the market for online full-episode TV viewing, with more than 44 million monthly visitors, according to the online measurement firm comScore. Monthly video streams more than tripled in 2009, reaching over 900 million by January 2010.

What if there are so many TV shows available for free on the Web that "Hulu households" cancel their cable subscriptions to watch free TV online? Cable service operators have begun worrying, especially when the cable networks posted some of their programming on the Web. By 2010, nearly 800,000 U.S. households had "cut the cord," dumping their cable, satellite, or high-speed television services from telecom companies such as Verizon's FiOS or AT&T's U-verse. In their place, they turned to Web-based videos from services such as Hulu, downloadable shows from iTunes, by-mail video subscription services such as Netflix, or even old-style over the-air broadcast programming. Although the "cord cutters" represent less than 1 percent of the 100 million U.S. households

subscribing to a cable/ satellite/telco television service, the number of cord-cutting U.S. households is predicted to double to about 1.6 million. What if this trend continues?

In July 2009, cable TV operator Comcast Corporation began a trial program to bring some of Time Warner's network shows, including TBS's My Boys and TNT's The Closer, to the Web. Other cable networks, including A&E and the History Channel, participated in the Comcast test.

By making more television shows available online, but only for cable subscribers, the cable networks hope to preserve and possibly expand the cable TV subscription model in an increasingly digital world. "The vision is you can watch your favorite network's programming on any screen," noted Time Warner Chief Executive Jeff Bewkes. The system used in the Comcast-Time Warner trial is interoperable with cable service providers' systems to authenticate subscribers.

The same technology might also allow cable firms to provide demographic data for more targeted ads and perhaps more sophisticated advertising down the road. Cable programmers stand to earn more advertising revenue from their online content because viewers can't skip ads on TV programs streamed from the Web as they do with traditional TV. Web versions of some television shows in the Comcast–Time Warner trial program, including TNT's The Closer, will carry the same number of ads as seen on traditional TV, which amounts to more than four times the ad load on many Internet sites, including Hulu. Many hour-long shows available online are able to accommodate five or six commercial breaks, each with a single 30-second ad. NBC Universal Digital Entertainment has even streamed episodes of series, including The Office, with two ads per break. According to research firm eMarketer, these Web-video ads will generate $1.5 billion in ad revenue in 2010 and $2.1 billion in 2011.

For all its early success, Hulu is experiencing growing pains. Although it had generated more than $100 million in advertising revenue within two years, it is still unprofitable. Hulu's content suppliers receive 50 to 70 percent of the advertising revenue Hulu generates from their videos. Some of these media companies have complained that this revenue is very meager, even though use of Hulu has skyrocketed. One major supplier, Viacom, withdrew its programming from Hulu after failing to reach a satisfactory agreement on revenue-sharing, depriving Hulu viewers of such popular shows as The Daily Show with Jon Stewart and The Colbert Report.

Other companies supplying Hulu's content have pressured the company to earn even more advertising dollars and to set up a subscription service requiring consumers to pay a monthly fee to watch at least some of the shows on the site. On June 29, 2010, Hulu launched such a service, called HuluPlus. For $9.99 per month, paid subscribers get the entire current season of Glee, The Office, House and other shows from broadcasters ABC, Fox, and NBC, as well as all the past seasons of several series. Hulu will continue to show a few recent episodes for free online. Paying subscribers will get the same number of ads as users of the free Web site in order to keep the subscription cost low. Paying subscribers are also able watch shows in high definition and on multiple devices, including mobile phones and videogame consoles as well as television screens.

Will all of this work out for the cable industry? It's still too early to tell. Although the cable programming companies want an online presence to extend their brands, they don't want to cannibalize TV subscriptions or viewership ratings that generate advertising revenue. Customers accustomed to YouTube and Hulu may rebel if too many ads are shown online. According to Oppenheimer analyst Tim Horan, cable companies will start feeling the impact of customers canceling subscriptions to view online video and TV by 2012. Edward Woo, an Internet and digital media analyst for Wedbush Morgan Securities in Los Angeles, predicts that in a few years, "it should get extremely interesting." Hulu and other Web TV and video sites will have much deeper content, and the technology to deliver that content to home viewers will be more advanced.

Case study Questions:

1. What competitive forces have challenged the television industry? What problems have these forces created?

2. Describe the impact of disruptive technology on the companies discussed in this case.
3. How have the cable programming and delivery companies responded to the Internet?
4. What management, organization, and technology issues must be addressed to solve the cable industry's problems?
5. Have the cable companies found a successful new business model to compete with the Internet? Why or why not?
6. If more television programs were available online, would you cancel your cable subscription? Why or why not?

Unit-4

Information Technology Infrastructure

4.1 IT infrastructure

IT infrastructure includes investment in hardware, software, and services—such as consulting, education, and training—that are shared across the entire firm or across entire business units in the firm. A firm's IT infrastructure provides the foundation for serving customers, working with vendors, and managing internal firm business processes.

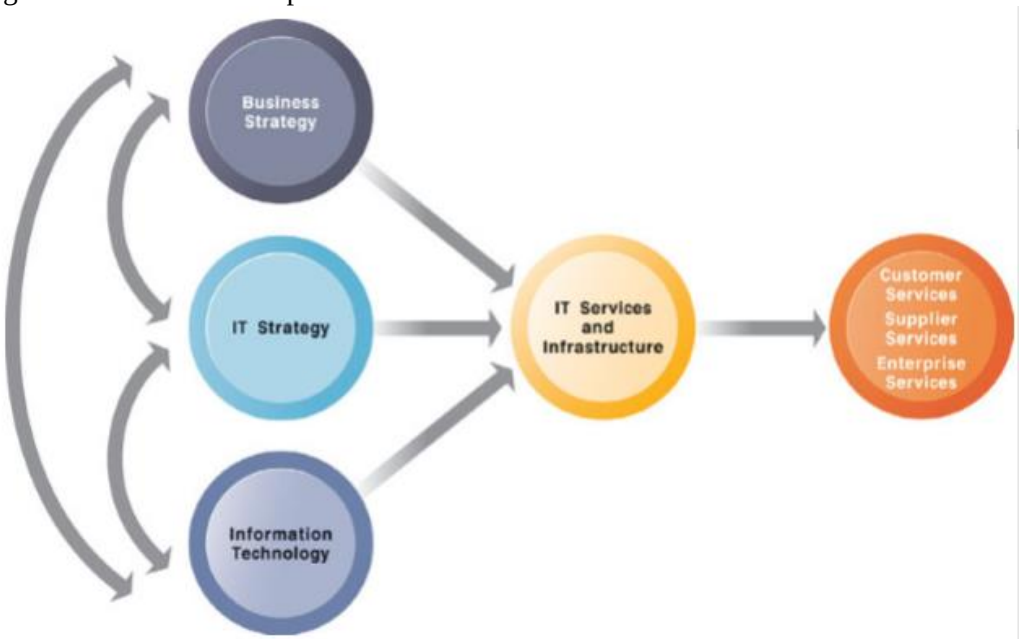


Fig: CONNECTION BETWEEN THE FIRM, IT INFRASTRUCTURE, AND BUSINESS CAPABILITIES

Points to remember

The services a firm is capable of providing to its customers, suppliers, and employees are a direct function of its IT infrastructure. Ideally, this infrastructure should support the firm's business and information systems strategy. New information technologies have a powerful impact on business and IT strategies, as well as the services that can be provided to customers.

Defining IT Infrastructure:

IT infrastructure consists of a set of physical devices and software applications that are required to operate the entire enterprise. But IT infrastructure is also a set of firmwide services budgeted by management and comprising both human and technical capabilities. These services include the following:

- Computing platforms used to provide computing services that connect employees, customers, and suppliers into a coherent digital environment, including large mainframes, midrange computers, desktop and laptop computers, and mobile handheld devices.
- Telecommunications services that provide data, voice, and video connectivity to employees, customers, and suppliers.
- Data management services that store and manage corporate data and provide capabilities for analyzing the data.

- Application software services that provide enterprise-wide capabilities such as enterprise resource planning, customer relationship management, supply chain management, and knowledge management systems that are shared by all business units.
- Physical facilities management services that develop and manage the physical installations required for computing, telecommunications, and data management services.
- IT management services that plan and develop the infrastructure, coordinate with the business units for IT services, manage accounting for the IT expenditure, and provide project management services.
- IT standards services that provide the firm and its business units with policies that determine which information technology will be used, when, and how.
- IT education services that provide training in system use to employees and offer managers training in how to plan for and manage IT investments.
- IT research and development services that provide the firm with research on potential future IT projects and investments that could help the firm differentiate itself in the marketplace.

Evolution of IT Infrastructure:

The IT infrastructure in organizations today is an outgrowth of over 50 years of evolution in computing platforms. There have been five stages in this evolution, each representing a different configuration of computing power and infrastructure elements. The five eras are general-purpose mainframe and minicomputer computing, personal computers, client/server networks, enterprise computing, and cloud and mobile computing.

1. General – Purpose Mainframe and Minicomputer Era (1959 to present): The introduction of the IBM 1401 and 7090 transistorized machines in 1959 marked the beginning of widespread commercial use of mainframe computers. In 1965, the mainframe computer truly came into its own with the introduction of the IBM 360 series. The 360 was the first commercial computer with a powerful operating system that could provide time sharing, multitasking, and virtual memory in more advanced models. IBM has dominated mainframe computing from this point on. Mainframe computers became powerful enough to support thousands of online remote terminals connected to the centralized mainframe using proprietary communication protocols and proprietary data lines.

This pattern began to change with the introduction of minicomputers produced by Digital Equipment Corporation (DEC) in 1965. DEC minicomputers (PDP-11 and later the VAX machines) offered powerful machines at far lower prices than IBM mainframes, making possible decentralized computing, customized to the specific needs of individual departments or business units rather than time sharing on a single huge mainframe. In recent years, the minicomputer has evolved into a midrange computer or midrange server and is part of a network.

2. Personal Computer Era (1981 to Present): Proliferation of PCs in the 1980s and early 1990s launched a spate of personal desktop productivity software tools—word processors, spreadsheets, electronic presentation software, and small data management programs—that were very valuable to both home and corporate users. These PCs were standalone systems until PC operating system software in the 1990s made it possible to link them into networks.

3. Client/Server Era (1983 to Present): In client/server computing, desktop or laptop computers called clients are networked to powerful server computers that provide the client computers with a variety of services and capabilities. Computer processing work is split between these two types of machines. The client is the user point of entry, whereas the server typically processes and stores shared data, serves up Web pages, or manages network activities. The term "server" refers to both the software application and the physical computer on which the network software runs. The server could be a mainframe, but today, server computers typically are more powerful versions of personal computers, based on inexpensive chips and often using multiple processors in a single computer box.

4. Enterprise Computing Era (1992 to Present): In In the early 1990s, firms turned to networking standards and software tools that could integrate disparate networks and applications throughout the

firm into an enterprise-wide infrastructure. As the Internet developed into a trusted communications environment after 1995, business firms began seriously using the Transmission Control Protocol/Internet Protocol (TCP/IP) networking standard to tie their disparate networks together. The resulting IT infrastructure links different pieces of computer hardware and smaller networks into an enterprise-wide network so that information can flow freely across the organization and between the firm and other organizations. It can link different types of computer hardware, including mainframes, servers, PCs, mobile phones, and other handheld devices, and it includes public infrastructures such as the telephone system, the Internet, and public network services. The enterprise infrastructure also requires software to link disparate applications and enable data to flow freely among different parts of the business, such as enterprise applications and web services.

5. Cloud computing and Mobile Computing Era (2000 to Present): The growing bandwidth power of the Internet has pushed the client/server model one step further, towards what is called the "Cloud Computing Model." Cloud computing refers to a model of computing that provides access to a shared pool of computing resources (computers, storage, applications, and services), over a network, often the Internet. These "clouds" of computing resources can be accessed on an as-needed basis from any connected device and location. Thousands or even hundreds of thousands computers are located in cloud data centers, where they can be accessed by desktop computers, laptop computers, netbooks, entertainment centers, mobile devices, and other client machines linked to the Internet, with both personal and corporate computing increasingly moving to mobile platforms. IBM, HP, Dell, and Amazon operate huge, scalable cloud computing centers that provide computing power, data storage, and high-speed Internet connections to firms that want to maintain their IT infrastructures remotely. Software firms such as Google, Microsoft, SAP, Oracle, and Salesforce.com sell software applications as services delivered over the Internet.

4.2 Infrastructure components

IT infrastructure today is composed of seven major components. Following figure illustrates these infrastructure components and the major vendors within each component category. These components constitute investments that must be coordinated with one another to provide the firm with a coherent infrastructure.

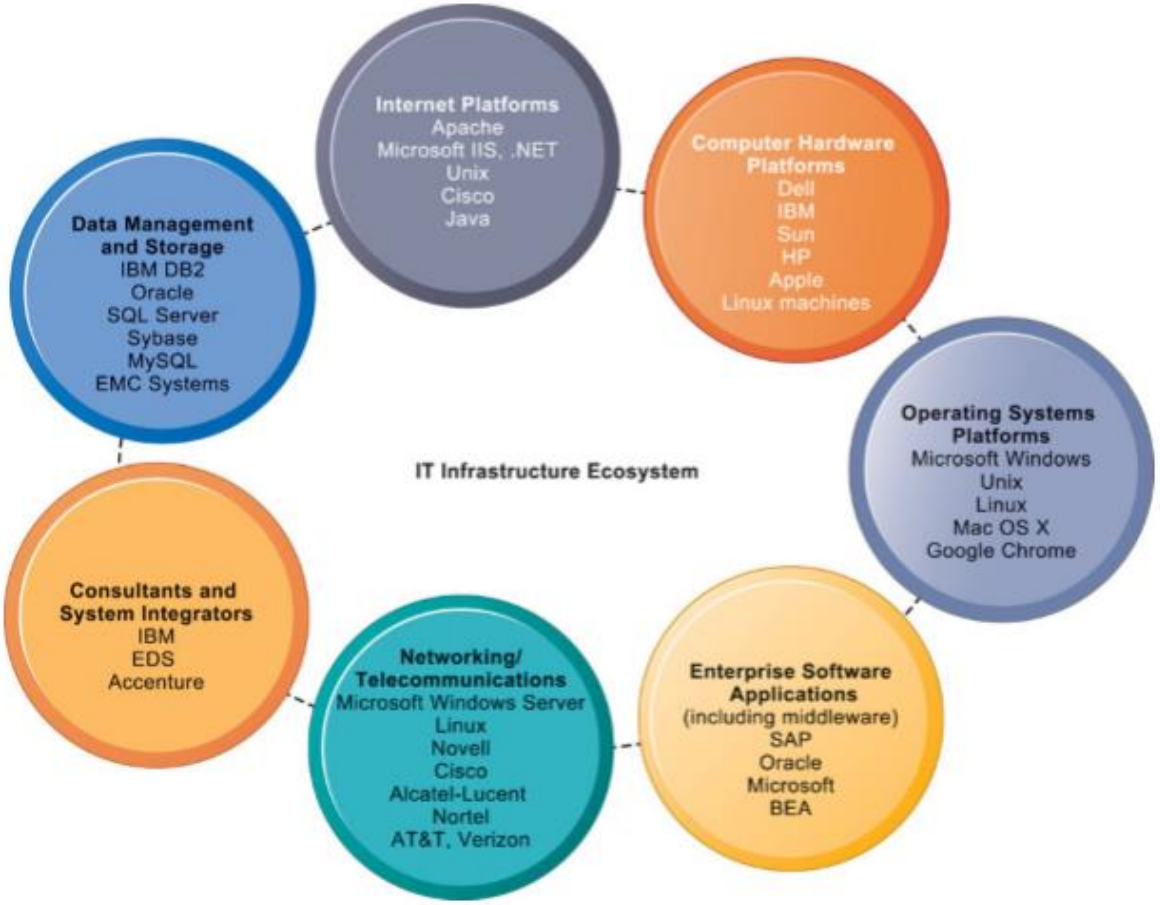


Fig: The IT infrastructure ecosystem

1. Computer Hardware Platforms: This component includes client machines (desktop PCs, mobile computing devices such as netbooks and laptops but not including iPhones or BlackBerrys) and server machines. The client machines use primarily Intel or AMD microprocessors. The marketplace for computer hardware has increasingly become concentrated in top firms such as IBM, HP, Dell, and Sun Microsystems (acquired by Oracle), and three chip producers: Intel, AMD, and IBM. The industry has collectively settled on Intel as the standard processor, with major exceptions in the server market for Unix and Linux machines, which might use Sun or IBM Unix processors.

2. Operating System Platforms: In 2010, Microsoft Windows comprises about 75 percent of the server operating system market, with 25 percent of corporate servers using some form of the Unix operating system or Linux, an inexpensive and robust open source relative of Unix. Microsoft Windows Server is capable of providing enterprise-wide operating system and network services, and appeals to organizations seeking Windows-based IT infrastructures.

At the client level, 90 percent of PCs use some form of Microsoft Windows operating system (such as Windows 7, Windows Vista, or Windows XP) to manage the resources and activities of the computer. However, there is now a much greater variety of operating systems than in the past, with new operating systems for computing on handheld mobile digital devices or cloud-connected computers.

Google's Chrome OS provides a lightweight operating system for cloud computing using netbooks. Programs are not stored on the user's PC but are used over the Internet and accessed through the Chrome Web browser. User data resides on servers across the Internet. Microsoft has introduced the Windows Azure operating system for its cloud services and platform. Android is a mobile operating system developed by Android, Inc. (purchased by Google) and later the Open Handset Alliance as a flexible, upgradeable mobile device platform.

3. Enterprise Software Applications: The largest providers of enterprise application software are SAP and Oracle (which acquired PeopleSoft). Also included in this category is middleware software supplied by vendors such as BEA for achieving firm wide integration by linking the firm's existing application systems. Microsoft is attempting to move into the lower ends of this market by focusing on small and medium sized businesses that have not yet implemented enterprise applications.

4. Data Management and Storage: Enterprise database management software is responsible for organizing and managing the firm's data so that they can be efficiently accessed and used. The leading database software providers are IBM (DB2), Oracle, Microsoft (SQL Server), and Sybase (Adaptive Server Enterprise), which supply more than 90 percent of the U.S. database software marketplace. MySQL is a Linux open source relational database product now owned by Oracle Corporation. The physical data storage market is dominated by EMC Corporation for largescale systems, and a small number of PC hard disk manufacturers led by Seagate, Maxtor, and Western Digital.

With the amount of new digital information in the world growing so rapidly, the market for digital data storage devices has been growing at more than 15 percent annually over the last five years. In addition to traditional disk arrays and tape libraries, large firms are turning to network-based storage technologies. Storage area networks (SANs) connect multiple storage devices on a separate high-speed network dedicated to storage. The SAN creates a large central pool of storage that can be rapidly accessed and shared by multiple servers.

5. Networking/Telecommunications Platforms: Windows Server is predominantly used as a local area network operating system, followed by Linux and Unix. Large enterprise wide area networks primarily use some variant of Unix. Most local area networks, as well as wide area enterprise networks, use the TCP/IP protocol suite as a standard. The leading networking hardware providers are Cisco, Alcatel-Lucent, Nortel, and Juniper Networks. Telecommunications platforms are typically provided by telecommunications/telephone services companies that offer voice and data connectivity, wide area networking, wireless services, and Internet access.

6. Internet Platforms: Internet platforms overlap with, and must relate to, the firm's general networking infrastructure and hardware and software platforms. U.S. firms spent an estimated $40 billion annually on Internet-related infrastructure. These expenditures were for hardware, software, and management services to support a firm's Web site, including Web hosting services, routers, and cabling or wireless equipment. A Web hosting service maintains a large Web server, or series of servers, and provides fee-paying subscribers with space to maintain their Web sites. The Internet revolution created a veritable explosion in server computers, with many firms collecting thousands of small servers to run their Internet operations. Since then there has been a steady push toward server consolidation, reducing the number of server computers by increasing the size and power of each. The Internet hardware server market has become increasingly concentrated in the hands of IBM, Dell, and HP/Compaq, as prices have fallen dramatically.

7. Consulting and System Integration Services: Today, even a large firm does not have the staff, the skills, the budget, or the necessary experience to deploy and maintain its entire IT infrastructure. Implementing a new infrastructure requires significant changes in business processes and procedures, training and education, and software integration. Leading consulting firms providing this expertise include Accenture, IBM Global Services, HP Enterprise Services, Infosys, and Wipro Technologies. Software integration means ensuring the new infrastructure works with the firm's older, so-called legacy systems and ensuring the new elements of the infrastructure work with one another. Legacy systems are generally older transaction processing systems created for mainframe computers that continue to be used to avoid the high cost of replacing or redesigning them. Replacing these systems is cost prohibitive and generally not necessary if these older systems can be integrated into a contemporary infrastructure.

4.3 Contemporary hardware platform trends

The exploding power of computer hardware and networking technology has dramatically changed how businesses organize their computing power, putting more of this power on networks and mobile handheld devices. We look at seven hardware trends: the emerging mobile digital platform, grid computing, virtualization, cloud computing, green computing, high-performance/power saving processors, and autonomic computing.

1. The emerging mobile digital platform: Cell phones and smartphones such as the BlackBerry and iPhone have taken on many functions of handheld computers, including transmission of data, surfing the Web, transmitting e-mail and instant messages, displaying digital content, and exchanging data with internal corporate systems. The new mobile platform also includes small low-cost lightweight subnotebooks called netbooks optimized for wireless communication and Internet access, with core computing functions such as word processing; tablet computers such as the iPad; and digital e-book readers such as Amazon's Kindle with some Web access capabilities.

In a few years, smartphones, netbooks, and tablet computers will be the primary means of accessing the Internet, with business computing moving increasingly from PCs and desktop machines to these mobile devices. For example, senior executives at General Motors are using smartphone applications that drill down into vehicle sales information, financial performance, manufacturing metrics, and project management status. At medical device maker Astra Tech, sales reps use their smartphones to access Salesforce.com customer relationship management (CRM) applications and sales data, checking data on sold and returned products and overall revenue trends before meeting with customers.

2. GRID Computing: Grid computing, involves connecting geographically remote computers into a single network to create a virtual supercomputer by combining the computational power of all computers on the grid. Grid computing takes advantage of the fact that most computers use their central processing units on average only 25 percent of the time for the work they have been assigned, leaving these idle resources available for other processing tasks. Grid computing was impossible until high-speed Internet connections enabled firms to connect remote machines economically and move enormous quantities of data.

Grid computing requires software programs to control and allocate resources on the grid. Client software communicates with a server software application. The server software breaks data and application code into chunks that are then parceled out to the grid's machines. The client machines perform their traditional tasks while running grid applications in the background.

3. Virtualization: Virtualization is the process of presenting a set of computing resources (such as computing power or data storage) so that they can all be accessed in ways that are not restricted by physical configuration or geographic location. Virtualization enables a single physical resource (such as a server or a storage device) to appear to the user as multiple logical resources. For example, a server or mainframe can be configured to run many instances of an operating system so that it acts like many different machines. Virtualization also enables multiple physical resources (such as storage devices or servers) to appear as a single logical resource, as would be the case with storage area networks or grid computing. Virtualization makes it possible for a company to handle its computer processing and storage using computing resources housed in remote locations. VMware is the leading virtualization software vendor for Windows and Linux servers. Microsoft offers its own Virtual Server product and has built virtualization capabilities into the newest version of Windows Server.

4. Cloud Computing: In cloud computing, firms and individuals obtain computer processing, storage, software, and other services as a pool of virtualized resources over a network, primarily the Internet. These resources are made available to users, based on their needs, irrespective of their physical location or the location of the users themselves.

Characteristics of cloud computing:

- **On demand self service:** Individuals can obtain computing capabilities such as server time or network storage on their own.
- **Ubiquitous network access:** Individuals can use standard network and Internet devices, including mobile platforms, to access cloud resources.
- **Location independent resource pooling:** Computing resources are pooled to serve multiple users, with different virtual resources dynamically assigned according to user demand. The user generally does not know where the computing resources are located.
- **Rapid elasticity:** Computing resources can be rapidly provisioned, increased, or decreased to meet changing user demand.
- **Measured service:** Charges for cloud resources are based on amount of resources actually used.

Cloud computing consists of three different types of services:

- **Cloud infrastructure as a service:** Customers use processing, storage, networking, and other computing resources from cloud service providers to run their information systems. For example, Amazon uses the spare capacity of its IT infrastructure to provide a broadly based cloud environment selling IT infrastructure services. These include its Simple Storage Service (S3) for storing customers' data and its Elastic Compute Cloud (EC2) service for running their applications. Users pay only for the amount of computing and storage capacity they actually use.
- **Cloud platform as a service:** Customers use infrastructure and programming tools hosted by the service provider to develop their own applications. For example, IBM offers a Smart Business Application Development & Test service for software development and testing on the IBM Cloud. Another example is Salesforce.com's Force.com, described in the chapter-ending case study, which allows developers to build applications that are hosted on its servers as a service.
- **Cloud software as a service:** Customers use software hosted by the vendor on the vendor's hardware and delivered over a network. Leading examples are Google Apps, which provides common business applications online and Salesforce.com, which also leases CRM and related software services over the Internet. Both charge users an annual subscription fee, although Google Apps also has a pared-down free version. Users access these applications from a Web browser, and the data and software are maintained on the providers' remote servers.

5. Green Computing: By curbing hardware proliferation and power consumption, virtualization has become one of the principal technologies for promoting green computing. Green computing or green IT, refers to practices and technologies for designing, manufacturing, using, and disposing of computers, servers, and associated devices such as monitors, printers, storage devices, and networking and communications systems to minimize impact on the environment. Reducing computer power consumption has been a very high "green" priority. As companies deploy hundreds or thousands of servers, many are spending almost as much on electricity to power and cool their systems as they did on purchasing the hardware.

6. Autonomic Computing: With large systems encompassing many thousands of networked devices, computer systems have become so complex today that some experts believe they may not be manageable in the future. One approach to dealing with this problem is to employ autonomic computing. Autonomic computing is an industry-wide effort to develop systems that can configure themselves, optimize and tune themselves, heal themselves when broken, and protect themselves from outside intruders and self-destruction.

7. High-performance and power-saving processors: Another way to reduce power requirements and hardware sprawl is to use more efficient and power-saving processors. Contemporary microprocessors now feature multiple processor cores (which perform the reading and execution of computer instructions) on a single chip. A multicore processor is an integrated circuit to which two or more processor cores have been attached for enhanced performance, reduced power consumption, and more

efficient simultaneous processing of multiple tasks. This technology enables two or more processing engines with reduced power requirements and heat dissipation to perform tasks faster than a resource-hungry chip with a single processing core. Today you'll find dual-core and quad-core processors in PCs and servers with 8-, 10-, 12-, and 16-core processors.

4.4 Contemporary software platform trends

There are four major themes in contemporary software platform evolution:

1. Linux and Open Source Software: Open source software is software produced by a community of several hundred thousand programmers around the world. According to the leading open source professional association, OpenSource.org, open source software is free and can be modified by users. Works derived from the original code must also be free, and the software can be redistributed by the user without additional licensing. Open source software is by definition not restricted to any specific operating system or hardware technology, although most open source software is currently based on a Linux or Unix operating system. The open source movement has been evolving for more than 30 years and has demonstrated that it can produce commercially acceptable, high-quality software. Popular open source software tools include the Linux operating system, the Apache HTTP Web server, the Mozilla Firefox Web browser, and the Oracle Open Office desktop productivity suite. Open source tools are being used on netbooks as inexpensive alternatives to Microsoft Office. Major hardware and software vendors, including IBM, HP, Dell, Oracle, and SAP, now offer Linux-compatible versions of their products.

2. Software for the web : Java and Ajax:

Java: Java is an operating system-independent, processor-independent, object oriented programming language that has become the leading interactive environment for the Web. Java was created by James Gosling and the Green Team at Sun Microsystems in 1992. In November 13, 2006, Sun released much of Java as open source software under the terms of the GNU General Public License (GPL), completing the process on May 8, 2007. The Java platform has migrated into cellular phones, smartphones, automobiles, music players, game machines, and finally, into set-top cable television systems serving interactive content and pay-per-view services. Java software is designed to run on any computer or computing device, regardless of the specific microprocessor or operating system the device uses. For each of the computing environments in which Java is used, Sun created a Java Virtual Machine that interprets Java programming code for that machine. In this manner, the code is written once and can be used on any machine for which there exists a Java Virtual Machine.

Ajax: Ajax (Asynchronous JavaScript and XML) is another Web development technique for creating interactive Web applications that prevents all of this inconvenience. Ajax allows a client and server to exchange small pieces of data behind the scene so that an entire Web page does not have to be reloaded each time the user requests a change. So if you click North on a map site, such as Google Maps, the server downloads just that part of the application that changes with no wait for an entirely new map. You can also grab maps in map applications and move the map in any direction without forcing a reload of the entire page. Ajax uses JavaScript programs downloaded to your client to maintain a near-continuous conversation with the server you are using, making the user experience more seamless.

3. Web services and service – oriented architecture: Web services refer to a set of loosely coupled software components that exchange information with each other using universal Web communication standards and languages. They can exchange information between two different systems regardless of the operating systems or programming languages on which the systems are based. They can be used to build open standard Web-based applications linking systems of two different organizations, and they can also be used to create applications that link disparate systems within a single company. Web services are not tied to any one operating system or programming language, and different applications can use them to communicate with each other in a standard way without time-consuming custom coding.

4. Software outsourcing and cloud services: Today many business firms continue to operate legacy systems that continue to meet a business need and that would be extremely costly to replace. But they will purchase or rent most of their new software applications from external sources. There are three external sources for software: software packages from a commercial software vendor, outsourcing custom application development to an external vendor, and cloud-based software services and tools.

Software packages and enterprise software: A software package is a prewritten commercially available set of software programs that eliminates the need for a firm to write its own software programs for certain functions, such as payroll processing or order handling. Enterprise application software vendors such as SAP and Oracle-PeopleSoft have developed powerful software packages that can support the primary business processes of a firm worldwide from warehousing, customer relationship management, supply chain management, and finance to human resources. These large-scale enterprise software systems provide a single, integrated, worldwide software system for firms at a cost much less than they would pay if they developed it themselves.

Software Outsourcing: Software outsourcing enables a firm to contract custom software development or maintenance of existing legacy programs to outside firms, which often operate offshore in low-wage areas of the world.

Cloud-based software services and tools: Cloud-based software and the data it uses are hosted on powerful servers in massive data centers, and can be accessed with an Internet connection and standard Web browser. In addition to free or low-cost tools for individuals and small businesses provided by Google or Yahoo!, enterprise software and other complex business functions are available as services from the major commercial software vendors. Instead of buying and installing software programs, subscribing companies rent the same functions from these services, with users paying either on a subscription or per-transaction basis. Services for delivering and providing access to software remotely as a Web-based service are now referred to as software as a service (SaaS). A leading example is Salesforce.com, described in the chapter-ending case study, which provides on-demand software services for customer relationship management.

4.5 Management issues

Creating and managing a coherent IT infrastructure raises multiple challenges: dealing with platform and technology change (including cloud and mobile computing), management and governance, and making wise infrastructure investments.

1. Dealing with platform and infrastructure change

As firms grow, they often quickly outgrow their infrastructure. As firms shrink, they can get stuck with excessive infrastructure purchased in better times. How can a firm remain flexible when most of the investments in IT infrastructure are fixed-cost purchases and licenses? How well does the infrastructure scale? Scalability refers to the ability of a computer, product, or system to expand to serve a large number of users without breaking down. New applications, mergers and acquisitions, and changes in business volume all impact computer workload and must be considered when planning hardware capacity.

Firms using mobile computing and cloud computing platforms will require new policies and procedures for managing these platforms. They will need to inventory all of their mobile devices in business use and develop policies and tools for tracking, updating, and securing them and for controlling the data and applications that run on them. Firms using cloud computing and SaaS will need to fashion new contractual arrangements with remote vendors to make sure that the hardware and software for critical applications are always available when needed and that they meet corporate standards for information security. It is up to business management to determine acceptable levels of computer response time and availability for the firm's mission-critical systems to maintain the level of business performance they expect.

2. Management and Governance

A long-standing issue among information system managers and CEOs has been the question of who will control and manage the firm's IT infrastructure. Other important questions about IT governance are: Should departments and divisions have the responsibility of making their own information technology decisions or should IT infrastructure be centrally controlled and managed? What is the relationship between central information systems management and business unit information systems management? How will infrastructure costs be allocated among business units? Each organization will need to arrive at answers based on its own needs.

3. Making wise infrastructure investments

IT infrastructure is a major investment for the firm. If too much is spent on infrastructure, it lies idle and constitutes a drag on firm financial performance. If too little is spent, important business services cannot be delivered and the firm's competitors (who spent just the right amount) will outperform the underinvesting firm. How much should the firm spend on infrastructure? This question is not easy to answer. A related question is whether a firm should purchase and maintain its own IT infrastructure components or rent them from external suppliers, including those offering cloud services. The decision either to purchase your own IT assets or rent them from external providers is typically called the rent-versus-buy decision.

Total cost of ownership of technology assets:

The actual cost of owning technology resources includes the original cost of acquiring and installing hardware and software, as well as ongoing administration costs for hardware and software upgrades, maintenance, technical support, training, and even utility and real estate costs for running and housing the technology. The total cost of ownership (TCO) model can be used to analyze these direct and indirect costs to help firms determine the actual cost of specific technology implementations.

Infrastructure component	Cost Components
Hardware acquisition	Purchase price of computer hardware equipment, including computers, terminals, storage, and printers
Software acquisition	Purchase or license of software for each user.
Installation	Cost to install computers and software.
Training	Cost to provide training for information systems specialists and end users.
Support	Cost to provide ongoing technical support, help desks, and so forth.
Maintenance	Cost to upgrade the hardware and software.
Infrastructure	Cost to acquire, maintain, and support related infrastructure, such as networks and specialized equipment (including storage backup units)
Downtime	Cost of lost productivity if hardware or software failures cause the system to be unavailable for processing and user tasks
Space and energy	Real estate and utility costs for housing and providing power for the technology

Competitive forces model for IT infrastructure investment:

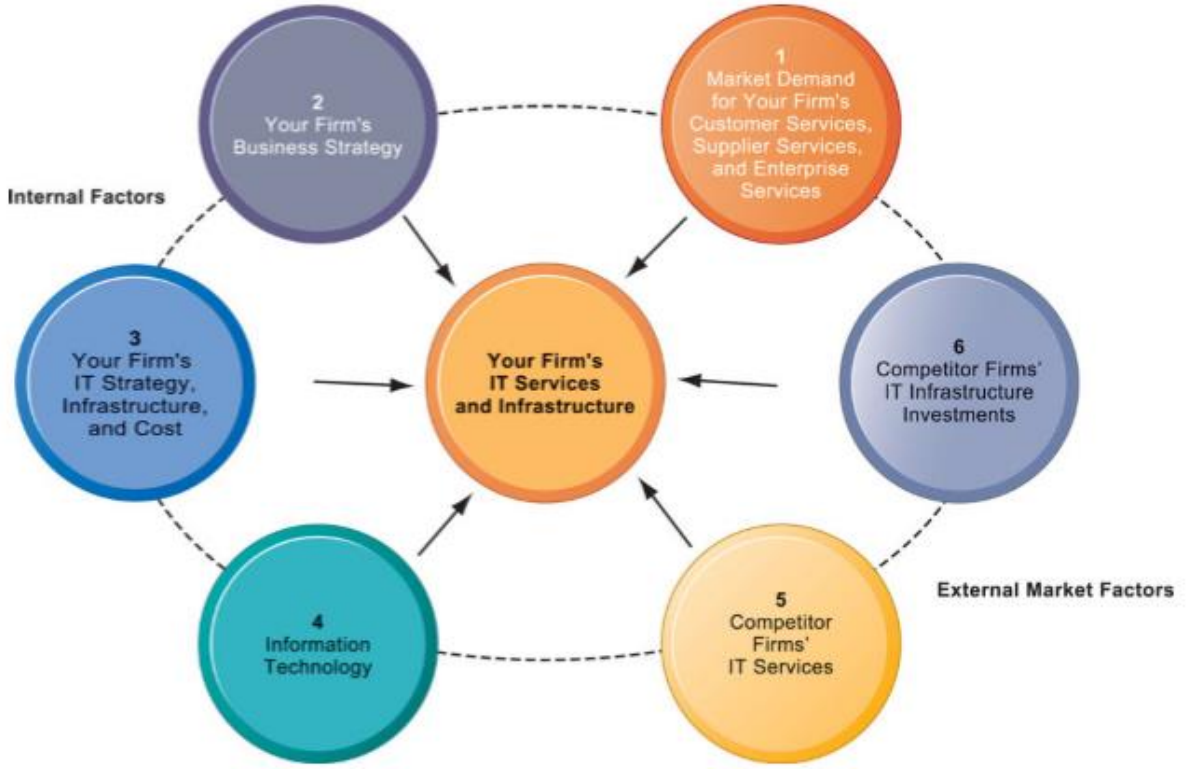


Fig: Competitive forces model for IT infrastructure

- **Market demand for your firm's services.** Make an inventory of the services you currently provide to customers, suppliers, and employees. Survey each group, or hold focus groups to find out if the services you currently offer are meeting the needs of each group. For example, are customers complaining of slow responses to their queries about price and availability? Are employees complaining about the difficulty of finding the right information for their jobs? Are suppliers complaining about the difficulties of discovering your production requirements?
- **Your firm's business strategy.** Analyze your firm's five-year business strategy and try to assess what new services and capabilities will be required to achieve strategic goals.
- **Your firm's IT strategy, infrastructure, and cost.** Examine your firm's information technology plans for the next five years and assess its alignment with the firm's business plans. Determine the total IT infrastructure costs. You will want to perform a TCO analysis. If your firm has no IT strategy, you will need to devise one that takes into account the firm's five-year strategic plan.
- **Information technology assessment.** Is your firm behind the technology curve or at the bleeding edge of information technology? Both situations are to be avoided. It is usually not desirable to spend resources on advanced technologies that are still experimental, often expensive, and sometimes unreliable. You want to spend on technologies for which standards have been established and IT vendors are competing on cost, not design, and where there are multiple suppliers. However, you do not want to put off investment in new technologies or allow competitors to develop new business models and capabilities based on the new technologies.
- **Competitor firm services.** Try to assess what technology services competitors offer to customers, suppliers, and employees. Establish quantitative and qualitative measures to compare them to those of your firm. If your firm's service levels fall short, your company is at a competitive disadvantage. Look for ways your firm can excel at service levels.
- **Competitor firm IT infrastructure investments.** Benchmark your expenditures for IT infrastructure against your competitors. Many companies are quite public about their innovative expenditures on IT. If competing firms try to keep IT expenditures secret, you may be able to find IT investment information in public companies' SEC Form 10-K annual reports to the federal government when those expenditures impact a firm's financial results.

Unit-5

Foundation of Business Intelligence

5.1 Using database to improve business performance and decision making

Businesses use their databases to keep track of basic transactions, such as paying suppliers, processing orders, keeping track of customers, and paying employees. But they also need databases to provide information that will help the company run the business more efficiently, and help managers and employees make better decisions. If a company wants to know which product is the most popular or who is its most profitable customer, the answer lies in the data. In a large company, with large databases or large systems for separate functions, such as manufacturing, sales, and accounting, special capabilities and tools are required for analyzing vast quantities of data and for accessing data from multiple systems. These capabilities include data warehousing, data mining, and tools for accessing internal databases through the Web.

Data Warehouses:

A data warehouse is a database that stores current and historical data of potential interest to decision makers throughout the company. The data originate in many core operational transaction systems, such as systems for sales, customer accounts, and manufacturing, and may include data from Web site transactions. The data warehouse consolidates and standardizes information from different operational databases so that the information can be used across the enterprise for management analysis and decision making.

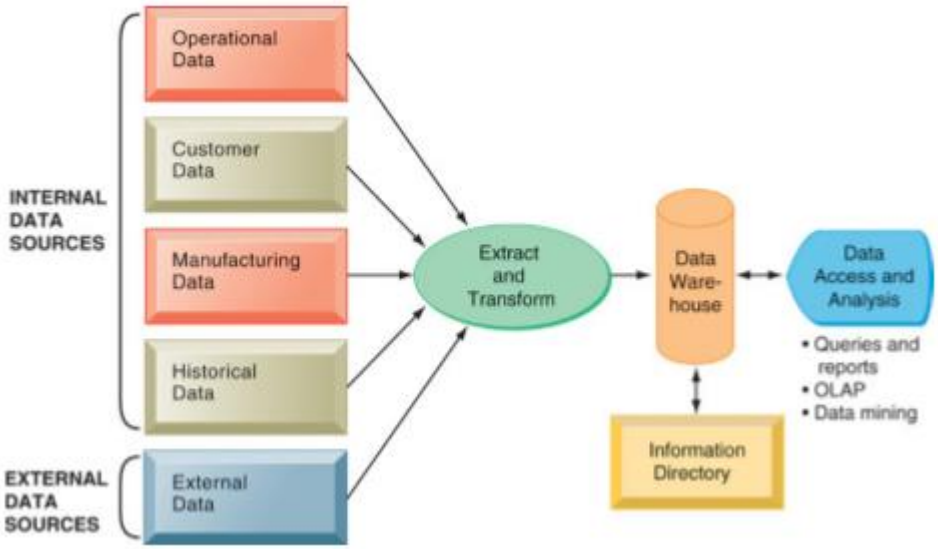


Fig: Components of data warehouse

Points to remember

The data warehouse extracts current and historical data from multiple operational systems inside the organization. These data are combined with data from external sources and reorganized into a central database designed for management reporting and analysis. The information directory provides users with information about the data available in the warehouse.

Data Marts
A data mart is a subset of a data warehouse in which a summarized or highly focused portion of the organization's data is placed in a separate database for a specific population of users. A data mart typically focuses on a single subject area or line of business, so it usually can be constructed more rapidly and at lower cost than an enterprise-wide data warehouse.

Tools for business intelligence: Multidimensional data analysis and data mining:
Once data have been captured and organized in data warehouses and data marts, they are available for further analysis using tools for business intelligence. Business intelligence tools enable users to analyze data to see new patterns, relationships, and insights that are useful for guiding decision making. Principal tools for business intelligence include software for database querying and reporting, tools for multidimensional data analysis (online analytical processing), and tools for data mining.

Online Analytical Processing (OLAP)
OLAP supports multidimensional data analysis, enabling users to view the same data in different ways using multiple dimensions. Each aspect of information—product, pricing, cost, region, or time period—represents a different dimension. So, a product manager could use a multidimensional data analysis tool to learn how many washers were sold in the East in June, how that compares with the previous month and the previous June, and how it compares with the sales forecast. OLAP enables users to obtain online answers to ad hoc questions such as these in a fairly rapid amount of time, even when the data are stored in very large databases, such as sales figures for multiple years.

Data Mining:
Data mining is more discovery-driven. Data mining provides insights into corporate data that cannot be obtained with OLAP by finding hidden patterns and relationships in large databases and inferring rules from them to predict future behavior. The patterns and rules are used to guide decision making and forecast the effect of those decisions. The types of information obtainable from data mining include associations, sequences, classifications, clusters, and forecasts.

- ***Associations*** are occurrences linked to a single event. For instance, a study of supermarket purchasing patterns might reveal that, when corn chips are purchased, a cola drink is purchased 65 percent of the time, but when there is a promotion, cola is purchased 85 percent of the time. This information helps managers make better decisions because they have learned the profitability of a promotion.
- In ***sequences***, events are linked over time. We might find, for example, that if a house is purchased, a new refrigerator will be purchased within two weeks 65 percent of the time, and an oven will be bought within one month of the home purchase 45 percent of the time.
- ***Classification*** recognizes patterns that describe the group to which an item belongs by examining existing items that have been classified and by inferring a set of rules. For example, businesses such as credit card or telephone companies worry about the loss of steady customers. Classification helps discover the characteristics of customers who are likely to leave and can provide a model to help managers predict who those customers are so that the managers can devise special campaigns to retain such customers.
- ***Clustering*** works in a manner similar to classification when no groups have yet been defined. A data mining tool can discover different groupings within data, such as finding affinity groups for bank cards or partitioning a database into groups of customers based on demographics and types of personal investments.
- Although these applications involve predictions, ***forecasting*** uses predictions in a different way. It uses a series of existing values to forecast what other values will be. For example, forecasting might find patterns in data to help managers estimate the future value of continuous variables, such as sales figures.

Text Mining and Web Mining
Text Mining: Text mining tools are the tools which stores E-mail, memos, call center transcripts, survey responses, legal cases, patent descriptions, and service reports are all valuable for finding patterns and trends that will help employees make better business decisions. Text mining is a relatively

new technology, but what's really new are the myriad ways in which unstructured data are being generated by consumers and the business uses for these data. The Interactive Session on Technology explores some of these business applications of text mining.

Web Mining: The web is another rich source of valuable information, some of which can now be mined for patterns, trends, and insights into customer behavior. The discovery and analysis of useful patterns and information from the World Wide Web is called Web mining. Businesses might turn to Web mining to help them understand customer behavior, evaluate the effectiveness of a particular Web site, or quantify the success of a marketing campaign. For instance, marketers use Google Trends and Google Insights for Search services, which track the popularity of various words and phrases used in Google search queries, to learn what people are interested in and what they are interested in buying.

Case study

The Terror Watch List Database's Troubles Continue

In the aftermath of the 9-11 attacks, , the FBI's Terrorist Screening Center, or TSC, was established to consolidate information about suspected terrorists from multiple government agencies into a single list to enhance inter-agency communication. A database of suspected terrorists known as the terrorist watch list was created. Multiple U.S. government agencies had been maintaining separate lists and these agencies lacked a consistent process to share relevant information.

Records in the TSC database contain sensitive but unclassified information on terrorist identities, such as name and date of birth, that can be shared with other screening agencies. Classified information about the people in the watch list is maintained in other law enforcement and intelligence agency databases. Records for the watchlist database are provided by two sources: The National Counterterrorism Center (NCTC) managed by the Office of the Director of National Intelligence provides identifying information on individuals with ties to international terrorism. The FBI provides identifying information on individuals with ties to purely domestic terrorism.

These agencies collect and maintain terrorist information and nominate individuals for inclusion in the TSC's consolidated watch list. They are required to follow strict procedures established by the head of the agency concerned and approved by the U.S. Attorney General. TSC staff must review each record submitted before it is added to the database. An individual will remain on the watch list until the respective department or agency that nominated that person to the list determines that the person should be removed from the list and deleted from the database

The TSC watch list database is updated daily with new nominations, modifications to existing records, and deletions. Since its creation, the list has ballooned to 400,000 people, recorded as 1.1 million names and aliases, and is continuing to grow at a rate of 200,000 records each year. Information on the list is distributed to a wide range of government agency systems for use in efforts to deter or detect the movements of known or suspected terrorists.

Recipient agencies include the FBI, CIA, National Security Agency (NSA), Transportation Security Administration (TSA), Department of Homeland Security, State Department, Customs and Border Protection, Secret Service, U.S. Marshals Service, and the White House. Airlines use data supplied by the TSA system in their NoFly and Selectee lists for prescreening passengers, while the U.S. Customs and Border Protection system uses the watchlist data to help screen travelers entering the United States. The State Department system screens applicants for visas to enter the United States and U.S. residents applying for passports, while state and local law enforcement agencies use the FBI system to help with arrests, detentions, and other criminal justice activities. Each of these agencies receives the subset of data in the watch list that pertains to its specific mission.

When an individual makes an airline reservation, arrives at a U.S. port of entry, applies for a U.S. visa, or is stopped by state or local police within the United States, the frontline screening agency or airline conducts a name-based search of the individual against the records from the terrorist watch list database. When the computerized name-matching system generates a "hit" (a potential name match) against a watch list record, the airline or agency will review each potential match. Matches that are clearly positive or exact matches that are inconclusive (uncertain or difficult to verify) are referred to the applicable screening agency's intelligence or operations center and to the TSC for closer examination. In turn, TSC checks its databases and other sources, including classified databases maintained by the

NCTC and FBI to confirm whether the individual is a positive, negative, or inconclusive match to the watch list record. TSC creates a daily report summarizing all positive matches to the watch list and distributes them to numerous federal agencies.

The process of consolidating information from disparate agencies has been a slow and painstaking one, requiring the integration of at least 12 different databases. Two years after the process of integration took place, 10 of the 12 databases had been processed. The remaining two databases (the U.S. Immigration and Customs Enforcement's Automatic Biometric Identification System and the FBI's Integrated Automated Fingerprint Identification System) are both fingerprint databases. There is still more work to be done to optimize the list's usefulness.

Reports from both the Government Accountability Office and the Office of the Inspector General assert that the list contains inaccuracies and that government departmental policies for nomination and removal from the lists are not uniform. There has also been public outcry resulting from the size of the list and well-publicized incidents of obvious non-terrorists finding that they are included on the list.

Information about the process for inclusion on the list must necessarily be carefully protected if the list is to be effective against terrorists. The specific criteria for inclusion are not public knowledge. We do know, however, that government agencies populate their watch lists by performing wide sweeps of information gathered on travelers, using many misspellings and alternate variations of the names of suspected terrorists. This often leads to the inclusion of people who do not belong on watch lists, known as "false positives." It also results in some people being listed multiple times under different spellings of their names.

While these selection criteria may be effective for tracking as many potential terrorists as possible, they also lead to many more erroneous entries on the list than if the process required more finely tuned information to add new entries. Notable examples of 'false positives' include Michael Hicks, an 8-year-old New Jersey Cub Scout who is continually stopped at the airport for additional screening and the late senator Ted Kennedy, who had been repeatedly delayed in the past because his name resembles an alias once used by a suspected terrorist. Like Kennedy, Hicks may have been added because his name is the same or similar to a different suspected terrorist.

These incidents call attention to the quality and accuracy of the data in the TSC consolidated terrorist watch list. In June 2005, a report by the Department of Justice's Office of the Inspector General found inconsistent record counts, duplicate records, and records that lacked data fields or had unclear sources for their data. Although TSC subsequently enhanced its efforts to identify and correct incomplete or inaccurate watch list records, the Inspector General noted in September 2007 that TSC management of the watch list still showed some weaknesses.

Given the option between a list that tracks every potential terrorist at the cost of unnecessarily tracking some innocents, and a list that fails to track many terrorists in an effort to avoid tracking innocents, many would choose the list that tracked every terrorist despite the drawbacks. But to make matters worse for those already inconvenienced by wrongful inclusion on the list, there is currently no simple and quick redress process for innocents that hope to remove themselves from it.

The number of requests for removal from the watch list continues to mount, with over 24,000 requests recorded (about 2,000 each month) and only 54 percent of them resolved. The average time to process a request in 2008 was 40 days, which was not (and still is not) fast enough to keep pace with the number of requests for removal coming in. As a result, law-abiding travelers that inexplicably find themselves on the watch list are left with no easy way to remove themselves from it.

In February 2007, the Department of Homeland Security instituted its Traveler Redress Inquiry Program (TRIP) to help people that have been erroneously added to terrorist watch lists remove themselves and avoid extra screening and questioning. John Anderson's mother claimed that despite her best efforts, she was unable to remove her son from the watch lists. Senator Kennedy reportedly was only able to remove himself from the list by personally bringing up the matter to Tom Ridge, then the Director of the Department of Homeland Security.

Security officials say that mistakes such as the one that led to Anderson and Kennedy's inclusion on no-fly and consolidated watch lists occur due to the matching of imperfect data in airline reservation systems with imperfect data on the watch lists. Many airlines don't include gender, middle name, or date of birth in their reservations records, which increases the likelihood of false matches.

One way to improve screening and help reduce the number of people erroneously marked for additional investigation would be to use a more sophisticated system involving more personal data about

individuals on the list. The TSA is developing just such a system, called "Secure Flight," but it has been continually delayed due to privacy concerns regarding the sensitivity and safety of the data it would collect. Other similar surveillance programs and watch lists, such as the NSA's attempts to gather information about suspected terrorists, have drawn criticism for potential privacy violations.

Additionally, the watch list has drawn criticism because of its potential to promote racial profiling and discrimination. Some allege that they were included by virtue of their race and ethnic descent, such as David Fathi, an attorney for the ACLU of Iranian descent, and Asif Iqbal, a U.S. citizen of Pakistani decent with the same name as a Guantanamo detainee. Outspoken critics of U.S. foreign policy, such as some elected officials and university professors, have also found themselves on the list.

A report released in May 2009 by Department of Justice Inspector General Glenn A. Fine found that the FBI had incorrectly kept nearly 24,000 people on its own watch list that supplies data to the terrorist watch list on the basis of outdated or irrelevant information. Examining nearly 69,000 referrals to the FBI list, the report found that 35 percent of those people remained on the list despite inadequate justification. Even more worrisome, the list did not contain the names of people who should have been listed because of their terrorist ties.

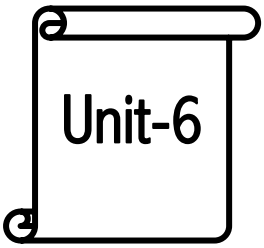
FBI officials claim that the bureau has made improvements, including better training, faster processing of referrals, and requiring field office supervisors to review watch-list nominations for accuracy and completeness. But this watch list and the others remain imperfect tools. In early 2008, it was revealed that 20 known terrorists were not correctly listed on the consolidated watch list. (Whether these individuals were able to enter the U.S. as a result is unclear.)

Umar Farouk Abdulmutallab, the Nigerian who unsuccessfully tried to detonate plastic explosives on the Northwest Airlines flight from Amsterdam to Detroit on Christmas Day 2009, had not made it onto the no-fly list. Although Abdulmutallab's father had reported concern over his son's radicalization to the U.S. State Department, the Department did not revoke Adbulmutallab's visa because his name was misspelled in the visa database, so he was allowed to enter the United States. Faisal Shahzad, the Times Square car bomber, was apprehended on May 3, 2010, only moments before his Emirates airline flight to Dubai and Pakistan was about to take off. The airline had failed to check a last-minute update to the no-fly list that had added Shahzad's name.

Sources: Scott Shane, "Lapses Allowed Suspect to Board Plane," The New York Times, May 4, 2010; Mike McIntire, "Ensnared by Error on Growing U.S. Watch List," The New York Times, April 6, 2010; Eric Lipton, Eric Schmitt, and Mark Mazzetti, "Review of Jet Bomb Plot Shows More Missed Clues," The New York Times, January 18, 2010; Lizette Alvarez, "Meet Mikey, 8: U.S. Has Him on Watch List," The New York Times, January 14, 2010; Eric Lichtblau, "Justice Dept. Finds Flaws in F.B.I. Terror List," The New York Times, May 7, 2009; Bob Egelko, "Watch-list Name Confusion Causes Hardship," San Francisco Chronicle, March 20, 2008; "Reports Cite Lack of Uniform Policy for Terrorist Watch List," The Washington Post, March 18, 2008; Siobhan Gorman, "NSA's Domestic Spying Grows as Agency Sweeps Up Data," The Wall Street Journal, March 10, 2008; Ellen Nakashima, and Scott McCartney, "When Your Name is Mud at the Airport," The Wall Street Journal, January 29, 2008.

Case Study Questions:

1. What concepts in this chapter are illustrated in this case?
2. Why was the consolidated terror watch list created? What are the benefits of the list?
3. Describe some of the weaknesses of the watch list. What management, organization, and technology factors are responsible for these weaknesses?
4. How effective is the system of watch lists described in this case study? Explain your answer.
5. If you were responsible for the management of the TSC watch list database, what steps would you take to correct some of these weaknesses?
6. Do you believe that the terror watch list represents a significant threat to individuals' privacy or Constitutional rights? Why or why not?



Decision Support System (DSS)

6.1 Definition of Decision Support System

A **decision support system** (**DSS**) is a computer-based information system that supports business or organizational decision-making activities. DSSs serve the management, operations, and planning levels of an organization (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance—i.e. Unstructured and Semi-Structured decision problems. Decision support systems can be either fully computerized, human-powered or a combination of both.

While academics have perceived DSS as a tool to support decision making process, DSS users see DSS as a tool to facilitate organizational processes.

1. DSS tends to be aimed at the less well structured, underspecified problem that upper level managers typically face;
2. DSS attempts to combine the use of models or analytic techniques with traditional data access and retrieval functions;
3. DSS specifically focuses on features which make them easy to use by noncomputer people in an interactive mode; and
4. DSS emphasizes flexibility and adaptability to accommodate changes in the environment and the decision making approach of the user.

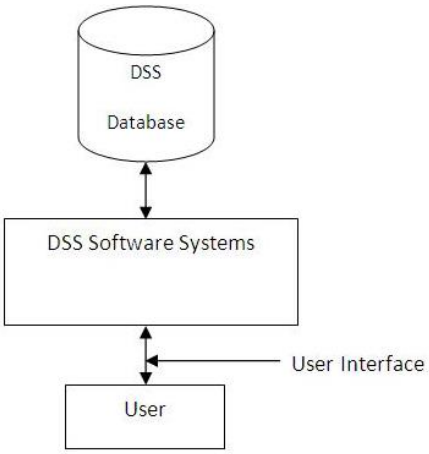
DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions.

Typical information that a decision support application might gather and present includes:

- inventories of information assets (including legacy and relational data sources, cubes, data warehouses, and data marts),
- comparative sales figures between one period and the next,
- projected revenue figures based on product sales assumptions.

6.2 Components of DSS

A decision support system consists of three main components, namely database, software system and user interface.



1. DSS Database: It contains data from various sources, including internal data from the organization, the data generated by different applications, and the external data mined form the Internet, etc. The decision support systems database can be a small database or a standalone system or a huge data warehouse supporting the information needs of an organization. To avoid the interference of decision support system with the working of operational systems, the DSS database usually contains a copy of the production database.

2. DSS Software System: It consists of various mathematical and analytical models that are used to analyze the complex data, thereby producing the required information. A model predicts the output in the basis of different inputs or different conditions, or finds out the combination of conditions and input that is required to produce the desired output.

A decision support system may compromise different models where each model performs a specific function. The selection of models that must be included in a decision support system family depends on user requirements and the purposes of DSS. Note that the DSS software contains the predefined models (or routines) using which new models can be built to support specific type of decisions.
Some of the commonly used mathematical and statistical models are as follows:-

- **Statistical Models:** They contain a wide range of statistical functions, such as mean, median, mode, deviations etc. These models are used to establish, relationships between the occurrences of an event and various factors related to that event. It can, for example, relate sale of product to differences in area, income, season, or other factors. In addition to statistical functions, they contain software that can analyze series of data to project future outcomes.
- **Sensitivity Analysis Models:** These are used to provide answers to what-if situations occurring frequently in an organization. During the analysis, the value of one variable is changed repeatedly and resulting changes on other variables are observed. The sale of product, for example, is affected by different factors such as price, expenses on advertisements, number of sales staff, productions

etc. Using a sensitivity model, price of the product can be changed (increased or decreased) repeatedly to ascertain the sensitivity of different factors and their effect on sales volume. Excel spreadsheets and Lotus 1-2-3 are often used for making such analysis.

- **Optimization Analysis Models:** They are used to find optimum value for a target variable under given circumstances. They are widely used for making decisions related to optimum utilization of resources in an organization. During optimization analysis, the values for one or more variables are changed repeatedly keeping in mind the specific constraints, until the best values for target variable are found. They can, for example, determine the highest level of production that can be achieved by varying job assignments to workers, keeping in mind that some workers are skilled and their job assignment cannot be changed. Linear programming techniques and Solver tool in Microsoft excel are mostly used for making such analysis.
- **Forecasting Models:** They use various forecasting tools and techniques, including the regression models, time series analysis, and market research methods etc., to make statements about the future or to predict something in advance. They provide information that helps in analyzing the business conditions and making future plans. These systems are widely used for forecasting sales.
- **Backward Analysis Sensitivity Models:** Also known as goal seeking analysis, the technique followed in these models is just opposite to the technique applied in sensitivity analysis models. In place of changing the value of variable repeatedly to see how it affects other variables, goal seeking analysis sets a target value for a variable and then repeatedly changes other variables until the target value is achieved. To increase the production level by 40 percent using the backward sensitivity analysis, for example, first, the target value for the production level can be set and then the required changes to made in other factors, such as the amount of raw material, machinery and tools, number of production staff, etc., to achieve the target production level.

3. DSS User Interface: It is an interactive graphical interface which makes the interaction easier between the DSS and its users. It displays the results (output) of the analysis in various forms, such as text, table, charts or graphics. The user can select the appropriate option to view the output according to his requirement.

A manager, for example, would like to view comparative sales data in tabular form whereas an architect creating a design plan would be more interested in viewing the result of analysis in a graphical format. The present-day decision support system built using the Web-based interface provides its users some special capabilities like better interactivity, facility for customization and personalization, and more ease of use.

6.3 Advantages of DSS

1. Time savings: For all categories of decision support systems, research has demonstrated and substantiated reduced decision cycle time, increased employee productivity and more timely information for decision making. The time savings that have been documented from using computerized

decision support are often substantial. Researchers, however, have not always demonstrated that decision quality remained the same or actually improved.

2. Enhance effectiveness: A second category of advantage that has been widely discussed and examined is improved decision making effectiveness and better decisions. Decision quality and decision making effectiveness are however hard to document and measure. Most researches have examined soft measures like perceived decision quality rather than objective measures. Advocates of building data warehouses identify the possibility of more and better analysis that can improve decision making.

3. Improve interpersonal communication: DSS can improve communication and collaboration among decision makers. In appropriate circumstances, communications- driven and group DSS have had this impact. Model-driven DSS provides a means for sharing facts and assumptions. Data-driven DSS make "one version of the truth" about company operations available to managers and hence can encourage fact-based decision making. Improved data accessibility is often a major motivation for building a data-driven DSS. This advantage has not been adequately demonstrated for most types of DSS.

4. Competitive advantage: Vendors frequently cite this advantage for business intelligence systems, performance management systems, and web-based DSS. Although it is possible to gain a competitive advantage from computerized decision support, this is not a likely outcome. Vendors routinely sell the same product to competitors and even help with the installation. Organizations are most likely to gain this advantage from novel, high risk, enterprise-wide, inward facing decision support systems. Measuring this is and will continue to be difficult.

5. Cost reduction: Some researches and especially case studies have documented DSS cost saving from labor savings in making decisions and from lower infrastructure or technology costs. This is not always a goal of building DSS.

6. Increase decision maker satisfaction: The novelty of using computers has and may continue to confound analysis of this outcome. DSS may reduce frustrations of decision makers, create perceptions that better information is being used and/or creates perceptions that the individual is a "better" decision maker. Satisfaction is a complex measure and researchers often measure satisfaction with the DSS rather than satisfaction with using a DSS in decision making. Some studies have compared satisfaction with and without computerized decision aids. Those studies suggest the complexity and "love/hate" tension of using computers for decision support.

7. Promote learning: Learning can occur as a by-product of initial and ongoing use of a DSS. Two types of learning seem to occur: learning of new concepts and the development of a better factual understanding of the business and decision making environment. Some DSS serve as "de facto" training tools for new employees. This potential advantage has not been adequately examined.

8. Increase organizational control: Data-driven DSS often make business transaction data available for performance monitoring and ad hoc querying. Such systems can enhance management understanding of business operations and managers perceive that this is useful. What is not always evident is the financial benefit from increasingly detailed data.

6.4 Functions of DSS

1) The most important consideration is the Decision Support System's ease of use - its ability to allow non -technical people to deal with it directly. The single greatest and most enduring problem with computers has been their inflexibility, their inability to let the person who actually needs the data to deal directly with the computer.
2) The ability to access information should not be restricted to only the part of an organization or to only certain managerial or professional groups. Instead the resource should be distributed to

all of the people and part of an organization needing it without widespread access; the power of advanced Distributed Processing System will go untapped as they typically have in the past.

3) The ideal Decision Support System in sharp contrast to previous method of designing applications should not be a 'system' at all in the strict sense of the term. Rather, it should be a highly adaptive decision support generator that can easily be used by professionals to quickly design data support prototypes suited to each specific decision-making task. This adaptive tool must allow quick design changes if the original design does not closely match a person's information gathering style or needs.
4) To adequately support the human element, this highly adaptive support capability must be able to provide access to operational data and as well as to summary data that already has been processed by application programs designed for other specific operational tasks. Equally important this tool must provide the professional with access to an organization's raw data and it must allow the access to be accomplished in one step using a single uncomplicated procedure or command and without having to re-key non summary data.
5) The organizations need to access original data sometimes because efficiency is related to how well the original data is organized in the system; the Decision Support Generator should be able to interface with a true DBMS. It should also be able to access standard 'flat' files indirectly using the power of the host computer to facilitate both the user interface and data access without changing existing files.
6) The Decision Support Generator should let the user decide whether information should be displayed on the CRT screen for immediate use or whether it should be printed for later use. The best way to accomplish such flexible data presentation is through a work station. The management or professional information workstation would incorporate a keyboard, display screen and an interface to a printer which could print everything from straight text to graphics like pie charts, bar charts and line charts.
7) The support tool must interface with several different systems and capabilities, it must be compatible with all of them, the tool must provide users with a single easily used language to access manipulate and present data in a way that will best support the end-user.
8) To facilitate formatting and manipulating displayed data, the decision support generator should ideally be able to interface with word processing software. With this capability, the DSS becomes the critical link between data processing and office automation, integrating both functions in an easily-used, straight forward, extremely powerful system.

Executive Information System (EIS) and Business Information System

7.1 Definition of EIS

An executive information system (EIS) is a decision support system (DSS) used to assist senior executives in the decision-making process. It does this by providing easy access to important data needed to achieve strategic goals in an organization. An EIS normally features graphical displays on an easy-to-use interface.

Executive information systems can be used in many different types of organizations to monitor enterprise performance as well as to identify opportunities and problems.
Executive Information System / executive support system depends on some of the factors that can be summarized as the follows

1. Internal factors

i. Need for the timely information.

ii. Need for the improved communications.

iii. Need for the access to the operational data.

iv. Need for the rapid status updates on the various business activities.

v. Need for the access to the corporate database.

vi. Need for very accurate information.

vii. Need for the ability to identify the various historical trends.

2. External Factors

i. Increasing and intensifying the global competition.

ii. Rapidly changing the business environment.

iii. Need to be more pro active.

iv. Need to access the external database.

v. Increasing the various government regulations.

7.2 Characteristics of EIS

1. **Informational characteristics**
   i. Flexibility and ease of use.
   ii. Provides the timely information with the short response time and also with the quick retrieval.
   iii. Produces the correct information.
   iv. Produces the relevant information.
   v. Produces the validated information.

2. User interface/orientation characteristics

i. Consists of the sophisticated self-help.

ii. Contains the user friendly interfaces consisting of the graphic user.

iii. Can be used from many places.

iv. Offers secure reliable, confidential access along with the access procedure.

v. Is very much customized.

vi. Suites the management style of the individual executives.

3. Managerial / executive characteristics

i. Supports the overall vision, mission and the strategy.

ii. Provides the support for the strategic management.

iii. Sometimes helps to deal with the situations that have a high degree of risk.

iv. Is linked to the value added business processes.

v. Supports the need/ access for/ to the external data/ databases.

vi. Is very much result oriented in the nature.

Components of EIS:

Hardware:

When talking about hardware for an EIS environment, we should focus on the hardware that meet the executive's needs. The executive must be put first and the executive's needs must be defined before the hardware can be selected. The basic computer hardware needed for a typical EIS includes four components:

1. Input data entry devices. These devices allow the executive to enter, verify and update data immediately.
2. The central processing unit (CPU), which is the kernel because it controls the other computer system components.
3. Data storage files. The executive can use this part to save useful business information, and this part also help the executive to search historical business information easily.
4. Output devices, which provide a visual or permanent record for the executive to save or read. This device refers to the visual output device such as monitor or printer.

Software:

Choosing the appropriate software is vital to design an effective EIS. Therefore, the software components and how they integrate the data into one system are very important. The basic software needed for a typical EIS includes four components:

1. Text based software: The most common form of text are probably documents.
2. Database: Heterogeneous databases residing on a range of vendor-specific and open computer platforms help executives access both internal and external data.
3. Graphic base: Graphics can turn volumes of text and statistics into visual information for executives. Typical graphic types are: time series charts, scatter diagrams, maps, motion graphics, sequence charts, and comparison – oriented graphics.
4. Model base: The EIS models contain routine and special statistical, financial, and other quantitative analysis.

User interface:

An EIS needs to be efficient to retrieve relevant data for decision makers, so the user interface is very important. Several types of interfaces can be available to the EIS structure, such as scheduled reports, questions/answers, menu driven, command language, natural language, and input/output. It is crucial

that the interface must fit the decision maker's decision-making style. If the executive is not comfortable with the information questions/answers style, the EIS will not be fully utilized. The ideal interface for an EIS would be simple to use and highly flexible, providing consistent performance, reflecting the executive's world, and containing help information.

Telecommunication:
As decentralizing is becoming the current trend in companies, telecommunications will play a pivotal role in networked information systems. Transmitting data from one place to another has become crucial for establishing a reliable network. In addition, telecommunications within an EIS can accelerate the need for access to distributed data.

7.3 Functional information systems

IS are pervasive versatile and instrumental in helping organizations achieve their strategic, tactical and operational goals. One way of assessing the contribution of IS to organizational productivity and market growth is to study the impact of IS on each of the five functional areas in an organization such as marketing, manufacturing, accounting and finance, quality control and human resources.

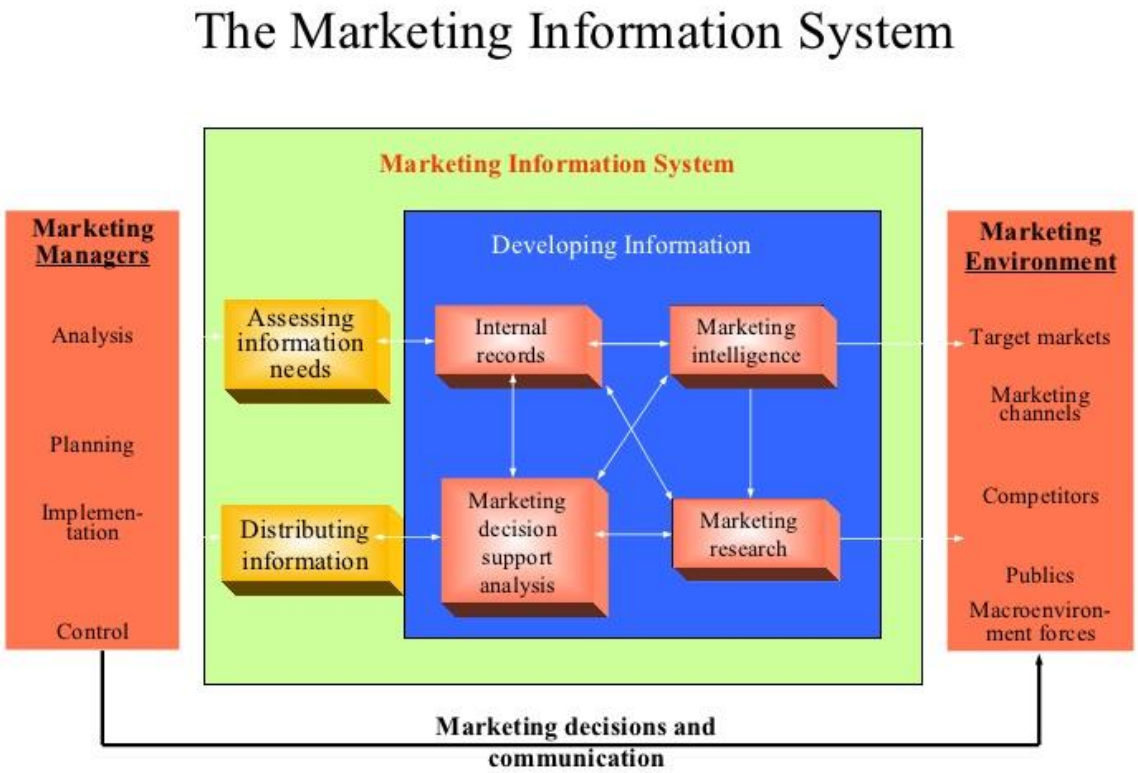
Except above one, there are other types of IS such as transaction processing system, management information system, intelligent support system (including decision support system, executive information system, expert system) and office automation system, which plays a vital role in business function.

7.4 Marketing information systems

A marketing information system (MIS) is a set of procedures and methods designed to generate, analyze, disseminate, and store anticipated marketing decision information on a regular, continuous basis. An information system can be used operationally, managerially, and strategically for several aspects of marketing.

A marketing information system can be used operationally, managerially, and strategically for several aspects of marketing.

We all know that no marketing activity can be carried out in isolation, know when we say it doesn't work in isolation that means there are various forces could be external or internal, controllable or uncontrollable which are working on it. Thus to know which forces are acting on it and its impact the marketer needs to gathering the data through its own resources which in terms of marketing we can say he is trying to gather the market information or form a *marketing information system*.



The total information needs of the marketing department can be specified and satisfied via a marketing intelligence network, which contains three components.

1. Continuous monitoring is the procedure by which the changing environment is regularly viewed.
2. Marketing research is used to obtain information on particular marketing issues.
3. Data warehousing involves the retention of all types of relevant company records, as well as the information collected through continuous monitoring and marketing research that is kept by the organization.

An Marketing Information System offers many advantages:

1. Organized data collection.
2. A broad perspective.
3. The storage of important data.
4. An avoidance of crises.
5. Coordinated marketing plans.
6. Speed in obtaining sufficient information to make decisions.
7. Data amassed and kept over several time periods.
8. The ability to do a cost-benefit analysis.

The disadvantages of a Marketing information system are high initial time and labor costs and the complexity of setting up an information system. Marketers often complain that they lack enough marketing information or the right kind, or have too much of the wrong kind. The solution is an effective **marketing information system**.

Components of Marketing Information system:

a) Interactive marketing

It describes as a customer focus marketing process that is based on using the internet, intranet, and extranet to establish the two way transaction between a business and a customer. Its goal is to enable a company to profitably use the network to attract and keep customers who will become partners with the business in creating, purchasing, and improving the sales and services. It encourages the customer to become involved in the development, delivery and service issue. It can be enabled by the various internet technology including chat and groups.

b) Targeted marketing

It plays a very important tools in developing the advertising and promotion strategies for a company's web sites. It contains the five components:

i) **Community:** The company should customize the web site and product according to the people of specific community such as craft and art items, local newspaper etc.

ii) **Content:** The advertisement such as electronic billboard and the banner can be placed on the various web sites pages.

iii) **Context:** The web page should be related with the product only. So advertising targeted only at people who are already looking for information about a subject matter.

iv) **Demographic/psychographic:** The advertising and marketing should be aimed only a specific type of the people such as unmarried, middle income, college graduates etc.

c) Sales force automation

It provides to sale the product on the online using the internet and web based software throughout the world. The salespeople use their computer to record their sales data as they make their calls on customers and prospects during the day. They can upload sale information and sales records as send the electronic mail message and access website sales support information.

d) Customer relationship

The marketing method should be created in order to satisfy the customer requirement and the necessity as well as the complaint done by the customer to keep the relation good because once the customer is unsatisfied then it is very difficult to satisfy the customer for purchasing the product which will be loss for the company.

7.5 Manufacturing information systems

It is a system that supports the manufacturing function of purchasing, receiving, quality control, inventory management, material requirement planning, capacity planning, production scheduling, and plant design. It actually on both manufacturing and service environments. It should be viewed within the broad context of delivering both goods and services. It is an umbrella terms that covers all activities related to manufacturing and services, production systems specifically address information needs related to acquiring and management of raw materials scheduling equipment, manpower planning, repair and maintenance and other activities directly related with the production.

There are different types of the manufacturing information system, some of them are web enabled, and used to support computer integrated manufacturing.

The objective of manufacturing information systems are:

1. **Simplify:** Simplify the production processes, design and factory organization as a vital foundation to automation and integration.
2. **Automate:** Automate production processes and the business function that support them with computers, machines and robots.
3. **Integrate:** Integrate all production and support processes using computers, telecommunication networks and other information technology.

Manufacturing information system are performing monitoring information system for factory floor operation. They monitor, track and contrive the five essential components involved in the production process. These components are:

1. Materials
2. Equipment
3. Personnel

4. Instructions and specification
5. Production facilities

Manufacturing Information System also controls the other type of control system which includes shop floors scheduling and control, machine control, robotic control and process control system.

Process control: It is the use of computer to control the ongoing physical process. These computers control the physical process in the petroleum refineries, cement plants, steel mills, chemical plants, food product, paper mills etc. It require the use of special sensing device that measure pressure and temperature changes.

Machine control (Numerical Control): It is the use of computer to control the action on a machine. The control of machine tools in factories to manufactures products of all kinds is typical numerical control application. It control computer program for machine tools convert geometric data from engineering drawing and machining instruction from process planning into a numerical code of command that control the action of a machine tool.

Human Resource information system: HRM involves the recruitments, placements, evaluation, compensation, and development of an employee of an organization. The goal of HRM is the effective use of employee in the organization. So, human resource information system are designed to support:

i. Planning to meet the personnel needs of the business.
ii. Development of employees to their full potential.
iii. Control of all personnel policies and programs.

Many firms have gone beyond this traditional personnel management functions and have developed human resource information system that also support:

a. recruitment, hiring, selection
b. job placements
c. performance appraisals
d. employee benefits analysis
e. training and development
f. health, safety and security

7.6 Finance and accounting information systems

It is a system that provides information related to the accounting and financial activities in an organization. The FIS includes a number of subsystems such as budgeting, cash and asset management, capital budgeting, portfolio analysis, general ledger, accounts receivable, inventory control and payroll system. Other include recordkeeping, account analysis, cash management, financial analysis, insurance claim processing etc. Financial institution such as banks, use specialized FAIS such as commercial loan analyzers, credit approval systems, credit application system, automated teller system etc.

Types of accounting information system:

General Ledger: It process the data from the payroll, account payable/receivable, and other information system. At the end of the accounting period they closed all the business books and produce the trial balance, income statements, and balance sheet. It control better financial and management reports and involve fewer personnel and lower costs than the manual accounting methods.

Order processing: It captures and processes customer orders and produce data needed for sales analysis and inventory control. It provide a fast accurate and efficient method of recording and screening customer orders and sales transaction.

Inventory control: It captures, processes and manage all data related to the company's inventory, such as items in inventory, inventory levels and costs, accounting practices related to inventory maintenance, stock balance and data on lost, damaged or return goods. It process data reflecting changes to items in

inventory. Once data about customer order are received from an order processing system, it changes to the inventory levels and prepares appropriate shipping documents. It provides the high quality service to the customers while minimizing investments in inventory and inventory carrying cost.

Account receivable: It keeps records of amounts owned by customers from data generated by customers purchase and payments. It produce invoice to customers, monthly customer statements, and credit management reports. It provide the report for the management to control the amount of credit extended and the collection of money owed. It helps to maximize the profitable credit sale while minimizing losses from bad debts.

Account payable: It keeps the data related to the sales and payment to customers. It prepare checks in payments of outstanding invoices and produces cash management reports. It provide tight financial control over all cash flow in the business. It also produce the report of amount payment, expenses, purchases, employee expenses accounts.

Payroll: It keeps the employee time cards and work records. It produce paychecks and other documents such as payroll reports, labour analysis etc. It provide the report to analysis the labour cost and productivity.

Types of financial information system:

1. **Cash Management:** It ensures that the organization has enough cash to conduct normal business, to receive the best possible return on its short term cash deposits and to leverage its cash flow to achieve good rating in financial markets.
   It collects on all cash receipts and disbursements within a company on a real time basis. Such information allows business to deposits or invest excess funds more quickly and thus increase the income generated by deposited or invested funds. It produce daily, weekly, monthly and yearly forecast or cash receipts or disbursement. It can determine optimal cash collection programs and determine alternative financing or investment strategies for dealing with forecasted cash deficits or surpluses.
2. **Investment management:** Many business invest their excess cash in short-term-low-risk marketable securities or in higher return/higher risk alternatives, so that the investment income may be earned until the funds are required. The portfolio of such securities can be managed with the help of portfolio management software packages. Investment information and securities trading are available from hundreds of online resources on the internet and networks. On line investment services helps financial manager make buying, selling or holding decision, for each type of securities.
3. **Capital budgeting:** It involves profitability and financial impact of proposed capital expenditure. Long terms expenditure proposal for plants and equipment can be analysed using a variety of techniques. This application makes heavy use of spreadsheets models that incorporate present value analysis or expected cash flow and probability analysis of risk to determine the optimum mix of capital budget for a business.
4. **Financial forecasting and planning:** It typically use the electronic spreadsheet and other software or evaluate the present and projected financial performance of a business. It helps to determine the financing needs of a business and analyse alternative methods of financing. Financial analyst use financial forecasts concerning the economic situation, business operating, types of financing available, interest rates, and stock and bond prices to develop an optimal financing plan for the business. Electronic spreadsheet packages, DSS software and web based groupware can be used to build and financial models.

Unit-8

Securing Information Systems

8.1 System vulnerability and Abuse

Can you imagine what would happen if you tried to link to the Internet without a firewall or antivirus software? Your computer would be disabled in a few seconds, and it might take you many days to recover. If you used the computer to run your business, you might not be able to sell to your customers or place orders with your suppliers while it was down. And you might find that your computer system had been penetrated by outsiders, who perhaps stole or destroyed valuable data, including confidential payment data from your customers. If too much data were destroyed or divulged, your business might never be able to operate!

In short, if you operate a business today, you need to make security and control a top priority. Security refers to the policies, procedures, and technical measures used to prevent unauthorized access, alteration, theft, or physical damage to information systems. Controls are methods, policies, and organizational procedures that ensure the safety of the organization's assets; the accuracy and reliability of its records; and operational adherence to management standards.

Why Systems are Vulnerable:

When large amounts of data are stored in electronic form, they are vulnerable to many more kinds of threats than when they existed in manual form. Through communications networks, information systems in different locations are interconnected. The potential for unauthorized access, abuse, or fraud is not limited to a single location but can occur at any access point in the network.

Following figure illustrates the most common threats against contemporary information systems.

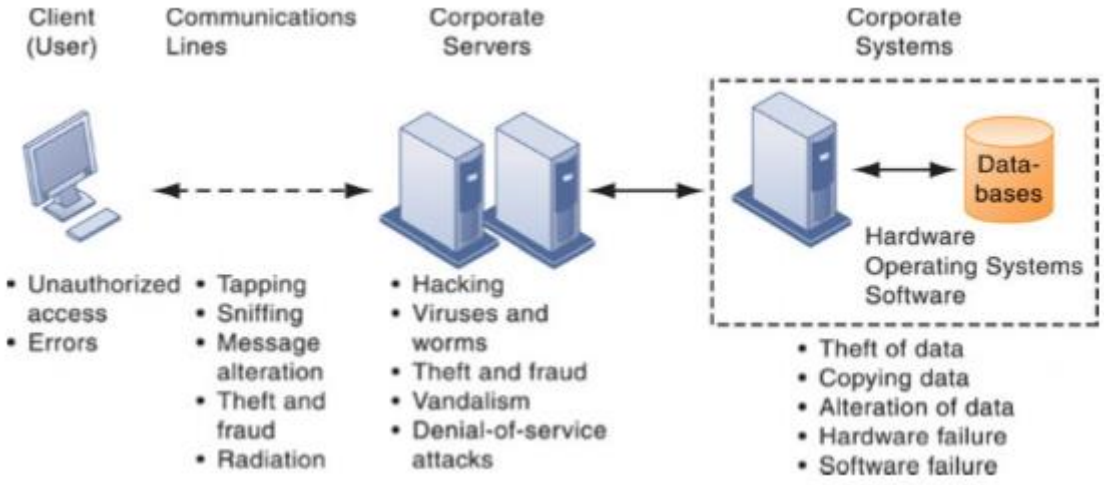


Fig: Contemporary security challenges and vulnerabilities

Points to Remember!

The architecture of a Web-based application typically includes a Web client, a server, and corporate information systems linked to databases. Each of these components presents security challenges and vulnerabilities. Floods, fires, power failures, and other electrical problems can cause disruptions at any point in the network.

Internet Vulnerabilities:
Large public networks, such as the Internet, are more vulnerable than internal networks because they are virtually open to anyone. The Internet is so huge that when abuses do occur, they can have an enormously widespread impact. When the Internet becomes part of the corporate network, the organization's information systems are even more vulnerable to actions from outsiders.

Computers that are constantly connected to the Internet by cable modems or digital subscriber line (DSL) lines are more open to penetration by outsiders because they use fixed Internet addresses where they can be easily identified. (With dial-up service, a temporary Internet address is assigned for each session.) A fixed Internet address creates a fixed target for hackers.

Telephone service based on Internet technology is more vulnerable than the switched voice network if it does not run over a secure private network. Most Voice over IP (VoIP) traffic over the public Internet is not encrypted, so anyone with a network can listen in on conversations. Hackers can intercept conversations or shut down voice service by flooding servers supporting VoIP with bogus traffic.

Vulnerability has also increased from widespread use of e-mail, instant messaging (IM), and peer-to-peer file-sharing programs. E-mail may contain attachments that serve as springboards for malicious software or unauthorized access to internal corporate systems. Employees may use e-mail messages to transmit valuable trade secrets, financial data, or confidential customer information to unauthorized recipients. Popular IM applications for consumers do not use a secure layer for text messages, so they can be intercepted and read by outsiders during transmission over the public Internet. Instant messaging activity over the Internet can in some cases be used as a back door to an otherwise secure network. Sharing files over peer-to-peer (P2P) networks, such as those for illegal music sharing, may also transmit malicious software or expose information on either individual or corporate computers to outsiders.

Wireless security challenges:
Even the wireless network in your home is vulnerable because radio frequency bands are easy to scan. Both Bluetooth and Wi-Fi networks are susceptible to hacking by eavesdroppers. Although the range of Wi-Fi networks is only several hundred feet, it can be extended up to one-fourth of a mile using external antennae. Local area networks (LANs) using the 802.11 standard can be easily penetrated by outsiders armed with laptops, wireless cards, external antennae, and hacking software. Hackers use these tools to detect unprotected networks, monitor network traffic, and, in some cases, gain access to the Internet or to corporate networks. Wi-Fi transmission technology was designed to make it easy for stations to find and hear one another. The service set identifiers (SSIDs) identifying the access points in a Wi-Fi network are broadcast multiple times and can be picked up fairly easily by intruders' sniffer programs as in figure.

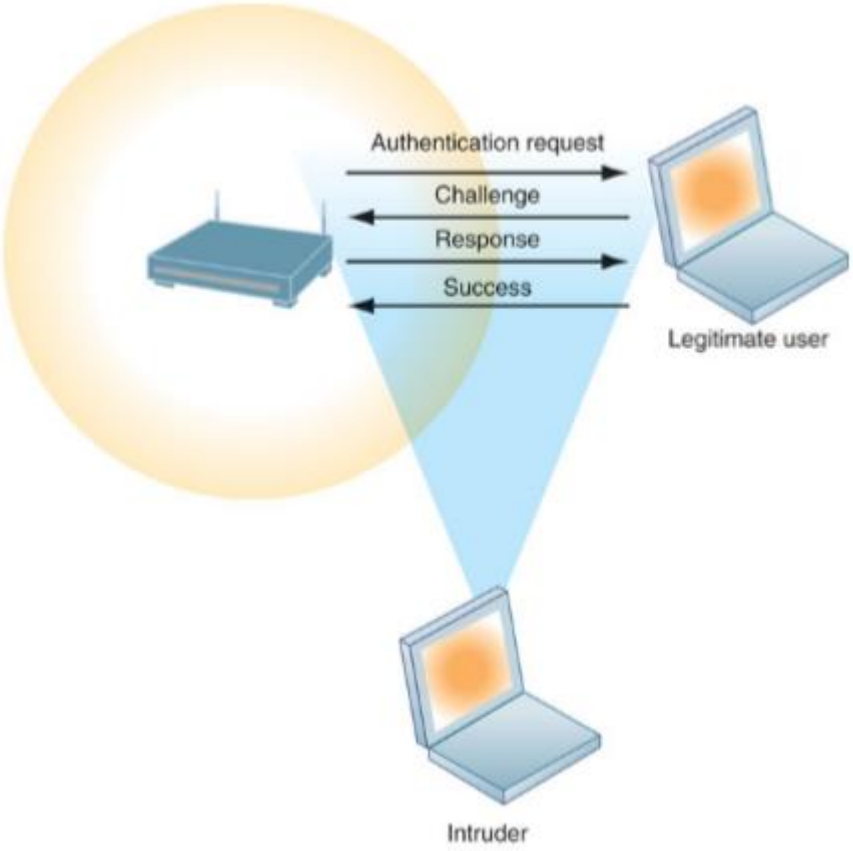


Fig: Wi-Fi security challenges

Intruders also use the information they have gleaned to set up rogue access points on a different radio channel in physical locations close to users to force a user's radio NIC to associate with the rogue access point. Once this association occurs, hackers using the rogue access point can capture the names and passwords of unsuspecting users.

The initial security standard developed for Wi-Fi, called Wired Equivalent Privacy (WEP), is not very effective. WEP is built into all standard 802.11 products, but its use is optional. Many users neglect to use WEP security features, leaving them unprotected. The basic WEP specification calls for an access point and all of its users to share the same 40-bit encrypted password, which can be easily decrypted by hackers from a small amount of traffic. Stronger encryption and authentication systems are now available, such as Wi-Fi Protected Access 2 (WPA2), but users must be willing to install them.

Malicious Software: Viruses, Worms, Trojan Horses, and Spyware:

Malicious software programs are referred to as **malware** and include a variety of threats, such as computer viruses, worms, and Trojan horses. A computer virus is a rogue software program that attaches itself to other software programs or data files in order to be executed, usually without user knowledge or permission. Most computer viruses deliver a "payload." The payload may be relatively benign, such as the instructions to display a message or image, or it may be highly destructive—destroying programs or data, clogging computer memory, reformatting a computer's hard drive, or causing programs to run improperly. Viruses typically spread from computer to computer when humans take an action, such as sending an e-mail attachment or copying an infected file.

Most recent attacks have come from worms, which are independent computer programs that copy themselves from one computer to other computers over a network. (Unlike viruses, they can operate on their own without attaching to other computer program files and rely less on human behavior in order to spread from computer to computer. This explains why computer worms spread much more rapidly than computer viruses.) Worms destroy data and programs as well as disrupt or even halt the operation of computer networks.

Worms and viruses are often spread over the Internet from files of downloaded software, from files attached to e-mail transmissions, or from compromised e-mail messages or instant messaging. Viruses have also invaded computerized information systems from "infected" disks or infected machines. E-mail worms are currently the most problematic.

Malware targeting mobile devices is not as extensive as that targeting computers, but is spreading nonetheless using e-mail, text messages, Bluetooth, and file downloads from the Web via Wi-Fi or cellular networks. There are now more than 200 viruses and worms targeting mobile phones, such as Cabir, Commwarrior, Frontal.A, and Ikee.B. Frontal.A installs a corrupted file that causes phone failure and prevents the user from rebooting, while Ikee.B turns jailbroken iPhones into botnet-controlled devices. Mobile device viruses pose serious threats to enterprise computing because so many wireless devices are now linked to corporate information systems.

A Trojan horse is a software program that appears to be benign but then does something other than expected, such as the Zeus Trojan described in the chapter-opening case. The Trojan horse is not itself a virus because it does not replicate, but it is often a way for viruses or other malicious code to be introduced into a computer system. The term Trojan horse is based on the huge wooden horse used by the Greeks to trick the Trojans into opening the gates to their fortified city during the Trojan War. Once inside the city walls, Greek soldiers hidden in the horse revealed themselves and captured the city.

At the moment, SQL injection attacks are the largest malware threat. SQL injection attacks take advantage of vulnerabilities in poorly coded Web application software to introduce malicious program code into a company's systems and networks. These vulnerabilities occur when a Web application fails to properly validate or filter data entered by a user on a Web page, which might occur when ordering something online. An attacker uses this input validation error to send a rogue SQL query to the underlying database to access the database, plant malicious code, or access other systems on the network. Large Web applications have hundreds of places for inputting user data, each of which creates an opportunity for an SQL injection attack.

Many users find such spyware annoying and some critics worry about its infringement on computer users' privacy. Some forms of spyware are especially nefarious. Keyloggers record every keystroke made on a computer to steal serial numbers for software, to launch Internet attacks, to gain access to e-mail accounts, to obtain passwords to protected computer systems, or to pick up personal information such as credit card numbers. Other spyware programs reset Web browser home pages, redirect search requests, or slow performance by taking up too much memory.

Hackers and Computer Crime:
A hacker is an individual who intends to gain unauthorized access to a computer system. Within the hacking community, the term cracker is typically used to denote a hacker with criminal intent, although in the public press, the terms hacker and cracker are used interchangeably. Hackers and crackers gain unauthorized access by finding weaknesses in the security protections employed by Web sites and computer systems, often taking advantage of various features of the Internet that make it an open system that is easy to use.

Spoofing and Sniffing:
Spoofing: Spoofing may involve redirecting a Web link to an address different from the intended one, with the site masquerading as the intended destination. For example, if hackers redirect customers to a fake Web site that looks almost exactly like the true site, they can then collect and process orders, effectively stealing business as well as sensitive customer information from the true site.

Sniffer: A sniffer is a type of eavesdropping program that monitors information traveling over a network. When used legitimately, sniffers help identify potential network trouble spots or criminal activity on networks, but when used for criminal purposes, they can be damaging and very difficult to detect. Sniffers enable hackers to steal proprietary information from anywhere on a network, including e-mail messages, company files, and confidential reports.

Denial of service attacks:
In a denial-of-service (DoS) attack, hackers flood a network server or Web server with many thousands of false communications or requests for services to crash the network. The network receives so many queries that it cannot keep up with them and is thus unavailable to service legitimate requests. A distributed denial-of-service (DDoS) attack uses numerous computers to inundate and overwhelm the network from numerous launch points.

Although DoS attacks do not destroy information or access restricted areas of a company's information systems, they often cause a Web site to shut down, making it impossible for legitimate users to access the site. For busy e-commerce sites, these attacks are costly; while the site is shut down, customers cannot make purchases. Especially vulnerable are small and midsize businesses whose networks tend to be less protected than those of large corporations.

Computer Crime:
Most hacker activities are criminal offenses, and the vulnerabilities of systems we have just described make them targets for other types of computer crime as well. No one knows the magnitude of the computer crime problem—how many systems are invaded, how many people engage in the practice, or the total economic damage.

Examples of Computer Crime:

Computers as targets of crime
• Breaching the confidentiality of protected computerized data • Accessing a computer system without authority • Knowingly accessing a protected computer to commit fraud • Intentionally accessing a protected computer and causing damage, negligently or deliberately Knowingly transmitting a program, program code, or command that intentionally causes damage to a protected computer • Threatening to cause damage to a protected computer
Computers as instruments of crime
• Theft of trade secrets • Unauthorized copying of software or copyrighted intellectual property, such as articles, books, music, and video • Schemes to defraud • Using e-mail for threats or harassment • Intentionally attempting to intercept electronic communication • Illegally accessing stored electronic communications, including e-mail and voice mail • Transmitting or possessing child pornography using a computer

Identity Theft:
With the growth of the Internet and electronic commerce, identity theft has become especially troubling. ***Identity theft is a crime in which an imposter obtains key pieces of personal information, such as social security identification numbers, driver's license numbers, or credit card numbers, to impersonate someone else.*** The information may be used to obtain credit, merchandise, or services in the name of the victim or to provide the thief with false credentials. Identify theft has flourished on the Internet, with credit card files a major target of Web site hackers. Moreover, e-commerce sites are wonderful sources of customer personal information—name, address, and phone number. Armed with this information, criminals are able to assume new identities and establish new credit for their own purposes.

One increasingly popular tactic is a form of spoofing called phishing. Phishing involves setting up fake Web sites or sending e-mail or text messages that look like those of legitimate businesses to ask users for confidential personal data. The message instructs recipients to update or confirm records by providing social security numbers, bank and credit card information, and other confidential data either

by responding to the e-mail message, by entering the information at a bogus Web site, or by calling a telephone number. EBay, PayPal, Amazon.com, Walmart, and a variety of banks, are among the top spoofed companies.

Click Fraud:
When you click on an ad displayed by a search engine, the advertiser typically pays a fee for each click, which is supposed to direct potential buyers to its products. ***Click fraud occurs when an individual or computer program fraudulently clicks on an online ad without any intention of learning more about the advertiser or making a purchase. Click fraud has become a serious problem at Google and other Web sites that feature pay-per-click online advertising. Some companies hire third parties (typically from low-wage countries) to fraudulently click on a competitor's ads to weaken them by driving up their marketing costs.*** Click fraud can also be perpetrated with software programs doing the clicking, and botnets are often used for this purpose. Search engines such as Google attempt to monitor click fraud but have been reluctant to publicize their efforts to deal with the problem.

Global threats: Cyberterrorism and cyberwarfare:
The cybercriminal activities we have described—launching malware, denial-of-service attacks, and phishing probes—are borderless. The global nature of the Internet makes it possible for cybercriminals to operate—and to do harm—anywhere in the world. Concern is mounting that the vulnerabilities of the Internet or other networks make digital networks easy targets for digital attacks by terrorists, foreign intelligence services, or other groups seeking to create widespread disruption and harm. Such cyberattacks might target the software that runs electrical power grids, air traffic control systems, or networks of major banks and financial institutions. At least 20 countries, including China, are believed to be developing offensive and defensive cyberwarfare capabilities.

Software Vulnerability:
Software errors pose a constant threat to information systems, causing untold losses in productivity. Growing complexity and size of software programs, coupled with demands for timely delivery to markets, have contributed to an increase in software flaws or vulnerabilities.

A major problem with software is the presence of hidden bugs or program code defects. Studies have shown that it is virtually impossible to eliminate all bugs from large programs. The main source of bugs is the complexity of decision-making code. A relatively small program of several hundred lines will contain tens of decisions leading to hundreds or even thousands of different paths. Important programs within most corporations are usually much larger, containing tens of thousands or even millions of lines of code, each with many times the choices and paths of the smaller programs.

Zero defects cannot be achieved in larger programs. Complete testing simply is not possible. Fully testing programs that contain thousands of choices and millions of paths would require thousands of years. Even with rigorous testing, you would not know for sure that a piece of software was dependable until the product proved itself after much operational use.

To correct software flaws once they are identified, the software vendor creates small pieces of software called patches to repair the flaws without disturbing the proper operation of the software. An example is Microsoft's Windows Vista Service Pack 2, released in April 2009, which includes some security enhancements to counter malware and hackers. It is up to users of the software to track these vulnerabilities, test, and apply all patches. This process is called patch management.

8.2 Technologies and tools for protecting information resources

Businesses have an array of technologies for protecting their information resources. They include tools for managing user identities, preventing unauthorized access to systems and data, ensuring system availability, and ensuring software quality.

Identity management and authentication:
Large and midsize companies have complex IT infrastructures and many different systems, each with its own set of users. Identity management software automates the process of keeping track of all these users and their system privileges, assigning each user a unique digital identity for accessing each system. It also includes tools for authenticating users, protecting user identities, and controlling access to system resources.

To gain access to a system, a user must be authorized and authenticated. Authentication refers to the ability to know that a person is who he or she claims to be. Authentication is often established by using passwords known only to authorized users. An end user uses a password to log on to a computer system and may also use passwords for accessing specific systems and files. However, users often forget passwords, share them, or choose poor passwords that are easy to guess, which compromises security. Password systems that are too rigorous hinder employee productivity. When employees must change complex passwords frequently, they often take shortcuts, such as choosing passwords that are easy to guess or writing down their passwords at their workstations in plain view. Passwords can also be "sniffed" if transmitted over a network or stolen through social engineering.

New authentication technologies, such as tokens, smart cards, and biometric authentication, overcome some of these problems. A token is a physical device, similar to an identification card, that is designed to prove the identity of a single user. Tokens are small gadgets that typically fit on key rings and display passcodes that change frequently. A smart card is a device about the size of a credit card that contains a chip formatted with access permission and other data. (Smart cards are also used in electronic payment systems.) A reader device interprets the data on the smart card and allows or denies access.

Biometric authentication uses systems that read and interpret individual human traits, such as fingerprints, irises, and voices, in order to grant or deny access. Biometric authentication is based on the measurement of a physical or behavioral trait that makes each individual unique. It compares a person's unique characteristics, such as the fingerprints, face, or retinal image, against a stored profile of these characteristics to determine whether there are any differences between these characteristics and the stored profile. If the two profiles match, access is granted. Fingerprint and facial recognition technologies are just beginning to be used for security applications, with many PC laptops equipped with fingerprint identification devices and several models with builtin webcams and face recognition software.

Firewalls, intrusion detection systems, and antivirus software:
Firewalls: Firewalls prevent unauthorized users from accessing private networks. A firewall is a combination of hardware and software that controls the flow of incoming and outgoing network traffic. It is generally placed between the organization's private internal networks and distrusted external networks, such as the Internet, although firewalls can also be used to protect one part of a company's network from the rest of the network.

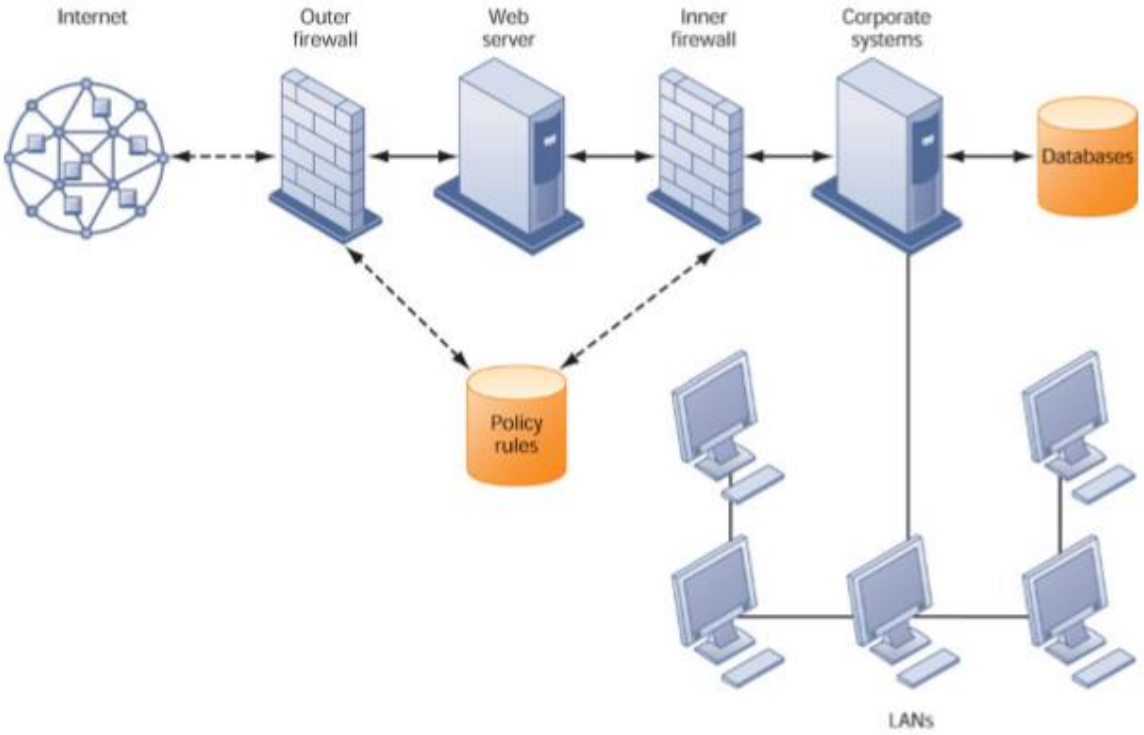


Fig: A corporate firewall

- **Packet filtering** examines selected fields in the headers of data packets flowing back and forth between the trusted network and the Internet, examining individual packets in isolation. This filtering technology can miss many types of attacks.
- **Stateful inspection** provides additional security by determining whether packets are part of an ongoing dialogue between a sender and a receiver. It sets up state tables to track information over multiple packets. Packets are accepted or rejected based on whether they are part of an approved conversation or whether they are attempting to establish a legitimate connection.
- **Network Address Translation (NAT)** can provide another layer of protection when static packet filtering and stateful inspection are employed. NAT conceals the IP addresses of the organization's internal host computer(s) to prevent sniffer programs outside the firewall from ascertaining them and using that information to penetrate internal systems.
- **Application proxy filtering** examines the application content of packets. A proxy server stops data packets originating outside the organization, inspects them, and passes a proxy to the other side of the firewall. If a user outside the company wants to communicate with a user inside the organization, the outside user first "talks" to the proxy application and the proxy application communicates with the firm's internal computer. Likewise, a computer user inside the organization goes through the proxy to talk with computers on the outside.

Intrusion Detection Systems

Intrusion detection systems feature full-time monitoring tools placed at the most vulnerable points or "hot spots" of corporate networks to detect and deter intruders continually. The system generates an alarm if it finds a suspicious or anomalous event. Scanning software looks for patterns indicative of known methods of computer attacks, such as bad passwords, checks to see if important files have been removed or modified, and sends warnings of vandalism or system administration errors. Monitoring software examines events as they are happening to discover security attacks in progress. The intrusion detection tool can also be customized to shut down a particularly sensitive part of a network if it receives unauthorized traffic.

Antivirus and Antispyware software:

Antivirus software is designed to check computer systems and drives for the presence of computer viruses. Often the software eliminates the virus from the infected area. However, most antivirus

software is effective only against viruses already known when the software was written. To remain effective, the antivirus software must be continually updated. Antivirus products are available for many different types of mobile and handheld devices in addition to servers, workstations, and desktop PCs. Leading antivirus software vendors, such as McAfee, Symantec, and Trend Micro, have enhanced their products to include protection against spyware. Antispyware software tools such as Ad-Aware, Spybot S&D, and Spyware Doctor are also very helpful.

Unified Threat management systems:
To help businesses reduce costs and improve manageability, security vendors have combined into a single appliance various security tools, including firewalls, virtual private networks, intrusion detection systems, and Web content filtering and antispam software. These comprehensive security management products are called unified threat management (UTM) systems. Although initially aimed at small and medium-sized businesses, UTM products are available for all sizes of networks. Leading UTM vendors include Crossbeam, Fortinent, and Check Point, and networking vendors such as Cisco Systems and Juniper Networks provide some UTM capabilities in their equipment.

Securing wireless networks:
Despite its flaws, WEP provides some margin of security if Wi-Fi users remember to activate it. A simple first step to thwart hackers is to assign a unique name to your network's SSID and instruct your router not to broadcast it. Corporations can further improve Wi-Fi security by using it in conjunction with virtual private network (VPN) technology when accessing internal corporate data.

Encryption and public key infrastructure:
Many businesses use encryption to protect digital information that they store, physically transfer, or send over the Internet. Encryption is the process of transforming plain text or data into cipher text that cannot be read by anyone other than the sender and the intended receiver. Data are encrypted by using a secret numerical code, called an encryption key, that transforms plain data into cipher text. The message must be decrypted by the receiver.

Two methods for encrypting network traffic on the Web are SSL and S-HTTP. Secure Sockets Layer (SSL) and its successor Transport Layer Security (TLS) enable client and server computers to manage encryption and decryption activities as they communicate with each other during a secure Web session. Secure Hypertext Transfer Protocol (S-HTTP) is another protocol used for encrypting data flowing over the Internet, but it is limited to individual messages, whereas SSL and TLS are designed to establish a secure connection between two computers.

The capability to generate secure sessions is built into Internet client browser software and servers. The client and the server negotiate what key and what level of security to use. Once a secure session is established between the client and the server, all messages in that session are encrypted.

Points to remember!

A public key encryption system can be viewed as a series of public and private keys that lock data when they are transmitted and unlock the data when they are received. The sender locates the recipient's public key in a directory and uses it to encrypt a message. The message is sent in encrypted form over the Internet or a private network. When the encrypted message arrives, the recipient uses his or her private key to decrypt the data and read the message.

Securing issues for cloud computing and the mobile digital platform:

Although cloud computing and the emerging mobile digital platform have the potential to deliver powerful benefits, they pose new challenges to system security and reliability. We now describe some of these challenges and how they should be addressed.

Securing in the cloud:

When processing takes place in the cloud, accountability and responsibility for protection of sensitive data still reside with the company owning that data. Understanding how the cloud computing provider organizes its services and manages the data is critical. The Interactive Session on Technology details some of the cloud security issues that should be addressed. Cloud users need to confirm that regardless of where their data are stored or transferred, they are protected at a level that meets their corporate requirements. They should stipulate that the cloud provider store and process data in specific jurisdictions according to the privacy rules of those jurisdictions. Cloud clients should find how the cloud provider segregates their corporate data from those of other companies and ask for proof that encryption mechanisms are sound. It's also important to know how the cloud provider will respond if a disaster strikes, whether the provider will be able to completely restore your data, and how long this should take. Cloud users should also ask whether cloud providers will submit to external audits and security certifications. These kinds of controls can be written into the service level agreement (SLA) before to signing with a cloud provider.

Securing mobile platforms:

If mobile devices are performing many of the functions of computers, they need to be secured like desktops and laptops against malware, theft, accidental loss, unauthorized access, and hacking attempts. Mobile devices accessing corporate systems and data require special protection. Companies should make sure that their corporate security policy includes mobile devices, with additional details on how mobile devices should be supported, protected, and used. They will need tools to authorize all devices in use; to maintain accurate inventory records on all mobile devices, users, and applications; to control updates to applications; and to lock down lost devices so they can't be compromised. Firms should develop guidelines stipulating approved mobile platforms and software applications as well as the required software and procedures for remote access of corporate systems. Companies will need to ensure that all smartphones are up to date with the latest security patches and antivirus/antispam software, and they should encrypt communication whenever possible.

Unit-9

Achieving Operational Excellence and Customer Intimacy

9.1 Enterprise Systems

Around the globe, companies are increasingly becoming more connected, both internally and with other companies. If you run a business, you'll want to be able to react instantaneously when a customer places a large order or when a shipment from a supplier is delayed. You may also want to know the impact of these events on every part of the business and how the business is performing at any point in time, especially if you're running a large company. Enterprise systems provide the integration to make this possible.

At the very least, your decision making would often be based on manual hardcopy reports, often out of date, and it would be difficult to really understand what is happening in the business as a whole. Sales personnel might not be able to tell at the time they place an order whether the ordered items are in inventory, and manufacturing could not easily use sales data to plan for new production. You now have a good idea of why firms need a special enterprise system to integrate information.

Enterprise systems, also known as enterprise resource planning (ERP) systems, which are based on a suite of integrated software modules and a common central database. The database collects data from many different divisions and departments in a firm, and from a large number of key business processes in manufacturing and production, finance and accounting, sales and marketing, and human resources, making the data available for applications that support nearly all of an organization's internal business activities. When new information is entered by one process, the information is made immediately available to other business processes.

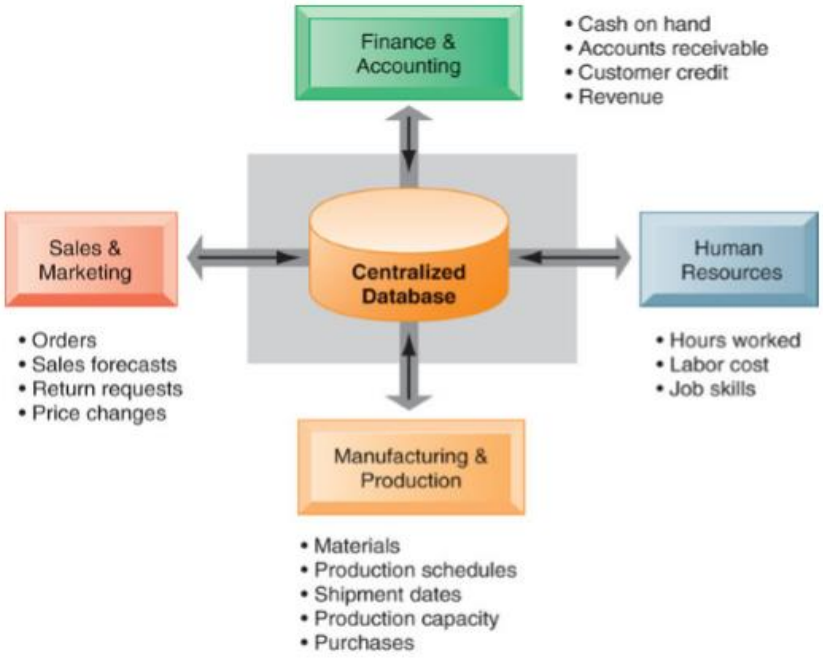


Fig: How enterprise system work

Enterprise software:

Enterprise software is built around thousands of predefined business processes that reflect best practices. Companies implementing this software must first select the functions of the system they wish to use and then map their business processes to the predefined business processes in the software.

Identifying the organization's business processes to be included in the system and then mapping them to the processes in the enterprise software is often a major effort. A firm would use configuration tables provided by the software to tailor a particular aspect of the system to the way it does business. For example, the firm could use these tables to select whether it wants to track revenue by product line, geographical unit, or distribution channel.

Business process supported by enterprise systems:

Financial and accounting processes:	including general ledger, accounts payable, accounts receivable, fixed assets, cash management and forecasting, product-cost accounting, cost-center accounting, asset accounting, tax accounting, credit management, and financial reporting.
Human resources processes	including personnel administration, time accounting, payroll, personnel planning and development, benefits accounting, applicant tracking, time management, compensation, workforce planning, performance management, and travel expense reporting.
Manufacturing and production processes	including procurement, inventory management, purchasing, shipping, production planning, production scheduling, material requirements planning, quality control, distribution, transportation execution, and plant and equipment maintenance.
Sales and marketing processes	including order processing, quotations, contracts, product configuration, pricing, billing, credit checking, incentive and commission management, and sales planning.

Business value of enterprise systems:

Enterprise systems provide value both by increasing operational efficiency and by providing firm-wide information to help managers make better decisions. Large companies with many operating units in different locations have used enterprise systems to enforce standard practices and data so that everyone does business the same way worldwide. Coca Cola, for instance, implemented a SAP enterprise system to standardize and coordinate important business processes in 200 countries. Lack of standard, company-wide business processes prevented the company from leveraging its worldwide buying power to obtain lower prices for raw materials and from reacting rapidly to market changes.

Enterprise systems help firms respond rapidly to customer requests for information or products. Because the system integrates order, manufacturing, and delivery data, manufacturing is better informed about producing only what customers have ordered, procuring exactly the right amount of components or raw materials to fill actual orders, staging production, and minimizing the time that components or finished products are in inventory.

Enterprise systems provide much valuable information for improving management decision making. Corporate headquarters has access to up-to-the minute data on sales, inventory, and production and uses this information to create more accurate sales and production forecasts. Enterprise software includes analytical tools for using data captured by the system to evaluate overall organizational performance. Enterprise system data have common standardized definitions and formats that are accepted by the entire organization. Performance figures mean the same thing across the company. Enterprise systems allow senior management to easily find out at any moment how a particular organizational unit is performing, determine which products are most or least profitable, and calculate costs for the company as a whole.

9.2 Supply chain management systems

If you manage a small firm that makes a few products or sells a few services, chances are you will have a small number of suppliers. You could coordinate your supplier orders and deliveries using a telephone

and fax machine. But if you manage a firm that produces more complex products and services, then you will have hundreds of suppliers, and your suppliers will each have their own set of suppliers. Suddenly, you are in a situation where you will need to coordinate the activities of hundreds or even thousands of other firms in order to produce your products and services. Supply chain management systems, are an answer to these problems of supply chain complexity and scale.

The Supply Chain:
A firm's supply chain is a network of organizations and business processes for procuring raw materials, transforming these materials into intermediate and finished products, and distributing the finished products to customers. It links suppliers, manufacturing plants, distribution centers, retail outlets, and customers to supply goods and services from source through consumption. Materials, information, and payments flow through the supply chain in both directions Goods start out as raw materials and, as they move through the supply chain, are transformed into intermediate products (also referred to as components or parts), and finally, into finished products. The finished products are shipped to distribution centers and from there to retailers and customers. Returned items flow in the reverse direction from the buyer back to the seller.

Information systems and supply chain management:
Inefficiencies in the supply chain, such as parts shortages, underutilized plant capacity, excessive finished goods inventory, or high transportation costs, are caused by inaccurate or untimely information. For example, manufacturers may keep too many parts in inventory because they do not know exactly when they will receive their next shipments from their suppliers. Suppliers may order too few raw materials because they do not have precise information on demand. These supply chain inefficiencies waste as much as 25 percent of a company's operating costs.

If a manufacturer had perfect information about exactly how many units of product customers wanted, when they wanted them, and when they could be produced, it would be possible to implement a highly efficient just-in-time strategy. Components would arrive exactly at the moment they were needed and finished goods would be shipped as they left the assembly line.

In a supply chain, however, uncertainties arise because many events cannot be foreseen—uncertain product demand, late shipments from suppliers, defective parts or raw materials, or production process breakdowns. To satisfy customers, manufacturers often deal with such uncertainties and unforeseen events by keeping more material or products in inventory than what they think they may actually need. The safety stock acts as a buffer for the lack of flexibility in the supply chain. Although excess inventory is expensive, low fill rates are also costly because business may be lost from canceled orders.

How information systems facilitate supply chain management?

- Decide when and what to produce, store, and move
- Rapidly communicate orders
- Track the status of orders
- Check inventory availability and monitor inventory levels
- Reduce inventory, transportation, and warehousing costs
- Track shipments
- Plan production based on actual customer demand
- Rapidly communicate changes in product design

Supply chain management software
Supply chain software is classified as either software to help businesses plan their supply chains (supply chain planning) or software to help them execute the supply chain steps (supply chain execution). Supply chain planning systems enable the firm to model its existing supply chain, generate demand forecasts for products, and develop optimal sourcing and manufacturing plans. Such systems help companies make better decisions such as determining how much of a specific product to manufacture in a given time period; establishing inventory levels for raw materials, intermediate products, and

finished goods; determining where to store finished goods; and identifying the transportation mode to use for product delivery.

For example, if a large customer places a larger order than usual or changes that order on short notice, it can have a widespread impact throughout the supply chain. Additional raw materials or a different mix of raw materials may need to be ordered from suppliers. Manufacturing may have to change job scheduling. A transportation carrier may have to reschedule deliveries. Supply chain planning software makes the necessary adjustments to production and distribution plans. Information about changes is shared among the relevant supply chain members so that their work can be coordinated. One of the most important—and complex— supply chain planning functions is demand planning, which determines how much product a business needs to make to satisfy all of its customers' demands.

Supply chain execution systems manage the flow of products through distribution centers and warehouses to ensure that products are delivered to the right locations in the most efficient manner. They track the physical status of goods, the management of materials, warehouse and transportation operations, and financial information involving all parties.

Global supply chains and the internet:
Before the Internet, supply chain coordination was hampered by the difficulties of making information flow smoothly among disparate internal supply chain systems for purchasing, materials management, manufacturing, and distribution. It was also difficult to share information with external supply chain partners because the systems of suppliers, distributors, or logistics providers were based on incompatible technology platforms and standards. Enterprise and supply chain management systems enhanced with Internet technology supply some of this integration.

Global supply chain issues:
More and more companies are entering international markets, outsourcing manufacturing operations, and obtaining supplies from other countries as well as selling abroad. Their supply chains extend across multiple countries and regions. There are additional complexities and challenges to managing a global supply chain.

Global supply chains typically span greater geographic distances and time differences than domestic supply chains and have participants from a number of different countries. Although the purchase price of many goods might be lower abroad, there are often additional costs for transportation, inventory (the need for a larger buffer of safety stock), and local taxes or fees. Performance standards may vary from region to region or from nation to nation. Supply chain management may need to reflect foreign government regulations and cultural differences. All of these factors impact how a company takes orders, plans distribution, sizes warehousing, and manages inbound and outbound logistics throughout the global markets it services.

The Internet helps companies manage many aspects of their global supply chains, including sourcing, transportation, communications, and international finance. Today's apparel industry, for example, relies heavily on outsourcing to contract manufacturers in China and other low-wage countries. Apparel companies are starting to use the Web to manage their global supply chain and production issues.

As goods are being sourced, produced, and shipped, communication is required among retailers, manufacturers, contractors, agents, and logistics providers. Many, especially smaller companies, still share product information over the phone, via e-mail, or through faxes. These methods slow down the supply chain and also increase errors and uncertainty. With e-SPS, all supply chain members communicate through a Web-based system. If one of Koret's vendors makes a change in the status of a product, everyone in the supply chain sees the change.

Demand-Driven supply chains: From push to pull manufacturing and efficient customer response:

In addition to reducing costs, supply chain management systems facilitate efficient customer response, enabling the workings of the business to be driven more by customer demand.

Earlier supply chain management systems were driven by a push-based model (also known as build-to-stock). In a push-based model, production master schedules are based on forecasts or best guesses of demand for products, and products are "pushed" to customers. With new flows of information made possible by Web-based tools, supply chain management more easily follows a pull-based model. In a pull-based model, also known as a demand driven model or build-to-order, actual customer orders or purchases trigger events in the supply chain. Transactions to produce and deliver only what customers have ordered move up the supply chain from retailers to distributors to manufacturers and eventually to suppliers. Only products to fulfill these orders move back down the supply chain to the retailer. Manufacturers use only actual order demand information to drive their production schedules and the procurement of components or raw materials, as illustrated in Figure.

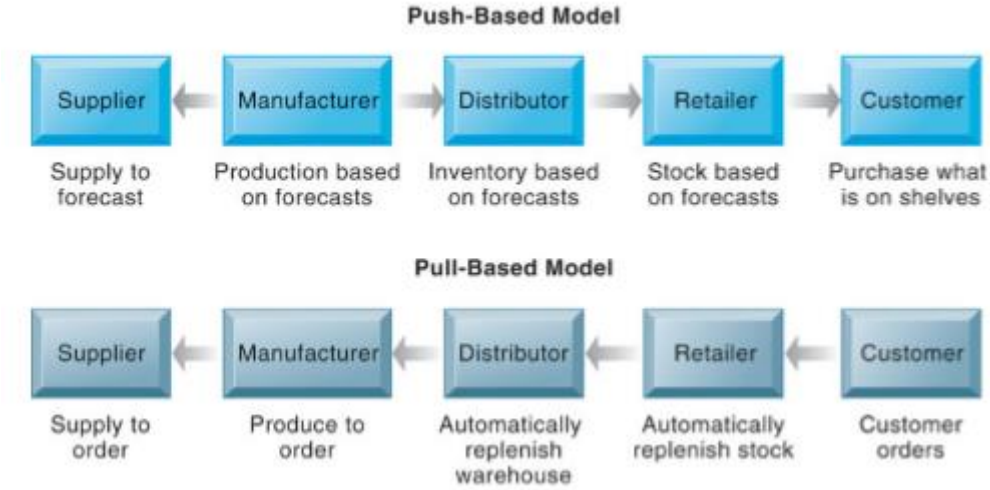


Fig: Push versus Pull based supply chain models

Business value of supply chain management systems:
Supply chain management systems enable firms to streamline both their internal and external supply chain processes and provide management with more accurate information about what to produce, store, and move. By implementing a networked and integrated supply chain management system, companies match supply to demand, reduce inventory levels, improve delivery service, speed product time to market, and use assets more effectively.

Total supply chain costs represent the majority of operating expenses for many businesses and in some industries approach 75 percent of the total operating budget. Reducing supply chain costs may have a major impact on firm profitability. In addition to reducing costs, supply chain management systems help increase sales. If a product is not available when a customer wants it, customers often try to purchase it from someone else. More precise control of the supply chain enhances the firm's ability to have the right product available for customer purchases at the right time.

9.3 Customer relationship management systems

Customer relationship management (CRM) systems, capture and integrate customer data from all over the organization, consolidate the data, analyze the data, and then distribute the results to various systems and customer touch points across the enterprise. A touch point (also known as a contact point) is a method of interaction with the customer, such as telephone, e-mail, customer service desk, conventional mail, Web site, wireless device, or retail store.

Well-designed CRM systems provide a single enterprise view of customers that is useful for improving both sales and customer service. Such systems likewise provide customers with a single view of the company regardless of what touch point the customer uses as in figure.

Fig: Customer relationship management (CRM)

Good CRM systems provide data and analytical tools for answering questions such as these: "What is the value of a particular customer to the firm over his or her lifetime?" "Who are our most loyal customers?" (It can cost six times more to sell to a new customer than to an existing customer.) "Who are our most profitable customers?" and "What do these profitable customers want to buy?" Firms use the answers to these questions to acquire new customers, provide better service and support to existing customers, customize their offerings more precisely to customer preferences, and provide ongoing value to retain profitable customers.

Customer relationship management software:

Commercial CRM software packages range from niche tools that perform limited functions, such as personalizing Web sites for specific customers, to large-scale enterprise applications that capture myriad interactions with customers, analyze them with sophisticated reporting tools, and link to other major enterprise applications, such as supply chain management and enterprise systems. The more comprehensive CRM packages contain modules for partner relationship management (PRM) and employee relationship management (ERM).

PRM uses many of the same data, tools, and systems as customer relationship management to enhance collaboration between a company and its selling partners. If a company does not sell directly to customers but rather works through distributors or retailers, PRM helps these channels sell to customers directly. It provides a company and its selling partners with the ability to trade information and distribute leads and data about customers, integrating lead generation, pricing, promotions, order configurations, and availability. It also provides a firm with tools to assess its partners' performances so it can make sure its best partners receive the support they need to close more business.

ERM software deals with employee issues that are closely related to CRM, such as setting objectives, employee performance management, performance based compensation, and employee training. Major CRM application software vendors include Oracle-owned Siebel Systems and PeopleSoft, SAP, Salesforce.com, and Microsoft Dynamics CRM.

Sales Force Automation (SFA)

Sales force automation modules in CRM systems help sales staff increase their productivity by focusing sales efforts on the most profitable customers, those who are good candidates for sales and services. CRM systems provide sales prospect and contact information, product information, product configuration capabilities, and sales quote generation capabilities. Such software can assemble information about a particular customer's past purchases to help the salesperson make personalized recommendations. CRM software enables sales, marketing, and delivery departments to easily share customer and prospect information. It increases each salesperson's efficiency in reducing the cost per

sale as well as the cost of acquiring new customers and retaining old ones. CRM software also has capabilities for sales forecasting, territory management, and team selling.

Customer Service:
Customer service modules in CRM systems provide information and tools to increase the efficiency of call centers, help desks, and customer support staff. They have capabilities for assigning and managing customer service requests. One such capability is an appointment or advice telephone line: When a customer calls a standard phone number, the system routes the call to the correct service person, who inputs information about that customer into the system only once. Once the customer's data are in the system, any service representative can handle the customer relationship. Improved access to consistent and accurate customer information help call centers handle more calls per day and decrease the duration of each call. Thus, call centers and customer service groups achieve greater productivity, reduced transaction time, and higher quality of service at lower cost. The customer is happier because he or she spends less time on the phone restating his or her problem to customer service representatives.

Marketing:
CRM systems support direct-marketing campaigns by providing capabilities for capturing prospect and customer data, for providing product and service information, for qualifying leads for targeted marketing, and for scheduling and tracking direct-marketing mailings or e-mail.

Cross-selling is the marketing of complementary products to customers. (For example, in financial services, a customer with a checking account might be sold a money market account or a home improvement loan.) CRM tools also help firms manage and execute marketing campaigns at all stages, from planning to determining the rate of success for each campaign.

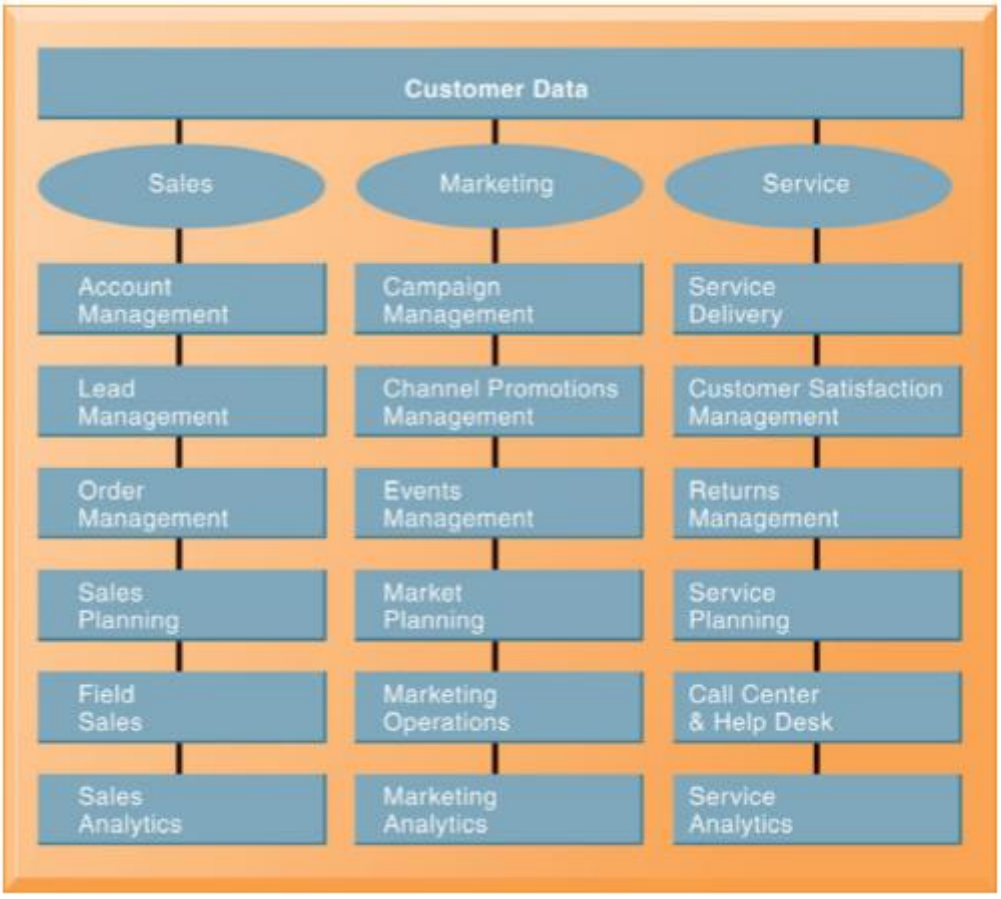


Fig: CRM software capabilities

Fig: Customer Loyalty Management Process Map

Above figure shows how a best practice for increasing customer loyalty through customer service might be modeled by CRM software. Directly servicing customers provides firms with opportunities to increase customer retention by singling out profitable long-term customers for preferential treatment. CRM software can assign each customer a score based on that person's value and loyalty to the company and provide that information to help call centers route each customer's service request to agents who can best handle that customer's needs. The system would automatically provide the service agent with a detailed profile of that customer that includes his or her score for value and loyalty. The service agent would use this information to present special offers or additional service to the customer to encourage the customer to keep transacting business with the company.

Operational and analytical CRM:

All of the applications we have just described support either the operational or analytical aspects of customer relationship management. Operational CRM includes customer-facing applications, such as tools for sales force automation, call center and customer service support, and marketing automation. Analytical CRM includes applications that analyze customer data generated by operational CRM applications to provide information for improving business performance.

Analytical CRM applications are based on data warehouses that consolidate the data from operational CRM systems and customer touch points for use with online analytical processing (OLAP), data mining, and other data analysis techniques. Customer data collected by the organization might be combined with data from other sources, such as customer lists for direct-marketing campaigns purchased from other companies or demographic data. Such data are analyzed to identify buying patterns, to create segments for targeted marketing, and to pinpoint profitable and unprofitable customers as in figure.

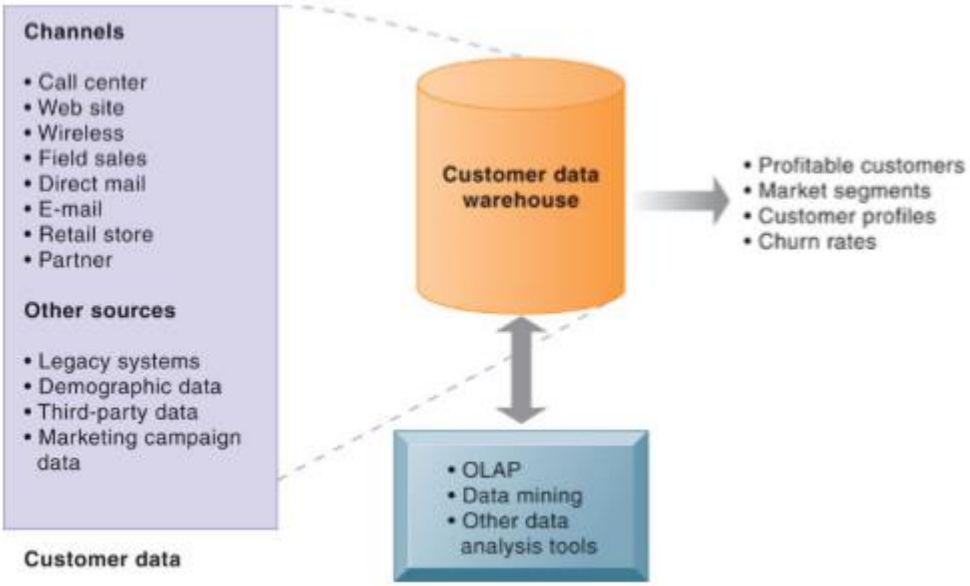


Fig: Analytical CRM data warehouse

Another important output of analytical CRM is the customer's lifetime value to the firm. Customer lifetime value (CLTV) is based on the relationship between the revenue produced by a specific customer, the expenses incurred in acquiring and servicing that customer, and the expected life of the relationship between the customer and the company.

Business value of customer relationship management systems:
Companies with effective customer relationship management systems realize many benefits, including increased customer satisfaction, reduced direct marketing costs, more effective marketing, and lower costs for customer acquisition and retention. Information from CRM systems increases sales revenue by identifying the most profitable customers and segments for focused marketing and cross-selling. Customer churn is reduced as sales, service, and marketing better respond to customer needs. The churn rate measures the number of customers who stop using or purchasing products or services from a company. It is an important indicator of the growth or decline of a firm's customer base.

9.4 Enterprise applications

Many firms have implemented enterprise systems and systems for supply chain management and customer relationship because they are such powerful instruments for achieving operational excellence and enhancing decision making. But precisely because they are so powerful in changing the way the organization works, they are challenging to implement.

Enterprise Application Challenges
Promises of dramatic reductions in inventory costs, order-to-delivery time, as well as more efficient customer response and higher product and customer profitability make enterprise systems and systems for supply chain management and customer relationship management very alluring.

Enterprise applications involve complex pieces of software that are very expensive to purchase and implement. It might take a large Fortune 500 company several years to complete a large-scale implementation of an enterprise system or a system for SCM or CRM. The total cost for an average large system implementation based on SAP or Oracle software, including software, database tools, consulting fees, personnel costs, training, and perhaps hardware costs.

Enterprise applications require not only deep-seated technological changes but also fundamental changes in the way the business operates. Companies must make sweeping changes to their business processes to work with the software. Employees must accept new job functions and responsibilities. They must learn how to perform a new set of work activities and understand how the information they enter into the system can affect other parts of the company. This requires new organizational learning. Enterprise applications also introduce "switching costs." Once you adopt an enterprise application from a single vendor, such as SAP, Oracle, or others, it is very costly to switch vendors, and your firm becomes dependent on the vendor to upgrade its product and maintain your installation. Enterprise applications are based on organization-wide definitions of data. You'll need to understand exactly how your business uses its data and how the data would be organized in a customer relationship management, supply chain management, or enterprise system. CRM systems typically require some data cleansing work.

Enterprise software vendors are addressing these problems by offering pared-down versions of their software and "fast-start" programs for small and medium-sized businesses and best-practice guidelines for larger companies. Companies adopting enterprise applications can also save time and money by keeping customizations to the minimum.

Next-Generation Enterprise Applications
Today, enterprise application vendors are delivering more value by becoming more flexible, Web-enabled, and capable of integration with other systems. Standalone enterprise systems, customer relationship systems, and supply chain management systems are becoming a thing of the past.

The major enterprise software vendors have created what they call enterprise solutions, enterprise suites, or e-business suites to make their customer relationship management, supply chain management, and enterprise systems work closely with each other, and link to systems of customers and suppliers. SAP Business Suite, Oracle's e-Business Suite, and Microsoft's Dynamics suite (aimed at mid-sized companies) are examples, and they now utilize Web services and service-oriented architecture.

SAP's next-generation enterprise applications are based on its enterprise service-oriented architecture. It incorporates service-oriented architecture (SOA) standards and uses its NetWeaver tool as an integration platform linking SAP's own applications and Web services developed by independent software vendors. The goal is to make enterprise applications easier to implement and manage. For example, the current version of SAP enterprise software combines key applications in finance, logistics and procurement, and human resources administration into a core ERP component. Businesses then extend these applications by linking to function-specific Web services such as employee recruiting or collections management provided by SAP and other vendors. SAP provides over 500 Web services through its Web site.

Next-generation enterprise applications also include open source and on-demand solutions. Compared to commercial enterprise application software, open source products such as Compiere, Apache Open for Business (OFBiz), and Openbravo are not as mature, nor do they include as much support. However, companies such as small manufacturers are choosing this option because there are no software licensing fees and fees are based on usage. (Support and customization for open source products cost extra.)

SAP now offers an on-demand enterprise software solution called Business ByDesign for small and medium-sized businesses in select countries. For large businesses, SAP's on-site software is the only version available. SAP is, however, hosting function-specific applications (such as e-sourcing and expense management) available by subscription that integrate with customers' on-site SAP Business Suite systems.

Service Platforms:

Another way of extending enterprise applications is to use them to create service platforms for new or improved business processes that integrate information from multiple functional areas. These enterprise-wide service platforms provide a greater degree of cross-functional integration than the traditional enterprise applications. A service platform integrates multiple applications from multiple business functions, business units, or business partners to deliver a seamless experience for the customer, employee, manager, or business partner.

For instance, the order-to-cash process involves receiving an order and seeing it all the way through obtaining payment for the order. This process begins with lead generation, marketing campaigns, and order entry, which are typically supported by CRM systems. Once the order is received, manufacturing is scheduled and parts availability is verified—processes that are usually supported by enterprise software. The order then is handled by processes for distribution planning, warehousing, order fulfillment, and shipping, which are usually supported by supply chain management systems. Finally, the order is billed to the customer, which is handled by either enterprise financial applications or accounts receivable. If the purchase at some point required customer service, customer relationship management systems would again be invoked.

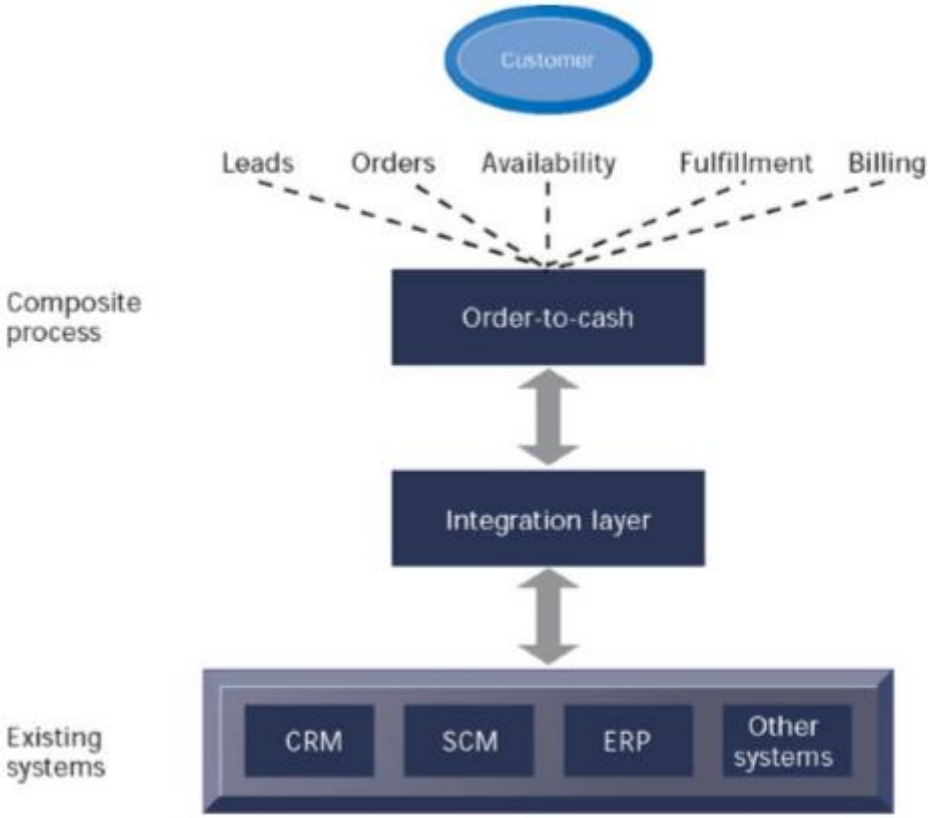


Fig: Order to cash service

Point to Remember !

Order-to-cash is a composite process that integrates data from individual enterprise systems and legacy financial applications. The process must be modeled and translated into a software system using application integration tools.

Case study

Border States Industries Fuels Rapid Growth with ERP

Border States Industries Inc., also known as Border States Electric (BSE), is a wholesale distributor for the construction, industrial, utility, and data communications markets. The company is headquartered in Fargo, North Dakota, and has 57 sales offices in states along the U.S. borders with Canada and Mexico as well as in South Dakota, Wisconsin, Iowa, and Missouri. BSE has 1,400 employees and is wholly employee-owned through its employee stock ownership plan. For the fiscal year ending March 31, 2008, BSE earned revenues of over US $880 million.

BSE's goal is to provide customers with what they need whenever they need it, including providing custom services beyond delivery of products. Thus, the company is not only a wholesale distributor but also a provider of supply chain solutions, with extensive service operations such as logistics, job-site trailers, and kitting (packaging individually separate but related items together as one unit). BSE has distribution agreements with more than 9,000 product vendors.

BSE had relied on its own legacy ERP system called Rigel since 1988 to support its core business processes. However, Rigel had been designed exclusively for electrical wholesalers, and by the mid-1990s, the system could not support BSE's new lines of business and extensive growth.

At that point, BSE's management decided to implement a new ERP system and selected the enterprise software from SAP AG. The ERP solution included SAP's modules for sales and distribution, materials management, financials and controlling, and human resources.

BSE initially budgeted $6 million for the new system, with a start date of November 1, 1998. Senior management worked with IBM and SAP consulting to implement the system. Although close involvement of management was one key ingredient in the systems' success, day-to-day operations suffered while managers were working on the project.

BSE also decided to customize the system extensively. It wrote its own software to enable the ERP system to interface automatically with systems from other vendors, including Taxware Systems, Inc., Innovis Inc., and TOPCALL International GmbH. The Taxware system enabled BSE to comply with the sales tax requirements of all the states and municiB palities where it conducts business. The Innovis system supported electronic data interchange (EDI) so that BSE could electronically exchange purchase and payment transactions with its suppliers. The TOPCALL system enabled BSE to fax customers and vendors directly from the SAP system.

At the time of this implementation, BSE had no experience with SAP software, and few consultants familiar with the version of the SAP software that BSE was using. Instead of adopting the best-practice business processes embedded in the SAP software, BSE hired consultants to further customize the SAP software to make its new SAP system look like its old Rigel system in certain areas. For example, it tried to make customer invoices resemble the invoices produced by the old Rigel system.

Implementing these changes required so much customization of the SAP software that BSE had to delay the launch date for the new ERP system until February 1, 1999. By that time, continued customization and tuning raised total implementation costs to $9 million (an increase of 50 percent).

Converting and cleansing data from BSE's legacy system took far longer than management had anticipated. The first group of "expert users" were trained too early in the project and had to be retrained when the new system finally went live. BSE never fully tested the system as it would be used in a working production environment before the system actually went live.

For the next five years, BSE continued to use its SAP ERP system successfully as it acquired several small companies and expanded its branch office infrastructure to 24 states. As the business grew further, profits and inventory turns increased. However, the Internet brought about the need for additional changes, as customers sought to transact business with BSE through an e-commerce storefront. BSE automated online credit card processing and special pricing agreements (SPAs) with designated customers. Unfortunately, the existing SAP software did not support these changes, so the company had to process thousands of SPAs manually.

To process a credit card transaction in a branch office, BSE employees had to leave their desks, walk over to a dedicated credit card processing system in the back office, manually enter the credit card numbers, wait for transaction approval, and then return to their workstations to continue processing sales transactions.

In 2004, BSE began upgrading its ERP system to a more recent version of the SAP software. The software included new support for bills of material and kitting, which were not available in the old system. This functionality enabled BSE to provide better support to utility customers because it could prepare kits that could be delivered directly to a site.

This time the company kept customization to a minimum and used the SAP best practices for wholesale distribution embedded in the software. It also replaced TOPCALL with software from Esker for faxing and emailing outbound invoices, order acknowledgments, and purchase orders and added capabilities from Vistex Inc. to automate SPA rebate claims processing. BSE processes over 360,000 SPA claims each year, and the Vistex software enabled BSE to reduce rebate fulfillment time to 72 hours and transaction processing time by 63 percent. In the past, it took 15 to 30 days for BSE to receive rebates from vendors.

BSE budgeted $1.6 million and 4.5 months for implementation, which management believed was sufficient for a project of this magnitude. This time there were no problems. The new system went live on its target date and cost only $1.4 million to implement—14 percent below budget.

In late 2006, BSE acquired a large company that was anticipated to increase sales volume by 20 percent each year. This acquisition added 19 new branches to BSE. These new branches were able to run BSE's SAP software within a day after the acquisition had been completed. BSE now tracks 1.5 million unique items with the software.

Since BSE first deployed SAP software in 1998, sales have increased 300 percent, profits have climbed more than 500 percent, 60 percent of accounts payable transactions take place electronically using EDI, and SPA processing has been reduced by 63 percent. The company turns over its inventory more than four times per year. Instead of waiting 15 to 20 days for monthly financial statements, monthly and year-to-date financial results are available within a day after closing the books. Manual work for handling incoming mail, preparing bank deposits, and taking checks physically to the bank has been

significantly reduced. Over 60 percent of vendor invoices arrive electronically, which has reduced staff size in accounts payable and the number of transaction errors. Transaction costs are lower.

The number of full-time BSE employees did increase in the information systems area to support the SAP software. BSE had initially expected to have 3 IT staff supporting the system, but needed 8 people when the first ERP implementation went live in 1999 and 11 by 2006 to support additional SAP software and the new acquisition. BSE's information technology (IT) costs rose by approximately $3 million per year after the first SAP implementation. However, sales expanded during the same period, so the increased overhead for the system produced a cost increase of only .5 percent of total sales.

BSE management has pointed out that much of the work that was automated by the ERP systems has been in the accounting department and involved activities that were purely transactional. This has freed up resources for adding more employees who work directly with customers trying to reduce costs and increase sales.

In the past, BSE had maintained much of its data outside its major corporate systems using PC-based Microsoft Access database and Excel spreadsheet software. Management lacked a single company-wide version of corporate data because the data were fragmented into so many different systems. Now the company is standardized on one common platform and the information is always current and available to management. Management can obtain a picture of how the entire business is performing at any moment in time. Since the SAP system makes all of BSE's planning and budgeting data available online, management is able to make better and quicker decisions. In 2006, Gartner Group Consultants performed an independent evaluation of BSE's ERP implementation. Gartner interviewed top executives and analyzed BSE data on the impact of the ERP system on BSE's business process costs, using costs as a percentage of sales as its final metric for assessing the financial impact of SAP software. Cost categories analyzed included costs of goods sold, overhead and administration, warehousing costs, IT support, and delivery.

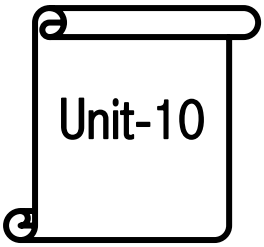
Gartner's analysis validated that the SAP software implementation cost from 1998 to 2001 did indeed total $9 million and that this investment was paid back by savings from the new ERP system within 2.5 years. Between 1998 and 2006, the SAP software implemented by BSE produced total savings of $30 million, approximately one-third of BSE's cumulative earnings during the same period. As a percentage of sales, warehouse costs went down 1 percent, delivery costs decreased by .5 percent, and total overhead costs declined by 1.5 percent. Gartner calculated the total return on investment (ROI) for the project between 1998 and 2006 was $3.3 million per year, or 37 percent of the original investment.

BSE is now focusing on providing more support for Internet sales, including online ordering, inventory, order status, and invoice review, all within a SAP software environment. The company implemented SAP NetWeaver Master Data Management to provide tools to manage and maintain catalog data and prepare the data for publication online and in traditional print media. The company is using SAP's Web Dynpro development environment to enable wireless warehouse and inventory management activities to interact with the SAP software. And it is using SAP NetWeaver Business Intelligence software to learn more about customers, their buying habits, and opportunities to cross-sell and upsell products.

Sources: Border States Industries, "Operating System-SAP Software," 2010; Jim Shepherd and Aurelie Cordier, "Wholesale Distributor Uses ERP Solution to Fuel Rapid Growth," AMR Research, 2009; SAP AG, "Border States Industries: SAP Software Empowers Wholesale Distributor," 2008; www.borderstateselectric.com, accessed July 7, 2009; and "Border States (BSE)," 2008 ASUG Impact Award.

Case Study Questions:

1. What problems was Border States Industries encountering as it expanded? What management, organization, and technology factors were responsible for these problems?
2. How easy was it to develop a solution using SAP ERP software? Explain your answer.
3. List and describe the benefits from the SAP software.
4. How much did the new system solution transform the business? Explain your answer.
5. How successful was this solution for BSE? Identify and describe the metrics used to measure the success of the solution.
6. If you had been in charge of SAP's ERP implementations, what would you have done differently?



Strategic Information Systems

10.1 Definition of Strategic Information system

Strategic Information System are those computer systems that implement business strategies. They are those systems where information services resources are applied to strategic business opportunities in such a way that the computer systems have an impact on the organization's products and business operations. Strategic information systems are always systems that are developed in response to corporate business initiative. The ideas in several well-known cases came from information services people, but they were directed at specific corporate business thrusts. In other cases, the ideas came from business operational people, and information services supplied the technological capabilities to realize profitable results.

Strategic information system delivers information products and services that play a direct and prominent role in helping a firm achieve its strategic goals. It also supplies an organization with business intelligence or competitive information. It consists of internal and external data used to assess and analyse opportunities and threats in the business environment.

An information system is classified as strategic system based on how it is used and on the benefits it provides to the organization. Any Information system can be viewed as an strategic information system if it is used in creative ways to achieve the goals and fulfil the mission of the organization. Basically a strategic information system is classified into two parts:

1. Internal Strategic Information System: It is used by employees within the organization and do not have a value added component. They focus on issues such as improving the quality of products and services and enhancing the decision making capabilities of managers. This type of system are often used in all level of organization.

2. External Strategic Information System: It is used primarily by external entities in the business environment, such as customers, suppliers and distributors and have a value added component that gives developers some time to read the benefits of system innovation.

Classification of Strategic Information System:

In general, strategic information system can be divided into three broad areas, based on three strategies:

1. System that focus on innovation for competitive advantage: It helps companies to be responsive to customer needs. It include customer-oriented system and planning systems. For example: Merill Lynch's cash management account system allows customers to withdraw cash, conduct credit transactions, and analyse investment options using just a single account. This can manage their financial portfolios by moving money among stock, bonds and other financial instruments, at their convenience, all free of charge.

Name	Description
Customer service system	Order, order enquiry, service systems
Marketing planning system	Forecasting, sales analysis

2. Systems that use information as a weapon: It provides help to the manager with vital financial and statistical data that enhance internal decision making. Financial planning, executive information, logistics systems, electronic data interchange, external database access and expert system can be considered as information service system.

Name	Description
Financial planning system	System with mathematical models to aid financial planning.
Executive information system	It allow stock management to retrieve internal and external data and information direction from the computer.
Electronic data interchange	It sends bills, payments or orders to suppliers and customers.

3. Systems that increase productivity and lower the costs of goods and services: These are the support system such as transaction processing, inventory management, centralized databases, production planning, personnel, factory floor control systems and other systems that help to increase the overall productivity of the organization.

Name	Description
Transaction processing	Accounting, billing, payroll
Inventory management	Raw materials, finished products, work process
Centralized DBMS	Software system to facilitate access to all organizational data and information.

Characteristics of Strategic Information System:

There are three common characteristics of strategic information systems:

1. Telecommunication: It is a central part of SIS. The most successful SIS are those that transcend traditional organizational boundaries and eliminate the barriers of time and space through the use of telecommunication. Developing and implementing information systems that rely heavily on telecommunication is an extremely challenging task and is often cited as one of the development bottlenecks in SIS.

2. Multiple Vendors: SIS often requires the integration of complex technologies, such as several vendors are needed to develop an SIS. One of the critical ingredients of an SIS is the ability to identify, coordinate, and manage transactions with a number of vendors and effectively bring together diverse technologies to achieve a goal.

3. Inter-organizational system (IOS): IOS are systems shared by two or more companies, in the spirit of cooperation and collaboration rather than that of blind competition. IOS often involve bringing together a diverse group of assets and talents such as ventures often result in powerful systems that enhance productivity, reduce operating costs, increase market share and create new partnerships, especially for companies that conduct business transactions in global markets.

10.2 Strategic information system plan

The strategy that a company chooses to follow in order to capture and retain markets and to achieve its mission is in strategic information system plan. In the company identifies and defines its strategic mission and its overall goals. It also include what is popularly referred to as the SWOT analysis: strengths, weakness, opportunities and threats in the marketplace. Identifies the information system and technologies required to support the business strategy identified in the strategic business plan. It is like a roadmap that helps IS managers determine where to go and how to get there by identifying current and future information requirements and matching these needs with existing system and technologies to identify and potential gap between what is available and what should be available to promote good decision making.

It is the analysis of a corporation's information and processes using business information models together with the evaluation of risk, current needs and requirements. The result is an action plan showing the desired course of events necessary to align information use and needs with the strategic direction of the company. SISP thus is used to identify the best targets for purchasing and installing new management information systems and help an organization maximize the return on its information technology investment.

The SISP identifies emerging technologies and explores the ways these technologies can strengthen the competitive posture of the company.
It specifically targets the following four areas:

- Aligning IS investment with business goals.
- Exploiting information technologies for competitive advantage.
- Ensuring the efficient management of IS resources.
- Developing technology policies and practices.

10.3 Strategy for developing strategic information system

Strategic systems are among the most difficult to develop. If a company is successful in developing a strategic system, it is extremely difficult and challenging to maintain a strategic edge over the long term as competitors relentlessly pursue new ways to improve their operations. It includes several steps:

- Establish the purpose of the plan and develop and broad outline describing what the plan will address.
- Update the strategic business plan and the goals of the business. Reassess the current business environment.
- Identify the existing information systems including hardware, software and networking capabilities. Determine future information needs and system.
- Identify the new systems, projects and capabilities required to meet the changing environment and changing information needs.
- Identify the resources required to implement the plan and to win the support of top management for the plan.

There are not set of rule or formula for building a successful strategic system, only some guidelines that eventually lead to one. In most cases innovation, risk taking and a good deal of luck seem to be the main ingredients of a successful strategic system.

Barriers of SMIS:

If a company were to follow some the strategies, it might still face many barriers to developing an SIS. Some of these barriers are identified as follows:

1. **Problem definition (Development):** This process is particularly difficult in organizations that do not encourage risk taking or experimentation and that penalize their employees for failure. Defining a strategic idea requires that business managers communicate clearly with technical managers. If the two group cannot communicate clearly, it can be a barrier to the development of strategic systems.
   Some of the development barriers are as follows:
   - Generating workable ideas requires leadership and teamwork.
   - Many innovative ideas are technically infeasible.
   - Many innovative ideas are prohibitively expensive.
   - Many ideas die because they lack a sufficient market.
2. **Implementation:** If companies cross the barriers to defining an idea they often have a difficult time to implementing it. Strategic systems rely heavily on telecommunication and other leading edge technologies; many companies lack the talent necessary to build such systems.
   Some of the implementation barriers are as follows:
   - Telecommunication increases the complexity of implementing SIS.
   - Multiple systems are difficult to integrate.
   - SIS systems often require inter-organizational cooperation.
   - State – of-the-art technologies are difficult to implement.
3. **Maintenance:** Strategic system are often expensive to maintain and can sometimes be an enormous drain on the corporate budget. When competitors diligently try to imitate the strategic idea, the success of a strategic system can be diminished.
   Some of the maintenance barriers are as follows:
   - Competitors can copy SIS.

- Unanticipated demand can overwhelm the usefulness of an SIS.
- Applications can be expensive to maintain or enhance.
- High exit barriers can case devastating losses.