Fundamental concepts of *"Advanced Information Systems"*

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Chapter 1 : General concepts

•A **stakeholder** is any person who has an interest in an existing or new information system. Stakeholders can be technical or non-technical workers.
•For information systems, the stakeholders can be classified as:
–System owners
–System users
–Systems analysts
–System designers
–System builders
–IT vendors and consultants

Information workers are those workers whose jobs involve the creation, collection, processing, distribution, and use of information.

Knowledge workers are a subset of information workers whose responsibilities are based on a specialized body of knowledge.

System owners are the information system's sponsors and chief advocates. They are usually responsible for funding the project to develop, operate, and maintain the information system. They set the objectives, scopes and perform cost-benefit analysis.

System users are the people who use or are affected by the information system on a regular basis—capturing, validating, entering, responding to, storing, and exchanging data and information. A common synonym is client. Types include:
•Clerical and service workers
•Technical and professional staff
•Supervisors, middle managers, and executive managers
•Remote and mobile users (internal but disconnected)

CRM, is a cross functional enterprise system that integrates and automates many of the customer – serving processes in sales, marketing, and customers.
A major source of information and support needed to promote effective decision making by managers and business professionals.
Control involves monitoring and evaluating feedback to determine whether a system is moving toward the achievement of its goal.

Data are typically subjected to processing activities, such as calculating, comparing, sorting, classifying, and summarizing. These activities organize, analyze, and manipulate data, thus converting them into information for end user.

Data are raw facts about the organization and its business transactions. Most data items have little meaning and use by themselves.

Information is data that has been refined and organized by processing and purposeful intelligence. The latter, purposeful intelligence is crucial to the definition—People provide the purpose and the intelligence that produces true information.

System builders construct the information system components based on the design specifications from the system designers. In many cases, the system designer and builder for a component are one and the same.

The **three levels** of management activity consist of strategic, tactical, and operational decision making) and three types of decision structures (structured, semi structured, and unstructured).

General Problem-Solving Approach

1. Identify the problem.
2. Analyze and understand the problem.
3. Identify solution requirements or expectations.
4. Identify alternative solutions and decide a course of action.
5. Design and implement the "best" solution.
6. Evaluate the results. If the problem is not solved, return to step 1 or 2 as appropriate.

Total quality management (TQM) is a comprehensive approach to facilitating quality improvements and management within a business.

•Information systems quality standards:

–ISO 9001, *Quality systems – Model for quality assurance in design/development, production, installation, and servicing*.

–Capability Maturity Model (CMM) is a framework to assess the maturity level of an organization's information systems development and management processes and products. It consists of five levels of maturity as measured by a set of guidelines called the key process areas.

Legacy systems are older information system applications that have become crucial to the day-to-day operation of a business and that may use technologies considered old or outdated by current standards.

User dialogues describe how the user moves from window-to-window, interacting with the application programs to perform useful work.

Process management is an ongoing activity that documents, manages the use of, and improves an organization's chosen methodology (the "process") for system development. Process

management is concerned with the activities, deliverables, and quality standards to be applied to all projects.

A **repository** is a location (or set of locations) where systems analysts, systems designers, and system builders keep all of the documentation associated with one or more systems or projects.

A **model** is a representation of either reality or vision. Just as a picture is worth a thousand words, most models use pictures to represent the reality or vision.

Algorithm is a set of well defined rules or processes for the solution of a problem in a defined number of steps.
Heuristic or **heuristics** refers to experience-based techniques for problem solving, learning, and discovery. Heuristic methods are used to come to an optimal solution as rapidly as possible. Part of this method is using a "rule of thumb", an educated guess, an intuitive judgment, or common sense. A heuristic is a general way of solving a problem.

In more precise terms, heuristics stand for strategies using readily accessible, though loosely applicable, information to control problem solving in human beings and machines.

In computer science, a heuristic is a technique designed to solve a problem that ignores whether the solution can be proven to be correct, but which usually produces a good solution or solves a simpler problem that contains or intersects with the solution of the more complex problem. Most real-time, and even some on-demand, anti-virus scanners use heuristic signatures to look for specific attributes and characteristics for detecting viruses and other forms of malware.

Information engineering (IE) is a model-driven and data-centered, but process-sensitive technique to plan, analyze, and design information systems. IE models are pictures that illustrate and synchronize the system's data and processes.

Joint Requirements Planning (JRP) is a process whereby highly structured group meetings are conducted for the purpose of analyzing problems and defining requirements. JRP is a subset of a more comprehensive joint application development or JAD technique that encompasses the entire systems development process.

Brainstorming is a technique for generating ideas during group meetings. Participants are encouraged to generate as many ideas as possible in a short period of time without any analysis until all the ideas have been exhausted.

Business knowledge is the insight that is gained from timely, accurate, and relevant information. (Recall that information is a product of raw data.)

Functional business systems, support a variety of operational and managerial applications of the basic business functions of a company.

Data requirements are a representation of users' data in terms of entities, attributes, relationships, and rules. Data requirements should be expressed in a format that is independent of the technology that can or will be used to store the data.

Business functions are ongoing activities that support the business. Functions can be decomposed into other sub-functions and eventually into processes that do specific tasks.

A **cross-functional information system** supports relevant business processes from several business functions without regard to traditional organizational boundaries such as divisions, departments, centers, and offices.

Business processes are activities that respond to business events. Business processes are the "work" performed by the system.

Process requirements are a representation of the users' business processes in terms of activities, data flows, or work flow.

A **policy** is a set of rules that govern a business process.

A **procedure** is a step-by-step set of instructions and logic for accomplishing a business process.

A **process manager** is an automated tool that helps to document and manage a methodology and routes, its deliverables, and quality management standards.

A **project manager** is an automated tool to help plan system development activities (preferably using the approved methodology), estimate and assign resources (including people and costs), schedule activities and resources, monitor progress against schedule and budget, control and modify schedule and resources, and report project progress.

Project management is the process of scoping, planning, staffing, organizing, directing, and controlling the development of an acceptable system at a minimum cost within a specified time frame.

Measures of Project Success

–The resulting information system is acceptable to the customer.

–The system was delivered "on time."

–The system was delivered "within budget."

–The system development process had a minimal impact on ongoing business operations.

A **PERT chart** is a graphical network model that depicts a project's tasks and the relationships between those tasks.

A **Gantt chart** is a simple horizontal bar chart that depicts project tasks against a calendar. Each bar represents a named project task. The tasks are listed vertically in the left-hand column. The horizontal axis is a calendar timeline.

Joint project planning (JPP) is a strategy wherein all stakeholders in a project (meaning system owners, users, analysts, designers, and builders) participate in a one-to-three day project management workshop, the result of which is consensus agreement on project scope, schedule, resources, and budget. (Of course, subsequent workshops or meetings may be required to adjust scope, budget, and schedule.)
The **critical path** for a project is that sequence of dependent tasks that have the largest sum of most likely durations. The critical path determines the earliest possible completion date of the project.
–Tasks that are on the critical path cannot be delayed without delaying the entire project schedule. To achieve resource leveling, critical tasks can only be split.

The **slack time** available for any non-critical task is the amount of delay that can be tolerated between the starting time and completion time of a task without causing a delay in the completion date of the entire project.
–Tasks that have slack time can be delayed to achieve resource leveling

Strategic Systems. Strategic systems provide organizations with strategic advantages that enable them to increase their market share and/or profit, to better negotiate with suppliers, or to prevent competitors from entering their territory.

Strategic management is the way an organization maps the strategy of its future operations. The term *strategic* points to the long-term nature of this mapping exercise and to the large magnitude of advantage the exercise is expected to give an organization. Information technology contributes to strategic management in many ways.
Our basic IS model shows that an information system consists of five major resources: people , hardware, software, data, and networks.
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Enterprise Resource Planning (ERP) or just **enterprise systems,** is a process of planning and managing all resources and their use in the entire enterprise. Enterprise resource planning is a cross – functional enterprise system that integrates and automates many of the internal business processes of a company, particularly those within the manufacturing, logistics, distribution accounting, finance and human resource functions of the business.

An **Enterprise resource planning** (ERP) software product is a fully integrated information system that spans most basic business functions required by a major corporation. An ERP product is built around a common database shared these business functions.

Knowledge management (KM) is a process that helps organizations identify, select, organize, disseminate, and transfer important information and expertise that are part of the organization's memory and that typically reside within the organization in an unstructured manner. This structuring of knowledge enables effective and efficient problem solving, dynamic learning, strategic planning, and decision making. Knowledge management initiatives focus on

identifying knowledge, explicating it in such a way that it can be shared in a formal manner, and leveraging its value through reuse.

Business intelligence (BI) is a broad category of applications and techniques for gathering, storing, analyzing and providing access to date to help enterprise users make better business and strategic decisions.

Chapter 2: Information Systems

An **information system** (IS) is an arrangement of data, processes, communications, people, and information technology that interact to support and improve day-to-day operations in a business, as well as support the problem-solving and decision-making needs of management and users.

An **information system (IS)** collects, processes, stores, analyzes, and disseminates information for a specific purpose. Like any other system, an information system includes *inputs* (data, instructions) and *outputs* (reports, calculations). It *processes* the inputs by using technology such as PCs and produces outputs that are sent to users or to other systems via electronic networks. A *feedback* mechanism that controls the operation may be included. Like any other system, an information system also includes people, procedures, and physical facilities, and it operates within an *environment*. An information system is not necessarily computerized, although most of them are.
We have noted that an information system is a system that accepts data resources as input and processes them into information products as output.

Information system performance is extensive and meaningful management, as well as user involvement in the governance and development of IT applications.
The success of an information system should not be measured only by its ***efficiency*** in terms of minimizing costs, time, and the use of information resources. Success should also be measured by the ***effectiveness*** of the information technology in supporting an organization's business strategies,

End users (also called users or clients) are people who use an information system or the information it produces and found at all levels of an organization.

The user interface is the part of the operating system that allows you to communicate with it so you can load programs, access files, and accomplish other tasks.

Front-office information systems support business functions that reach out to customers (or constituents).
–Marketing
–Sales
–Customer management

Back-office information systems support internal business operations and interact with suppliers (of materials, equipment, supplies, and services).
–Human resources
–Financial management
–Manufacturing
–Inventory control

Personal information systems are those designed to meet the needs of a single user. They are designed to boost an individual's productivity.

Information systems architecture provides a unifying framework into which various people with different perspectives can organize and view the fundamental building blocks of information systems.
Essentially, IS architecture provides a foundation for organizing the various components of any information system being developed.

Computer-aided systems engineering (CASE) tools are software programs that automate or support the drawing and analysis of system models and provide for the translation of system models into application programs.
A **CASE repository** is a system developers' database. It is a place where developers can store system models, detailed descriptions and specifications, and other products of system development. Synonyms include **dictionary** and **encyclopedia**.

Forward engineering requires the systems analyst to draw system models, either from scratch or from templates. The resulting models are subsequently transformed into program code.

Reverse engineering allows a CASE tool to read existing program code and transform that code into a representative system model that can be edited and refined by the systems analyst.

Formal information systems include agreed-upon procedures, standard inputs and outputs, and fixed definitions. A company's accounting system, for example, would be a formal information system that processes financial transactions.

Informal information systems take many shapes, ranging from an office gossip network to a group of friends exchanging letters electronically. It is important for management to understand that informal systems exist. These systems may consume information resources and may sometimes interface with the formal systems. They may also play an important role in employees' resistance to change. On the other hand, some of them may be used to influence people and processes or even to encourage change.

The difference between computer and information
Computers provide effective and efficient ways of processing data, and they are a necessary part of an information system. An IS, however, involves much more than just computers. The successful application of an IS requires an understanding of the business and its environment that is supported by the IS. For example, to build an IS that supports transactions executed on

the New York Stock Exchange, it is necessary to understand the procedures related to buying and selling stocks, bonds, options, and so on, including irregular demands made on the system, as well as all related government regulations. In learning about information systems, it is therefore not sufficient just to learn about computers. Computers are only one part of a complex system that must be designed, operated, and maintained. A public transportation system in a city provides an analogy. Buses are a necessary ingredient of the system, but more is needed. Designing the bus routes, bus stops, different schedules, and so on requires considerable understanding of customer demand, traffic patterns, city regulations, safety requirements, and the like. Computers, like buses, are only one component in a complex system.

Managerial information system (MIS) is an information system application that provides for management-oriented reporting. These reports are usually generated on a predetermined schedule and appear in a prearranged format.
Managerial information system (**MIS**) is a system or process that provides information needed to manage organizations effectively. Management information systems are regarded to be a subset of the overall internal controls procedures in a business, which cover the application of people, documents, technologies, and procedures used by management accountants to solve business problems such as costing a product, service or a business-wide strategy. Management information systems are distinct from regular information systems in that they are used to analyze other information systems applied in operational activities in the organization. Academically, the term is commonly used to refer to the group of information management methods tied to the automation or support of human decision making, e.g. Report Information Systems, Strategic Information Systems, Executive Information Systems, Decision Support Systems and Expert Systems.

MSS is an information system that provides information to support managerial decision making. When information system applications focus on providing information support for effective Decision Making by managers, they are called management support systems.

Human Resources Information Systems (HRIS) are information systems that support human resource management activities.

HRIS, include information systems for staffing the organization, training and development, and comprehension administration.

Decision Support Systems (DSS) constitute a class of computer-based information systems including knowledge-based systems that support decision-making activities.

DSS is an information system that utilizes decision models, a data base and a decision maker's own insights in an ad hoc, interactive analytical modeling process.
DSS serve the management level of the organization and help to take decisions, which may be rapidly changing and not easily specified in advance.

DSS are interactive, systems – based information that use DSS software and a model base and database to provide information tailored to support semi-structured and unstructured decisions faced by individual managers.

A **Decision Support System (DSS)** is a class of information systems (including but not limited to computerized systems) that support business and organizational decision-making activities. 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, personal knowledge, or business models to identify and solve problems and make decisions.

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

- An inventory of all of your current information assets (including legacy and relational data sources, cubes, data warehouses, and data marts),
- Comparative sales figures between one week and the next,
- Projected revenue figures based on new product sales assumptions.

A **decision support system** (DSS) is an information system application that provides its users with decision-oriented information whenever a decision-making situation arises. When applied to executive managers, these systems are sometimes called **executive information systems** (EIS)**.**

DSS does not make decisions, people do. They provide useful information to support decision process.
Decision support system (DSS) is a computer-based information system that combines models and data in an attempt to solve semi structured and some unstructured problems with extensive user involvement.
But the term decision support system (DSS), like the terms MIS and MSS, means different things to different people. DSS can be viewed as an *approach* or a *philosophy* rather than a precise methodology. However, a DSS does have certain recognized characteristics, which we will present later.

Work group information systems are those designed to meet the needs of a work group. They are designed to boost the group's productivity.
A **group decision support system (GDSS)** is an interactive computer based system that facilitates the solution of semi structured and unstructured problems when made by a group of decision makers. The objective of a GDSS is to support the *process* of arriving at a decision.

Unstructured decisions are the decisions that must be made in situations where it is not possible to specify in advance most of the decision procedure to follow.

Business Information Systems (BIS) use computers to solve business problems in organizations. The field of information systems includes the acquisition, deployment and management of information systems resources. Professionals develop, deploy, and manage applications for planning, operations, and implementation of business strategy in organizations.
BIS is an information system that provides information to support strategic decision making.

Office Automation (OA) systems support the wide range of business office activities that provide for improved work flow and communications between workers, regardless of whether or not those workers are located in the same office.

An **Expert System (ES)** is software that attempts to provide an answer to a problem, or clarify uncertainties where normally one or more human experts would need to be consulted.
ES can provide expert advice for operational chores like equipment diagnostics or managerial decisions such as loan portfolio management. **ES** is a system based information system that uses its knowledge about a specific complex application area to act as an expert consultant to users.
Expert Systems are most common in a specific problem domain, and are a traditional application and/or subfield of artificial intelligence. A wide variety of methods can be used to simulate the performance of the expert however common to most or all are 1) the creation of a knowledge base which uses some knowledge representation formalism to capture the Subject Matter Expert's (SME) knowledge and 2) a process of gathering that knowledge from the SME and codifying it according to the formalism, which is called knowledge engineering. Expert systems may or may not have learning components but a third common element is that once the system is developed it is proven by being placed in the same real world problem solving situation as the human SME, typically as an aid to human workers or a supplement to some information system.

The topic of expert systems has many points of contact with general systems theory, operations research, business process reengineering and various topics in applied mathematics and management science

An **expert system** is a programmed decision-making information system that captures and reproduces the knowledge and expertise of an expert problem solver or decision maker and then simulates the "thinking" or "actions" of that expert.

Expert systems are implemented with **artificial intelligence** technology that captures, stores, and provides access to the reasoning of the experts.
Expert Systems (ES) are an attempt to mimic human experts. Expert systems can either *support* decision makers or completely *replace* them.
Typically, an ES is decision-making software that can reach a level of performance comparable to a human expert in some specialized and usually narrow problem area. The basic idea behind an ES is simple: *Expertise* is transferred from an expert (or other source of expertise) to the computer. This knowledge is then stored in the computer. Users can call on the computer for specific advice as needed. The computer can make inferences and arrive at a conclusion. Then, like a human expert, it advises the non-experts and explains, if necessary, the logic behind the advice. ES can sometimes perform better than any single expert can. *Expertise* is the extensive, task-specific knowledge acquired from training, reading, and experience. It enables experts to make better and faster decisions than non-experts in solving complex problems. Expertise takes a long time (possibly years) to acquire, and it is distributed in organizations in an uneven manner. A senior expert possesses about 30 times more expertise than a junior (novice) staff member.
The transfer of expertise from an expert to a computer and then to the user involves four activities: *knowledge acquisition* (from experts or other sources), *knowledge representation* (in the computer), *knowledge inferencing*, and *knowledge transfer* to the user.
Knowledge is acquired from experts or from documented sources. Through the activity of knowledge representation, acquired knowledge is organized as rules or frames (object-oriented) and stored electronically in a knowledge base. Given the necessary expertise stored in the knowledge base, the computer is programmed so that it can make inferences. The inferencing is

performed in a component called the **inference engine** the "brain" of the ES and results in a recommendation for novices. Thus, the expert's knowledge has been *transferred* to users. A unique feature of an ES is its ability to explain its recommendations. The explanation and justification is done in a subsystem called the *justifier* or the *explanation subsystem* (e.g., presents the sequence of rules used by the inference engine to generate a recommendation).
A knowledge base consists of facts about a specific subject area and heuristics (rules of thumb) that express the reasoning procedures of an expert.

The limitations of Expert Systems.
Despite their many benefits, available ES methodologies are not always straightforward and effective.

Marketing Information System (KIS) can be defined as system or consist of People, equipment and procedures to gather, sort, analyze, evaluate and distribute needed, timely and accurate information to marketing decision makers.

The system is created through an understanding of the information needs of marketing management. It is available to supply information when, where and how the manager requires it. Data is taken from the marketing environment and transferred into the information that marketing managers can use in their decision-making processes.

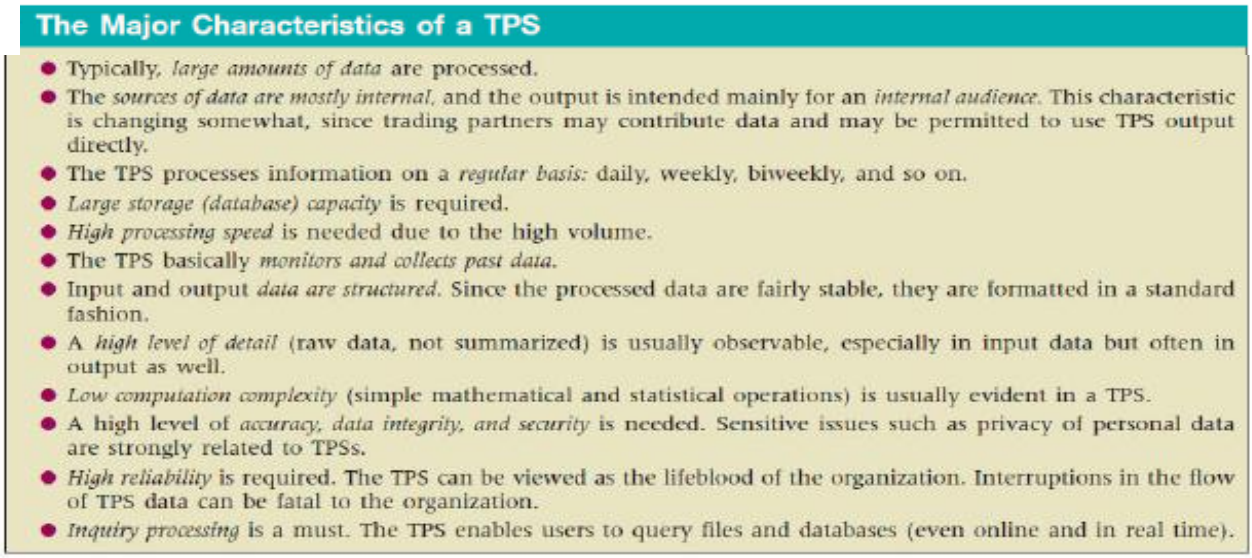
Accounting Information System (**AIS**) is the system of records a business keeps maintaining its accounting system. This includes the purchase, sales, and other financial processes of the business. The purpose of AIS is to accumulate data and provide decision makers (investors, creditors, and managers) with information.

AIS are an information system that records and reports business transaction the flow of founds through an organization.
While this was previously a paper-based process, most businesses now use accounting software. In an electronic financial accounting system, the steps in the accounting cycle are dependent upon the system itself. For example, some systems allow direct journal posting to the various ledgers and others do not.

Accounting Information Systems (AIS) combine the study and practice of accounting with the design, implementation, and monitoring of information systems. Such systems use modern information technology resources together with traditional accounting controls and methods to provide users the financial information necessary to manage their organizations.

Transaction Processing System (TPS) supports the monitoring, collection, storage, processing, and dissemination of the organization's basic business transactions. It also provides the input data for many applications involving support systems such as DSS. Sometimes several TPS exist in one company. The transaction processing systems are considered critical to the success of any organization since they support core operations, such as purchasing of materials, billing customers, preparing a payroll, and shipping goods to customers.

Transaction processing involves the basic activities of (1) data entry, (2) transaction processing, (3) database maintenance, (4) document and report generation, and (5) inquiry processing.



Objectives of TPS

The primary goal of TPS is to provide all the information needed by law and/or by organizational policies to keep the business running properly and efficiently. Specifically, a TPS has to efficiently handle high volume, avoid errors due to concurrent operations, be able to handle large variations in volume (e.g., during peak times), avoid downtime, never lose results, and maintain privacy and security.

Next, the system processes data in one of two basic ways: *batch* or *online processing*. In **batch processing,** the firm collects data from transactions as they occur, placing them in groups or batches. The system then prepares and processes the batches periodically (say, every night). Batch processing is particularly useful for operations that require processing for an extended period of time. Once a batch job begins, it continues until it is completed or until an error occurs. In **online processing,** data are processed as soon as a transaction occurs.

A **Geographical Information System (GIS)** is a computer-based system for capturing, storing, checking, integrating, manipulating, and displaying data using digitized maps. Its most distinguishing characteristic is that every record or digital object has an identified geographical location. By integrating maps with spatially oriented databases and other databases (called *geocoding*), users can generate information for planning, problem solving, and decision making, increasing their productivity and the quality of their decisions.

Strategic Information Systems (SIS) applies information technology to a firm's products, services, or business processes to help it gain a strategic advantage over its competitors. **SIS** is an information system that provides information to support strategic decision making.

Strategic information systems are systems that *support* or *shape* a business unit's competitive strategy. An SIS is characterized by its ability to *significantly* change the manner in which business is conducted, in order to give the firm strategic advantage. An SIS cannot be classified by organizational structure, functional area, or support system as described in the previous chapter. Any information system—EIS, OIS, TPS, KMS—that changes the goals, processes, products, or environmental relationships to help an organization gain a competitive advantage or reduce a competitive disadvantage is a strategic information system. **A *competitive strategy*** is a

broad-based formula for how a business is going to compete, what its goals should be, and what plans and policies will be required to carry out those goals (Porter, 1985). Through its competitive strategy an organization seeks a **competitive advantage** in an industry—an advantage over competitors in some measure such as cost, quality, or speed. Competitive advantage is at the core of a firm's success or failure (Porter and Millar, 1985, and Porter, 1996); such advantage seeks to lead to control of the market and to larger-than-average profits. A strategic information system helps an organization gain a competitive advantage through its contribution to the strategic goals of an organization and/or its ability to significantly increase performance and productivity. An SIS enables companies to gain competitive advantage and to benefit greatly at the expense of those that are subject to competitive disadvantage.

Executive information system (EIS) is an information system that provides classic and strategic information tailored to the need of executives and other decision makers.
EIS, provide critical information from a wide variety of internal and external sources in easy-to-use displays to executives and managers.
An EIS is a computer-based system that serves the information needs of top executives. It provides rapid access to timely information and direct access to management reports. An EIS is very user friendly, is supported by graphics, and provides the capabilities of *exception reporting* (reporting of only the results that deviate from a set standard) and *drill down* (investigating information in increasing detail). It is also easily connected with online information services and electronic mail.
EIS provide critical information from a wide variety of internal and external sources in easy-to-use displays to executives and managers.

Executive Support System (ESS). An ESS is a comprehensive support system that goes beyond EIS to include analyze support, communications, office automation, and intelligence support.

Chapter 3: Systems analysis and design

Systems analysis is a problem-solving technique that decomposes a system into its component pieces for the purpose of studying how well those component parts work and interact to accomplish their purpose.

Systems design (also called systems synthesis) is a complementary problem-solving technique (to systems analysis) that reassembles a system's component pieces back into a complete system—hopefully, an improved system. This may involves adding, deleting, and changing pieces relative to the original system.

System designers translate system users' business requirements and constraints into technical solutions. They design the computer files, databases, inputs, outputs, screens, networks, and programs that will meet the system users' requirements.

A **systems analyst** studies the problems and needs of an organization to determine how people, data, processes, communications, and information technology can best accomplish

improvements for the business. When information technology is used, the analyst is responsible for:
–The efficient capture of data from its business source,
–The flow of that data to the computer,
–The processing and storage of that data by the computer, and
–The flow of useful and timely information back to the business and its people.
This means system analyst must understand both the business and the information system.

•A **business analyst** is a systems analyst that specializes in business problem analysis and technology-independent requirements analysis.
•A **programmer/analyst** (or **analyst/programmer**) includes the responsibilities of both the computer programmer and the systems analyst.
•Other synonyms for systems analyst include:
–Systems consultant
–Systems architect
–Systems engineer
–Information engineer
–Systems integrator

Information systems analysis is defined as those development phases in a project that primarily focus on the business problem, independent of any technology that can or will be used to implement a solution to that problem.

A Business Process is a set of logically related tasks performed to achieve a defined business outcome.

Business Process Reengineering (BPR) is the study, analysis, and redesign of fundamental business processes or workflow to reduce complexity, costs and/or improve value added to the business within an organization.
Reengineering is a fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in cost, quality, speed, and service.

Business Process Reengineering is also known as Business Process Redesign, Business Transformation, or Business Process Change Management.
Business process reengineering (BPR) began as a private sector technique to help organizations fundamentally rethink how they do their work in order to dramatically improve customer service, cut operational costs, and become world-class competitors. A key stimulus for reengineering has been the continuing development and deployment of sophisticated information systems and networks. Leading organizations are becoming bolder in using this technology to support innovative business processes, rather than refining current ways of doing work.
As a structured ordering of work steps across time and place, a business process can be decomposed into specific activities, measured, modeled, and improved. It can also be completely redesigned or eliminated altogether. Reengineering identifies, analyzes, and redesigns an organization's core business processes with the aim of achieving dramatic improvements in critical performance measures, such as cost, quality, service, and speed.

BPR is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed.

A **workflow** consists of a sequence of connected steps. It is a depiction of a sequence of operations, declared as work of a person, a group of persons, an organization of staff, or one or more simple or complex mechanisms. Workflow may be seen as any abstraction of real work, segregated in workshare, work split or other types of ordering. For control purposes, workflow may be a view on real work under a chosen aspect,' thus serving as a virtual representation of actual work. The flow being described often refers to a document that is being transferred from one step to another.
A workflow is a model to represent real work for further assessment, e.g., for describing a reliably repeatable sequence of operations. More abstractly, a workflow is a pattern of activity enabled by a systematic organization of resources, defined roles and mass, energy and information flows, into a work process that can be documented and learned. Workflows are designed to achieve processing intents of some sort, such as physical transformation, service provision, or information processing.
Workflows may be viewed as one primitive building block of organizations. The relationships among these concepts are described later in this entry.
The term workflow is used in computer programming to capture and develop human-to-machine interaction.

The role of Information Technology in BPR
Information Technology (IT) has historically played an important role in the reengineering concept. It is considered by some as a major enabler for new forms of working and collaborating within an organization and across organizational borders.
Technology is concerned with the use of computer systems and other forms of communication technology in the business. In BPR, information technology is generally considered as playing a role as enabler of new forms of organizing and collaborating, rather than supporting existing business functions. The people / human resources dimension deals with aspects such as education, training, motivation and reward systems. The concept of business processes - interrelated activities aiming at creating a value added output to a customer - is the basic underlying idea of BPR. These processes are characterized by a number of attributes: Process ownership, customer focus, value adding, and cross-functionality.

Early BPR literature identified several so called *disruptive technologies* that were supposed to challenge traditional wisdom about how work should be performed.

- Shared databases, making information available at many places
- Expert systems, allowing generalists to perform specialist tasks
- Telecommunication networks, allowing organizations to be centralized and decentralized at the same time
- Decision-support tools, allowing decision-making to be a part of everybody's job
- Wireless data communication and portable computers, allowing field personnel to work office independent
- Interactive videodisk, to get in immediate contact with potential buyers

- Automatic identification and tracking, allowing things to tell where they are, instead of requiring to be found
- High performance computing, allowing on-the-fly planning and revisioning

A **prototype** is a smaller-scale, representative or working model of the users' requirements or a proposed design for an information system.

Prototyping is a technique for quickly building a functioning, but incomplete model of the information system using rapid application development tools.

Model-driven analysis emphasizes the drawing of pictorial system models to document and validate both existing and/or proposed systems. Ultimately, the system model becomes the blueprint for designing and constructing an improved system.

Structured analysis is a model-driven, process-centered technique used to either analyze an existing system, define business requirements for a new system, or both. The models are pictures that illustrate the system's component pieces: processes and their associated inputs, outputs, and files.

System Models
A model is a representation of reality.

Logical models show what a system is or does. They are implementation independent; that is, they depict the system independent of any technical implementation.

Physical models show not only what a system is or does, but also how the system is physically and technically implemented. They are implementation *de*pendent because they reflect technology choices.

Why Logical System Models
•Logical models remove biases that are the result of the way the system is currently implemented, or the way that any one person thinks the system might be implemented.
•Logical models reduce the risk of missing business requirements because we are too preoccupied with technical results.
•Logical models allow us to communicate with end-users in non-technical or less technical languages.

Process Modeling and DFD
Process modeling is a technique for organizing and documenting the structure and flow of data through a system's processes, and/or the logic, policies, and procedures to be implemented by a system's processes.

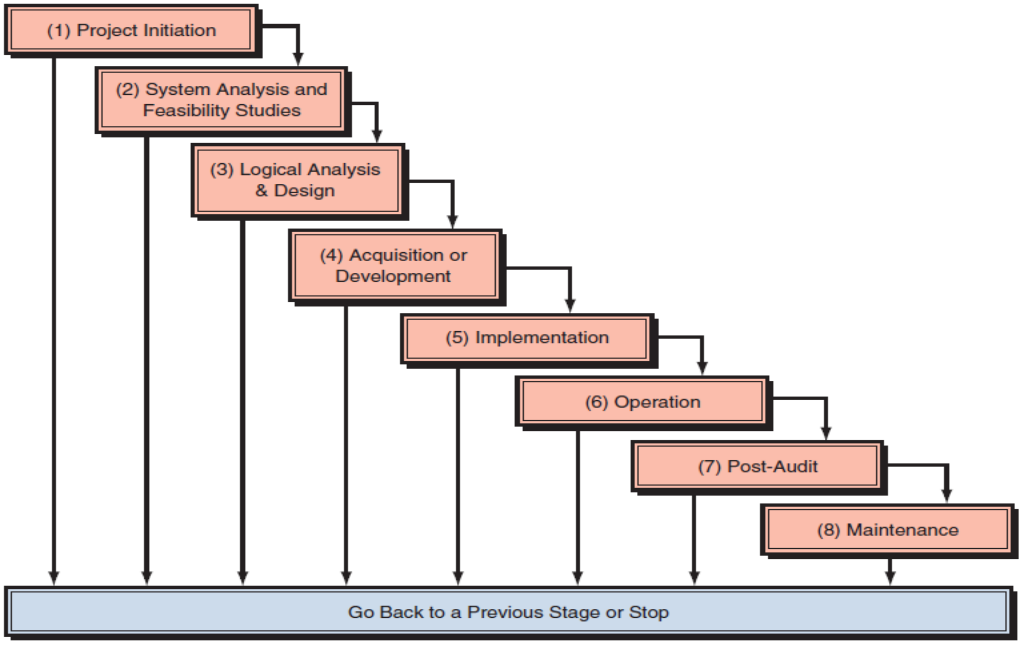
A Data Flow Diagram (DFD) is a tool (and type of process model) that depicts the flow of data through a system and the work or processing performed by that system.

Feasibility is the measure of how beneficial or practical the development of an information system will be to an organization.

A feasibility study is the process by which feasibility is measured.
•**Operational feasibility** is a measure of how well the solution will work in the organization. It is also a measure of how people feel about the system/project.
•**Technical feasibility** is a measure of the practicality of a specific technical solution and the availability of technical resources and expertise.
•**Schedule feasibility** is a measure of how reasonable the project timetable is.
•**Economic feasibility** is a measure of the cost-effectiveness of a project or solution.

A **system life cycle** divides the life of an information system into five stages : system analysis, system design, system implementation, system evaluation and system maintenance.

A model of Stages of Systems Development Life Cycle (SDLC)



Data Modeling
Data modeling is a technique for organizing and documenting a system's data. Data modeling is sometimes called database modeling because a data model is eventually implemented as a database. It is sometimes called information modeling.

A **data administrator** is responsible for the data planning, definition, architecture, and management.

A Database consolidates many records previously stored in separate files so that a common pool of data serves many applications.

One or more **database administrators** are responsible for the database technology, database design and construction, security, backup and recovery, and performance tuning.

Database architecture refers to the database technology including the database engine, database utilities, CASE tools, and database development tools.

A **database management system (DBMS)** is specialized software that is used to create, access, control, and manage the database. The core of the DBMS is a **database engine**.
A data definition language (DDL) is that part of the engine used to physically define tables, fields, and structural relationships.
A data manipulation language (DML) is that part of the engine used to create, read, update, and delete records in the database, and navigate between different files (tables) in the database.

Relational databases implement stored data in a series of two-dimensional tables that are "related" to one another via foreign keys.
The physical data model is called a **schema**.
The DDL and DML for a relational database is called **SQL** (Structured Query Language).

Triggers are programs embedded within a table that are automatically invoked by updates to another table.

Stored procedures are programs embedded within a table that can be called from an application program.

Database structures, such as the hierarchical, network, relational, and object-oriented models, are used to organize the relationships among the data records stored in databases.

Relational data structure is a logical data structure in which all data elements within the database are viewed as being stored in the form of simple tables.

Chapter 4: ICT and E-Commerce

Information technology and Communication Technology (ICT) is a contemporary term that describes the combination of computer technology (hardware and software) with telecommunications technology (data, image, and voice networks).
ICT, in its narrow definition, refers to the technological side of an information system. It includes the hardware, databases, software, networks, and other electronic devices. It can be viewed as a subsystem of an information system. Sometimes, though, the term **ICT** is also used interchangeably with *information system*.

Telecommunications technology is moving toward open, inter- networked digital networks for voice, data, video, and multimedia.

ICT is a key ingredient in reengineering business operations because it enables radical changes to business processes that dramatically improve their efficiency and effectiveness.
ICT is a set of hardware, software, telecommunication, database management, and other information.

Managing Information Technology, can be viewed as managing three major components: (1) the joint development and implementation of e – business and IT strategies, (2) the development of e – business applications and the research and implementation of new information technologies, and (3) IT processes, professionals, and subunits within a company's IT organization and IS function.

Information infrastructure consists of the physical facilities, services, and management that support all shared computing resources in an organization. There are five major components of the infrastructure: (1) computer hardware, (2) software, (3) networks and communication facilities (including the Internet and intranets), (4) databases, and (5) information management personnel. Infrastructures include these resources as well as their integration, operation, documentation, maintenance, and management.

Information technology architecture is a high-level map or plan of the information assets in an organization including the physical design of the building that holds the hardware. On the Web, IT architecture includes the content and organization of the site and the interface to support browsing and search capabilities.

Data resource management is a managerial activity that applies information technology and software tools to the task of managing an organization's data resources.

A **computer-based information system (CBIS)** is an information system that uses computer technology to perform some or all of its intended tasks. Such a system can include as little as a personal computer and software. Or it may include several thousand computers of various sizes with hundreds of printers, plotters, and other devices, as well as communication networks (wireline and wireless) and databases. In most cases an information system also includes people. The basic components of information systems are listed below. Note that not every system includes all these components.

- *Hardware* is a set of devices such as processor, monitor, keyboard, and printer. Together, they accept data and information, process them, and display them.
- *Software* is a set of programs that enable the hardware to process data.
- A *database* is a collection of related files, tables, relations, and so on, that stores data and the associations among them.
- A *network* is a connecting system that permits the sharing of resources by different computers. It can be wireless.
- *Procedures* are the set of instructions about how to combine the above components in order to process information and generate the desired output.
- *People* are those individuals who work with the system, interface with it, or use its output.

–An **application schema** is a model that communicates how selected business processes are, or will be, implemented using the software and hardware.
–Software specifications represent the technical design of business processes to be automated or supported by computer programs to be written by system builders.
Most computer – based information systems are conceived, designed, and implemented using some form of systematic development process.

An operating system is an integrated system of programs that manages the operations of the CPU. Controls the input/output and storage resources.
An operating system is an integrated system of programs that manages the operations of the CPU . Controls the input/output and storage resources.

Both information technology and the myriad of information systems it supports have created interesting, challenging, and lucrative career opportunities for millions of men and women all over the globe.

The concept of **software resources** includes all sets of information processing instructions. This generic concept of software includes not only the sets of operating instructions called programs, which direct and control computer hardware, but also the sets of information processing instructions called procedures that people need.
Midrange systems are increasingly used as powerful network servers and for many multiuse business data processing and scientific applications.

Middleware is a layer of utility software that sits in between application software and systems software to transparently integrate differing technologies so that they can interoperate. Examples: open database connectivity (ODBC), JDBC

Processor is a hardware device or software system capable to performing operations upon data.

Batch processing is a category of data processing in which data are accumulated into batches and processed periodically contrast with real time processing.

In many computer systems, the **CPU** includes the arithmetic–logic unit, the control unit and the primary storage unit.

Optical disk is a secondary type of memory used for permanent storage.
ROM is a basic type of memory used for permanent storage.
RAM is a basic type of memory used for temporary storage.

A **communications protocol** is a formal description of digital message formats and the rules for exchanging those messages in or between computing systems and in telecommunications. Protocols may include signaling, authentication and error detection and correction capabilities. A protocol describes the syntax, semantics, and synchronization of communication and may be implemented in hardware or software, or both.

Telecommunication is the transmission of messages, over significant distances, for the purpose of communication. In earlier times, telecommunications involved the use of visual signals, such as beacons, smoke, semaphore telegraphs, signal flags, and optical heliographs, or audio messages via coded drumbeats, lung-blown horns, or sent by loud whistles, for example. In the modern age of electricity and electronics, telecommunications now also includes the use of electrical devices such as telegraphs, telephones, and teletypes, the use of radio and microwave communications, as well as fiber optics and their associated electronics, plus the use of the orbiting satellites and the Internet.

Network is an interconnected system of computer, terminal and communications channels and devices.

A **computer network**, often simply referred to as a network, is a group of computers and devices interconnected by communications channels that facilitate communications among users and allows users to share resources. Networks may be classified according to a wide variety of characteristics.

Telecommunications networks consist of computers, communications processors , and other devices interconnected by communications media and controlled by communications software.

Network Resources consist of communications media, communications processors, network access and control software.

Firewalls are computers, communication processor and software that protect computer network traffic and serving as a safe transfer of data flow.

WAN is a data communication network covering a large geographic area.
Protocol is a set of rules and procedures for the control of communication in the network.

A local area network (LAN) is a network that connects computers and devices in a limited geographical area such as home, school, computer laboratory, office building, or closely positioned group of buildings. Each computer or device on the network is a node. Current wired LANs are most likely to be based on Ethernet technology, although new standards like ITU-T G.hn also provide a way to create a wired LAN using existing home wires (coaxial cables, phone lines and power lines).

An intranet is a set of networks, using the Internet Protocol and IP-based tools such as web browsers and file transfer applications that are under the control of a single administrative entity. That administrative entity closes the intranet to all but specific, authorized users. Most commonly, an intranet is the internal network of an organization. A large intranet will typically have at least one web server to provide users with organizational information.

An extranet is a network that is limited in scope to a single organization or entity and also has limited connections to the networks of one or more other usually, but not necessarily, trusted organizations or entities—a company's customers may be given access to some part of its intranet—while at the same time the customers may not be considered *trusted* from a security standpoint. Technically, an extranet may also be categorized as a CAN, MAN, WAN, or other

type of network, although an extranet cannot consist of a single LAN; it must have at least one connection with an external network.

Star network : In local area networks with a star topology, each network host is connected to a central hub. In contrast to the bus topology, the star topology connects each node to the hub with a point-to-point connection. All traffic that traverses the network passes through the central hub. The hub acts as a signal booster or repeater. The star topology is considered the easiest topology to design and implement. An advantage of the star topology is the simplicity of adding additional nodes. The primary disadvantage of the star topology is that the hub represents a single point of failure.

ELECTRONIC BUSINESS AND E-COMMERCE.

To illustrate the importance of e-commerce, let's look at what a management guru, Peter Drucker, has to say about EC. The truly revolutionary impact of the Internet Revolution is just beginning to be felt. But it is not "information" that fuels this impact. It is not "artificial intelligence." It is not the effect of computers and data processing on decision-making, policymaking, or strategy. It is something that practically no one foresaw or, indeed even talked about ten or fifteen years ago; e-commerce—that is, the explosive emergence of the Internet as a major, perhaps eventually *the* major, worldwide distribution channel for goods, for services, and, surprisingly, for managerial and professional jobs. This is profoundly changing economics, markets and industry structure, products and services and their flow; consumer segmentation, consumer values and consumer behavior, jobs and labor markets.

Businesses are installing and extending intranets throughout their organizations to (1) improve communications, (2) publish and share valuable business information easily, and (3) develop and deploy critical applications to support business operations and decision making.

Conducting business in the **Digital Economy** means using Web-based systems on the Internet and other electronic networks to do some form of electronic commerce.

The **Digital Economy** refers to an economy that is based on digital technologies, including digital communication networks (the Internet, intranets, and private *value-added networks* or VAN), computers, software, and other related information technologies. The digital economy is also sometimes called the *Internet economy*, the *new economy*, or the *Web economy***.**

A **business model** is a method of doing business by which a company can generate revenue to sustain itself. The model spells out how the company adds value that consumers are willing to pay for, in terms of the goods and/or services the company produces in the course of its operations. Some models are very simple.

Business architecture describes organizational plans, visions, objectives and problems, and the information required to support them. The potential users of IT must play a critical role in the creation of business architecture, in order to have both business architecture *and* an IT architecture that meets the organization's long-term needs. We can use the architecture of a house as an analogy.

E-Business Strategic Systems. As we saw in Chapter 1, e-commerce and e-business have become a new way of conducting business in the last decade or so. In this new approach, business transactions take place via telecommunications networks, primarily the Internet. E-commerce refers not only to buying and selling electronically, but also involves e-collaboration and e-learning. It aims at increasing productivity, reaching new customers, and sharing knowledge across institutions for competitive advantage. EC-supported strategic systems are changing how business is done. We will provide e-business strategic examples throughout the book.

Electronic commerce (e-commerce or EC) involves conducting both internal and external business over the Internet, intranets, and extranets.
Three basic types of electronic commerce applications include:
•Marketing
•Business-to-consumer (B2C)
•Business-to-business (B2B)

Electronic Commerce (EC or e-commerce) includes and describes the process of buying, selling, transferring, or exchanging of goods, products, services, information, and the simplification of day-to-day business processes – all through digital communications, via computer networks, including the Internet. Some people view the term *commerce* as describing only transactions conducted between business partners.
When this definition of commerce is used, some people find the term electronic commerce to be fairly narrow. Thus, many use the term e-business instead. **E-business** refers to a broader definition of EC, not just the buying and selling of goods and services, but also servicing customers, collaborating with business partners, conducting e-learning, and conducting electronic transactions within an organization. Others view e-business as the "other than buying and selling" activities on the Internet, such as collaboration and intrabusiness activities.

Types of E-Commerce Transactions

E-commerce transactions can be done between various other parties, as follows:
●□**Business-to-business (B2B):** In B2B transactions, both the sellers and the buyers are business organizations. The vast majority of EC volume is of this type.
Business – to business applications(B2B) of e – commerce involve electronic catalog, exchange, and auction marketplaces that use internet, intranet, and extranet Web sites and portals to unite buyers and sellers.

●□**Collaborative commerce (c-commerce):** In c-commerce, business partners collaborate electronically. Such collaboration frequently occurs between and among business partners along the supply chain (see Chapters 4 and 8).

●□**Business-to-consumers (B2C):** In B2C, the sellers are organizations, and the buyers are individuals.

●□**Consumers-to-businesses (C2B):** In C2B, consumers make known a particular need for a product or service, and suppliers compete to provide the product or service to consumers. An

example is Priceline.com, where the customer names a product and the desired price, and Priceline tries to find a supplier to fulfill the stated need.

- **Consumer-to-consumer (C2C):** In C2C, an individual sells products or services to other individuals. (You also will see the term C2C used as "customer-to-customer." The terms interchangeable, and both will be used in this book to describe individual's sells products and services to each other.)

- **Intrabusiness (intraorganizational) commerce:** In this case an organization uses EC internally to improve its operations. A special case of this is known as **B2E (business to its employees) EC,** which was illustrated in the opening case.

- **Government-to-citizens (G2C) and to others:** In this case the government provides services to its citizens via EC technologies. Governments can do business with other governments as well as with businesses (G2B).

- **Mobile commerce (m-commerce):** When e-commerce is done in a wireless environment

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