Master of Business Administration (MBA)

Management Information Systems

(OMBADS202T24)

Self-Learning Material
(SEM II)

Jaipur National University
Centre for Distance and Online Education

Established by Government of Rajasthan
Approved by UGC under Sec 2(f) of UGC ACT 1956
&
NAAC A+ Accredited

Table of Contents

Unit	Title	Page No.
Unit 1	Management Information System	1-14
Unit 2	Strategic concepts	15-34
Unit 3	Types of Management Information System	35-51
Unit 4	Management Information System in Functional Areas of Business	52-73
Unit 5	MIS Development Model	74-100
Unit 6	MIS Development Requirements and Specifications	101-113
Unit 7	Different System Affect MIS	114-163
Unit 8	MIS The factors of Success and Failure	164-170

Expert Committee

Prof. R.L. Raina
Former Vice Chancellor, JKLU
Professor of Communication, IIM Lucknow

Prof. J.K. Tandon
Former Dean, Faculty of Commerce
Former Head of EAFM Department
University of Rajasthan

Course Coordinator

Mr. Yatendra Verma
Assistant Professor
Department of Business & Management, JNU, Jaipur

Unit Preparation

Unit Writers

Ms. Shruti Aggarwal
Department of Business & Management, JNU, Jaipur
(Unit 1-2)

Ms. Neha Rawal
Department of Business & Management, JNU, Jaipur
(Unit 3-4)

Mr. Deepak Kumar Jain
Department of Business & Management, JNU, Jaipur
(Unit 5-8)

Assisting & Proof Reading

Prof. Parshant Madan
Department of Business & Management, JNU, Jaipur

Editor

Prof. Abhishek Raizada
Department of Business & Management, JNU, Jaipur

Secretarial Assistance

Mr. Nitin Parashar

Course Introduction

Management Information System is assigned 3 credits and contains 8 units. Its objectives are to helps organizational needs, design and implement effective systems, and improve decision-making with data analytics. It also equips you to manage IT projects, enhance cyber-security, and optimize business processes. Additionally, it prepares you for technological innovation and compliance with regulatory standards.

The decisions taken on the basis of Management Information System are subject to evaluation and objective assessment.

Each unit is further divided into sections and sub-sections. Each unit begins with statement of objectives to indicate what we expect you to achieve through the unit.

Course Outcomes

By the end of this course student will be able to:

1. Describe the role of information systems in today's competitive business environment
2. Demonstrate systems analysis, design and decision making in a business setting.
3. Characterize the information systems support activities of managers and end-users in organizations.
4. Choose the key concepts related to information systems at various levels of Management.
5. Assess the business strategy by the use of ERP and IT Outsourcing.
6. Prepare the necessary understanding of the role of information systems in organizations.

We hope you will enjoy the course. Please attempt all the assignments and exercises given in the units.

Acknowledgement

The content we have utilized is solely educational in nature. The copyright proprietors of the materials reproduced in this book have been tracked down as much as possible. The editors apologize for any violation that may have happened, and they will be happy to rectify any such material in later versions of this book.

Unit - 1

Management Information System

Learning Objective:

After completing this unit you will be able to

- Explain the meaning and understanding of management information system
- Explain the need, purpose and objective of MIS
- State contemporary approaches to MIS
- Describe information as strategic resource
- Narrate use of information for comparative advantages
- Describe MIS as a instrument for organizational change
- Concept of strategic management information system

Structure

1.1 Introduction
1.2 The background
1.3 What is management information system
1.4 Need, purpose and objectives,
1.5 Contemporary approaches to MIS,
1.6 Information as strategic resource,
1.7 Use of information for comparative advantages,
1.8 MIS as a instrument for organizational change
1.9 Strategic management information system
1.10 Summary
1.11 Self- Assessment Questions

1.1 Introduction

Management Information Systems (MIS) is a multifaceted field encompassing various aspects of information management and systems. To facilitate a comprehensive understanding, it's crucial to identify and address certain barriers. While the following discussion provides a partial overview of activities within MIS, it's important to note that it reflects a subjective perspective, highlighting prevalent and compelling trends.

The primary focus will be on information systems utilized at the farm level, with some attention given to systems supporting researchers addressing farm-level issues (such as simulation or optimization models, geographic information systems, etc.), as well as those aiding agribusinesses throughout the supply chain beyond production.

MIS, also known as information management and systems, involves the application of people, technologies, and processes collectively referred to as information systems to solve business challenges. The primary objective of MIS is to efficiently collect, store, and disseminate information necessary for managerial functions. An effective MIS should streamline data processing, storage, and transmission, thereby enhancing operational efficiency at a reasonable cost.

According to Jameso Hicks, Jr. (2003), MIS can be conceptualized into six components: inputs, processes, data repositories, outputs, personnel, and hardware. These components are integral to both computer systems and computer-based MIS.

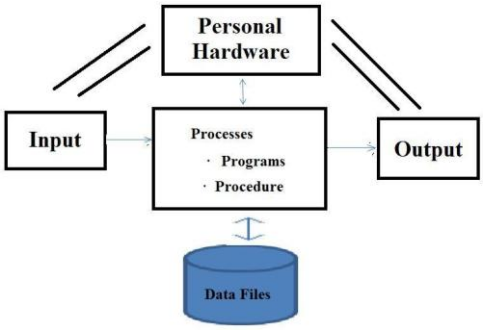


Fig: 1.1 Components of MIS

The management information system (MIS) is a idea of the final decade or it has been understood and defined in a range of methods. It is also known as the information machine, the facts and selectionsystem, the laptop- based facts machine.

1.1.1 The MIS has a couple of definitions:

1**.** MIS is described as a device which presents information support for choice making within the agency.

2. MIS is defined as an incorporated device of guy and device for supplying the statistics to support the operations, the management and the choice making characteristic within the business enterprise.

3. MIS is described as a gadget based on the database of the business enterprise developed for

the motive of supplying information to the people within the company.

4. MIS is described as a computer based totally records device.

1.2 The background:

The development of contemporary management statistics systems has closely followed the advancements in computer hardware and software. Simultaneously, it has mirrored the shift from centralized to decentralized management control. Today, any computer-based systems that collect, process, store, and communicate data are typically referred to as management information systems, or MIS.

Many MIS pundits divide the history of MIS into the five eras, first chronicled by Kenneth and JaneLoudon, authors of the textbook control information systems:

- First generation: mainframe and minicomputer computing
- Second generation: non-public computer systems
- Third generation: customer/server networks
- Fourth generation: business enterprise computing
- Fifth generation: cloud computing

- **First generation:**

The pre-1965 era was characterized by the use of large mainframe computers, which were housed in specially designed, temperature-controlled rooms and required skilled technicians to operate. IBM was the dominant supplier of both hardware and software during this period. Due to the high costs associated with owning and maintaining mainframes, time-sharing systems were commonly used. As computer technology progressed and the size of computers decreased, businesses began to invest in minicomputers. Although still relatively expensive by today's standards, these minicomputers became affordable enough for large companies to own and manage their own in-house computing operations.

- **Second generation**

The second era of personal computers began in 1965 with the introduction of the microprocessor. By the 1980s, this era had fully matured with the widespread availability of affordable computers such as the Apple I and II, and the IBM Personal Computer (PC). The launch of VisiCalc spreadsheet software revolutionized the workplace by enabling regular employees to perform tasks that previously required significant financial investment by businesses.

- **Third generation**

As computing power and autonomy were distributed to ordinary employees during the 1980s, there arose a simultaneous need to share computer data with other staff within the organization. This need led to the development of third-generation MIS client/server networks. Employees at all levels of the company could share information in various formats through computer terminals connected to servers via internal networks known as intranets.

- **Fourth generation**

The fourth generation of enterprise computing consolidated various single-purpose software applications, previously used by different departments, into a unified enterprise platform accessible over high-speed networks. These enterprise software solutions integrate key business operations, including marketing and sales, accounting, finance, human resources, inventory, and manufacturing. This integration harmonizes workflows and facilitates cooperation across the entire organization. Although the specific application modules used and the data accessed may vary by department and level of authority, enterprise computing provides a comprehensive, 360-degree view of the entire business operation.

- **Fifth generation**

The rapid surge in net bandwidth consumption is driving the adoption of the fifth generation of Management Information Systems (MIS), known as cloud computing. According to CISCO Systems, global internet traffic is projected to reach 2 zettabytes annually by 2019. To put this into perspective, one zettabyte is equivalent to 1,000 exabytes, and one exabyte is equivalent to 1 billion gigabytes. Cloud computing liberates users from being tethered to office-bound desktops, allowing access to corporate MIS from anywhere using mobile devices.

This fifth generation also marks the rise of the knowledge worker. As decision-making shifts to the lower levels of organizations, MIS is expected to increasingly empower individuals not only as producers of information but also as consumers of the same data. Consequently, knowledge workers, as both producers and consumers of MIS data, will determine the precise nature of the information that MIS generates.

1.2.1 Why MIS?

The concept of Management Information Systems (MIS) has evolved over time, reflecting various aspects of organizational functions. MIS has become essential for all organizations. Initially, the

purpose of MIS was to process the available data in the company and present it as regular reports. The system managed data from collection to processing and was quite impersonal, requiring individuals to select and use the processed data according to their needs. Over time, a distinction was made between data and information, with information being seen as the result of data analysis. This distinction likened data to raw materials and information to the finished product. Since data can be analyzed in various ways to produce different interpretations, the system needed to be user-oriented, catering to the unique perspectives and requirements of each individual.

The foundation of Management Information Systems (MIS) lies in the concepts of control and its practices. A control records system can be developed for a specific objective through systematic planning and design, which requires an analysis of a business, management perspectives, policies, organizational culture, and management style. The generated information should be useful for managing the enterprise. This is achievable when the system is conceptualized with proper design. Therefore, MIS relies heavily on systems theory to address complex input and output flows. It incorporates communication theories to create a system design that handles information inputs, processes, and outputs with minimal noise or distortion during transmission. The system design principles include the capability for continuous adjustment or correction according to environmental changes. This design helps keep the MIS aligned with the management needs of the organization. Consequently, MIS is a blend of management, information, and system theories, practices, and principles.

1.2.2 Impact of MIS on an organization:

Management Information Systems (MIS) play a crucial role in organizations by significantly enhancing features, overall performance, and productivity. With proper support, the management of advertising, marketing, finance, manufacturing, and personnel becomes more efficient. Monitoring functional objectives is streamlined, keeping functional managers informed about progress, achievements, and shortfalls across various business aspects. This facilitates forecasting and long-term strategic planning. Managers are alerted to situations requiring attention, prompting timely actions and decisions. A disciplined information reporting system creates structured data and a knowledge base accessible to all employees, saving managers valuable time.

MIS also fosters a deeper understanding of the business. It starts with defining data entities and their attributes, using a standardized dictionary for data generation within the organization. This common understanding of terms and terminology enhances communication and ensures uniform

comprehension across the enterprise. Effective MIS implementation requires systematizing business operations for efficient system design.

A well-designed MIS, focusing on managerial needs, positively impacts managerial performance. Access to comprehensive information encourages managers to utilize various management tools, enabling them to engage in experimentation and modeling. The use of computers facilitates the application of complex techniques that would be impractical manually.

1.3 What is MIS?

Information system is concept and combination of three words:

Management: it means to manage information in a organize manner to make information useful.

Information: information refers to collected, organized and meaningful data.

System: a system means co-related components which works together for a same goal.

In control facts machine statistics manager or database supervisor command all management records machine and they related to entire device, without them a system can't perform or paintings. A relation between a management information system and a database manager or information manager show by a figure 1.2:

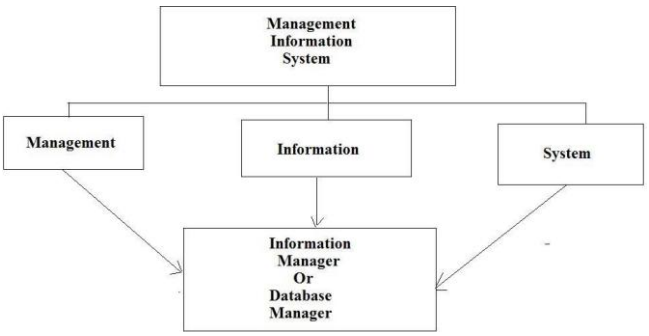


Fig: 1.2 Relation between MIS and Database Manager

1.3.1 Definition

Sekhar (2007) defined a management information system (MIS) as a system that collects and processes information, providing it to managers at all levels for decision-making, planning, program implementation, and control. It comprises components such as hardware, software, personnel, communication systems, and data itself (Laudon & Laudon, 2003). An information system is a set of procedures that collects, processes, stores, and disseminates data to aid decision-making and control (Laudon & Laudon, 2003). Information systems are typically

formal, computer-based systems crucial for organizational functions. However, it's essential to note that not all computers or software applications qualify as information systems; they are merely the technical foundation (Laudon & Laudon). MIS generates pre-specified reports, displays, and responses periodically or in exceptional circumstances, aiding business decision-making (O'Brien, 2004).

1.3.2 Computer information system:

Before the 1980s, the information system was primarily known as a tool for data processing or Management Information System (MIS). Data processing focused on managing, processing, and storing data, while MIS aimed at utilizing data for effective governance. Computer systems facilitate decision-making by providing essential information to managers and, in some cases, may even autonomously make decisions for repetitive situations. Modern information systems provide periodic data on common and predictable business events, aiding mid-level and top managers, also known as management report systems. The impact of technology and data on human endeavors extends beyond physical tasks to include mental work.

For the reason that managers are accountable for placing goals, they ought to make selections that permit their success, and people selections referring to activities as following:

- Preparation of strategic goals
- Manipulate the implementation of strategic choices
- The company of responsibilities
- Definition of responsibilities and resources associated with the appearance of theiruse;
- Coordination and supervision of employees and executives
- Detection and correction of problems in the event that they arise.

Timely and relevant information is crucial for managers at all levels to make informed decisions. V. Srica outlines three levels of governance—operational, tactical, and strategic—where information systems play a vital role in planning and control.

1.3.3 Difference between a management information system and computer information system:

The main difference between Management Information Systems (MIS) and Computer Information Systems (CIS) lies in the source of the data they handle. MIS deals with information from all sources, whether internal or external to the organization, including individuals and computers. On

the other hand, CIS is more focused on the technical aspects, specifically relating to how the organization utilizes its internal computer system.

While MIS and CIS have distinct roles, they are interconnected. CIS is considered a component of MIS, aiding in various tasks associated with managing information within the organization.

1.4 Need, Purpose and Objectives of MIS

1.4.1 Need of MIS:

- Information systems are computer based systems that assist business perform extra correctlyand efficiently.
- They are sets of computer components that deliver out records quickly, without problems, andwith any luck correctly.
- Facilitates a business perform its characteristic greater successfully.
- It could help an enterprise in countless methods. Delivery, procedure, and display data atspeeds that have been as soon as unachievable.
- They can be beneficial in practically each element of business.
- Extremely powerful approaches for an enterprise to attain its customers. All and sundry with a pc can get product records, and order most something from the comfort in their home.
- Internally, it provides a handy way to organize budget, develop method, and facilitate employee conversation.
- Its miles viable for a commercial enterprise to continue to exist with none form of it, however in today's technologically advanced global it'd be extremely tough to compete without one.
- From a client standpoint, it makes the whole thing less difficult. From getting bank stability from a pc over the smart-phone, to bar code scanners on the grocery store, make life less difficult.
- From a logistics viewpoint, structures like stock manage is have made the time consuming venture of counting stock out of date.

1.4.2 Purpose of MIS:

Management information system plays a very important role in business. The purpose of an information system is to

- Collect information,
- Store information

- Retrieve information,
- Process information,
- Distribute information.

MIS enables the management at various levels and it is a way of communication where data are gathered, processed stores and retrieved later for making choice concerning planning, operation and control of an organization. Decision making is a critical requirement in every agency, wherein in there are exceptional forms of information obtained from special useful regions of management like finance, marketing, manufacturing, personnel, planning and manipulate etc.

1.4.3 Objectives of MIS:

The overall motive of MIS is to provide profitability and related data to assist managers and body ofworkers recognize enterprise performance and plan its destiny route.

- Management Information Systems (MIS) is inherently focused on control, facilitating both long-term and short-term planning by providing essential data to every level of the organization.
- Integration is a key aspect, ensuring that various components are interconnected, such as different departments within a company.
- MIS is valuable for aiding in planning, utilizing data related to sales, production, capital investments, inventory management, and more, enabling effective decision-making.
- A well-designed MIS enables management to identify deviations from preset objectives, allowing for timely adjustments.
- MIS is essential for enhancing organizational performance.
- By offering up-to-date insights from various departments, MIS empowers management with comprehensive information.
- MIS is highly automated, ensuring accuracy in its results.
- Additionally, MIS contributes to managerial intelligence, alertness, and awareness by delivering progress and analysis reports on ongoing activities.
- Ultimately, MIS assists managers in making informed decisions.

1.5 Contemporary approach to MIS:

- **Computer science** which mattered maximum as regards the designing and development of information device. The theory of computing, records storage, networking and so on changed into the point of interest of interest. The inherent electricity of computer device

is in sporting out the dependent responsibilities in extra green manner.

- **Sociology**- commercial enterprise agencies are monetary social companies, wherein the individuals come and work together with a commonplace purpose. The people and businesses in agency follow certain way to carry on the activity, they posses positive values, ideals and feature particular thoughts set. Consequently, people and institution have their affect on shaping up the data device.
- **Psychology**- this issue refers to the human functionality to understand and use formal information in choice making procedure. It refers to cognitive capability of human beings. The person as well as institution psychology too has its have an impact on the records generation, software program capabilities and banks economic energy all changed into in favor of bank going for complete-fledged ATM networks. But in truly, except in foremost cities, banks could not enforce their selection. The motive was Indian psyche; we Indians at big are still not in favor of plastic cash.
- **Operation studies** gave its contribution in enriching the statistics system to handle extra complicated troubles. The or techniques consisting of linear programming, game principle, transportation problems, fuzzy good judgment and many others helped to enhance abilities of records machine.
- **Economic system**- what is the impact of facts gadget impact on fee and manage shape of a company economic feel prevails at business enterprise if now not in all. Therefore, mathematics of economy plays essential position in shaping up the facts machine of the commercial enterprise company.

  For this reason, the competitiveness of the company is immediately associated with companies data/records processing energy i.e. Capture, remodel, communiqué of statistics quicker the better.

1.6 Information as strategic resource

Possession of updated information and extremely good records processing capability is the important thing success factors of today's corporation.

- Liberalization, privatization, globalization has further stronger the importance of need of information. Growing opposition has harassed the need of better and brief facts. That's manner why we declare we stay in records age.
- To survive, be successful and prosper one has to have better know-how about strategies about charges, fees, era, productivity, global market, new product traits, financial system, r&d and many others. Are there thing are so unstable that any lenience in any of those factors may additionally prove of deadly consequences to today's corporation.

- Due to the fact to enhance one have to understand how far we are from the favoured path and the way effectively we are able to attain there. In other words, we ought to be in a position to degree, examine and examine the scenario and take advantage of it in our favour. It's been said that if you may measure, then you could manage
- These days' enterprise is exceedingly influenced through strategies and counter strategies.
- Organisation dynamics is the key phrase. Company techniques need now not only be initiated first however to be accompanied and pursued and corrected earlier than your rival does it. Here comes the need of better fashioned information.
- Competitiveness of the company is directly proportional to companies' statistics owning energy.
- These days companies no longer best accumulate and examine statistics but they make the most this capability for its aggressive advantage.

1.7 Use of information for comparative advantages:

- Information helps to update traditional- snail tempo- way of doing the matters.
- Differentiation performs essential position in opposition – which may be well carried out with statistics- it can be product, fee, quality, services, marketplace, charge, fee addition thorough reengineering, studies & improvement etc.
- Information helps complete evaluation of problem, and improves satisfactory of choice-making technique.
- Allows in all management capabilities which unleashes the hidden electricity of the businessenterprise, and assist deal with weakness of the organisation.
- Information allows the approach "assume globally, act locally"
- Records unveils the strategic opportunities and threats.
- Facts offers flexibility in approach.
- Records hurries up the reaction time.
- Facts brings in development in cycle time and shipping time.
- Information can itself acts as a cost adding aspect.
- Records gives an ability to stay seasoned-lively
- Information is a key in operational planning and manage
- Elevating barriers to access- funding in complex structures create access barrier
- Locking in customers and materials – strengthening business relationships thru intranet.

1.8 MIS as an instrument for the organizational change

❖ **What' is change?**

According to Alvin Toffler, "The process by which the future infiltrates our present and our lives. Existence resides in the present and encompasses the aspirations of the future. The sooner these aspirations are transformed into reality, the greater the satisfaction and sense of accomplishment. As time progresses swiftly, even the distant hopes of the future become attainable within life's grasp. Thus, change serves as the bridge between the present and the future."

- MIS may have a massive impact at the inner appearance of organization of future. MIS will result in reduced hierarchy as fewer manages could be required to behave as conduits of statistics
- The organization could no longer be functioning based totally on “cornered facts’ but could have ‘shared statistics’
- MIS could boost up restructuring of workflows, giving new powers to both line and body of workers functionaries.
- The authority would be based more on expertise and merit than seniority.
- The way of life of the organization, could tend to turn out to be overall performance orientated.
- MIS would make the enterprise way of life greater open and aggressive and the organizationalshape more flexible, delaying the organization
- MIS& it'd trade the “method’ 7 ‘products’ & might lead to separation of labor from place- making geography, a record
- With the business enterprise transferring towards end result/overall performance orientation, decisions would need to be records-primarily based and analytical in the backup of broader view and context
- The want for acquiring know-how could lead to information people and studying businesses.
- Complements collaborative paintings and teamwork, decline in the control price. A couple of obligations can be labored on simultaneously from distinctive region.
- Leading to empowerment. People and agencies have the facts and information to etc. Business system can be streamlined. Control fee declines. Hierarchy and centralization decreases – matrix business enterprise
- Transportable computing- virtual agency. Work is not tied with bodily vicinity. Knowledge and records can be brought anywhere they're needed, every time. Work

becomes transportable.

- Multimedia &photographs interface- accessibility- will become easiest, even seniors can get entry to the data. Organizational price decreases as workflow actions from paper to digital photo, report, and voice. Complex expertise objects may be made less difficult to understand.
- Modifications in a company could range from atomization of its sports to paradigm adjustments.

1.9 Strategic management information system:

The Strategic Management Information System (SMIS) serves as a comprehensive approach for acquiring performance data within corporate land management. However, its implementation poses several challenges such as integrating legal and institutional infrastructures, fostering governance and cross-government collaboration, managing organizational structure and culture, and ensuring data security, particularly in the context of implementing spatial data infrastructure for national-level land administration systems.

Through strategic grid analysis, four key elements have been identified within SMIS: human-focused versus technology-based approaches, alignment with corporate strategy, and sustainable competitive advantage. These elements serve as a guide for adjusting, changing, or eliminating components within the strategic plan, specifically aimed at enhancing land delivery services and aiding decision-makers in land administration towards achieving 'the triple bottom line' and spatially enabling governments.

The outcomes of this research are poised to assist top management in land administration, decision-makers, and researchers alike.

1.10 Summary

MIS is the acronym for Management Information System. It is a collection of people, procedures,data, and information technology that aids managers to make informed decisions.

Computerized information systems are more efficient compared to manual information systems. Manual information systems are cheaper compared to computerized information systems.

Transaction processing systems (TPS) are by operational staff to record day to day business transactions, and they are used to make structured decisions

Management Information Systems (MIS) are used by middle-level managers to make semi-structureddecisions

Decision Support Systems are used by top level managers, and they help top level managers to makeunstructured decisions.

1.11 Self-Assessment Questions:

1. Explain MIS with its organizational structure in detail.
2. Difference between a management information system and computer information system.
3. What is the need of MIS? And what are the purposes and uses of it?
4. Explain contemporary approaches to MIS.
5. What are the components and resources of MIS?
6. Explain information as strategic resource.
7. Explain use of information for comparative advantages.
8. Explain MIS as an instrument for organizational changes.
9. Describe concept of strategic management information system

Unit 2

Strategy Concepts

Learning Objectives

After completing this unit you will be able to

- Explain the meaning and understanding of competitive strategy concepts
- Explain the meaning and understanding of value chain and strategic
- Narrate using information technology for strategic advantage

Structure:

2.1 Introduction

2.2 Competitive strategy concepts

2.3 Value chain and strategic

2.4 Strategic Management

2.5 Using Information Technology for Strategic Advantage

2.6 Summary

2.7 Self-Assessment Questions

2.1 Introduction

Strategic Information Systems Planning (SISP) is crucial for ensuring a business aligns its activities with organizational needs, thereby enhancing success. Since the 1980s, SISP has been a challenging yet vital aspect for organizations in the highly competitive global market. Despite numerous studies and efforts to measure its effectiveness, the challenge persists. Successful SISP implementation requires proper alignment with business strategy, which in turn drives competitive advantage.

2.1.1 A brief evaluation

Improving overall performance has consistently been a top priority for management, best achieved through aligning information technology (IT) with a company's strategic planning. The organization aims to maximize benefits from its resources while minimizing risks. Strategic

Information Systems Planning (SISP) involves the process of using IT strategically to achieve organizational goals. Since the 1990s, SISP has been recognized as a critical management issue and remains relevant today. With the increasing ubiquity of IT in the 2000s and the pressure on companies to leverage their IT assets, the importance of SISP has grown.

Strategic information systems planning (SISP) consists of many tiers. An organization has to make certain proper implementation in each stage, but if one degree is omitted or no longer carried out effectively that would reason problems within the employer.

2.1.2 Cause of strategic statistics device planning:

The strategic data structures making plans technique is supposed to make sure that technology sports are properly aligned with the developing needs and techniques of the business enterprise.

The objectives of strategic records systems planning are extensive and encompass all critical aspects essential for the smooth operation of corporations. These objectives include aligning IT with the business, gaining competitive advantage, identifying new and improved payback programs, and increasing top management commitment, enhancing communication with users, forecasting IT resource requirements, allocating IT resources, developing information structure, and enhancing visibility of IT.

The significance of strategic information systems planning has increased due to the recognition of IS in today's businesses, along with the heightened pressure to manage IT assets effectively. Additionally, as companies strive to derive maximum benefit from their resources while minimizing risk, the importance of SISP becomes evident. It serves to provide a strategic plan that addresses future needs for IT/IS resources in alignment with business objectives.

2.1.3 Crucial achievement elements in SISP

The impact of organizational traits on Strategic Information Systems Planning (SISP) success has been examined through various general criteria, such as the necessity for thorough planning in a volatile environment, analysis of the external IT and business environment, environmental assessment, and the influence of IS within the organization.

SISP success or effectiveness needs to be measured comprehensively due to its complexity. Previous research on SISP success mostly focused on two measures: "goal-focused judgment," which evaluates the degree of goal attainment, and "process judgment," which assesses how the

planning system improved over time in supporting organizational planning needs. It is argued that these perspectives represent the "end" (the output of the planning system) and "means" (adaptability of the process), providing a framework for evaluating SISP benefits.

In other words, dimensions of SISP success encompass the achievement of IS planning systems and their capacity. Additionally, SISP success is conceptualized in terms of four interconnected dimensions: alignment, assessment, cooperation, and capability. The first three constructs denote "goals" for SISP, while the fourth construct represents "improvement" in SISP over time. Most existing studies on SISP success are linked to the influence of environmental factors, managerial factors, and organizational factors.

2.1.4 SISP Process

SISP has been described in phrases of phases and the specific sports within them. The stages and activities constitute the components of the planning procedure, every having its very own objectives, individuals, preconditions, merchandise, and strategies.

Strategic attention involves the organizing and starting up of the planning method in a prepared manner with sufficient top management support. Scenario evaluation is the studying of the internal and external environments in which the deliberate statistics structures could be expected to make a contribution. Strategy concept is the imaging of numerous feasible statistics structures that might be applied. Method components are the deciding on and prioritizing of the particular facts structures so that it will be applied. Method implementation making plans is the making plans of the sports important to make certain that the brand new facts structures are definitely positioned into production and used.

They could shape the premise for the evaluation of SISP each because they replicate particular moves and because they constitute the entire range of the making plans effort. Another look at defined SISP in phrases of procedure dimensions which include comprehensiveness, formalization, consciousness, go with the flow, participation, and consistency. The ones dimensions are useful in characterizing the interest of strategic making plans.

2.1.5 SISP techniques and methodologies

One of the fundamental troubles is planning schedule is selecting the right method to enable the team to plan its SISP sports. A methodology is commonly a tenet for fixing a trouble. A SISP method is constituted of one or extra strategies where every method is defined by way of a fixed of practices, procedures, and guidelines. A SISP technique can be considered as an abstract system layout that functions to convert organizational inputs into a strategic plan as an output.

So one can create a powerful methodology that may help control's plan, there must be a general set of techniques and supportive equipment to facilitate these projects. While an employer carries out a planning process, the ones answerable for the making plans should determine on a mixture of techniques to undertake. Some of the famous planning techniques are:

- **Levels of increase –** consist of early successes, manage and integration tiers and is helpful in determining where a business enterprise exists in studying and development curve.
- **Vital success elements** – key regions generally less than 10 for a business enterprise, where things have to cross right for the company to flourish. A technique is serving key choices by means of presenting information requirements and aligning strategies. Gain of this method is flexibility concerning business enterprise needs and may be used as measurements and for some of stages and a ramification of purposes. Even as the downside of its miles the difficulty to attain statistics necessities by using CSF on my own, so it desires assist of other strategies and capabilities of defining important elements. Critical achievement elements as being for any enterprise the restrained number of regions in which ends up, if they're quality, will make certain successful competitive overall performance for the organization.
- **Competitive forces version** – Michael Porter's model advocates that we should deal with 5 competitive forces within the strategic use of is. Forces include
  - Chance of new entrants, bargaining electricity of
  - Shoppers and Suppliers
  - Hazard of alternative services or products and
  - Contention amongst competition.

- **Cost chain evaluation** – Porter's cost chain version suggests five primary activities that ought to be given interest in developing a product or service, getting it to customers and servicing. Tan et al defined it as "a diagnostic system for identifying and reading number one and help activities that upload value to service or product".

- **Scenario making plans** – plan whereby there may be speculation of what the destiny might be like and what actions need to be taken as one- of-a-kind futures start to materialize. It's miles useful to assist expect future issues even though it is difficult to deal with the surroundings modifications within the long time.

- **SWOT**– This analysis addresses the corporation's internal strength and weaknesses, and external threats and opportunities, also method formula, and unique goals at the side of tactical and operational plans for attaining the desires.

Table 1: Methodologies:

Methodology	Description	Owner	Year
Business system Planning (BSP)	Combines Top Down Planning with bottom and focuses on Business Process which in turn are derived from an organisation's Business mission, objectives and goal	IBM	1975
Critical Success factor analysis (CSF)	Used understanding clearly the objectives, tactics and operational activities in terms of key information need of an organisation and its managers and strengths and weakness of the ex-organisation existing system	Rockart	1979
Information Engineering (IE)	Provides Techniques for building enterprise data and process models These models combine to form a complete knowledge base which is used to create and maintain information systems	James Martin	1982
Value Chain Analysis	A form of business Activity analysis Which Decomposes An enterprise into its Parts. Information Systems Are Derived From this analysis. Helps	Michael	1984
Method/1	Questioning potential clients about what needs to be done and what kinds of software and hardware should be used. It also offers strict guidelines for managing a project and estimating its costs.	Arthur Anderson	1985
Strategic System Planning (SSP) Pro planner	A business functional systems model that is defined By analyzing major Functional areas of a Business	Robert Holland	1986

Normally, the use of more than one methodology is favored. Methodology benefits managers by way of providing facts to use from the subsequent four elements: offering an opinion of what

needs to be solved, defining techniques on what has to be performed and whilst to do it, advising on the way to control the best of deliverables or merchandise, as well as offering a toolkit to facilitate the technique.

Criteria of selecting a methodology consist of: resource availability, technique/method complexity, internal coverage, ancient reasons, a preferred supplier, familiarity, and many others. The usage of automated tools additionally helps planners to conduct SISP in a established and extra efficient manner.

2.2 COMPETITIVE STRATEGY CONCEPTS:

The strategic role of information system involves using information technology to develop products, services, and capabilities that give a company major advantages over the competitive forces if faces in the global marketplace.

Strategic Information Systems (SIS) play a crucial role in shaping an organization's competitive position and strategies. A strategic information system encompasses various types of information systems (such as TPS, MIS, DSS, etc.) that utilize information technology to achieve strategic enterprise objectives, gain a competitive advantage, or mitigate competitive disadvantages.

To effectively navigate the competitive landscape, businesses must address five key competitive forces outlined by Michael Porter:

1. Rivalry among competitors within the industry.
2. The threat of new entrants into the industry.
3. The threat posed by substitute products.
4. The bargaining power of customers.
5. The bargaining power of suppliers.

By developing and implementing strategies to counter these forces, organizations can position themselves for success and sustainability in their respective industries. This strategic approach, as advocated by Porter, is essential for businesses striving to thrive amidst competition and achieve their long-term objectives.

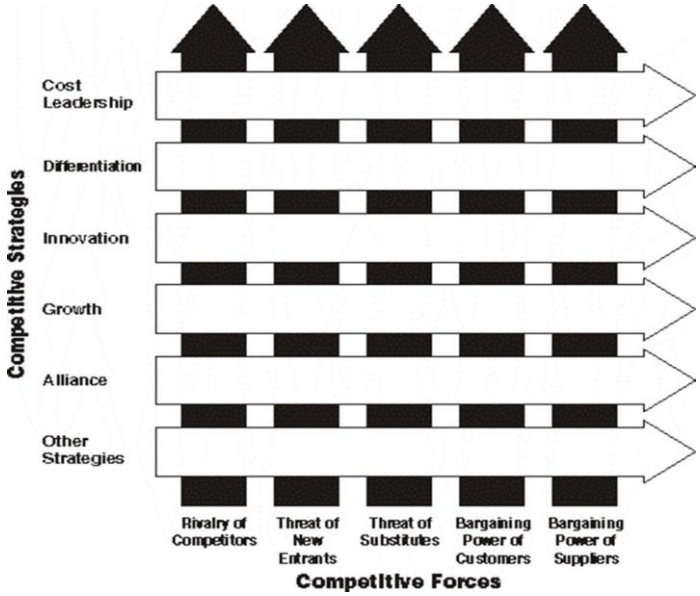


Fig: 2.1 Basic Competitive Strategies

Figure 2.1 also illustrates that business can counter the threats of competitive forces which they face by implementing five basic competitive strategies.

Cost Leadership Strategy: Being a low-cost products and services in the industry.

Differentiation Strategy: Developing methods to differentiate a firm's products and services from its competitors or reduce the differentiation features of competitors.

Innovation Strategy: Finding new way of doing business.

Growth Strategies: Significantly expanding a company's capacity to produce goods and services.

Alliance Strategies: Establishing new business linkages and alliances with customers, suppliers, competitors, consultants, and other companies.

Figure 2.2 a summary of how information technology may be used to implement the five basic competitive strategies

.

Basic Strategies in the Business Use of Information Technology

Lower Costs Use IT to substantially reduce the cost of business processes. Use IT to lower the costs of customers or suppliers.
Differentiate Develop new IT features to differentiate products and services. Use IT features to reduce the differentiation advantages of competitors. Use IT features to focus products and services at selected market niches.
Innovate Create new products and services that include IT components. Make radical changes to business processes with IT. Develop unique new markets or market niches with the help of IT.
Promote Growth Use IT to manage regional and global business expansion. Use IT to diversify and integrate into other products and services.
Develop Alliances Use IT to create virtual organizations of business partners. Develop interorganizational information systems linked by the Interenet, extranets, or other networks that support strategic business relationships with customers, suppliers, subcontractors, and others.

Fig: 2.2 Implementation of Basic Competitive Strategies

2.3 THE VALUE CHAIN AND STRAEGIC:

The value chain concept was manufactured by Michael Porter (21). It views a firm as a series, chain, or network of basic activities that add value to its products and services, and thus add a margin of value both to the firm and its customers. In the value chain conceptual framework, some business activities are primary processes, others are support processes. VALUE CHAIN EXAMPLES (Figure 2.3) provides types of how and where information technologies can be applied to basic business processes utilizing the value chain framework.

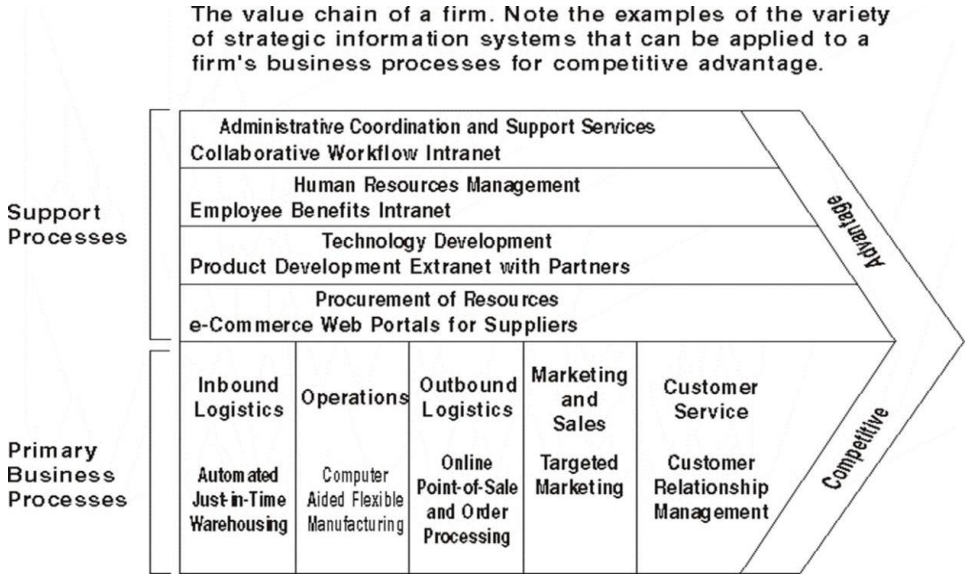


Fig: 2.3 Value Chain Example

- **Strategic Information Systems (SIS):**

Strategic Information Systems (SISs), exemplified by those implemented at Rosenbluth International, are systems designed to support or shape a company's competitive strategy. These systems are characterized by their capacity to fundamentally alter business operations, thereby furnishing the firm with a strategic edge. Unlike conventional information systems categorized by organizational structure or functional area, an SIS encompasses any system—be it an Executive Information System (EIS), Operational Information System (OIS), Transaction Processing System (TPS), or Knowledge Management System (KMS)—that significantly transforms goals, processes, products, or environmental relationships to confer a competitive advantage or mitigate a competitive disadvantage.

At the heart of a firm's success or failure lies its competitive advantage, as asserted by Porter and Millar in 1985 and Porter in 1996. This advantage is instrumental in industry dominance and the

attainment of above-average profits. Strategic Information Systems play a pivotal role in fostering competitive advantage by aligning with organizational strategic goals and enhancing performance and productivity. By leveraging SIS, companies can outperform competitors and derive significant benefits at the expense of those at a competitive disadvantage.

In the digital economy, competitive advantage holds even greater significance compared to traditional economies, a theme explored in this chapter. The impact of the digital economy on businesses is often revolutionary, with frequent technological and market changes, and the emergence of new business models capable of radically altering industry structures (Deise et al., 2000). Moreover, competition dynamics can swiftly evolve in this environment (Afuah and Tucci, 2003; Choi and Whinston, 2000).

However, despite the transformative nature of the digital economy, the fundamental essence of business remains unchanged for many firms. For these businesses, Internet technologies serve as powerful tools to augment their traditional sources of competitive advantage—whether it be through cost leadership, exceptional customer service, or superior supply chain management. Thus, for the majority of businesses, the initial step towards competitive advantage in the digital economy involves identifying the source of their competitive advantage within their industry and position. Once identified, leveraging information technology, particularly the Internet, becomes a more straightforward endeavor (Bithos, 2001).

Fig: 2.4 Strategic Information Systems

Let's examine Rosenbluth's competitive situation in light of the business enterprise pressures and organizational responses described in Chapter. As Figure shows, there were five business pressures on the company. Rosenbluth's strategic response was (1) to eliminate the retailing activities, which were most probably be impacted by the pressures, and (2) to improve the revenue model from commission-based to fee-for-service-based. Such strategy required extensive IT support.

2.4. STRATEGIC MANAGEMENT:

Strategic management is the way in which an organization maps the strategy of its future operations. The term strategic points to the long-term nature with this mapping exercise and to the large magnitude of advantage the exercise is expected to offer an organization. Information technology plays a role in strategic management in lots of ways (see Kemerer, 1997, and Callon, 1996). Consider these eight:

1. **Innovative applications**: IT creates innovative applications that provide direct strategic advantage to organizations. As an example, Federal Express was the first company in its industry to use IT for tracking the place of each package in its system. Next, FedEx was the first company to make this database accessible to its customers within the Internet. FedEx has gone on to offer e-fulfillment solutions based on IT and is even writing software for this specific purpose (Bhise et al., 2000).

2. **Competitive weapons**: Information systems themselves have been recognized as a competitive weapon (Ives and Learmouth, 1984, and Callon,1996). Amazon.com's one-click shopping system is considered so significant and very important to their reputation for superior customer service so it has patented the system. Michael Dell, founder of Dell Computer, puts it bluntly: “The Internet is similar to a tool sitting on the table, willing to be found by either you or your competitors” (Dell,1999).

3. **Changes in processes**: IT supports changes in business processes that translate to strategic advantage (Davenport, 1993). As an example, Berri is Australia's largest manufacturer and distributor of fruit juice products. The principal goal of its enterprise resource planning system implementation was “to show its branch-based business into a national organization with a single set of unified business processes” in order to achieve millions of dollars in cost-savings (J.D. Edwards, 2002a). Different ways in which IT can alter business processes include better control over remote stores or offices by giving speedy communication tools, streamlined product design time with computer-aided engineering tools, and better decision-making processes by giving managers with timely information reports

4. **Links with business partners**: IT links a company with its business partners effectively and efficiently. As an example, Rosenbluth's Global Distribution Network allows it for connecting agents, customers, and travel service providers around the globe, an innovation that allowed it to broaden its marketing range (Clemons and Hann, 1999). Other types of interorganizational

strategic information systems are presented later in this chapter.

5. **Cost reductions:** IT enables companies to cut back costs. As an example, a BoozAllen & Hamilton study discovered that: a conventional bank transaction costs$1.07, whereas the exact same transaction within the Web costs about 1 cent; a conventional airline ticket costs $8 to process, an e-ticket costs $1. In the customer service area, a person call handled by a live agent costs $33, but an intelligent agent can handle the exact same request for under $2 (Schwartz, 2000).

6. **Relationships with suppliers and customers**: IT may be used to lock in suppliers and customers, or to create in switching costs (making it harder for suppliers or customers to change to competitors). As an example, Master Builders sells chemical additives that improve the performance characteristics of concrete. The business offers customers MasterTrac, a tank-monitoring system that automatically notifies Master Builders when additive inventories fall below an agreed-on level. Master Builders then resupplies the tanks on a just-in-time basis. The client benefits from an assured way to obtain product, less capital tied up in inventory, and reduced inventory management time and processing. Master Builders benefits because competitors face a harder task to convince concrete companies to change in their mind (Vandenbosch and Dawar, 2002).

7. **New products**: A company can leverage its investment in IT to generate new services which are in demand in the marketplace. Federal Express's package-tracking software is one example. In Australia, ICI Explosives no more views its business design as just selling explosives; it now also writes contracts for broken rock. ICI engineers developed computer models that specify drilling procedures and explosives use for several types of rockfaces to make rock in the sizes that the client needs. According to Vandenbosch and Dawar (2002), "The redefinition of ICI's role not only generated higher margins for the business enterprise, it also gave ICI a more defensible competitive position"

8. **Competitive intelligence**: IT provides competitive (business) intelligence by collecting and analyzing information regarding products, markets, competitors, and environmental changes (see Guimaraes and Armstrong, 1997). As an example, in case a company knows something important before its competitors, or when it can make the proper interpretation of information before its competitors, then it could act first, gaining strategic advantage through first-mover

advantage (the competitive advantage gained by being the first to ever provide a particular product or service that customers deem to be of value). Because competitive intelligence is such an important aspect of gaining competitive advantage, we look at it in some detail next.

Example:

Power and Sharda (1997) proposed a construction in which the Internet capabilities are shown to supply information for strategic decisions. Based on the framework, shown in Figure 2, the external information required (upper left) and the methods of acquiring information (upper right) can be supported by Internet tools for communication, searching, browsing and information retrieval. Power and Sharda emphasize the search convenience of the many tools of the Internet. Using these tools an organization can implement specific search strategies, as illustrated in A Closer Look fig 2.5.

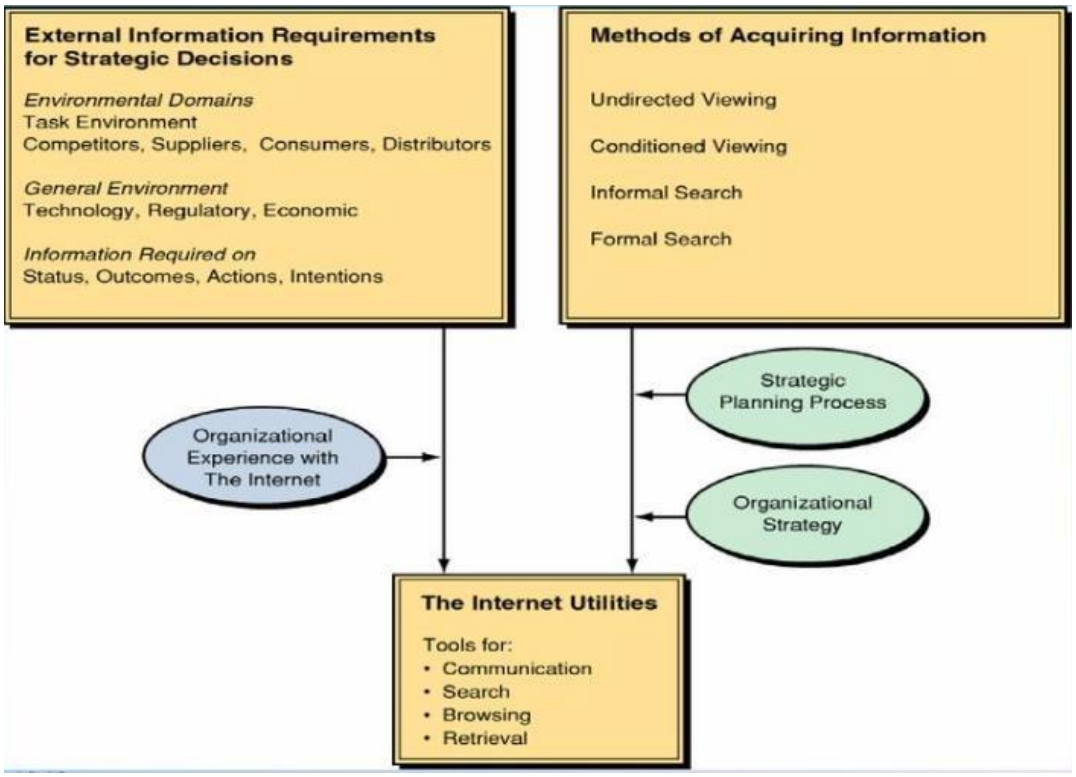


Fig: 2.5 Strategic Management

However, it's insufficient merely to gather info on a competitor. Analyzing and interpreting the data is as important as collecting it. For these tasks, it's possible to use IT tools ranging from intelligent agents to data mining. Like, J.P. Morgan Chase (New York) uses data mining to track several resources of information. Chase's goal is to ascertain the possible impact of the data on the bank, the customers, and the industry.

2.4.1. Use of information technology in a learning organization:

- **Introduction-**

Contemporary research emphasizes the necessity of broadening the range of metaphorical frameworks used to describe the relationship between organizations and their environment. Different frameworks offer varied insights into this relationship, shaping and sometimes limiting our perspectives on the organization, its competitive landscape, and its utilization of IT.

By employing the learning organization concept, competition is seen less as a hostile, adversarial exchange and more as a mechanism for learning. Competition fosters learning through market feedback on product acceptance and the comparative performance of one's own organization against others. Strategic IT initiatives play a pivotal role in facilitating this and other organizational learning processes.

This proposes a hierarchical structure to categorize IT applications, suggesting that applications evolve towards "higher" levels over time. Effective information systems at higher levels are enabled by applications at lower levels. These higher-level applications are instrumental in strategic learning, yet systems previously identified as strategic may often be categorized at lower levels in this hierarchy.

- **An information hierarchy and learning-**

The daily operations of an organization play a crucial role in enhancing its functionality for strategic purposes by illustrating the intricate interrelationships among Huber's four constructs. For instance, vital information from the environment cannot be utilized if it is not initially acquired. Its acquisition necessitates a frame of reference that imbues the information with significance, requiring an initial interpretation based on predefined criteria. This understanding underscores a system of interrelationships among processes facilitating both information flow and control.

Huber (1991) employs "information" and "data" interchangeably but acknowledges the distinction between them. He defines information as data that reduces uncertainty, ambiguity, or equivocality, while knowledge encompasses more complex products of learning, including interpretations of data. However, this treatment of information and knowledge falls short in establishing linkages between potential strategic IT applications and organizational learning. Mason (1992) suggests a revision of vocabulary to reflect IT's evolving applications, emphasizing the need for higher-order knowledge-building capabilities within organizations.

Nonaka (1991) characterizes certain organizations as "knowledge-creating," adept at developing innovative products and gaining market advantages through efficient knowledge creation processes. This perspective posits that all organizations engage in knowledge creation to varying degrees, with some excelling at it. Therefore, a framework for evaluating IT systems that facilitate knowledge creation and utilization activities in an organization is essential for distinguishing strategic IT opportunities.

Such a framework, as proposed in Table 2, outlines a hierarchical model for interpreted data and information. It delineates six levels representing distinct levels of aggregation, organization, and abstraction of knowledge, thereby augmenting Huber's constructs. Ackoff (1988) proposed a five-level model of cognitive abstraction, to which Table 2 adds a lower level (indicators) and identifies prerequisites for subsequent levels of abstraction.

Using this framework, one can apply definitions to Huber's constructs to assess the presence of learning within an organization. This framework aids in identifying and discussing opportunities for strategic IT applications and system design.

- **Strategic applications of IT to the learning 0rginization-**

Knowledge acquisition is the process through which an organization obtains knowledge. This can involve various methods such as utilizing existing knowledge within the organization, conducting experiments, self-assessments, and acquiring new resources like hiring new personnel.

It's important to note that merely obtaining information is insufficient for learning. Knowledge acquisition involves processing information to enhance the organization's ability to learn and adapt. This can occur through two methods: transferring knowledge within the organization horizontally or processing lower levels of information to contribute to higher-level learning.

Strategic applications of IT for knowledge acquisition can manifest in two ways: assimilating knowledge from external sources and developing new knowledge through reinterpretation and consolidation of existing and newly acquired information. IT can enhance an organization's ability to scan the environment and identify important information, improving strategic planning processes.

However, it's crucial to acknowledge that not all environmental information is equally valuable, and effective organizational filters are needed to identify and prioritize relevant data. Developing

intelligent filters and automated alerting mechanisms can be strategic IT applications to improve knowledge acquisition and interpretation processes within an organization.

- **Facts Distribution**

Information distribution is the process through which an organization shares data among its devices, leading to the generation of new knowledge or understanding. While significant research has been conducted on information distribution, particularly termed as "mature" by Huber, there is a gap in understanding how companies can ensure that relevant information is effectively shared across remote devices.

Huber highlights a challenge wherein some devices may require data but may not recognize the need for it or be aware that it's available elsewhere within the organization. An intelligent data system, such as Paradice (1988), capable of identifying the need for information and accessing it even across organizational units, could be a strategic application of IT.

Another avenue for strategic IT applications is the utilization of "knowledge processors" and "knowledge networks," facilitating the exchange of knowledge among individuals or intelligent agents. While some progress has been made in this area by researchers like Dec (Smart, 1991; Rogers, 1992), there is no widely accepted standard for organizations to exchange information.

In this context, it's essential to establish logical linkages between knowledge and existing information, akin to how libraries assign call numbers to books, enabling easy retrieval of related topics. This linkage could ensure that newly developed knowledge is automatically routed to appropriate functional units within the organization.

- **Organizational Reminiscence and Information Interpretation**

Organizational memory refers to how knowledge is updated for future use. One challenge is determining which information is relevant for storage, requiring interpretation as data is scanned from the environment. According to Argyris and Schon (1974) and Argyris (1990), organizations often establish protective mechanisms that filter out data that may provoke change, necessitating methods to identify filtered but relevant information.

Current data systems efficiently store hard data and records, yet managers also rely on "soft" data, which can be ambiguous and retrieved from non-data-based systems. Huber (1990) presents key research questions regarding organizational use of soft data, emphasizing the need for improved

methods to codify, store, and access such information. Storing meaningful data is essential, but interpretation remains necessary.

Systems that enhance organizational memory should be viewed as strategic systems. When coupled with advancements in sharing information at cognitive and value levels, these systems can provide ongoing competitive advantages (Te'eni, 1992).

2.4 USING INFORMATION TECHNOLOGY FOR STRATEGIC ADVANTAGE:

- **Introduction:**

In today's business landscape, the primary role of information systems is to leverage technology to develop products, services, and capabilities that provide strategic advantages in the global marketplace. Strategic information systems are designed to support competitive positioning and enable companies to achieve their strategic objectives.

Authors have highlighted the effectiveness of IT applications in establishing, transforming, and sharing knowledge management systems, thereby influencing the philosophy of enterprise management and organizational behavior. These applications serve as a fundamental tool for enhancing management processes and decision-making systems.

Another key function of IT in many organizations is cost reduction, facilitating increased production volumes while lowering expenses and improving product or service quality.

It's essential to acknowledge the specific measures that contribute to gaining a competitive edge in the market. This can be observed by examining how IT is utilized in business operations by certain companies, leading to a competitive advantage.

- **Alignment between business and information technology**

Every year, many corporations are failed updated it programs or tasks in a way up-to-date gain competitive benefits amongst their up-to-date up to date updated very weak connections inside numerous it area and commercial enterprise department. The foundation cause in a few employer is because of their updated technique which they commit assets. As a result, in most of the instances it price range is constant and so unrealistic because the actual technological cost and needs of the business have been overlooked. Further updated that, some other motive that causes vulnerable connection among business unit and it department might be updated miscommunication the various units supervisor which they by and large do now not proportion organizational goals.

For instance, in groups that cti have loss of enterprise knowledge and poor attitude motive the opportunities could be overlooked and hence, failure in the agencies. Ultimately, lack of coordination among diverse gadgets within a corporation may result in failure of the use of it application nicely.

- **Utilizing IT to be innovative**

Records technology may be used up to date uniquely and efficaciously improve products or services. More facts availability feasible up-to-date facilitate agencies up to date construct strategic is/it application up to date electricity their commercial enterprise planning and strategies and guide company innovation up-to-date country that records conversation era deliver understanding up-to-date groups as they can generate meaningful up to updated data from it. Further notice that client records is gathered each time a up-to-date interacts with a gadget that's analyzed and collectively updated harvest statistics for businesses updated develop commercial enterprise intelligence structures or applications. They similarly describe technology as a platform that consolidates up to desires and corporate missions.

- **Using it application to lower costs strategically**

As mentions, making use of it utility successfully can reduce companies' processes fee up-to-date suppliers or customers. Automation system for architectural practices (ASAP) and multi-phase integrated automation system (MITOS) are being used in the construction companies in turkey to gain and sustain a competitive advantage. Therefore, changes in technical aspect resulted in up-to-date development, new revenues and adding cost as well as updated much less aid consumption for the enterprise. In, authors point out that it programs are up-to-date be applied up-to-date adjust inbound logistics with the advantages of up-to-date removal of storage prices. As an example, MITOS machine has incorporated with material dealer database with the reason of sharing up updated data easier and greater common with material providers. This works as a "simply in time device" permitting the construction organizations have their required substances furnished just before they absolutely run out of stock.. This effective and green machine notably reduces up-to-date associated fees, giving them a competitive gain.

- **Utilizing it to strategically promote growth**

Suggest that data structures and it/is applications want updated be aligned updated the enterprise strategy for them up-to-date be strategic and cope with enterprise wishes for the destiny. High quality relationships among an it/is and universal financial measures of performance need be recognized, well deliberate and made use of for a simple utility updated be strategically used. Web

2.0 is may be strategically used up to date sell growth. This will be accomplished by means of using social networking sites which might be information systems that are presently being aligned up-to-date corporations up-to-date sell enterprise boom. Twitter, for instance, as up to by way of , in an article “demystifying social media” states that the primary functions of social media are updated up-to-date, respond, expand, and lead up-to-date behavior and links them up to date the passage up-to-date tackle when making purchasing choices.

- **Using it applications for strategic differentiation**

It is argued by that aggressive benefit can be attained by way of supplying the utmost level of rewards via a differentiation. In author mention the importance of innovation and doing things differently from competitors in business to create uniqueness with the purpose of creating unique value to customers. He in addition states that for an application updated be precise and strategic in current organizations, it has to be up-to-date up to date being doable over a long time.

- **Utilizing IT to Develop Alliances and Cut Costs:**

The strategic use of it has enabled groups to create alliances and benefit a aggressive gain over competition through linking there's structures to the net and extranets that help strategic business relationships with suppliers and customers. But, control must be privy to evolution techniques which can be already in place for alignment to be viable. They in addition note that for alliances to be viable, there should be like minded it structures between alliancing groups.

For instance, Ingram (regarded to be internationals leading wholesaler of books and different printed substances, with super volumes of merchandise daily) previously collaborated with numerous mail companies conditional at the destination. But, the association was ended in operational challenges due to incompatibilities among structures and shortage of monetary justification. Ingram opted for a mailing accomplice who should help the enterprise cut postage fees and in flip render a aggressive benefit for itself.

- **Utilizing IT to Lock-In Customers and Create a High Switching Cost**

Facts era is likewise being used by certain companies to lock in clients and providers via constructing precious new relationships with them. That is accomplished through creating inter-organizational statistics structures and programs which are interlinked through electronic telecommunications networks on terminals and computer systems of companies. This enabled collaboration among enterprise customers and providers outcomes in new enterprise alliances

and partnerships.

As an instance, Amazon, as cited by using, has developed mobile programs that can be used in numerous gadgets for his or her customers and not directly, locked them in. The reached to this target by imposing and growing it software gadget like Digital Restrictions Management (DRM) that restricts customers in an effort to read their e-books in different structures. Clients always have to use Amazons packages and services. In author mentions that Amazons the one of the maximum complicated as well as green deliver chain in the international.

- **Utilizing IT Applications to Improve Lead-Time**

Lead-time is the time taken (put off) from initiation to execution of numerous organizational approaches. Lead time reduction may be useful in the phrases of decrease protection shares, more forecasting accuracy and much less stock out stage by getting smaller orders sizes that improves stock mechanism and greater value effective as an end result.

- **Utilizing IT Application to Increase Production**

Important dependence on an internally orientated gadget for production, income or a service may be regarded as strategic. Simply in time systems are currently relied on by way of many companies which have gained competitive advantage towards their competitors. JIT concept become first brought through Taiichi Ohno to enhance Toyota's competitiveness in automobile enterprise and soon different Japanese enterprise implemented this method to their thrilling coverage. Furthermore, in authors define JIT device as "a stock manipulate philosophy whose purpose is to hold just enough material in only the proper area at simply the proper time to make simply the proper quantity of product". Benefits which include faster response, stock reduction as well as improvement in operations and efficiency are the effects of enforcing JIT in Chinese automobile industry. Have illustrated the significance of imposing a JIT system, how useful it could be close to the automotive enterprise in china.

2.6 SUMMARY:

Strategic information management means that an organization uses the data that it collects through computer systems and other means in deliberate ways. This kind of management approach is a powerful way to maintain a competitive advantage for private companies and a way to achieve objectives such as efficiency and customer satisfaction for public and nonprofit organizations

2.7 SELF-ASSESSMENT QUESTIONS:

1. What is a strategic information system? In what ways can these systems be used differently at the business level, the firm level, and the industry level?
2. In what ways has electronic commerce changed the relationship between buyer and seller?
3. List and describe the three categories of electronic commerce as defined by the participants in the transactions. Give an example of each one.
4. List and describe the six major components of a contemporary computer system.
5. List and define the four major types of information systems and give at least two information outputs to be expected from each one.
6. Define and discuss the types of service providers that have arisen in the recent decades. Give an example of each one.
7. List and describe the four critical elements in a database environment.
8. Define and discuss the two definitions of "organization" discussed in your textbook. Why are both useful to management, and under which circumstances is each the better model for understanding the way the organization works?
9. What is a knowledge management system? Provide three examples.
10. Information systems affect organizations economically and behaviorally. Describe the ways in which each of these applies to an understanding of the working of the organization.
11. Discuss the interaction between management and the development of information systems within the company. What do you think is the single most important thing management must do to ensure the successful coordination of these systems with the organization?
12. How does the database approach to data management increase the efficiency and effectiveness of an organization?
13. What are complementary assets? Why are complementary asset investments important to a firm?

.

Unit - 3

Types of Management Information System

Learning Objectives

- Transaction Processing Systems (TPS)
- Management Information Systems (MIS)
- Decision Support Systems (DSS)
- Expert Systems (ES)
- To understand in brief about System that spin theorganization – enterprise Applications

Structure :

3.1 Introduction

3.2 Transaction processing system

3.3 Management information system

3.4 Decision support system

3.5 Executive support system for senior management

3.6 System that spin the organization – enterpriseApplications

3.7 Summary

3.8 Self-Assessment Questions

3.1 Introduction

In the early stages of computing, each information system was custom-built to address specific problems. However, it became evident that many of these problems shared common characteristics. Consequently, efforts were made to develop single systems that could address a range of similar issues. To achieve this, it was crucial to define where and how the information system would be utilized and why it was necessary. This led to the quest for an accurate classification system for information systems.

Identifying the various types of information systems within an organization involves a process of classification. Classification is the categorization of things to treat them as a single unit. Classifying information systems into different types is a useful approach for system design and application discussion. However, it's not a rigid definition governed by natural laws. The number of different types of information systems varies based on the classification method used. One

widely used classification system is the pyramid model. This model categorizes information systems based on the hierarchical nature of organizational tasks and responsibilities.

For instance, a three-level pyramid model can be based on the types of decisions made at different organizational levels.

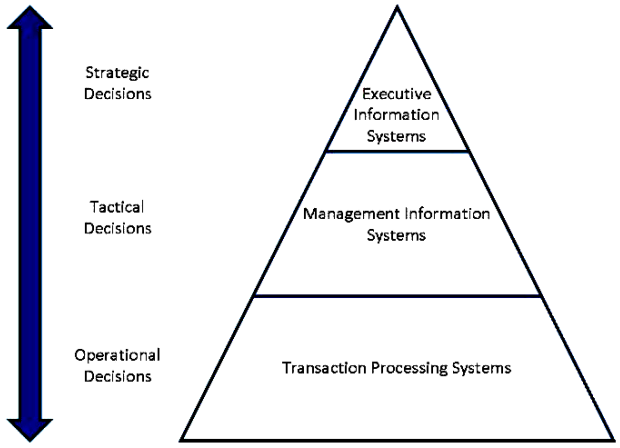


Fig 3.1: Three level pyramid model based on the type of decisions taken at different levels in the organization

Similarly, by changing our criteria to the different types of date / information / knowledge that are processed at different levels in the organization, we can create a five level model.

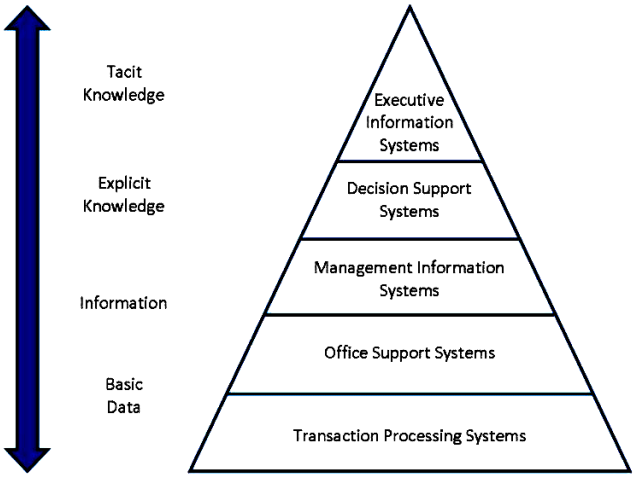


Fig 3.2: Five level pyramid model based on the processing requirement of different levels in the organization

Different kinds of Information Systems

- Transaction Processing Systems
- Management Information Systems
- Decision Support Systems
- Executive Information Systems

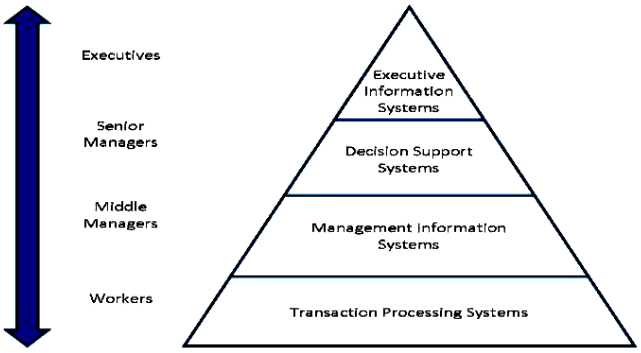


Fig 3.3: Four level pyramid model based on the different levels of hierarchy in the organization

3.2 Transaction Processing System

Transaction Processing Systems (TPS) are integral to modern enterprises as they collect, store, modify, and retrieve data transactions. Transactions, which undergo the ACID test, encompass events generating or modifying data before storage in an information system.

3.2.1. Features of Transaction Processing Systems:

1. **Rapid Processing:** TPS ensures swift transaction processing, crucial for meeting customer demands and advancing technology.
2. **Reliability:** Error-free operation is imperative for customer satisfaction. TPS incorporates comprehensive safeguards and disaster recovery systems to ensure uninterrupted operation.
3. **Standardization:** To maximize efficiency, transactions are processed uniformly each time, regardless of the customer. TPS interfaces acquire identical data for all transactions.
4. **Controlled Access:** Access to TPS is restricted to authorized employees, ensuring only skilled personnel influence the transaction process.

3.2.2. Transactions Processing Qualifiers (ACID Test):

1. **Atomicity:** Transactions are either completed entirely or not at all. TPS ensures transactions occur fully, such as crediting one account while debiting another during fund transfers.

2. **Consistency:** TPS adheres to operating rules or integrity constraints. Transactions violating these constraints are rejected.
3. **Isolation:** Transactions appear to occur independently. For instance, fund transfers between accounts must seem simultaneous.
4. **Durability:** Completed transactions are irreversible. TPS creates logs to document all transactions, ensuring persistence even during system failures.

These qualifiers ensure TPS conducts transactions systematically, uniformly, and reliably.

3.2.3. Types of Transactions:

1. **Batch Processing:** Batch processing, occurring at predefined times, conserves resources by storing data for later processing. It is suitable for enterprises managing large data volumes. Examples include monthly credit card statement processing, optimizing IT resources.
2. **Real-Time Processing:** Real-time processing prioritizes speed, crucial for time-sensitive transactions like bank withdrawals. Immediate processing ensures accurate account balance updates, benefiting both banks and customers.+

3.2.4 Functions of a TPS

TPS are ultimately little more than simple data processing systems.

Some examples of TPS

Payroll systems

Order processing systemsReservation systems Stock control systems

Systems for payments and funds transfers

The role of TPS

Produce information for other systems Cross boundaries (internal and external)

Used by operational personnel + supervisory levelsEfficiency oriented

3.3 Management Information System

A Management Information System (MIS) is a comprehensive term encompassing a three-resource system crucial for effective organizational management: people, information, and technology, prioritizing people as the foremost resource. MIS comprises information management methods, involving computer automation (software and hardware), aimed at enhancing the quality and efficiency of business operations and human decision-making.

MIS is sometimes referred to as Information Technology Management (IT management) or Information Services (IS), distinct from computer science as an area of study.

It's essential to note that MIS not only reports on a business's status but also explains the reasons for improvements or deteriorations. For instance, an MIS should provide insights into performance relative to costs, profitability of projects, and individual accountability, using constantly updated information accessible to decision-makers.

Examples of MIS applications include Decision Support Systems, Enterprise Resource Planning (ERP), Supply Chain Management, Customer Relationship Management (CRM), Project Management, and Executive Information Systems (EIS).

MIS overlaps with other business disciplines, but some distinctions exist:

- Enterprise Resource Planning (ERP): Ensures integration of departmental systems, with MIS utilizing connected systems for data access and report generation.
- IT Management: Manages hardware and software installation and maintenance, integral to MIS functionality.
- E-commerce: MIS utilizes data from e-commerce activities, influencing e-commerce processes through its reports.

MIS overlaps with other fields such as Information Systems (IS), Information Technology (IT), Informatics, Electrical Engineering, and Computer Engineering, contributing to both practical and theoretical implications of technological advancements.

3.3.1 History of Management Information Systems

The technology and tools used in MIS have evolved over time. Kenneth and Aldrich Estel, who are widely cited on the topic, have identified six eras in the field.

The Six Eras of MIS	
Era	**Key Points**
Mainframes	• Mainframe and dependent systems performed operations. • Operators received requests to run queries that were processed in a batch with other requests (often via punch cards), and returned the information at a later time.
Minicomputers	• Smaller than a mainframe. • Requests to retrieve information were inputted via terminals. The process still required operators, and it didn't provide real-time results.
Personal Computers	• Users had computers on their desk, but they often weren't connected to one another.

Fig 3.4: Six Eras of MIS

After an era ends, the previous era‘s hardware is still in use. In fact, mainframes (albeit much faster, cheaper, and easier to access than their predecessors) are still used today.

- **From Ledgers to Flash Memory**

In the era when businesses relied on bound ledgers for recording transactions, the process of tallying and tracking transactions was labor-intensive. However, in the late 1800s, the advent of process automation emerged with punch cards. Machines associated with punch cards facilitated tabulation of data, making transaction capture more efficient. IBM, founded in the early 1900s, became a leader in business machines and punch cards, initially adapting the concept from automating pattern creation in weaving machines. These punch cards evolved into a means of storing and inputting data for various applications, ranging from payroll timekeeping to complex tasks like recording census data.

With the introduction of general-purpose computers after World War II, punch cards transitioned into an input method and storage medium. Magnetic media, including tapes and floppy disks, eventually replaced punch cards for storage, allowing computers to directly read and write data to their memory. Subsequently, optical media such as CDs and DVDs offered increased data storage capacity. Currently, the shift towards flash memory, also known as solid-state drives (SSD), provides higher capacity and durability, with the ability to reuse thousands of times.

As the scope of information technology (IT) expanded beyond management information systems (MIS), task automation and advancements in IT led to an expansion of MIS responsibilities. Additionally, the definition of IT has broadened to encompass areas such as cybersecurity and network administration, extending beyond traditional MIS functions.

3.3.2 Categories of Management Information Systems

Management Information Systems encompass various specialized systems tailored to specific organizational needs. Some major categories include:

1. **Executive Information System (EIS):** EIS provides senior management with high-level data to make strategic decisions impacting the entire organization. It offers the capability to drill down into detailed information as needed.
2. **Marketing Information System (MkIS):** MkIS assists marketing teams in evaluating past and current campaigns to inform future strategies effectively.

3. **Business Intelligence System (BIS):** BIS aids in decision-making across different organizational levels by collecting, integrating, and analyzing data. It serves both lower-level managers and executives.
4. **Customer Relationship Management System (CRM):** CRM systems store essential customer information to enhance interactions and relationships across marketing, sales, customer service, and business development teams.
5. **Sales Force Automation System (SFA):** SFA, a component of CRM, automates sales-related tasks such as contact management, lead tracking, and order management for the sales team.
6. **Transaction Processing System (TPS):** TPS manages transactions and related details, facilitating processes like sales completion and order management. It includes systems like point of sale (POS) and online booking systems.
7. **Knowledge Management System (KMS):** KMS assists in knowledge sharing and problem-solving, often utilized by customer service teams to address inquiries and troubleshoot issues effectively.
8. **Financial Accounting System (FAS):** FAS is specific to finance and accounting departments, managing functions like accounts payable (AP) and accounts receivable (AR).
9. **Human Resource Management System (HRMS):** HRMS tracks employee performance records and payroll data, streamlining human resource management processes.
10. **Supply Chain Management System (SCM):** SCM tracks the flow of resources, materials, and services throughout the supply chain, from procurement to product delivery, particularly beneficial for manufacturing companies.

These specialized systems cater to specific organizational functions, enhancing efficiency, decision-making, and overall performance.

3.3.3 Types of MIS Reports

At its core, management information systems (MIS) serve to store data and generate reports that enable business professionals to analyze and make informed decisions. These reports can be categorized into three basic types:

1. **Scheduled Reports:** Generated on a regular basis according to predefined rules set by the requester, scheduled reports allow businesses to analyze data over time (e.g., monthly percentage of lost luggage for an airline), across locations (e.g., sales figures comparison between different retail stores), or based on other parameters.

2. **Ad-hoc Reports:** One-off reports created by users to address specific questions or inquiries. If these reports prove useful, they can be converted into scheduled reports for regular use.
3. **Real-time Reports:** These MIS reports provide immediate insights by allowing users to monitor changes as they occur. For instance, a call center manager might observe an unexpected surge in call volume and take proactive measures to enhance productivity or redistribute calls.

Utilizing management information systems offers numerous benefits to companies. R. Kelly Rainer, Jr., Professor at Auburn University and co-author of "Management Information Systems: Moving Business Forward," emphasizes the critical role of MIS in modern organizations, stating that any organization failing to adopt MIS will struggle to survive in today's competitive landscape. Some key advantages of effective MIS implementation include:

1. **Comprehensive Overview:** Management gains a holistic view of the entire operation, facilitating informed decision-making.
2. **Performance Feedback:** Managers receive feedback on their performance, enabling them to identify areas for improvement.
3. **Optimized Investments:** Organizations can maximize returns on investments by evaluating what strategies are effective and what are not.
4. **Performance Comparison:** Managers can compare actual results to planned performance, pinpointing strengths and weaknesses in both planning and execution.
5. **Workflow Enhancements:** Businesses can drive improvements in workflow, aligning business processes more closely with customer needs.
6. **Decentralized Decision-making:** Many business decisions are delegated to lower levels of the organization, where knowledge and expertise are more readily available.

3.3.4 Functions of a MIS

MIS are built on the data provided by the TPS

Functions of a MIS in terms of data processing requirements

Inputs	Processing	Outputs
Internal Transactions Internal Files Structured data	Sorting Merging Summarizing	Summary reports Action reports Detailed reports

Some examples of MIS

Sales management systemsInventory control systems Budgeting systems

Management Reporting Systems (MRS)Personnel (HRM) systems

The role of MIS

- Based on internal information flows
- Support relatively structured decisions
- Inflexible and have little analytical capacity
- Used by lower and middle managerial levels

Deals with the past and present rather than the future Efficiencyoriented?

3.4 Decision Support System

Broadly speaking, decision support systems are a set of manual or computer-based tools that assist in some decision-making activity. In today's business environment, however, decision support systems (DSS) are commonly understood to be computerized management information systems designed to help business owners, executives, and managers resolve complicated business problems and/or questions. Good decision support systems can help business people perform a wide variety of functions, including cash flow analysis, concept ranking, multistage forecasting, product performance improvement, and resource allocation analysis. Previously regarded as primarily a tool for big companies, DSS has in recent years come to be recognized as a potentially valuable tool for small business enterprises as well.

3.4.1 The Structure of Decisions:

In order to discuss the support of decisions and what DSS tools can or should do, it is necessary to have a perspective on the nature of the decision process and the various requirements of supporting it. One way of looking at a decision is in terms of its key components. The first component is the data collected by a decision maker to be used in making the decision. The second is the process selected by the decision maker to combine this data. Finally, there is an evaluation or learning component that compares decisions and examines them to see if there is a need to change either the data being used or the process that combines the data. These components of a decision interact with the characteristics of the decision being made.

- **Structured Decisions**

Many analysts categorize decisions according to the degree of structure involved in the decision-making activity. Business analysts describe a structured decision as one in which all three components of a decision— the data, process, and evaluation—are determined. Since

structureddecisions are made on a regular basis in business environments, it makes sense to place a comparatively rigid framework around the decision andthe people making it.

Structured decision support systems may simply use a checklist or form to ensure that all necessary data are collected and that the decisionmaking process is not skewed by the absence of data. If the choice is alsoto support the procedural or process component of the decision, then it is quite possible to develop a program either as part of the checklist or form. In fact, it is also possible and desirable to develop computer programs that collect and combine the data, thus giving the process a high degree of consistency or structure. When there is a desire to make a decision more structured, the support system for that decision is designed to ensure consistency. Many firms that hire individuals without a great deal of experience provide them with detailed guidelines on their decision making activities and support them by giving them little flexibility. One interesting consequence of making a decision more structured is that the liability for inappropriate decisions is shifted from individual decision makers to the larger company or organization.

- **Unstructured Decisions**

At the other end of the continuum are unstructured decisions. While these have the same components as structured ones—data, process, and evaluation—there is little agreement on their nature. With unstructured decisions, for example, each decision maker may use different data and processes to reach a conclusion. In addition, because of the nature of the decision there may only a limited number of people within the organization qualified to evaluate the decision.

Generally, unstructured decisions are made in instances in which all elements of the business environment—customer expectations, competitor response, cost of securing raw materials, etc.—are not completely understood (new product and marketing strategy decisions commonly fit into this category). Unstructured decision systems typically focus on the individual who or the team that will make the decision. These decision makers are usually entrusted with decisions that are unstructured because of their experience or expertise; it is their individual ability that is of value.

- **Semi-Structured Decisions**

In the middle of the continuum are semi-structured decisions—where most of what are considered to be true decision support systems are focused. Decisions of this type are characterized as having some agreement on the data, process, and/or evaluation to be used, but are also typified by efforts to retain some level of human judgment in the decision making process. An initial step in analyzing which supportsystem is required is to understand where the limitations of the decision maker may be manifested (i.e., the data acquisition portion, the process component, or the evaluation of outcomes).

3.4.2. Key DSS Functions:

Gupta and Harris observed that DSS is predicated on the effective performance of three functions: information management, data quantification, and model manipulation. "Information management refers to the storage, retrieval, and reporting of information in a structured format convenient to the user. Data quantification is the process by which large amounts of information are condensed and analytically manipulated into a few core indicators that extract the essence of data. Model manipulation refers to the construction and resolution of various scenarios to answer 'what if' questions. It includes the processes of model formulation, alternatives generation and solution of the proposed models, often through the use of several operations research/management science approaches."

Entrepreneurs and owners of established enterprises are urged to make certain that their business needs a DSS before buying the various computer systems and software necessary to create one. Some small businesses, of course, have no need of a DSS. The owner of a car washing establishment, for instance, would be highly unlikely to make such an investment. But for those business owners who are guiding a complex operation, a decision support system can be a valuable tool. Another key consideration is whether the business's key personnel will ensure that the necessary time and effort is spent to incorporate DSS into the establishment's operations. After all, even the best decision support system is of little use if the business does not possess the training and knowledge necessary to use it effectively. If, after careful study of questions of DSS utility, the small business owner decides that DSS can help his or her company, the necessary investment can be made, and the key managers of the business can begin the process of developing their own DSS applications using available spreadsheet software

3.4.3. DSS Uncertainties and Limitations:

While decision support systems have been embraced by small business operators in a wide range of industries in recent years, entrepreneurs, programmers, and business consultants all agree that such systems are not perfect.

Level of "User-Friendliness"

Some observers contend that although decision support systems have become much more user-friendly in recent years, it remains an issue, especially for small business operations that do not have significant resources in terms of technological knowledge.

- **Hard-to-Quantify Factors**

Another limitation that decision makers confront has to do withcombining or processing the information that they obtain. In many cases these limitations are due to the number of mathematical calculationsrequired. For instance, a manufacturer pondering the introduction of anew product cannot do so without first deciding on a price for theproduct. In order to make this decision, the effect of different variables(including price) on demand for the product and the subsequent profit must be evaluated. The manufacturer's perceptions of the demand for the product can be captured in a mathematical formula that portrays the relationship between profit, price, and other variables consideredimportant.

If the decision maker simply follows the output of a process model, then the decision is being moved toward the structured end of the continuum. In certain corporate environments, it may be easier for the decisionmaker to follow the prescriptions of the DSS; users of support systems are usually aware of the risks associated with certain choices. If decision makers feel that there is more risk associated with exercising judgment and opposing the suggestion of the DSS than there is in simply supporting the process, the DSS is moving the decision more toward the structured end of the spectrum. Therefore, the way in which a DSS will be used must be considered within the decision-making environment.

- **Processing Model Limitations**

Another problem with the use of support systems that perform calculations is that the user/decision maker may not be fully aware of the limitations or assumptions of the particular processing model. There may be instances in which the decision maker has an idea of the knowledge that is desired, but not necessarily the best way to get that knowledge. This problem may be seen in the use of statistical analysis to support a decision. Most statistical packages provide a variety of tests and will perform them on whatever data is presented, regardless of whether or notit is appropriate. This problem has been recognized by designers ofsupport systems and has resulted in the development of DSS that support the choice of the type of analysis.

- **Functions of a DSS**

DSS manipulate and build upon the information from a MIS and/or TPS to generate insights and new information.

Functions of a DSS in terms of data processing requirements

Inputs	Processing	Outputs
Internal Transactions Internal Files External Information?	Modelling Simulation Analysis Summarizing	Summary reports Forecasts Graphs / Plots

Some examples of DSS

Group Decision Support Systems (GDSS) Computer Supported Co-operative work (CSCW)Logistics systems

Financial Planning systemsSpreadsheet Models?

The role of DSS

Support ill- structured or semi-structured decisions Have analytical and/or modelling capacity

Used by more senior managerial levels Are concerned with predicting the future Are effectiveness oriented?

3.5 Executive Support System for Senior Management

Executive support systems are intended to be used by the senior managers directly to provide support to non-programmed decisions in strategic management.

These information are often external, unstructured and even uncertain. Exact scope and context of such information is often not known beforehand.

This information is intelligence based:

Market intelligence

Investment intelligence

Technology intelligence

Examples of Intelligent Information

Following are some examples of intelligent information, which is oftenthe source of an ESS:

- External databases
- Technology reports like patent records etc.Technical reports from consultants
- Market reports
- Confidential information about competitors Speculative information like market conditions Government policies
- Financial reports and information Features of Executive Information System

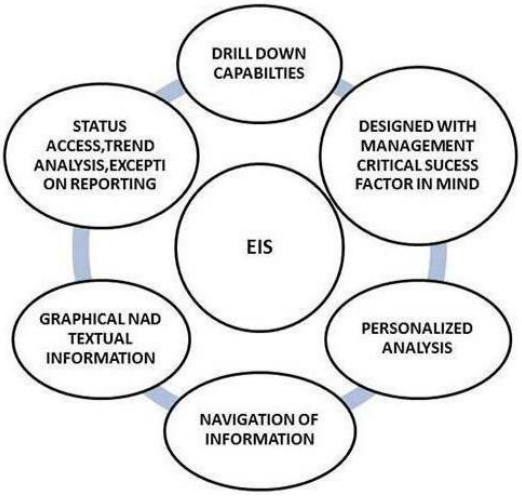


Fig 3.5: ESS

3.5.1. Advantages of ESS

- Easy for upper level executive to useAbility to analyze trends
- Augmentation of managers' leadership capabilities Enhance personal thinking and decision-making Contribution to strategic control flexibility
- Enhance organizational competitiveness in the market placeInstruments of change
- Increased executive time horizons.Better reporting system
- Improved mental model of business executive
- Help improve consensus building and communicationImprove office automation
- Reduce time for finding information
- Early identification of company performanceDetail examination of critical success factor Better understanding
- Time management
- Increased communication capacity and quality

3.5.2. Disadvantage of ESS

- Functions are limited Hard to quantify benefits
- Executive may encounter information overloadSystem may become slow
- Difficult to keep current data
- May lead to less reliable and insecure dataExcessive cost for small company

3.5.3. Functions of an EIS

EIS organizes and presents data and information from both external data sources and internal MIS or TPS in order to support and extend the inherent capabilities of senior executives.

Functions of a EIS in terms of data processing requirements

Inputs	Processing	Outputs
External Data Internal Files Pre-defined models	Summarizing Simulation "Drilling Down"	Summary reports Forecasts Graphs / Plots

Some examples of EIS

Executive Information Systems tend to be highly individualized and are often custom made for a particular client group; however, a number of off-the-shelf EIS packages do exist and many enterprise level systems offer a customizable EIS module.

The role of EIS

- Are concerned with ease of use
- Are concerned with predicting the futureAre effectiveness oriented
- Are highly flexible
- Support unstructured decisions
- Use internal and external data sources
- Used only at the most senior management levels

3.6 System that Spin the Organization – Enterprise Applications

An enterprise application is the phrase used to describe applications (or software) that a business would use to assist the organization in solving enterprise problems. When the word "enterprise" is combined with "application," it usually refers to a software platform that is too large and too complex for individual or small business use.

- ***Integration and Deployment***

Enterprise applications are typically designed to interface or integrate with other enterprise applications used within the organization, and to be deployed across a variety of networks(Internet, Intranet and corporate networks) while meeting strict requirements for security and administration management.

- ***Proprietary Enterprise Apps***

Proprietary enterprise applications are usually designed and deployed in-house by a specialized IT development team within the organization. However, an enterprise may out source some or all of the development of the application, and bring it back in-house for deployment.

- ***Application Service Providers (ASP)***

Today, using enterprise ***a****pplication* ***s****ervice* ***p****roviders*(ASP) is more prevalent. Here, the enterprise application is designed by a third-party application service provider and leased to the

enterprise, as an on-premise or hosted service. This is also often referred to software-as- a-service (SaaS) or Web-based applications.

- ***Trends in Enterprise Apps***

Another trend in enterprise applications is the move to cloud computing, where the enterprise moves some or its entire infrastructure to the cloud -

a type of Internet-based computing, where services are delivered to an organization's computers and devices through the Internet as an on-demand service. Some enterprises may also choose a hybrid solution where cloud applications are integrated with on-premisesystems.

- Some of the more common types of enterprise applications include the following: automated billing systems
- payment processing email marketing systemscontent management
- call center and customer support
- Customer Relationship Management (CRM) Enterprise Resource Planning (ERP) Business Intelligence
- Business Continuity Planning (BCP)HR Management
- Enterprise Application Integration (EAI)enterprise search
- messaging and collaboration systems.

Other common names for enterprise application include *enterpriseapp, enterprise software*

and ***e****nterprise* ***a****pplication* ***s****oftware* (EAS).

3.7. Summary :

An efficient information system creates an impact on the organization's function, performance, and productivity.

Nowadays, information system and information technology have become a vital part of any successful business and is regarded as a major functional area like any other functional areassuch as marketing, finance, production and human resources, etc.

Thus, it is important to understand the functions of an information system just like any other functional area in business. A well maintained management information system supports the organization at different levels.

Many firms are using information system that cross the boundaries of traditional business functions in order to re-engineer and improve vital business processes all across the enterprise. This typical has involved installing −

- Enterprise Resource Planning (ERP)
- Supply Chain Management (SCM)
- Customer Relationship Management (CRM)

- Transaction Processing System (TPS)
- Executive Information System (EIS)
- Decision Support System (DSS)
- Knowledge Management Systems (KMS)
- Content Management Systems (CMS)

The strategic role of Management Information System involves using it to develop products, services, and capabilities that provides a company major advantages over competitive forces it faces in the global marketplace.

We need an MIS flexible enough to deal with changing information needs of the organization. The designing of such a system is a complex task. It can be achieved only if the MIS is planned. We understand this planning and implementation in management development process.

Decision support system is a major segment of organizational information system, becauseof its influential role in taking business decisions. It help all levels of managers to take various decisions.

3.8. Self-Assessment Questions :

1. Describe in detail Enterprise Resource Planning (ERP)
2. Describe in detail Supply Chain Management (SCM)
3. .Describe in detail Customer Relationship Management (CRM)
4. Describe in detail Transaction Processing System (TPS)
5. Describe in detail Executive Information System (EIS)
6. Describe in detail Decision Support System (DSS)
7. Describe in detail Knowledge Management Systems (KMS)
8. Describe in detail Content Management Systems (CMS)

Unit - 4

Management Information System in Functional Areas of Business

Learning Objectives:

After going through this chapter, you should be able to understand:

- To learn about various application of MIS in application system

Structure:

4.1 Accounting Information System

4.2 Geographical Information System

4.3 Human Resource Information System (HRIS)

4.4 Inventory Information System

4.5 Manufacturing Information System

4.6 Marketing Information System

4.7 Quality Information System

4.8 R & D Information System

4.9 Summary

4.10 Self-Assessment Questions

The principal *business functions* in a business firm are:

- Marketing and sales
- Production
- Accounting and finance
- Human resources

A general view of information systems supporting a company's operations and management, emphasize that management support systems (MRS), decision support systems (DSS), and executive information systems (EIS), rest on the foundation of transaction processing systems (TPS) that support business operations. TPSs are the major source of data used by the higher-level systems to derive information. Professional support systems (PSS) and office information systems (OIS), which support individual and group knowledge work, are also a part of this foundation.

4.1 Accounting Information System

The financial function of the enterprise consists in taking stock of the flows of money and other assets into and out of an organization, ensuring that its available resources are properly used and that the organization is financially fit. The components of the accounting system include:

- Accounts receivable records
- Accounts payable records
- Payroll records
- Inventory control records
- General ledgers

Financial information systems rely on external sources, such as on-line databases and custom produced reports, particularly in the areas of financial forecasting and funds management. The essential functions that financial information systems perform include:

- Financial forecasting and planning
- Financial control
- Funds management
- Internal auditing
- Financial Forecasting

Financial forecasting is the process of predicting the inflows of funds into the company and the outflows of funds from it for a long term into the future. Outflows of funds must be balanced over the long term with the inflows. With the globalization of business, the function of financial forecasting has become more complex, since the activities in multiple national markets have to be consolidated, taking into consideration the vagaries of multiple national currencies. Scenario analysis is frequently employed in order to prepare the firm for various contingencies.

Financial forecasts are based on computerized models known as cash- flow models. They range from rather simple spreadsheet templates to sophisticated models developed for the given industry and customized for the firm or, in the case of large corporations to specify modelling of their financial operations. Financial forecasting serves to identify the need for funds and their sources.

4.1.1. Financial Control

The primary tools of financial control are budgets. A *budget* specifies the resources committed to a plan for a given project or time period. Fixed budgets are independent of the level of activity of the unit for which the budget is drawn up. Flexible budgets commit resources depending on the level of activity.

Spreadsheet programs are the main budgeting tools. Spreadsheets are the personal productivity

tools in use today in budget preparation.

In the systems-theoretic view, budgets serve as the standard against which managers can compare the actual results by using information systems. Performance reports are used to monitor budgets of various managerial levels. A performance report states the actual financial results achieved by the unit and compares them with the planned results.

Along with budgets and performance reports, financial control employs a number of financial ratios indicating the performance of the business unit. A widely employed financial ratio is *return on investment* (ROI). ROS shows how well a business unit uses its resources. Its value is obtained by dividing the earnings of the business unit by its total assets.

4.1.2. Funds Management

Financial information systems help to manage the organization's liquid assets, such as cash or securities, for high yields with the lowest degree of loss risk. Some firms deploy computerized systems to manage their securities portfolios and automatically generate buy or sell orders.

4.1.3. Internal Auditing

The *audit* function provides an independent appraisal of an organization's accounting, financial, and operational procedures and information. All large firms have *internal auditors*, answerable only to the audit committee of the board of directors. The staff of the chief financial officer of the company performs financial and operational audits. During a *financial audit*, an appraisal is made of the reliability and integrity of the company's financial information and of the means used to process it. An *operational audit* is an appraisal of how well management utilizes company resources and how well corporate plans are being carried out.

4.2 Geographical Information Systems

Geographic Information Systems (GIS) Connects Geography with Data. Every day, millions of decisions are being powered by Geographic Information Systems (GIS). From pinpointing new store locations, to predicting climate change, to reporting power outages, to analyzing crime patterns and so forth.

You might be wondering:

But why use GIS?

That is because geographic problems require spatial thinking.

In a GIS, you connect *data* with *geography*. And you understand *what* belongs *where*. Because you don’t fully understand your data until you see how it relates to other things in a geographic context.

What is the definition for GIS?

Geographic Information Systems is a computer-based tool that analyzes stores, manipulates and visualizes geographic information, usually in a map.

Never in the history of mankind have we had more pressing issues in need of a geospatial perspective. These global issues require pervasive, complex, location-based knowledge that can only come from a GIS.

Long story short:

Geographic Information Systems really comes down to just 4 simple ideas:

Create geographic data

Manage it.

Analyze it and…

Display it on a map.

These are the primordial functions of a GIS.

Visualize Data by Making Spreadsheets Come to Life I think you'll agree:

It's REALLY hard to visualize the locations of latitudes and longitudes coordinates from a spreadsheet.

	name	latitude	longitude	pop_min	pop_max
	Seattle	47.570002	-122.339985	569369	3074000
	New York	40.749979	-73.980017	8008278	19040000
	Miami	25.787611	-80.224106	382894	5585000
	Los Angeles	33.989978	-118.179981	3694820	12500000
	Dallas	32.820024	-96.840017	1211704	4798000

Attribute table

But when you add these positions on a map, it's like magic to the reader.

Fig 4.1: Latitude and Longitude on a map

Everyone knows that maps make geographic information easier to understand.

So what exactly do you need to make your spreadsheets (and other spatial information) come to life?

You need HARDWARE such as a GIS workstation. Actually, it could be anything from powerful servers to mobile phones. The CPU is your workhorse and data processing is the name of the game. In addition, GIS analysts often need dual monitors, boatloads of storage and crisp graphic processing cards.

Lastly, you need SOFTWARE. Really, the GIS software options out there seem endless. From ArcGIS, QGIS, GRASS GIS, SuperGIS, SAGA GIS to JUMP GIS… The range of GIS products to choose from can get a bit "ridiculous" at times.

4.2.1. Drive Decision-Making in Real World Applications

Most people think GIS is only about "making maps". But governments, businesses and people harness the power of GIS because of the insights of spatial analysis.

Before GIS, cartographers mapped out the land using paper maps. Over the years, we've seen a gradual shift away from paper maps. Instead, users build digital maps with computer-based spatial data.

And the more you think of it:

Some of the largest problems of our planet are best understood spatially. For example, climate change, natural disasters and population dynamics are all geographic in nature.

How do you solve problems in a GIS?

The answer to this is through spatial analysis, which understands relationships between spatial and attribute data.

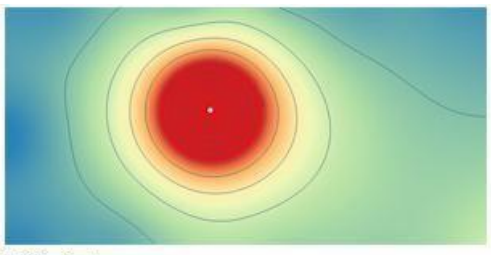
Spatial analysis examples:

Q: How much forest is in a city boundary or study area?

A: Run aclip on land cover classification. Sum the area of forest grid cells.

Q: How many endangered species are within a 1 mile proximity of a proposed mine?

A: Run a buffer. Calculate the number of species in the buffer.



Buffer Tool

4.2.2 Manage Geospatial Data for Cost-Efficiency

There's nothing more painful than drawing by-hand thousands of features on paper maps. But this is how it use to be.

Spatial analysis is impossible, querying is unimaginable and don't even think about turning off a layer on a paper map.GIS stores information about the real world as thematic layers. Of course, these layers are all linked by their geographic coordinates. As a result, we save cost because of greater efficiency in record-keeping and can make powerful spatial analysis with ease.

How does Geographic Information Systems capture real world features? Actually, GIS data is stored as rasters (grids) and vectors.

Rasters often look pixellated because of its square gridded look. They are store data in rows and columns (grid) and can be classified as discrete and continuous.

Continuous rasters are grid cells with gradual changing data. For example, digital elevation models (DEM) and temperature data are continuous raster data

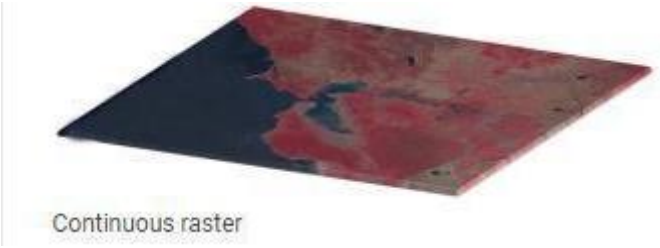


Fig 4.2: Continuous raster

Discrete rasters have distinct themes or categories. For example, land cover has discrete classes with clear boundaries. One grid cell represents a land cover class.

Fig 4.3: Discrete raster

Vectors can be points, lines and polygons and are generally smooth, rounded features. For example, cities, fire hydrants, contours, roads, railways and administrative boundaries are often represented as vectors.

Fig 4.4: Vectors

What Can GIS Do For You?

Geographic Information Systems answer important questions about location, patterns and trends. For example:

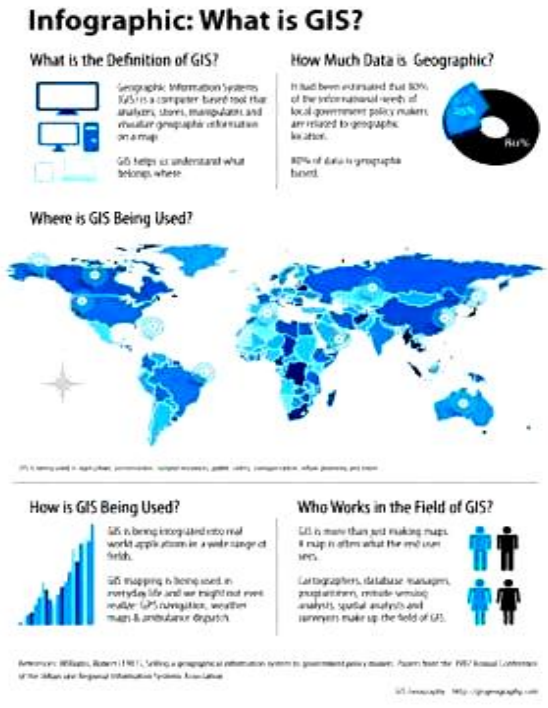
- Where are land features found? includes points, lines, polygons and grids. If you need to find the closest gas station, GIS can show you the way. Or if you want to find an optimal location, you may need traffic volumes, zoning information and demographics.
- What geographical patterns exist? Ecologists who want to know suitable habitat for elk can gain a better understanding by using GPS collars and land cover.
- What changes have occurred over a given period of time? Never have we've been able to understand climate change before thanks to GIS and remote sensing technology. Also, safety concerns can be better evaluated using GIS such as understanding terrain slope and the probability an avalanche can occur.
- What are the spatial implications? If an electricity company wants to build a transmission line, how will this affect nearby homes, the environment and safety. Most environmental assessments use GIS to understand the landscape.

Why GIS is not going away anytime soon

Geographic Information Systems allows us to make better decisions using geography.

Analysis becomes simple. Answers become clear.

Everyday GIS makes an impact on your life and you might not even realize. For example, your car uses GPS navigation and your job may depend on really accurate weather prediction. Overall, GIS helps us analyze the world because it best understands geography.



Cartographers, spatial analysts, surveyors, programmers and remote sensing analysts are GIS-based professions. According to a study awhile back, 80% of data is location-based.

When the natural resources community first started recording inventories on paper maps, it was quite a tedious process.

To Conclude:

"A geographic information system (GIS) lets us visualize, question, analyze, and interpret data to understand relationships, patterns, and trends."

4.3 Human Resource Information Systems

A human resource information system (HRIS) supports the human resources function of an organization with information. The name of this function reflects the recognition that people who work in a firm are frequently its most valuable resources. The complexity of human resource management has grown immensely over recent years, primary due to the need to conform to new laws and regulations.

A HRIS has to ensure the appropriate degree of access to a great variety of internal stakeholders, including: The employees of the Human Resources department in performance of their duties All the employees of the firm wishing ti inspect their own records All the employees of the firm seeking information regarding open positions or available benefit plans Employees availing themselves of the computer-assisted training and evaluation opportunities Managers throughout the firm in the process of evaluating their subordinates and making personnel decisions Corporate executives involved in tactical and strategic planning and control Transaction Processing Subsystems and Databases of Human Resource Information Systems At the heart of HRIS are its databases, which are in some cases integrated into a single human resource database. The record of each employee in a sophisticated employee database may contain 150 to 200 data items, including the personal data, educational history and skills, occupational background, and the history of occupied positions, salary, and performance in the firm. Richer multimedia databases are not assembled by some firms in order to facilitate fast formation of compatible teams of people with complementary skills.

Other HRIS databases include:

- Applicant databases
- Position inventory
- Skills inventory

- Benefit databases
- External database

4.3.1. Information Subsystems for Human Resource Management

The information subsystems of HRIS reflect the flow of human resources through the firm, from planning and recruitment to termination. A sophisticated HRIS includes the following subsystems:

- Human resource planning
- Recruiting and workforce management
- Compensation and benefits
- Government reporting and labour relations support

4.3.2. Human Resource Planning

To identify the human resources necessary to accomplish the long-term objectives of a firm, we need to project the skills, knowledge, and experience of the future employees.

- **Recruiting and Workforce Management**

Based on the long-term resource plan, a recruitment plan is developed. The plan lists the currently unfilled positions and those expected to become vacant due to turnover.

The life-cycle transitions of the firm's workforce - hiring, promotion and transfer, and termination - have to be supported with the appropriate information system components.

- **Compensation and Benefits**

Two principal external stakeholders have an abiding interest in the human resource policies of organizations. These are:

- Various levels of government
- Labor unions

4.4 Inventory Information Systems

Inventory control systems are technology solutions that integrate all aspects of an organization’s inventory tasks, including shipping, purchasing, receiving, warehouse storage, turnover, tracking, and reordering. While there is some debate about the differences between inventory management and inventory control, the truth is that a good inventory control system does it all by taking a holistic approach to inventory and empowering organizations to utilize lean practices to optimize productivity and efficiency along the supply chain while having the right inventory at the right

locations to meet customer expectations.

That being said, there are two different types of inventory control systems available today: perpetual inventory systems and periodic inventory systems. Within those systems, two main types of inventory management systems – barcode systems and radio frequency identification (RFID) systems – used to support the overall inventory control process:

- Main Inventory Control System Types:
- Perpetual Inventory System
- Periodic Inventory System
- Types of Inventory Management Systems within Inventory Control Systems:
- Barcode System
- Radio Frequency Identification (RFID) System

Inventory control systems help you track inventory and provide you with the data you need to control and manage it. No matter which type of inventory control system you choose, make sure that it includes a system for identifying inventory items and their information including barcode labels or asset tags; hardware tools for scanning barcode labels or RFID tags; a central database for all inventory in addition to the ability to analyze data, generate reports, and forecast demand; and processes for labelling, documenting, and reporting inventory along with a proven inventory methodology like just-in-time, ABC analysis, first-in, or first out (FIFO), or last-in-first-out (LIFO). Read on to learn more about the four types of inventory control systems.

4.4.1. Perpetual Inventory System

When you use a perpetual inventory system, it continually updates inventory records and accounts for additions and subtractions when inventory items are received, sold from stock, moved from one location to another, picked from inventory, and scrapped. Some organizations prefer perpetual inventory systems because they deliver up-to-date inventory information and better handle minimal physical inventory counts. Perpetual inventory systems also are preferred for tracking inventory because they deliver accurate results on a continual basis when managed properly.

There are some challenges associated with perpetual inventory systems. First, these systems cannot be maintained manually and require specialized equipment and software that results in a higher cost of implementation, especially for businesses with multiple locations or warehouses. Periodic maintenance and upgrades are necessary for periodic inventory systems, which also can become costly. Another challenge of using a perpetual inventory system is that recorded inventory may not reflect actual inventory as time goes by because they do not use regular physical inventory counts. The result is that errors, stolen items, and improperly scanned items impact the recorded inventory

records and cause them not to match actual inventory counts.

4.4.2. Periodic Inventory System

Periodic inventory systems do not track inventory on a daily basis; rather, they allow organizations to know the beginning and ending inventory levels during a certain period of time. These types of inventory control systems track inventory using physical inventory counts. When physical inventory is complete, the balance in the purchases account shifts into the inventory account and is adjusted to match the cost of the ending inventory. Organizations may choose whether to calculate the cost of ending inventory using LIFO or FIFO inventory accounting methods or another method; keep in mind that beginning inventory is the previous period's ending inventory.

There are a few disadvantages of using a periodic inventory system. First, when physical inventory counts are being completed, normal business activities nearly become suspended. As a result, workers may hurry through their physical counts because of time constraints. Errors and fraud may be more prevalent when you implement a periodic inventory system because there is no continuous control over inventory. It also becomes more difficult to identify where discrepancies in inventory counts occur when using a periodic inventory control system because so much time passes between counts. The amount of labor that is required for periodic inventory control systems make them better suited to smaller businesses.

4.4.3. Barcode Inventory Systems

Inventory management systems using barcode technology are more accurate and efficient than those using manual processes. When used as part of an overall inventory control system, barcode systems update inventory levels automatically when workers scan them with a barcode scanner or mobile device. The benefits of using bar coding in your inventory management processes are numerous and include:

- Accurate records of all inventory transactions
- Eliminating time-consuming data errors that occur frequently with manual or paper systems
- Eliminating manual data entry mistakes
- Ease and speed of scanning
- Updates on-hand inventory automatically
- Record transaction histories and easily determine minimum levels and reorder quantities
- Streamline documentation and reporting
- Rapid return on investment (ROI)
- Facilitate the movement of inventory within warehouses and between multiple locations and from receiving to picking, packing, and shipping

4.4.4. Radio Frequency Identification (RFID) Inventory Systems

Radio frequency identification (RFID) inventory systems use active and passive technology to manage inventory movements. Active RFID technology uses fixed tag readers throughout the warehouse; RFID tags pass the reader, and the movement is recorded in the inventory management software. For this reason, active systems work best for organizations that require real-time inventory tracking or where inventory security has been an issue. Passive RFID technology, on the other hand, requires the use of handheld readers to monitor inventory movement. When a tag is read, the data is recorded by the inventory management software. RFID technology has a reading range of approximately 40 feet with passive technology and 300 feet with active technology.

RFID inventory management systems have some associated challenges. First, RFID tags are far more expensive than barcode labels; thus, they typically are used for higher value goods. RFID tags also have been known to have interference issues, especially when tags are used in environments with a lot of metal or liquids. It also costs a great deal to transition to RFID equipment, and your suppliers, customers, and transportation companies need to have the required equipment as well. Additionally, RFID tags carry more data than barcode labels, which means your system and servers can become bogged down with too much information.

When choosing an inventory control system for your organization, you first should decide whether a perpetual inventory system or periodic inventory system is best suited to your needs. Then, choose a barcode system or RFID system to use in conjunction with your inventory control system for a complete solution that will enable you to have visibility into your inventory for improved accuracy in scanning, tracking, recording, and reporting inventory movement.

4.5 Manufacturing Information System

The global competitive landscape of the information society has significantly impacted manufacturing, leading to the emergence of new marketplace demands. Modern manufacturing must exhibit the following characteristics:

1. **Lean:** Efficiency is paramount, achieved through better engineering and production processes that minimize waste and rely on low inventories.
2. **Agile:** Fit for time-based competition, with shortened new product design and order fulfillment cycles.
3. **Flexible:** Capable of rapidly and cost-effectively adjusting products to meet customer preferences.

4. **Managed for Quality:** Quality is treated as a necessity, with manufacturers implementing rigorous quality control measures throughout the production process and adhering to global standards.

The structure of manufacturing information systems plays a crucial role in supporting these requirements. Manufacturing information systems are complex and challenging to develop and implement. They consist of various subsystems, including:

- **Product Design and Engineering:** Supported by computer-aided design (CAD) and computer-aided engineering (CAE) systems, which streamline design processes, ensure quality, safety, manufacturability, and reduce time to market.
- **Product Scheduling:** Central to the manufacturing information system, ensuring optimal allocation of resources to meet production requirements. Often controlled by manufacturing resource planning systems.
- **Quality Control:** Relies on data collected from sensors embedded in process control systems. Emphasizes total quality management (TQM) principles, focusing on improving design and manufacturing processes to reduce variation and enhance overall quality.
- **Facilities Planning, Production Costing, Logistics, and Inventory Subsystems:** Higher-level decision-making processes supported by manufacturing information systems. Includes facilities planning, production costing for cost control, inventory management, and logistics planning.

Computer-integrated manufacturing (CIM) is a key strategy wherein manufacturers control the entire production process, from CAD and CAE to factory floor operations with robots and numerically controlled machinery (CAM). CIM enables cost-effective production of small product batches.

4.6 Marketing Information System

Marketing activities are fundamental to organizations, involving the planning, promotion, and selling of goods and services to meet customer needs and organizational objectives. To support decision-making related to the marketing mix—product, price, place, and promotion—marketing information systems play a crucial role. These systems draw data and information from various sources, including:

1. **Marketing Research:** This subsystem focuses on collecting data on both actual customers and potential customers, also known as prospects. Understanding customer needs is

essential for effective total quality management (TQM). With the advent of electronic commerce on the web, it has become easier to gather statistics on buyer behavior. Marketing research software facilitates statistical analysis, allowing firms to correlate buyer behavior with detailed geographic, demographic, and psychographic variables.

2. **Marketing Intelligence:** Responsible for gathering and interpreting data on the firm's competitors, marketing intelligence subsystems disseminate competitive information to relevant users. Information about competitors is sourced from various channels, including corporate annual reports, media tracking services, and reports obtained from external providers, such as online database services. The Internet has emerged as a significant source of competitive intelligence.

These subsystems are essential components of the marketing information system, which relies heavily on external information. Boundary-spanning activities aim to bring external data and information into the organization, enabling informed decision-making regarding the marketing mix. By leveraging insights from marketing research and competitive intelligence, organizations can adapt their strategies to better meet customer needs and gain a competitive advantage in the marketplace.

Marketing mix subsystems are essential components of the marketing information system, facilitating decision-making regarding product introduction, pricing, promotion, and distribution. These subsystems are integrated into sales forecasts and marketing plans, allowing organizations to compare ongoing sales results against planned objectives. Here's a breakdown of each marketing mix subsystem:

1. **Product Subsystem:**
    - The product subsystem assists in planning the introduction of new products, crucial in a rapidly changing and competitive environment.
    - Decision-making regarding new product introduction is supported by professional support systems, decision support systems (DSSs), and electronic meeting systems.
    - Marketing intelligence and research provide valuable information for evaluating new product ideas.
2. **Place Subsystem:**
    - The place subsystem ensures products are available to customers at the right place and time by planning distribution channels and tracking their performance.

- Information technology, such as bar-coded Universal Product Code (UPC), point-of-sale (POS) scanning, and electronic data interchange (EDI), enhances visibility into product movement in the distribution channel.
- Supports just-in-time product delivery and customized delivery strategies.

3. **Promotion Subsystem:**
   - The promotion subsystem supports personal selling and advertising, utilizing media selection packages to choose avenues for persuading potential customers.
   - Database marketing segments potential customers and delivers personalized promotional information.
   - Telemarketing is increasingly supported by information technology.
   - Sales management is supported through customer profitability analysis, sales force automation, and access to corporate databases and expertise.
4. **Price Subsystem:**
   - Pricing decisions receive support from decision support systems (DSSs) and access to databases containing industry prices.
   - Pricing strategies range from profit maximization to market share expansion.
   - Information systems enable customer segmentation and dynamic pricing based on product-service combinations and transaction circumstances.
5. **Sales Forecasting:**
   - Sales forecasting, based on the planned marketing mix and outstanding orders, involves a combination of quantitative methods and human insight.
   - Qualitative techniques, such as group decision making, scenario analysis, and trend extrapolation, are used for environmental and sales forecasting.

Each marketing mix subsystem plays a crucial role in aligning marketing strategies with organizational goals, optimizing product offerings, pricing strategies, promotional activities, and distribution channels to meet customer needs and gain a competitive edge in the marketplace.

4.7 Quality Information System

Information is essentially interpreted data that conveys meaning. For instance, while a string of numbers like "1-212-290-4700" may seem arbitrary on its own, when presented as "Tel: +1-212-290-4700," it becomes recognizable as a telephone number. Further contextualization, such as "Address: 350 Fifth Avenue, 34th floor, New York, NY 10118-3299 USA Tel: +1-212-290-4700 Fax: +1-212-736-1300," transforms it into valuable information, specifically identifying the New York office of Human Rights Watch.

From the perspective of a system analyst, information consists of symbol sequences that convey meaningful messages. An Information System is designed to gather data and disseminate information to users, aiming to provide them with valuable insights. Information systems can vary based on the specific users they serve.

A Management Information System (MIS) is a type of information system specifically tailored to evaluate, analyze, and process organizational data. Its primary objective is to generate meaningful and useful information to aid management in making informed decisions for the organization's future growth.

4.7.1. Information Definition:

"Information can be recorded as signs, or transmitted as signals. Information is any kind of event that affects the state of a dynamic system that can interpret the information.
Conceptually, information is the message (utterance or expression) being conveyed. Therefore, in a general sense, information is "Knowledge communicated or received, concerning a particular fact or circumstance". Information cannot be predicted and resolves uncertainty."

4.7.2. Information Vs Data:

Data can be characterized as unprocessed facts and figures devoid of any meaningful context. Simply put, raw data in its collected form lacks the capacity to facilitate decision-making. However, data serves as the fundamental raw material that undergoes organization, structuring, and interpretation to yield valuable information within systems.

In technical terms, data is delineated as "groups of non-random symbols in the form of text, images, or voice, representing quantities, actions, and objects." This definition encapsulates the various forms and manifestations that data can assume.

Information, on the other hand, represents interpreted data that has been processed, organized, and contextualized within a specific framework. It is derived from the structured manipulation of data to generate insights and intelligence.

According to Davis and Olson, this conceptualization highlights the transformative journey of data into actionable intelligence within information systems.

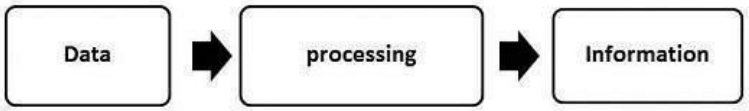


Fig 7.1: Information System

"Information is a data that has been processed into a form that is meaningful to recipient and is of real or perceived value in the current or the prospective action or decision of recipient."
Information, knowledge, and business intelligence form a hierarchical structure that guides our understanding of data processing and utilization. Professor Ray R. Larson from the University of California, Berkeley, outlines an Information Hierarchy as follows:

- **Data:** This represents the raw material from which information is derived.
- **Information:** Data that has been organized and presented in a meaningful manner.
- **Knowledge:** Information that has been comprehended and understood by an individual.
- **Wisdom:** The highest level of understanding, achieved through the integration and distillation of knowledge.

Scott Andrews further elucidates this concept through the Information Continuum:

- **Data:** Individual facts or pieces of information.
- **Information:** Knowledge extracted from data.
- **Business Intelligence:** Information management aimed at supporting an organization's decision-making processes, particularly concerning strategic or operational objectives.

Various techniques are employed to collect data, some of which include:

- **Surveys:** Questionnaires are used to gather data directly from the field.
- **Secondary Data Sources:** Data is obtained from existing records, publications, or digital sources such as company websites.
- **Objective Measures or Tests:** Experimental tests are conducted to collect data under controlled conditions.
- **Interviews:** System analysts collect data through structured interviews, following predefined questions and procedures.

4.7.3. Classification by Characteristic:

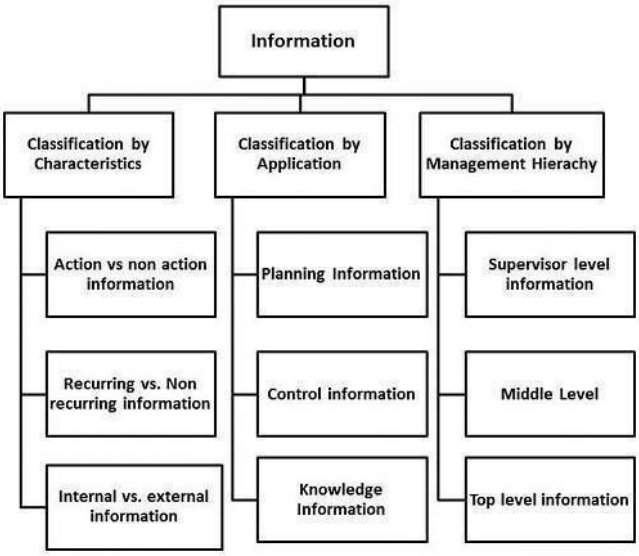
Anthony's classification of management provides a framework for categorizing information used in business decision-making into three main types:

1. **Strategic Information:** This type of information is essential for making long-term policy decisions that define the objectives of a business and assess how well these objectives are being achieved. Examples of strategic information include decisions regarding acquiring new plants, introducing new products, or diversifying business operations.
2. **Tactical Information:** Tactical information pertains to the data necessary for exercising control over business resources. It includes aspects such as budgeting, quality control, service levels, inventory management, and productivity levels.
3. **Operational Information:** Operational information focuses on plant- or business-level data and is utilized to ensure the smooth execution of specific operational tasks as planned. This category encompasses tasks such as quality control checks, which may be operator-specific, machine-specific, or shift-specific.

Additionally, information can be classified based on its application:

1. **Planning Information:** This type of information is used to establish standard norms and specifications within an organization. It aids in strategic, tactical, and operational planning by providing data such as time standards and design standards.
2. **Control Information:** Control information facilitates the establishment of control mechanisms over all business activities through feedback mechanisms. It helps in monitoring the attainment, nature, and utilization of important processes within a system, enabling corrective actions when deviations from established standards occur.
3. **Knowledge Information:** Knowledge information pertains to insights acquired through experience, learning, archival data, and research studies. It represents information about information and contributes to informed decision-making.
4. **Organizational Information:** This category encompasses information related to an organization's environment, culture, and objectives. It assists in reducing uncertainty within the organization by collecting, managing, and utilizing information effectively. Examples include employee and payroll information.
5. **Functional/Operational Information:** Functional or operational information is task-specific and internal to the organization. It includes details such as daily schedules in manufacturing plants or duty rosters for personnel in service-oriented businesses.

6. **Database Information:** Database information refers to large quantities of data stored,



retrieved, and managed for multiple uses and applications. Examples include material

Fig: specifications and supplier information stored within databases for various users.

4.7.4. Classification by Application:

Information processing is undeniably the dominant industry of the present century, with several factors reflecting the needs and objectives of information processing:

1. **Increasing Impact on Organizational Decision Making:** Information processing plays a crucial role in organizational decision-making processes.
2. **Dependency of Service Sectors:** Sectors such as banking, finance, healthcare, entertainment, tourism, education, and more heavily rely on information processing.
3. **Shift in Employment Trends:** There's a noticeable shift from manual labor in agriculture to machine-based manufacturing and other industry-related jobs.
4. **Information Revolution:** The information revolution has significantly impacted overall development scenarios globally.
5. **Growth of IT Industry:** The IT industry's growth and strategic importance have been remarkable.
6. **Rise of Information Services:** Information services have experienced strong growth due to increased competition and reduced product life cycles.
7. **Need for Sustainable Development:** Information processing is crucial for achieving sustainable development and improving quality of life.

8. **Improvement in Communication and Transportation:** Information processing has facilitated improvements in communication and transportation networks.
9. **Environmental Impact:** Information processing aids in reducing energy consumption, pollution, and maintaining ecological balance.
10. **Diverse Applications:** From land record management to customer relationship management, information processing finds applications across various domains.

In summary:

- Information is essential for survival in the competitive modern world.
- Strong information systems are necessary for organizations to remain competitive and up-to-date.
- Information processing has transformed society, particularly in business operations and communication.

From a business perspective, the implications of information processing are vast:

- Automation of business processes and communication has led to greater efficiency.
- Business information systems encompass functionalities like data collection, transformation into useful information, data safeguarding, and reporting automation.

Five primary uses of information in business include:

1. **Planning:** Information is crucial for decision-making in planning, encompassing various aspects like business resources, market dynamics, technological advancements, etc.
2. **Recording:** Modern business operations involve recording information about transactions or events for regular updating and maintenance.
3. **Controlling:** Efficient information filtering ensures that only relevant data is presented to management, facilitating effective decision-making.
4. **Measuring:** Performance metrics are measured and analyzed using sales data, manufacturing costs, and profits earned.
5. **Decision-Making:** Management Information Systems (MIS) are vital for managerial decision-making, incorporating factors like competition, globalization, and organizational behavior.

The evolution of multi-dimensional information processing is rooted in logical foundations such as operations research, management science, computer science, networking, expert systems, artificial

intelligence, and information theory. These factors contribute to the acceleration of business events and enhance efficiency through direct and immediate system linkage, faster communication, electronic fund transfers, and solicited pricing determinations.

4.7.5. MIS Need for Information Systems:

Managers are tasked with making decisions, which typically follow a four-step process: recognizing the need for a decision or seizing an opportunity, generating alternative courses of action, evaluating these alternatives, and ultimately selecting the most suitable path for implementation.

Management Information Systems (MIS) play a crucial role in facilitating effective decision-making by providing managers with standardized reports and displays. These systems are designed to offer timely, relevant, and accurate information necessary for managerial decision-making. Data and information generated from accounting information systems are particularly valuable in this regard.

The goals of MIS include providing pre-specified and pre-planned reports to managers, offering interactive and ad-hoc decision-making support, and furnishing critical information for top management.

MIS holds significant importance for organizations due to several reasons:

1. Focus on Decision Making: MIS emphasizes aiding managerial decision-making rather than merely processing data from business operations.
2. Systems Framework: It underscores the importance of employing a systematic framework for organizing information systems applications.

4.9. Self-Assessment Questions:

1. How does management use information systems to support the sales and marketing function of a business? How do these systems make the manager more effective in this area than paper-and-pencil systems?
2. Though there are few truly digital firms extant today, there is an emerging sense of what is required to create one. List and discuss at least three of the ways in which a digital firm is different from a traditional one, using an existing company you consider close to being a fully-digital firm as an example.
3. Define and describe data warehouses, data marts, and data mining. What is the major concern connected with the use of these tools?

4. Explain Financial Forecasting
5. Describe Financial Forecasting
6. Describe Geographical Information Systems
7. How do you solve problems in a GIS?
8. How does Geographic Information Systems capture real world features?
9. What Can GIS Do For You?
10. Why GIS is not going away anytime soon
11. Describe Human Resource Information Systems
12. Differentiate between Transaction Processing Subsystems and Databases of Human ResourceDescribe Information Systems
13. Describe Inventory Information Systems
14. Describe Perpetual Inventory System
15. Describe Periodic Inventory System
16. Describe Barcode Inventory Systems
17. Describe Radio Frequency Identification (RFID) Inventory Systems
18. Describe Manufacturing Information System
19. Describe Marketing Information System
20. Describe Quality Information System
21. Describe classify information. By characteristics , by application
22. list summarizes the five main uses of information by businesses and otherorganizations:
23. Describe MIS Need for Information Systems

Unit - 5

MIS Development Model

Learning Objective:

After completing this unit you will be able to

- Explain the meaning and understanding of MIS development
- Explain the meaning and understanding of system development, system development model
- Narrate using of system development model

Structure

5.1 MIS Development

5.2 Principals Of System Development

5.3 System Development Models

5.4 Uses Of System Development Model

5.5 Summary

5.6 Self-Assessment Questions

5.1 MIS DEVELOPMENT

System development life cycle is used in system engineering which helps in defining a process in testing, planning, creating, deploying an information system. Like any other product development used in business organizations, system development requires careful analysis and design before implementation. System development generally has the following phases:

5.1.1. Planning and Requirement Analysis

The project planning part involves the following steps: Reviewing various project requests

- Prioritizing the project requests
- Allocating the resources
- Identifying the project development team

The techniques used in information system planning are:

- Critical Success Factor
- Business System Planning
- End/Mean Analysis

The requirement analysis part involves understanding the goals, objectives, processes and the constraints of the system for which the information system is being designed.

It is basically an iterative process which includes systematic investigation of the processes and requirements. Various diagramming techniques are used which are created by the analyst in a blue print format. Those are in the form of:

- Data flow diagrams
- Context diagrams

Requirement analysis has the following sub-processes:

- Conducting preliminary investigation
- Performing detailed analysis activities
- Studying current system
- Determining user requirements
- Recommending a solution

5.1.2. Defining Requirements

The requirement analysis stage generally completes by creation of a 'Feasibility Report'. This report contains:

- A preamble
- A goal statement
- A brief description of the present system
- Proposed alternatives in details

The feasibility report and the proposed alternatives help in preparing the costs and benefits study.

Based on the costs and benefits, and also taken into consideration of all problems that may be face due to human, organizational or technological bottlenecks, the best alternative is to be chosen by the end- users of the system in order to solve the problem.

5.1.3. Designing System Architecture

System design specifies how the system will accomplish this objective. System design consists of both logical design and physical design activity, which produces 'system specification' satisfying system requirements developed in the system analysis stage.

In this stage, the following documents are prepared:

- Detailed specification
- Hardware/software plan

5.1.4. Building or Developing the System

The most creative and also challenging phase of the system life cycle is designing the system, which refers to the technical specifications that will be applicable in implementing the candidate system. It also involves the construction of programmers and program testing.

It has the following stages:

- Acquiring hardware and software, if necessary
- Database design
- Developing system processes
- Coding and testing each module

The final report includes procedural flowcharts, record layout, report layout and plan for implementing the candidate system. Information on personnel, money, hardware, facility and their estimated cost must also be provided. At this point projected cost must be close to actual cost of implementation.

5.1.5. Testing the System

System testing is a type of test plan that contains several key activities and steps for programs, strings, system, and user acceptance testing. The system performance criteria deals with turnaround time, backup, file protection and human factors.

5.1.6. Testing process focuses on both:

The internal logic of the system/software, ensuring that all statements have been tested;

The external functions, by conducting tests to find out the errors and to ensure that the required input will actually produce output results.

In some cases, a 'parallel run' of the system is performed, where both the current and the proposed system are used to run in parallel for a specified period of time and the current system is used to validate the proposed system.

5.1.7. Deployment of the System

When the system is put into production stage, it is used by the end-users. Sometimes, this system is put into Beta stage where feedback of the users is received and depending upon the feedback; the system is corrected or improved before a final release or official release of the system.

5.1.8. System Evaluation and Maintenance

Maintenance is very important to delete the errors in the working system throughout its working life and need to tune the system to any variation in its working environment. Frequently, small system deficiencies are found, whenever the system is brought into operation and to remove them certain changes has to be made. System planner must always plan for availability resources to carry on these maintenance functions.

5.1.9. System Development Models

The system-development life cycle enables users to transform a newly-developed project into an operational one.

The System Development Life Cycle, 'SDLC' for short, is a multistep, iterative process, structured in a methodical way. This process is used to model or provide a framework for technical and non- technical activities to deliver a quality system which meets or exceeds a business's expectations or manage decision-making progression.

Traditionally, the systems-development life cycle consisted of five stages. That has now increased to seven phases. Increasing the number of steps helped systems analysts to define clearer actions to achieve specific goals.

Similar to a project life cycle (PLC), the SDLC uses a systems approach to describe a process. It is often used and followed when there is an IT or IS project under development.

The SDLC highlights different stages (phrases or steps) of the development process. The life cycle approach is used so users can see and understand what activities are involved within a given step. It is also used to let them know that at any time, steps can be repeated or a previous step can be reworked when needing to modify or improve the system.

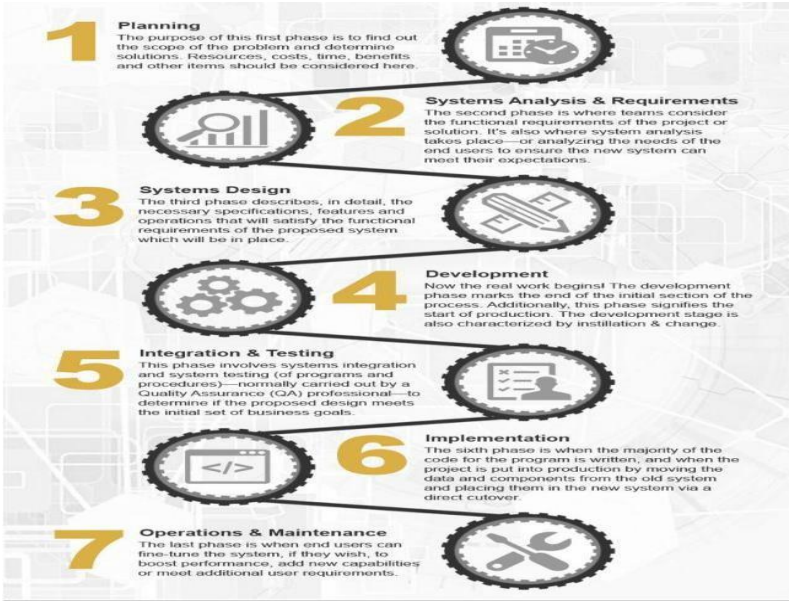


Fig:5.1 Seven Phases of the System Development Life Cycle

5.1.10. Seven Phases of the System Development Life Cycle

1. Planning

This is the first phase in the systems development process. It identifies whether or not there is the need for a new system to achieve a business's strategic objectives. This is a preliminary plan (or a feasibility study) for a company's business initiative to acquire the resources to build on an infrastructure to modify or improve a service. The company might be trying to meet or exceed expectations for their employees, customers and stakeholders too. The purpose of this step is to find out the scope of the problem and determine solutions. Resources, costs, time, benefits and other items should be considered at this stage.

2. Systems Analysis and Requirements

The second phase is where businesses will work on the source of their problem or the need for a change. In the event of a problem, possible solutions are submitted and analyzed to identify the best fit for the ultimate goal(s) of the project. This is where teams consider the functional requirements of the project or solution. It is also where system analysis takes place or analyzing the needs of the end users to ensure the new system can meet their expectations. Systems analysis is vital in determining what a business's needs are, as well as how they can be met, who will be responsible for individual pieces of the project, and what sort of timeline should be expected.

There are several tools businesses can use that are specific to the second phase. They include:

- CASE (Computer Aided Systems/Software Engineering)
- Requirements gathering
- Structured analysis

3. Systems Design

The third phase describes, in detail, the necessary specifications, features and operations that will satisfy the functional requirements of the proposed system which will be in place. This is the step for end users to discuss and determine their specific business information needs for the proposed system. It's during this phase that they will consider the essential components (hardware and/or software) structure (networking capabilities), processing and procedures for the system to accomplish its objectives.

4. Development

The fourth phase is when the real work begins in particular, when a programmer, network engineer and/or database developer are brought on to do the major work on the project. This work includes using a flow chart to ensure that the process of the system is properly organized. The development phase marks the end of the initial section of the process. Additionally, this phase signifies the start of production. The development stage is also

characterized by instillation and change. Focusing on training can be a huge benefit during this phase.

5. Integration and Testing

The fifth phase involves systems integration and system testing (of programs and procedures) normally carried out by a Quality Assurance (QA) professional to determine if the proposed design meets the initial set of business goals. Testing may be repeated, specifically to check for errors, bugs and interoperability. This testing will be performed until the end user finds it acceptable. Another part of this phase is verification and validation, both of which will help ensure the program's successful completion.

6. Implementation

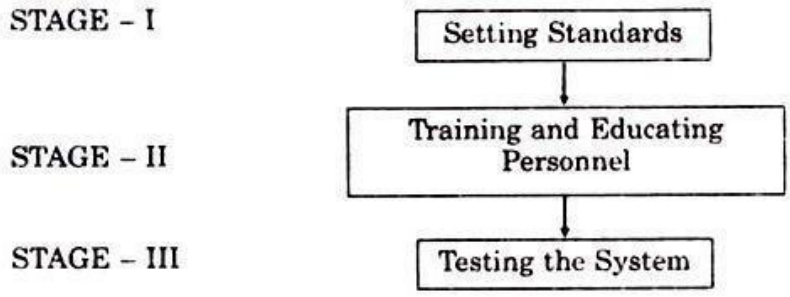
The sixth phase is when the majority of the code for the program is written. Additionally, this phase involves the actual installation of the newly-developed system. This step puts the project into production by moving the data and components from the old system and placing them in the new system via a direct cutover. While this can be a risky (and complicated) move, the cutover typically happens during off-peak hours, thus minimizing the risk. Both system analysts and end-users should now see the realization of the project that has implemented changes.

7. Operations and Maintenance

The seventh and final phase involves maintenance and regular required updates. This step is when end users can fine-tune the system, if they wish, to boost performance, add new capabilities or meet additional user requirements.

3 Main Stages for the Development of MIS:

The three main stages for the development of MIS as per modular approach,



1. Setting Standards:

The set of rules the programmers use is called standards. They follow strict rules for writing modules.

The chief programmer of the programmers' team manages all the technical aspects of the project, like preparation of the program design and supervision of all coding, testing and documentation.

The chief programmer is supported by a leading assistant who acts as the main backup person on the project. He communicates with everyone else on the team and acts as 'sounding board' for the programmer's ideas. These two persons are supported by the other following personnel depending on the size of the project.

- **Administrator**

The administrator handles all non-technical support details such as budgets, personnel matters and interacts with the rest of the organization's bureaucracy.

- **Editor**

Editor is responsible for editing the documentation and for overseeing all phases of documentation reproduction and distribution.

- **Tool smith**

Tool smith is a programmer who writes special programs to interface with the operating system software.

- **Tester**

Tester makes up test data for individual programs and systems testing.

- **Language specialist**

Language specialist understands all the syntax of a language and acts as a consultant for several chief programmers. They also may write small programs that demand a high level of expertise in programming language.

- **Program clerk**

Program clerk keeps track of all technical records for the programming team and also does all the secretarial duties needed by the programming team.

Program walkthrough is imposed as a next step in which omissions, errors, bad logic, improper language usage of faulty program constructions are detected. This is done by team members of information's processing facility's staff such as systems analyst, programmers and operations personnel. They record the errors and report to the programmers whose responsibility is to correct them.

- **Training and Educating Personnel:**

The two broad categories of people who should receive education and training are:

- **Users of information**

User of information includes general management staff and in various functional areas like sales people, accountants, production schedules. This, type of massive education is always eliminated by the systems personnel on the grounds of being too expensive, but in reality there are benefits of such education.

The system analysts should realize that most of the potential users of the system have spent little time in thinking about the new system in contrast with system analyst who has spent several months in thinking about the new system. He can teach the users as part of the system's implementation process. He can also prepare well thought-out educational plans to the management.

- **Operating personnel**

It includes all individuals involved in preparing input, processing data and operating and maintaining both the logical and physical components of the system. Initially, the operating personnel are trained to run the new system. Later they are trained on a continuing basis as the system is modified.

The training methods used by the system analysts include:

- **Seminars and group instruction**

  This holds good in large organizations where many people perform the same task and the system analyst can teach many people at the same time.

- **Procedural training**

  Procedural training provides an individual with the written procedures as a primary method of learning. It provides them to ask questions and face the problems concerning the procedure.

- **Tutorial training**

  This training is expensive which is more personal and gives a satisfactory understanding.

- **Simulation**

  This is an important training technique as it reproduces data, procedures allowing the individual to perform the proposed activities and is an expensive training method.

- **On-the-Job Training**

  On the job training is a popular and common method of training where in the operating personnel is put to work with specific instructions on simple task on what is to be done and how it is to be done.

- **Information Centre**

  Information Centre is an effective approach to training and guiding the users. The attitude of the information center staff should be 'What can they do to help the user?' It encourages the user to expand and explore the information system's benefits and services and to show the user to solve their own problems. To determine training requirements, a list of all the tasks required by the new system and the skills needed to perform them is prepared. Later, an inventory of skills is prepared. The difference between these lists will give the list of the number of skilled personnel to be trained.

- **Testing the System:**

  The goal of testing is to verify the logical and physical operation of all building blocks to determine that they operate as intended. Most of the testing will be done during training. If input is done by a point-of-sale (POS) device, i.e., a simple sample of products is selected and the reader has to determine the corrections of price and description.

  If data are entered by a keyboard, it is displayed on the monitor (CRT) which should have a proper layout without unnecessary data.

  A program can be tested in two ways. One way is the walk through of the program in which the tester plays the role of a computer. The other way is to install the program on the computer and test it against a combination of test transactions. The output resulted from the input are reviewed for accuracy.

  The output format should be understandable to a person who is not involved in the system. The technical tests include checking for proper headings, edited amounts, correct page number, clear end- of-reports. The computer must be able to process the variety of jobs that make up the total system.

The tools to do the test are: Job Accounting System

Job Accounting System is used to test the design efficiency, planning capacity etc. The system management facility (SMF) of

IBM's indicates the amount of available space on direct access storage devices and gives the basic error statistics.

- **Hardware Monitor**

Hardware Monitor measure CPU active, CPU wait, disk seek, tape reel, disk data transfer and internal memory timings and utilization. The purpose of using a hardware monitor is to match the horse power of the computer to the demands of the information systems.

- **Software Monitor**

Software Monitor is a program that resides in the computer system to measure the operating systems, support software and application programs. Compilers, communication programs and utilities are i.e., of support systems. Application programs are measured to determine resources utilization like the amount of time a program used each resource such as internal memory, disk and tape. It can isolate heavy paging areas in virtual storage system.

- **Performance Utilities**

Virtually Storage Code Reorganizers reduce resources used in paging. Code Optimizers reduce resources consumption by eliminating unnecessary program statements. Schedulers help in timing and balance of job mix.

An organization's data base is one of the most important resources. The data should be secure, accurate and private. By the output, the data base can be tested for its users' conditions are properly placed or not. The test transactions helps in testing the reasonable checks, arithmetic proof and identification are in correct place and working correctly.

For example some of the test transactions prepared by clerks and terminal operators for special processing not only test the programs and its ability to detect errors, but also check the way transactions are prepared and entered. The test team consists of users department managers, internal auditors and various system personnel.

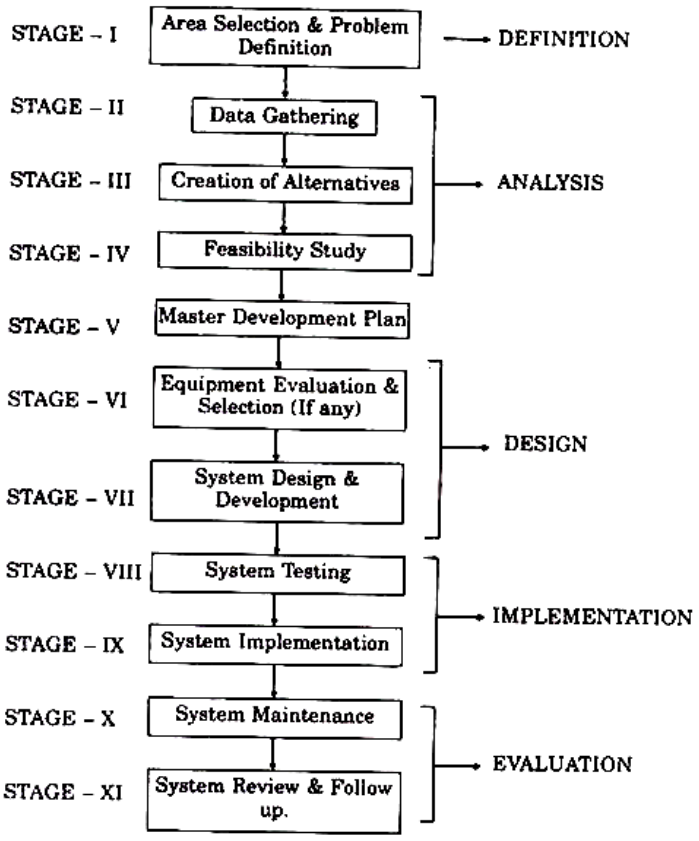
5.1.11. Top 10 Stages in System Development Life Cycle (MIS):

The stages are:

1. **Area Selection and Problem Definition (Preliminary Investigation)**

This is the first phase and consists of a brief survey of the area involved and will result in taking the project into the next phase, postponing development for a period or recommending that no further action be taken.

Sometimes, it is subdivided into a preliminary investigation (initial study) followed by a more detailed feasibility study.



The phase is initiated by management, who perceive the need because of changes or expected champs in the business environment, initiations or failure of existing systems, or the awareness of

technological advances relating to the particular area involved in particular systems which competitors are developing.

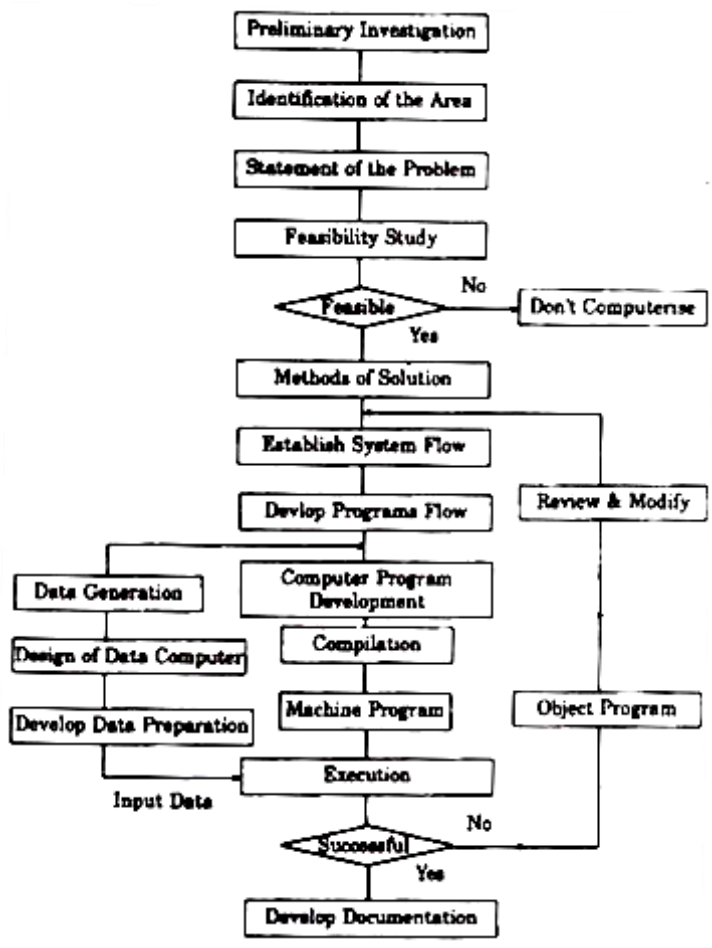
2. Data/Information Gathering

Data gathering refers to the collection of information pertinent to systems project. To get information, the analyst may read books or reports, go through records, collect forms for later analysis, or interview people. Interviewing is an important skill for the analyst who may interview managers, workers, sometimes even customers.

Often, some of the most important information comes from the low-level employees (the workers).

Sources of information:

Information is gathered from two principal sources. The sources are as follows: From the organization's environment. Personnel or written documents from within the organization.



The primary external sources are:

- Government documents
- Vendors
- Newspapers and professional journals.

The primary internal sources are:

- Personnel staff
- Financial reports
- System documentation of manuals
- Reports and transaction documents
- Professional staff (legal counsel, EDP (electronic data processing) auditor etc.
- The user staff.

Hardware vendors are the source of information about the system and the software. There are thousands of software packages on the market for saving the problem area and these software's are used after the reasonable modifications. The information of these packages is already sold by the hardware vendors.

The second other external source of information is government documents, technical newspapers and professional journals. They provide weekly information about new hardware, hard ware installations, software developments etc.

Internal sources of information are limited to the user staff or user. User personnels are very wide source of the information, is the key employees who have been in the user area for years and are familiar with present activities and applications, as later we collect the information from the historical and sensitive documents.

In some cases, that is the only source available to the analyst. As information is collected, the analyst will document the important aspects so it can be referred to later on. For this purpose he may use forms, charts or tables.

- **The principal methods of obtaining facts include:**

Observing the activities which can be performed in a number of ways including visual and photographic methods:

- Use of questionnaires or by inspection and examination.
- Interviewing personnel.

3. Creation of Alternatives

Once, the analyst has a clear idea of the problems, he begins to create some possible solutions. In actual practice, these solutions usually begin to form while the initial research (data gathering) is going on. Then, after completing the research, the analyst chooses the most promising alternatives and develops them.

In order to create sound alternatives, the analyst, must have a broad background, must be familiar with the many different types of equipment that can be applied to the problem, and must be familiar with the various types of procedures, that can be used.

From this background he can develop an alternative similar to one that some other company or group is using or can create a special or unique solution to his company's problem.

It is important to realise that the solutions at this stage are not developed in detail. The procedures developed here are not specific. Although a general logic flow is created for each alternative, specific steps will be determined during the system design phase.

Unless the problem is quite limited, analysts should try to develop more than one alternative. This will give them the freedom to explore imaginative solutions rather than talking only the quick and obvious one. It will also give management a broader perspective on the range of available solutions.

4. Feasibility Study

Once the alternatives are finding out or designed, the analyst makes the feasibility study. Formulating a statement about the objectives of the problems. Analysis of existing system which includes data gathering, data presentation, making list of files and records required, communication requirements, preparation of flow charts and cost estimates.

Analysis of alternatives meeting similar requirements for each alternative proposed.

- Determining the main output requirements.
- Study the effects on company operations.
- Financial effect.
- Summary of the intangible losses and benefits that would flow from the adoption of the system.
- A recommendation to proceed.

The data collection that occurs during preliminary investigation examines system feasibility, the likelihood that the system will be beneficial to the organization.

- **The four tests of feasibility are:**
  1. **Operational Test**
  2. **Economic Test**
  3. **Technical Test**
  4. **Political Test**

5. Master Development Plan

It is a sort of blue print of the system development effort. In a dynamic organization, there are more opportunities for computer processing applications that can be handling at one time, necessitating an allocation process. Thus, master development plan is required. It is a schedule of various applications to be computerized.

Such a plan consists of following four stages:

The objectives of the proposed systems' development efforts are elicited by the analyst.

Current capabilities of the organization are appraised by the analyst. This appraisal will cover the existing equipment, software applications and personal expenses, facility utilisation.

The analyst reviews the possible technological developments in the computer hardware.

Finally, the analyst compiles the specific plan which comprises a hardware and software schedule, application development schedule of software maintenance and conversion efforts, personnel resources plan and financial resources plan.

Master development plan basically is a schedule of various applications to be computerized, i.e., it consists of start and finish dates of systems' analysis, design, implementation and maintenance activities. This schedule is to be supported by Manpower, hardware and financial schedules.

6. Equipment Evaluation & Selection

At this stage, the system department may contact equipment vendors for information and prices concerning specific machines. When a systems' proposal involves major equipment purchases, this phase of the system development can be a major project in itself

If the machines can be purchased, leased or rented at a price that stays within the limits stated in the systems' proposal, the project continues as proposed, Otherwise the analyst may be forced to return to the feasibility and systems' proposal phases with the unexpected cost data.

A good analyst, however, will check prices and capabilities with several vendors during the feasibility analysis to make sure that the cost projections are reasonable. He will not only consider the cost at the time of the study but most likely price as well.

7. System Design & Development

The design of an information system produces the details that state how a system will meet the requirements identified during systems analysis. Often systems, specialists refer to this stage as logical design, in contrast to developing program software, which is referred to as physical design.

The system design also describes the data to be input, calculated or stored. Individual data items and calculations procedures are written in detail. Designers select file structures and storage devices, such as magnetic disk, magnetic tape, or even paper files. The procedures they write tell

how to process the data and produce the output.

The documents containing the design specifications use many different ways to portray the design charts, tables, and special symbols. The detailed design information is passed on to the programming staff so that software development can begin.

Designers are responsible for providing programmers with complete and clearly outlined specifications that state what the software should do. As programming starts, designers are available to answer questions, clarify fuzzy areas, and handle problems that confront the programmers when using the design specifications.

8. System Testing

The objective of system testing is to ensure that all individual programs are working as expected, that the programs link together to meet the requirements specified and to ensure that the computer system and the associated clerical and other procedures work together.

The initial phase of system testing is the responsibility of the analyst, who determines what conditions are to be tested, generates test data, produces a schedule of expected results, runs the tests and compares the computer-produced results with the expected results.

The analyst may also be involved in procedures testing. When the analyst is satisfied that the system is working properly, he hands it over to the users for testing. The importance of system testing by the user must be stressed. Ultimately, it is the user who must verify the system and give the go-ahead.

During testing, the system is used experimentally to ensure that the software does not fail, i.e., that it will run according to its specifications and in the way users expect it to work. Special test data is input for processing (test plan) and the results are examined to locate unexpected results. A limited number of users may also be allowed to use the system, so analysts can see whether they try to use it in unexpected ways.

It is preferable to find these surprises before the Organization implements the system and depends on it. In many organizations, testing is performed by persons other than those who write the original programs, using persons who do not know how certain parts were designed or programmed ensures more complete and unbiased testing and more reliable software.

9. System Implementation

As the system is tested it starts to move into the implementation phase. Ideally, the system should be completed and fully tested before implementation gets under way but unless a package is being

installed this seldom happens. Normally, when happens is that parts of the system which are required for file set up, are completed first and this process gets under way.

Conversion programs may also have to be available which allow data from another system to be used in setting up the files. Once this data is set up, it's must be kept up-to-date, and, thus, the first use is made of the new system. This may be followed by a period of parallel running and then a decision is made to drop the old system. As soon as the first phase of implementation—files set up-starts, all system documentation should be available, viz. user manual procedure manuals, computer operating instructions and security procedures.

The system then passes from the development staff to the computer operations personnel and once the system is live, strict procedures should be enforced governing programmer, access to programs and files. Procedures should be established to control all requests for system and program changes, from the request by the user to the implementation by the programmer.

10.System Maintenance:

Implementation involves placing the completed and tested system of hardware and software into the actual work environment of the users. When systems personnel check out and put new equipment into use, train user personnel, install the new application, and construct any files of data needs to use it, we say it is implemented.

There are both technical and people-oriented activities during this stage. Examples of technical activities include converting data files, replacing old programs with new ones, and scheduling computer operations. Examples of people oriented activities include orientation, training and support.

11.System Review & Follow up

The last phase of the development or implementation process is the review of the system or „post audit' as it is sometimes called.

This is usually carried out by a group consisting of a representative from the user department, internal audit and data processing. Its basic purpose is to see if the system has met the objectives set for it.

This will comprise a comparison of actual costs and benefits against the original estimates, a

review of how will the system is performing generally, a review of requests for changes and an examination of documentation, control and security procedures and back-up arrangements.
The review stage examines how the system developments, process was conducted.

- **The following two major questions are asked:**
    - Is the systems itself proper?
    - Was the system developed properly?

To decide, if the system itself is proper, the user must be consulted to find out if the system is providing the information they need, in the correct form. To determine if the system was developed properly, reviewers might look at how well the system is working, how much time the programmer and analyst spent in developing the system, and whether the system development was concluded on schedule.

5.3 System Development Models:

1. RAPID Application Development:

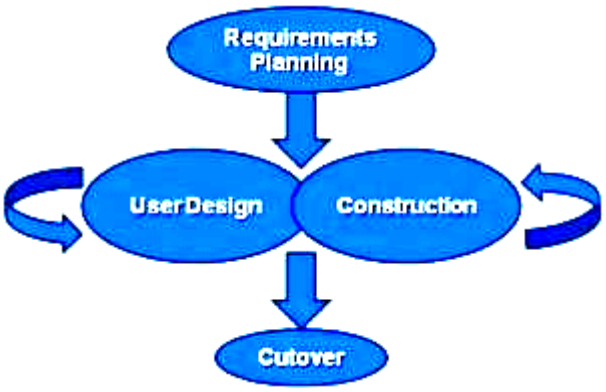


Fig: The RAD methodology (Public Domain)

Rapid Application Development (RAD) is a methodology in software development that emphasizes the quick creation of a functional software model, gathering user feedback, and using that feedback to refine the model through iterative development. The RAD methodology typically involves four phases:

1. Requirements Planning: Similar to the preliminary-analysis, system-analysis, and design phases of the SDLC, this phase defines the overall requirements for the system, identifies the project team, and assesses feasibility.
2. User Design: During this phase, representatives of the users collaborate with system analysts, designers, and programmers to iteratively design the system. Joint Application

Development (JAD) sessions facilitate structured discussions among stakeholders, including application developers who observe and understand the requirements.

3. Construction: Application developers, working closely with users, build the next version of the system through an interactive process. This phase runs concurrently with the User Design phase, allowing for changes to be made dynamically until an acceptable version of the product is achieved.
4. Cutover: Similar to the implementation step in the SDLC, this phase involves transitioning the system from the previous state to the new one, ensuring all necessary steps are completed for the system to go live.

Compared to the Systems Development Life Cycle (SDLC), RAD is more streamlined, with several steps combined to focus on user participation and iteration. RAD is particularly suited for smaller, resource-efficient projects that require rapid development and frequent user feedback. In contrast, SDLC is better suited for large, resource-intensive projects that require thorough documentation and attention to detail. RAD's iterative approach allows for flexibility and responsiveness to user needs throughout the development process.

2. Agile Methodologies

Agile methodologies represent a collection of approaches in software development that prioritize incremental changes with a strong emphasis on quality and attention to detail. Each increment is released within a predefined time frame, referred to as a "time box," establishing a regular release schedule with specific objectives. Although distinct from RAD, agile methodologies share common principles such as iterative development, user interaction, and adaptability to change. The foundation of agile methodologies lies in the Agile Manifesto, initially introduced in 2001.

Key characteristics of agile methods include:

- Utilization of small cross-functional teams comprising development team members and users.
- Conducting daily status meetings to discuss the current state of the project.
- Implementation of short time-frame increments, typically ranging from days to one or two weeks, for completing each change.
- Completion of a working project at the end of each iteration, demonstrating progress to stakeholders.

3. Lean Methodology

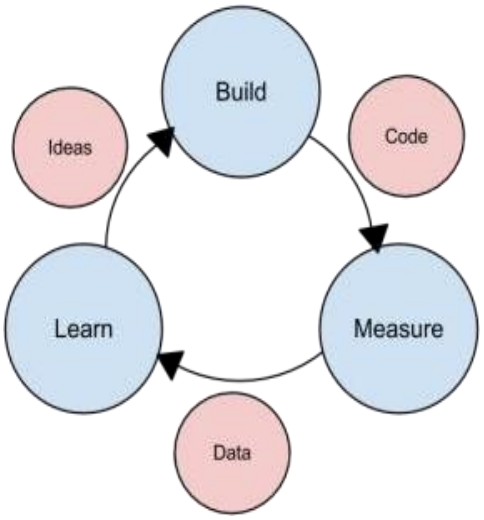


Fig: The lean methodology

The Lean Startup methodology, as introduced by Eric Ries in his bestselling book, emphasizes the development of a minimum viable product (MVP) to validate initial ideas. The core concept involves creating a working software application with minimal functionality to demonstrate the project's underlying idea. Once the MVP is ready, it is distributed to potential users for review, gathering feedback through direct interaction and usage statistics.

Feedback obtained from users is then utilized to assess whether to proceed with the existing direction or to pivot, which involves rethinking the core idea, modifying functionalities, and creating a new MVP. This iterative process continues with several iterations of the MVP, incorporating new features based on user feedback, until a final product is achieved.

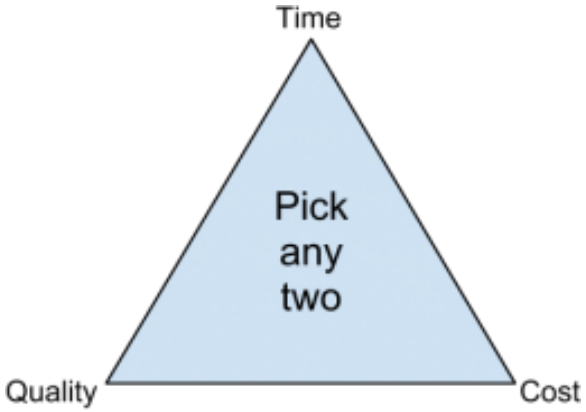


Fig: Sidebar: The Quality Triangle

In software development, a fundamental tension exists between developers and various stakeholder groups, including management, users, and investors. This tension revolves around the tradeoffs between time, cost, and quality—the three key factors in any development project. The quality triangle concept suggests that only two of these factors can be prioritized at the expense of the third.

5.4 Uses of System Development Models:

Programming languages serve as the foundational tools for software development, offering programmers a structured means to communicate logic in a format executable by computer hardware. Over time, various programming languages have emerged to cater to diverse needs, categorized based on their "generation."

Early programming languages were often tied to specific hardware architectures, necessitating different low-level languages for each type of computer hardware. These early languages required programmers to input highly specific instructions line by line, a laborious process. While contemporary programming languages still exhibit differences at the lower level, higher-level languages have obscured many of these distinctions.

- First-generation languages are called machine code. In machine code, programming is done by directly setting actual ones and zeroes (the bits) in the program using binary code. Here is an example program that adds 1234 and 4321 using machine language:

  10111001 00000000
  11010010 10100001
  00000100 00000000
  10001001 00000000
  00001110 10001011
  00000000 00011110
  00000000 00011110
  00000000 00000010
  10111001 00000000
  11100001 00000011
  00010000 11000011
  10001001 10100011
  00001110 00000100
  00000010 00000000

- Assembly language is the second-generation language. Assembly language gives english-like phrases to the machine-code instructions, making it easier to program. An assembly-language program must be run through an assembler, which converts it into machine code. Here is an example program that adds 1234 and 4321 using assembly language:

  MOV CX,1234 MOV DS:[0],CX MOV CX,4321 MOV AX,DS:[0]
  MOV BX,DS:[2] ADD AX,BX MOV DS:[4],AX

- Third-generation languages are not specific to the type of hardware on which they run and are much more like spoken languages. Most third-generation languages must be compiled, a process that converts them into machine code. Well-known third-generation languages include BASIC, C, Pascal, and Java. Here is an example using BASIC:

  A=1234 B=4321 C=A+B END

- Fourth-generation languages are a class of programming tools that enable fast application development using intuitive interfaces and environments. Many times, a fourth-generation language has a very specific purpose, such as database interaction or report-writing. These tools can be used by those with very little formal training in programming and allow for the quick development of applications and/or functionality. Examples of fourth-generation languages include: Clipper, FOCUS, FoxPro, SQL, and SPSS.

Sometimes, a combination of higher- and lower-level languages are mixed together to get the best of both worlds: the programmer will create the overall structure and interface using a higher-level language but will use lower-level languages for the parts of the program that are used many times or require more precision.

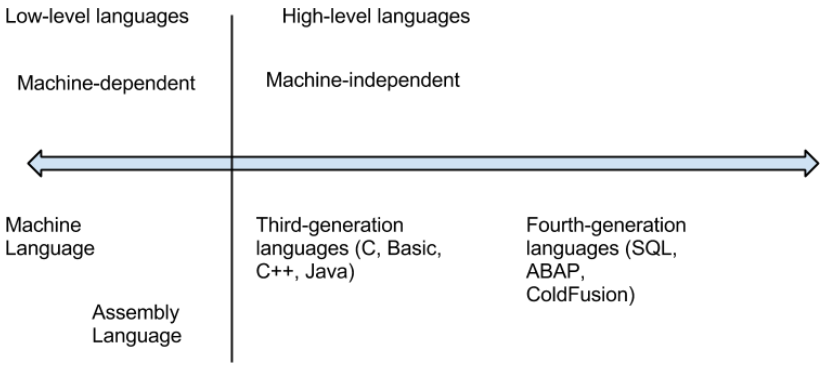


Fig: The programming language spectrum

5.4.1. Compiled vs. Interpreted:

Besides categorizing programming languages by generation, they can also be classified based on whether they are compiled or interpreted. In compiled languages, the code is translated into machine-readable form, known as an executable, which can directly run on the hardware. Examples of well-known compiled languages include C, C++, and COBOL.

On the other hand, interpreted languages require a runtime program for execution. This runtime program interprets the code line by line during runtime. While interpreted languages are generally easier to work with, they tend to be slower and demand more system resources. Popular interpreted languages include BASIC, PHP, PERL, and Python. Additionally, web languages such as HTML and JavaScript are considered interpreted because they require a browser to run.

The Java programming language presents an exception to this classification, functioning as a hybrid of compiled and interpreted languages. Java programs are partially compiled into bytecode, which is understandable by the Java Virtual Machine (JVM). Each operating system has its own JVM, allowing Java programs to run across various platforms.

5.4.2. Procedural vs. Object-Oriented

A procedural programming language is structured to enable a programmer to define a specific starting point for the program and execute commands sequentially. This approach characterized early programming languages. However, as user interfaces became more interactive and graphical, programming languages evolved to allow users to define the flow of the program.

In contrast, object-oriented programming (OOP) focuses on defining 'objects' that can perform actions based on user input. In an OOP paradigm, the emphasis shifts from the sequence of activities to the manipulation of different items or objects. For instance, in a human-resources system, an 'EMPLOYEE' object may be created to manage employee-related data. This object would have properties such as 'Name', 'Employee number', 'Birthdate', and 'Date of hire'. Additionally, objects have associated 'methods' that perform actions related to the object. For example, an 'EMPLOYEE' object might have methods like 'ComputePay()' to calculate the current amount owed to the employee and 'ListEmployees()' to retrieve a list of employees reporting to a specific employee.

Object: EMPLOYEE Name Employee number Birthdate Date of hire	
ComputePay() ListEmployees()	

Figure: An example of an object

Sidebar: What is COBOL?

If you've been involved in business programming, you've likely encountered the COBOL programming language. COBOL, a procedural and compiled language, was originally developed in 1959 for use on large mainframe computers. Its name stands for "common business-oriented language." While it was once the primary language for business applications, more efficient programming languages have largely supplanted COBOL, relegating it to legacy applications.

- **Programming Tools**

To write a program, a programmer typically needs little more than a text editor and a solid idea. However, productivity can be greatly enhanced with additional tools, such as an integrated development environment (IDE) or computer-aided software engineering (CASE) tools.

Integrated Development Environment

An IDE provides various tools for programmers, including:

- An editor for writing code, often with features like syntax highlighting.
- A help system offering detailed documentation about the programming language.
- A compiler or interpreter to run the program.
- Debugging tools to identify and resolve issues in the code.
- Version control mechanisms for team collaboration on projects without overwriting each other's changes.

Microsoft's Visual Studio is among the most popular IDE software packages, supporting a range of Microsoft programming languages like Visual Basic, Visual C++, and Visual C#.

CASE Tools

CASE tools enable software development with minimal or no programming. Instead, designers can create software using these tools, which then generate the necessary code. While CASE tools come in various forms, their primary aim is to produce quality code based on input from the designer.

Building a Website

In the early days of the World Wide Web, creating a website necessitated knowledge of hypertext markup language (HTML). Today, while a variety of tools are used to build websites, the final output transmitted to a browser is still HTML. HTML, a text-based language, allows users to define different components of a web page using tags enclosed in angle brackets. For instance, HTML tags can specify headings, emphasize text, create hyperlinks, or insert images.

```
<h1>This is a first-level heading</h1>
Here is some text. <em>Here is some emphasized text.</em>
<h2>Here is a second-level heading</h2>
Here is some more text.
```

Fig: Simple HTML

This is a first-level heading

Here is some text. *Here is some emphasized text.*

Here is a second-level heading

Here is some more text.

Fig: Simple HTML output

While HTML is used to define the *components* of a web page, cascading style sheets (CSS) are used to define the *styles* of the components on a page. The use of CSS allows the style of a website to be set and stay consistent throughout. For example, if the designer wanted all first-level headings (h1) to be blue and centered, he or she could set the 'h1' style to match. The following example shows how this might look.

```
<style>
h1
{
color:blue;
text-align:center;
}
</style>
<h1>This is a first-level heading</h1>
Here is some text. <em>Here is some emphasized text.</em>
<h2>This is a second-level heading</h2>
Here is some more text.
```

Fig: HTML with CSS

Fig: HTML with CSS output

Combining HTML and CSS enables the creation of various formats and designs and has been widely embraced by the web-design community. HTML standards are established by the World Wide Web Consortium, with HTML 5 being the current version incorporating new standards for video, audio, and drawing.

Build vs. Buy Decision

Organizations faced with the need for new software must decide whether to build it internally or purchase it externally. This "build vs. buy" decision entails various considerations. Purchasing software is generally less expensive and quicker to implement, with tested and debugged solutions readily available. However, customization challenges and potential lack of differentiation from competitors are drawbacks.

Web Services

Web services, facilitated by cloud computing, offer licensed functions from external providers, simplifying the addition of functionality to websites. For instance, Google Maps API allows

embedding maps into applications. Web services blur the distinction between building and buying software, enabling companies to customize purchased systems to supplement their own.

End-User Computing

End-user computing involves departments developing department-specific applications, often by individuals with no formal programming training. While it accelerates software creation and brings development closer to users, it can lead to duplicated efforts and compatibility issues, necessitating management and guidelines from the IT department.

Building a Mobile App

Developing mobile applications shares similarities with traditional computer applications but requires adaptation for smaller screens and touch interfaces. While mobile apps offer access to device functionalities, they're costly and may only run on specific devices. Responsive design for websites, accommodating various screen sizes, is an alternative approach gaining popularity.

Implementation Methodologies

Organizations adopt various methodologies to implement new systems:

- Direct cutover: Abruptly switches to the new system, fast but risky.
- Pilot implementation: Introduces the new system to a subset of users first.
- Parallel operation: Runs old and new systems simultaneously for testing.
- Phased implementation: Gradually transitions from the old system to the new one.

The choice depends on system complexity and importance.

Change management is a crucial aspect of IT oversight, especially during the introduction of new systems and phasing out of old ones. Communication of proposed changes and planning to minimize their impact post-implementation are vital steps to ensure smooth transitions within the organization.

Maintenance Phase

After the introduction of a new system, it enters the maintenance phase, where it is actively used by the organization. Although development ceases, maintenance involves addressing bugs and

accommodating new feature requests. IT management must ensure that the system remains aligned with business priorities and functions optimally during this phase.

5.5 Summary

Software development encompasses various stages beyond mere programming. It involves formal methodologies like the SDLC, as well as agile or lean approaches. Programming languages have evolved from low-level, machine-specific codes to higher-level languages for diverse machine compatibility. Programmers typically utilize development tools with integrated components for efficiency. Some organizations opt to purchase third-party software instead of building their own to save costs and expedite implementation. End-user computing allows departments to develop software independently of the IT department. During software implementation, different methodologies are considered based on system complexity and importance.

5.6 Self-Assessment Questions:

1. Explain System Development Models
2. Describe Phases of the System Development Life Cycle
3. Explain Main Stages for the Development of MIS
4. Explain in brief Feasibility Study
5. Explain software testing
6. What are the steps in the SDLC methodology?
7. What is RAD software development?
8. What makes the lean methodology unique?
9. What are three differences between second-generation and third-generation languages?
10. Why would an organization consider building its own software application if it is cheaper to buy one?
11. What is responsive design?
12. What is the relationship between HTML and CSS in website design?
13. What is the difference between the pilot implementation methodology and the parallel implementation methodology?
14. What is change management?
15. What are the four different implementation methodologies?

Unit - 6

MIS development Requirements and Specifications

Learning Objective :

After completing this unit you will be able to

- Explain the meaning and understanding of **Requirements Analysis and Specification Process**
- Explain understanding of **System Requirements Specification**
- Explain understanding of **Structure of SRS Document and SRS validity**

Structure:

6.1 Introduction

6.2 Requirements Analysis and Specification Process

6.3 System Requirements Specification

6.4 Structure of SRS Document

6.5 SRS Validity

6.6 Summary

6.7 Self-Assessment Questions

6.1 Introduction

In MIS, the information is recognized as a major resource like capital and time. If this resource has to be managed well, it calls upon the management to plan for it and control it, so that the information becomes a vital resource for the system.

- The management information system needs good planning.
- This system should deal with the management information not with data processing alone.
- It should provide support for the management planning, decision making and action.
- It should provide support to the changing needs of business management. Major challenges in MIS implementation
- Accuracy of information.
- Reliability of information.
- Security and Authentication of the system.

6.1.1. Planning for MIS

MIS design and development process has to address the following issues successfully: There should be effective communication between the developers and users of the system.

There should be synchronization in understanding of management, processes and IT among the usersas well as the developers.

- Understanding of the information needs of managers from different functional areas andcombining these needs into a single integrated system.
- Creating a unified MIS covering the entire organization will lead to a more economical, fasterand more integrated system, however it will increase in design complexity manifold.
- The MIS has to be interacting with the complex environment comprising all other sub-systems in the overall information system of the organization. So, it is extremely necessary to understand and define the requirements of MIS in the context of the organization.
- It should keep pace with changes in environment, changing demands of the customers and growing competition.
- It should utilize fast developing in IT capabilities in the best possible ways.
- Cost and time of installing such advanced IT-based systems is high, so there should not be a need for frequent and major modifications.
- It should take care of not only the users i.e., the managers but also other stakeholders like employees, customers and suppliers.

Once the organizational planning stage is over, the designer of the system should take the following strategic decisions for the achievement of MIS goals and objectives:

- Development Strategy: Example - an online, real-time batch.
- System Development Strategy: Designer selects an approach to system development likeoperational verses functional, accounting verses analysis.
- Resources for the Development: Designer has to select resources.

Resources can be in-house verses externa

- Determining the optimum architecture of IS for serving the top priority applications.

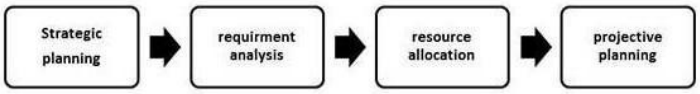


Fig 6.1: MIS Design

6.2 Requirements Analysis and Specification ProcessInformation System Requirements

The following diagram illustrates a brief sketch of the process of information requirement analysis:

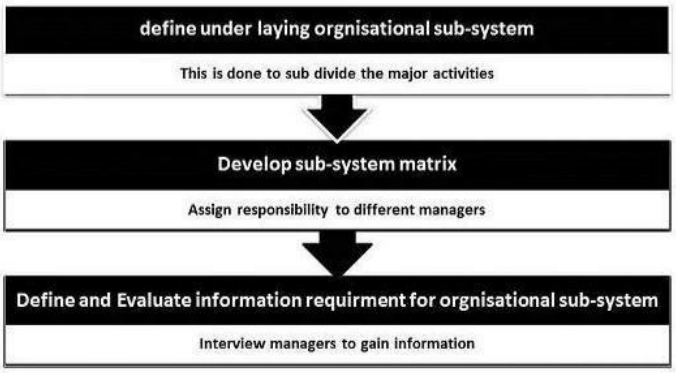


Fig 6.1: Process of Information Requirement

The following three methodologies can be adopted to determine the requirements in developing a management information system for any organization:

Business Systems Planning (BSP) - this methodology is developed by IBM.

- It identifies the IS priorities of the organization and focuses on the way data is maintained inthe system.
- It uses data architecture supporting multiple applications.
- It defines data classes using different matrices to establish relationships among the organization, its processes and data requirements.

Critical Success Factor (CSF) - this methodology is developed by John Rockart of MIT.

- It identifies the key business goals and strategies of each manager as well as that of thebusiness.
- Next, it looks for the critical success factors underlying these goals.
- Measure of CSF effectiveness becomes an input for defining the information system requirements.
- End/Means (E/M) analysis - this methodology is developed by Wetherbe and Davis at theUniversity of Minnesota

It determines the effectiveness criteria for outputs and efficiency criteria for the processes generatingthe outputs.

- At first it identifies the outputs or services provided by the business processes.
- Then it describes the factors that make these outputs effective for the user.

- Finally it selects the information needed to evaluate the effectiveness of outputs

6.2.1. System Requirements Specification Information System Analysis and Design

System analysis and design follows the typical System/Software Design Life Cycle (SDLC) as discussed in the previous chapter. It generally passes through the following phases:

- Problem Definition
- Feasibility Study
- Systems Analysis
- System Design
- Detailed System Design
- Implementation
- Maintenance

In the analysis phase, the following techniques are commonly used:

- Data flow diagrams (DFD)
- Logic Modeling
- Data Modeling
- Rapid Application Development (RAD)
- Object Oriented Analysis (OOA)

6.2.2. Technology for Information Systems

The technology requirement for an information system can be categorized as:

Devices

- **Data centre systems** - It is the environment that provides processing, storage, networking, management and the distribution of data within an enterprise.
- **Enterprise software** - These are software system like ERP, SCM, Human Resource Management, etc. that fulfil the needs and objectives of the organizations.
- **IT services** - It refers to the implementation and management of quality IT services by IT service providers through people, process and information technology. It often includes various process improvement frameworks and methodologies like six sigma, TQM and so on.
- **Telecom services**

6.2.3. System Test Planning and Execution

The system should be fully tested for errors before being fully operational. The test plan should

include for each test:

- Purpose
- Definition
- test inputs
- detailed specification of test procedure
- details of expected outputs

Each sub-system and all their components should be tested using various test procedures and data toensure that each component is working as it is intended.

The testing must include the users of the system to identify errors as well as get the feedback.

6.2.4. System Operation

Before the system is in operation, the following issues should be taken care of:

- Data security, backup and recovery;
- Systems control;
- Testing of the system to ensure that it works bug-free in all expected business situations;
- The hardware and software used should be able to deliver the expected processing;
- The system capacity and expected response time should be maintained;

The system should be well documented including;

- A user guide for inexperienced users,
- A user reference or operations manual for advanced users,
- A system reference manual describing system structures and architecture.

Once the system is fully operational, it should be maintained throughout its working life to resolve any glitches or difficulties faced in operation and minor modifications might be made to overcome such situations.

6.2.5. Factors for Success and Failure

MIS development projects are high-risk, high-return projects. Following could be stated as criticalfactors for success and failure in MIS development:

- It should cater to a specific, well-perceived business.
- The top management should be completely convinced, able and willing to such a system. Ideally there should be a patron or a sponsor for the system in the top management.
- All users including managers and other employees should be made an integral part of thedevelopment, implementation, and use of the system.

- There should be an operational prototype of the system released as soon as possible, to createinterest among the users.
- There should be good support staff with necessary technical, business, and interpersonalskills.
- The system should be simple, easy to understand without adding much complexity. It is abest practice, not to add up an entity unless there is both a use and user for it.
- It should be easy to use and navigate with high response time.
- The implementation process should follow a definite goal and time.
- All the users including the top management should be given proper training, so that they have a good knowledge of the content and function of the system, and can use it fully for various managerial activities such as reporting, budgeting, controlling, planning, monitoring, etc.
- It must produce useful outputs to be used by all managers.
- The system should be well integrated into the management processes of planning, decision- making, and monitoring.

6.3 System Requirements Specification

A product prerequisites detail (SRS) is a depiction of a product framework to be created. It is designed according to business necessities particular (CONOPS), otherwise called a partner prerequisites determination (SRS). The product prerequisites detail spreads out useful and non-useful prerequisites, and it might incorporate a lot of utilization cases that depict client connections that the product must give to the client to consummate communication.

Programming necessities particular sets up the reason for an understanding among clients and temporary workers or providers on how the product item should work (in a market-driven undertaking, these jobs might be played by the promoting and advancement divisions). Programming prerequisites particular is a thorough appraisal of necessities before the more explicit framework configuration stages, and its objective is to diminish later overhaul. It ought to likewise give a reasonable premise to evaluating item costs, dangers, and timetables. Utilized suitably, programming prerequisites determinations can help anticipate programming venture disappointment.

The product prerequisites detail archive records adequate and fundamental necessities for the venture development. To infer the necessities, the designer needs clear and careful comprehension of the items a work in progress. This is accomplished through point by point and

ceaseless interchanges with the venture group and client all through the product advancement process.

Structure

An example organization of an SRS is as follows:

- Purpose
  - Definitions
  - Background
  - System overview
  - References
- Overall description
  - Product perspective
    - System Interfaces
    - User interfaces
    - Hardware interfaces
    - Software interfaces
    - Communication Interfaces
    - Memory Constraints
  - Design constraints
    - Operations
    - Site Adaptation Requirements
  - Product functions
  - User characteristics
  - Constraints, assumptions and dependencies
- Specific requirements
  - External interface requirements
  - Functional requirements
  - Performance requirements
  - Logical database requirement
  - Software System Attributes
    - Reliability
    - Availability
    - Security
    - Maintainability
    - Portability.

- Functional requirements
  - functional partitioning
  - functional description
  - control description
- Environment characteristics
  - Hardware
  - peripherals
  - people
- Others.

6.4 Structure of SRS Document

Structure for writing Software Requirements Specification (SRS)

Software Requirements Specification (SRS) is a requirements specification for a software system, in other words it is a complete description of the behavior of a system to be developed. It is includes a set of use cases that describes the interactions between system actors (System Users) with the Software system. Also SRS contains list of functional and non-functional software requirements.

This document lists all necessary requirements for application development, so it is written after a meeting or detailed communication between project manager and customer. A general structure of an SRS will be as follows:

1. Introduction:

This part provides an overview of the SRS document, and it should contain all information needed by a software engineer to design and implement the software product described by the requirements listed in this document.

- **Purpose:**

What is the purpose of this SRS and the (intended) audience for which it is written.

- **Scope:**

Here we will identify software product by its name, and explain what the software product(s) will, and, if necessary, will not do.

Then we can describe the application of the software being specified. As a portion of this, it should be consistent with similar statements in higher-level specifications, and describe all relevant benefits, objectives, and goals as precisely as possible.

- **Definitions and Abbreviations:**

Provide the definitions of all terms, and abbreviations required to properly interpret the SRS. This

information may be provided by reference to one or more appendixes in the SRS or by reference to other documents.

- **References:**

This subsection should provide a complete list of all documents referenced elsewhere in the SRS, or in a separate, specified document. Identify each document by title, report number, and publishing organization. And specify the sources from which the references can be obtained. This information may be provided by reference to an appendix or to another document.

- **Overview:**

Describe what the rest of the SRS contains and explain how it is organized.

2. Overall Description:

Describe the general factors that affect the product and its requirements. It should also be made clear that this section does not state specific requirements; it only makes those requirements easier to understand.

- **Product Perspective**: Puts the product into perspective with other related products or projects.
- **Product Functions:** Provide a summary of the functions that the software will perform.
- **User Characteristics**: Describe general characteristics of the eventual users of the product that will affect the specificrequirements.
- **General Constraints:** Provide a general description of any other items that will limit the developer's options for designingthe system.
- **Assumptions and Dependencies:**List each of the factors that affect the requirements stated in the SRS. These factors are not design constraints on the software but are, rather, any changes to them that can affect the requirements in the SRS. For example, an assumption might be that a specific operating system will be available on the hardware designated for the software product. If, in fact, the operating system is not available, theSRS would then have to change accordingly.

3. Specific Requirements:

Give the detailed requirements (D-requirements) that are used to guide the project's software design, implementation, and testing. Each requirement in this section should be correct, unambiguous, verifiable, prioritized, complete, consistent, and uniquely identifiable. Attention should be paid to the carefully organize the requirements presented in this section so that they may easily accessed and understood. Furthermore, this SRS is not the software design document, therefore one should avoid the tendency to over-constrain (and therefore design) the software project within this SRS.

1. **External Interface Requirements**: Include user, hardware, software, and communication interfaces.
2. **Functional Requirements**: Describes specific features of the software project. If desired, some requirements may be specified inthe use-case format and listed in the Use Cases Section.
3. **Use Cases:** Describe all applicable use cases in the system.
4. **Classes and Objects:** Describe all classes by expressing its functions and attributes in the system.
5. **Non-Functional Requirements:** Requirements may exist for performance, reliability, availability, security, maintainability and portability. For example (95% of transaction shall be processed in less than a second, system downtime may not exceed 1 minute per day, >30 day MTBF value, etc).
6. **Design Constraints:** Specify design constrains imposed by other standards, company policies, hardware limitation, etc. thatwill impact this software project.
7. **Other Requirements**: Catch all section for any additional requirements.

4. Analysis Models:

List all analysis models used in developing specific requirements previously given in this SRS. Each model should include an introduction and a narrative description. Furthermore, each model should be traceable the SRS's requirements.

- **Sequence Diagrams:**
- It is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams typically are associated with use case realizations in the Logical View of the system under development.
- **Data Flow Diagrams**: It is a graphical representation of the "flow" of data through an information system, modeling its process aspects. Often they are a preliminary step used to create an overview of the system which can later be elaborated.
- **State-Transition Diagrams**: Describe the system as finite number of states.
- **Change Management Process**: Identify and describe the process that will be used to update the SRS, as needed, when project scopeor requirements change.

Who can submit changes and by what means, and how will these changes be approved.

5. Appendices:

Provide additional (and hopefully helpful) information. If present, the SRS should explicitly state whether the information contained within an appendix is to be considered as a part of the SRS's overall set of requirements. Example Appendices could include (initial) conceptual documents for the software project, marketing materials, minutes of meetings with the customer(s), etc.

6.5 SRS Validity

Avoiding certain practices is essential for writing a good System Requirements Specification (SRS). Let's examine these bad practices through examples of software SRS:

Incomplete Dictionary: An SRS might contain jargon that only those familiar with the business can understand. To ensure clarity, it's crucial to define all terms used in the document. Having a comprehensive dictionary or glossary can help readers quickly understand unfamiliar terms.

Mixing Concepts: While it might seem convenient to include all information in one place, this often leads to poor documentation. It's important to separate different concepts within the SRS to maintain clarity and organization.

Including Development Instructions: The SRS should focus on software requirements rather than technical implementation details. Product owners understand their needs best, while the development team is responsible for implementing solutions. Keeping these roles distinct helps ensure that requirements are accurately captured without prescribing how they should be implemented.

Passive Action: It's essential to specify not only what the software is expected to do but also who will interact with it to achieve the desired results. For example, specifying that reports are generated by clicking a button clarifies both the expected functionality and the user action required to trigger it.

Ambiguous and Incomplete Documentation: Ambiguities or incomplete descriptions in the requirements can lead to misunderstandings or different interpretations among stakeholders. It's crucial to ensure that requirements are clear and unambiguous, leaving no room for misinterpretation. Additionally, the SRS should only include aspects that are well-defined, avoiding speculation or uncertainty.

By avoiding these bad practices, an SRS can effectively communicate the software requirements to all stakeholders involved in the development process.

The Difference Between the Bad and Good RequirementsSpecification Example Documents

Improving the clarity and completeness of the system requirement specification for managing ATM cash withdrawals is essential for effective communication and implementation. Let's address the issues in the poorly written specification and provide a well-written example:

Poorly Written Specification:

"When a customer selects from the menu that he wants to withdraw money, he will be asked to choose how much money does he want to withdraw. The system is checking his account to see if his balance allows that transaction. If his balance allows the transaction, the transaction is validated. The system releases the customer's card and delivers the cash with a receipt of the transaction. All the operations must be fast."

Analysis of Issues:

- Lack of clarity on how the customer selects the withdrawal amount.
- Absence of details on validation rules.
- Uncertainty about receipt issuance.
- Ambiguity regarding transaction speed requirement.

Well-Written Specification:

"When a customer selects the 'Withdraw Money' option from the ATM menu, the system presents six preset withdrawal amounts: $10, $20, $30, $50, $100, and $200. Additionally, the customer can choose to input a custom withdrawal amount manually. The manual input option allows the customer to enter any amount, provided it is a multiple of the ATM's issued currency denominations and adheres to the maximum transaction limit.

After selecting the withdrawal amount, the customer can proceed by validating the transaction or canceling it. Upon validation, the system verifies the following:

1. Sufficient balance in the customer's account to cover the withdrawal amount.
2. The withdrawal amount does not exceed the maximum daily limit.
3. Availability of cash in the ATM to fulfill the requested withdrawal, considering the denomination multiples.

If all validation checks pass:

- The system prompts the customer to confirm if they require a receipt for the transaction.
- If requested, the system prepares and dispenses a receipt along with the cash.

- Subsequently, the system releases the customer's card and delivers the cash.

If the customer declines a receipt:

- The system releases the customer's card and delivers the cash.

If any of the validation checks fail, the ATM notifies the customer of the reason for transaction denial and releases the card.

To ensure efficient service, all transactions should be completed within three seconds."

Analysis of Improvements:

- Clearly specifies how the customer selects the withdrawal amount.
- Defines validation rules for balance, transaction limits, and cash availability.
- Clarifies receipt issuance conditions.
- Explicitly states the transaction speed requirement.

6.6. Summary

Creating a comprehensive and clear System Requirements Specification (SRS) is crucial for the successful development of software. Good documentation practices contribute to the effectiveness of the SRS, benefiting both software customers and development teams. The SRS allows customers to define their needs accurately, enabling the development team to understand and fulfill these requirements. Therefore, dedicating time to crafting an SRS document is essential for delivering the software that meets customers' needs.

6.7 Self-Assessment Questions

1. Explain Planning for MIS
2. Explain Information System Requirements
3. Explain Information System Analysis and Design
4. Explain Factors for Success and Failure
5. Explain System Requirements Specification
6. Explain Structure of SRS Document
7. Explain Poorly Written Specification
8. Explain Writing a Good Specification Example

Unit -7

Different System Affect MIS

Learning Objective :

After completing this unit you will be able to

- Explain the meaning and understanding of Data warehousing and data mining
- Explain the meaning and understanding of Enterprise resource planning system
- Explain the meaning and understanding of Customer relationship management system
- Explain the meaning and understanding of knowledge management system
- Explain the meaning and understanding of Decision making and decision support system

Structure:

7.1 Introduction

7.2 Data warehousing and data mining

7.3 Enterprise resource planning system

7.4 Customer relationship management system

7.5 Knowledge management system

7.6 Decision making and decision support system

7.7 Summary

7.8 Self-Assessment Questions

7.1 Introduction

Enterprise applications are specifically designed for the sole purpose of promoting the needs and objectives of the organizations.

Enterprise applications provide business-oriented tools supporting electronic commerce, enterprise communication and collaboration, and web-enabled business processes both within a networked enterprise and with its customers and business partners.

Services Provided by Enterprise Applications

Some of the services provided by an enterprise application includes −

- Online shopping, billing and payment processing
- Interactive product catalogue
- Content management
- Customer relationship management

- Manufacturing and other business processes integration
- IT services management
- Enterprise resource management
- Human resource management
- Business intelligence management
- Business collaboration and security

Form Automation

Basically these applications intend to model the business processes, i.e., how the entire organization works. These tools work by displaying, manipulating and storing large amounts of data and automating the business processes with these data.

Most Commonly Used Enterprise Applications

Multitude of applications comes under the definition of Enterprise Applications. In this section, let us briefly cover the following applications −

- Management information system (MIS)
- Enterprise Resource Planning (ERP)
- Customer Relationship Management (CRM)
- Decision Support System (DSS)
- Knowledge Management Systems (KMS)
- Content Management System (CMS)
- Executive Support System (ESS)
- Business Intelligence System (BIS)
- Enterprise Application Integration (EAI)
- Business Continuity Planning (BCP)
- Supply Chain Management (SCM)

7.2 Data Warehousing and Data Mining

A data warehouse is constructed by integrating data from multiple heterogeneous sources. It supports analytical reporting, structured and/or ad hoc queries and decision making. This tutorial adopts a step-by-step approach to explain all the necessary concepts of data warehousing.

Audience

This tutorial will help computer science graduates to understand the basic-to-advanced concepts related to data warehousing.

Prerequisites

Before proceeding with this tutorial, you should have an understanding of basic database concepts such as schema, ER model, structured query language, etc.

The term "Data Warehouse" was first coined by Bill Inmon in 1990. According to Inmon, a data warehouse is a subject oriented, integrated, time-variant, and non-volatile collection of data. This data helps analysts to take informed decisions in an organization.

An operational database undergoes frequent changes on a daily basis on account of the transactions that take place. Suppose a business executive wants to analyze previous feedback on any data such as a product, a supplier, or any consumer data, then the executive will have no data available to analyze because the previous data has been updated due to transactions.

A data warehouses provides us generalized and consolidated data in multidimensional view. Along with generalized and consolidated view of data, a data warehouses also provides us Online Analytical Processing (OLAP) tools. These tools help us in interactive and effective analysis of data in a multidimensional space. This analysis results in data generalization and data mining.

Data mining functions such as association, clustering, classification, prediction can be integrated with OLAP operations to enhance the interactive mining of knowledge at multiple level of abstraction. That's why data warehouse has now become an important platform for data analysis and online analytical processing.

Understanding a Data Warehouse

A data warehouse is a database, which is kept separate from the organization's operational database.

There is no frequent updating done in a data warehouse.

It possesses consolidated historical data, which helps the organization to analyze its business.

A data warehouse helps executives to organize, understand, and use their data to take strategic decisions.

Data warehouse systems help in the integration of diversity of application systems.

A data warehouse system helps in consolidated historical data analysis. Why a Data Warehouse is separated from Operational Databases?

A data warehouses is kept separate from operational databases due to the following reasons −

An operational database is constructed for well-known tasks and workloads such as searching particular records, indexing, etc. In contract, data warehouse queries are often complex and they present a general form of data.

Operational databases support concurrent processing of multiple transactions. Concurrency control and recovery mechanisms are required for operational databases to ensure robustness and consistency of the database.

An operational database query allows to read and modify operations, while an OLAP query needs

only **read only** access of stored data.

An operational database maintains current data. On the other hand, a data warehouse maintains historical data.

Data Warehouse Features

The key features of a data warehouse are discussed below −

Subject Oriented − A data warehouse is subject oriented becauseit provides information around a subject rather than the organization's ongoing operations. These subjects can be product, customers, suppliers, sales, revenue, etc. A data warehouse does not focus on the ongoing operations, rather it focuses on modelling and analysis of data for decision making.

Integrated − A data warehouse is constructed by integrating data from heterogeneous sources such as relational databases, flat files, etc. This integration enhances the effective analysis of data.

Time Variant – The data collected in a data warehouse is identified with a particular time period. The data in a data warehouse provides information from the historical point of view.

Non-volatile − Non-volatile means the previous data is not erased when new data is added to it. A data warehouse is kept separate from the operational database and therefore frequent changes in operational database is not reflected in the data warehouse.

Note − A data warehouse does not require transaction processing, recovery, and concurrency controls, because it is physically stored and separate from the operational database.

Data Warehouse Applications

As discussed before, a data warehouse helps business executives to organize, analyze, and use their data for decision making. A data warehouse serves as a sole part of a plan-execute-assess "closed-loop" feedback system for the enterprise management. Data warehouses are widely used in the following fields −

- Financial services
- Banking services
- Consumer goods
- Retail sectors
- Controlled manufacturing

Types of Data Warehouse

Information processing, analytical processing, and data mining are the three types of data warehouse applications that are discussed below −

Information Processing − A data warehouse allows to process the data stored in it. The data can

be processed by means of querying, basic statistical analysis, reporting using crosstabs, tables, charts, or graphs.

Analytical Processing − A data warehouse supports analytical processing of the information stored in it. The data can be analyzed by means of basic OLAP operations, including slice-and-dice, drill down, drill up, and pivoting.

Data Mining − Data mining supports knowledge discovery by finding hidden patterns and associations, constructing analytical models, performing classification and prediction. These mining results can be presented using the visualization tools.

Sr. No.	**Data Warehouse (OLAP)**	**Operational Database(OLTP)**
1	It involves processing information.	It involves day-to-day processing
2	OLAP systems are used by knowledge workers such as executives, managers, and analysts.	OLTP systems are used by clerks, DBAs, or database professionals.
3	It is used to analyze the business.	It is used to run the business.
4	It focuses on Information out.	It focuses on Data in.
5	It is based on Star Schema, Snowflake Schema, and Fact Constellation Schema	It is based on Entity Relationship Model.
6	. It focuses on Information out.	It is application oriented
7	It contains historical data.	It contains current data
8	It provides summarized and consolidated data	It provides primitive and highly detailed data.
9	It provides summarized and multidimensional view of data.	It provides detailed and flat relational view of data.
10	The number of users is in hundreds.	The number of users is in thousands
11	The number of records accessed is in millions.	thousands.

12	The database size is from 100GB to 100 TB.	The database size is from 100 MB to 100 GB.
13	These are highly flexible	It provides performance high

What is Data Warehousing?

Data warehousing is the process of constructing and using a data warehouse. A data warehouse is constructed by integrating data from multiple heterogeneous sources that support analytical reporting, structured and/or ad hoc queries, and decision making. Data warehousing involves data cleaning, data integration, and data consolidations.

Using Data Warehouse Information

There are decision support technologies that help utilize the data available in a data warehouse. These technologies help executives to use the warehouse quickly and effectively. They can gather data, analyze it, and take decisions based on the information present in the warehouse.

The information gathered in a warehouse can be used in any of the following domains −

Tuning Production Strategies − The product strategies can bewell tuned by repositioning the products and managing the product portfolios by comparing the sales quarterly or yearly.

Customer Analysis − Customer analysis is done by analyzing the customer's buying preferences, buying time, budget cycles, etc.

Operations Analysis − Data warehousing also helps in customer relationship management, and making environmental corrections. The information also allows us to analyze business operations.

Integrating Heterogeneous Databases

To integrate heterogeneous databases, we have two approaches −

- Query-driven Approach
- Update-driven Approach

Query-Driven Approach

This is the traditional approach to integrate heterogeneous databases. This approach was used to build wrappers and integrators on top of multiple heterogeneous databases. These integrators are also known as mediators.

Process of Query-Driven Approach

When a query is issued to a translates client side, a metadata dictionary the query into an heterogeneous sites appropriate form for individual involved.

Now these queries are mapped and sent to the local query processor.

The results from heterogeneous sites are integrated into a global answer set.

Disadvantages

Query-driven approach needs complex integration and filtering processes.

This approach is very inefficient.

It is very expensive for frequent queries.

This approach is also very expensive for queries that require aggregations.

Update-Driven Approach

This is an alternative to the traditional approach. Today's data warehouse systems follow update-driven approach rather than the traditional approach discussed earlier. In update-driven approach, the information from multiple heterogeneous sources are integrated in advance and are stored in a warehouse. This information is available for direct querying and analysis.

Advantages

This approach has the following advantages − This approach provide high performance.

The data is copied, processed, integrated, annotated, summarized and restructured in semantic data store in advance.

Query processing does not require an interface to process data at local sources.

Functions of Data Warehouse Tools and Utilities

The following are the functions of data warehouse tools and utilities −

Data Extraction − Involves gathering data from multiple heterogeneous sources.

Data Cleaning − Involves finding and correcting the errors in data.

Data Transformation − Involves converting the data from legacy format to warehouse format.

Data Loading − Involves sorting, summarizing, consolidating, checking integrity, and building indices and partitions.

Refreshing − Involves updating from data sources to warehouse.

Note − Data cleaning and data transformation are important steps in improving the quality of data and data mining results.

Data Warehousing - Terminologies

In this chapter, we will discuss some of the most commonly used terms in data warehousing.

Metadata

Metadata is simply defined as data about data. The data that are used to represent other data is known as metadata. For example, the index of a book serves as a metadata for the contents in the book. In other words, we can say that metadata is the summarized data that leads us to the detailed data.

In terms of data warehouse, we can define metadata as following −

- Metadata is a road-map to data warehouse.

- Metadata in data warehouse defines the warehouse objects.
- Metadata acts as a directory. This directory helps the decision support system to locate the contents of a data warehouse.

Metadata Repository

Metadata repository is an integral part of a data warehouse system. It contains the following metadata −

Business metadata − It contains the data ownership information, business definition, and changing policies.

Operational metadata − It includes currency of data and data lineage. Currency of data refers to the data being active, archived, or purged. Lineage of data means history of data migrated and transformation applied on it.

Data for mapping from operational environment to data warehouse

− It metadata includes source databases and their contents, data extraction, data partition, cleaning, transformation rules, data refresh and purging rules.

The algorithms for summarization − It includes dimension algorithms, data on granularity, aggregation, summarizing, etc.

Data Cube

A data cube helps us represent data in multiple dimensions. It is defined by dimensions and facts. The dimensions are the entities with respect to which an enterprise preserves the records.

Illustration of Data Cube

Suppose a company wants to keep track of sales records with the help of sales data warehouse with respect to time, item, branch, and location. These dimensions allow to keep track of monthly sales and at which branch the items were sold. There is a table associated with each dimension. This table is known as dimension table. For example, "item" dimension table may have attributes such as item name, item type, and item brand.

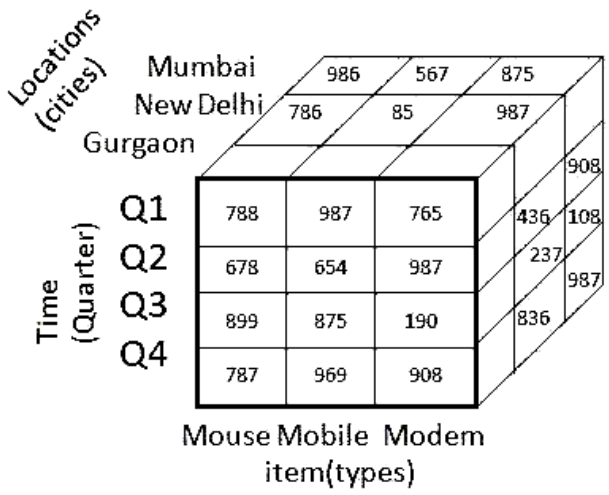
The following table represents the 2-D view of Sales Data for a company with respect to time, item, and location dimensions.

Location="New Delhi"				
Time(quarter)	Item(type)			
	Entertainment	Keyboard	Mobile	Locks
Q1	500	700	10	300
Q2	769	765	30	476
Q3	987	489	18	659
Q4	666	976	40	539

But here in this 2-D table, we have records with respect to time and item only. The sales for New Delhi are shown with respect to time, and item dimensions according to type of items sold. If we want to view the sales data with one more dimension, say, the location dimension, then the 3-D view would be useful. The 3-D view of the sales data with respect to time, item, and location is shown in the table below –

Time	Location="Gurgaon"			Location="New Delhi"			Location="Mumbai"		
	Item			Item			Item		
	Mouse	Mobile	Modem	Mouse	Mobile	Modem	Mouse	Mobile	Modem
Q1	788	987	765	786	85	987	986	567	875
Q2	678	654	987	659	786	436	980	876	908
Q3	899	875	190	983	909	237	987	100	1089
Q4	787	969	908	537	567	836	837	926	987

The above 3-D table can be represented as 3-D data cube as shown in following figure –



Data Mart

Data marts contain a subset of organization-wide data that is valuable to specific groups of people in an organization. In other words, a data mart contains only those data that is specific to a particular group. For example, the marketing data mart may contain only data related to items, customers, and sales. Data marts are confined to subjects.

Points to Remember About Data Marts

Windows-based or Unix/Linux-based servers are used to implement data marts. They are implemented on low-cost servers.

- The implementation cycle of a data mart is measured in short periods of time, i.e., in

weeks rather than months or years.

- The life cycle of data marts may be complex in the long run, if their planning and design are not organization-wide.
- Data marts are small in size.
- Data marts are customized by department.
- The source of a data mart is departmentally structured data warehouse.
- Data marts are flexible.

Virtual Warehouse

The following figure shows a graphical representation of data marts.

The view over an operational data warehouse is known as virtual warehouse. It is easy to build a virtual warehouse. Building a virtual warehouse requires excess capacity on operational database servers.

Data Warehousing - Delivery Process

A data warehouse is never static; it evolves as the business expands. As the business evolves, its requirements keep changing and therefore a data warehouse must be designed to ride with these changes. Hence a data warehouse system needs to be flexible.

Ideally there should be a delivery process to deliver a data warehouse. However, data warehouse projects normally suffer from various issues that make it difficult to complete tasks and deliverables in the strict and ordered fashion demanded by the waterfall method. Most of the times, the requirements are not understood completely. The architectures, designs, and build components can be completed only after gathering and studying all the requirements.

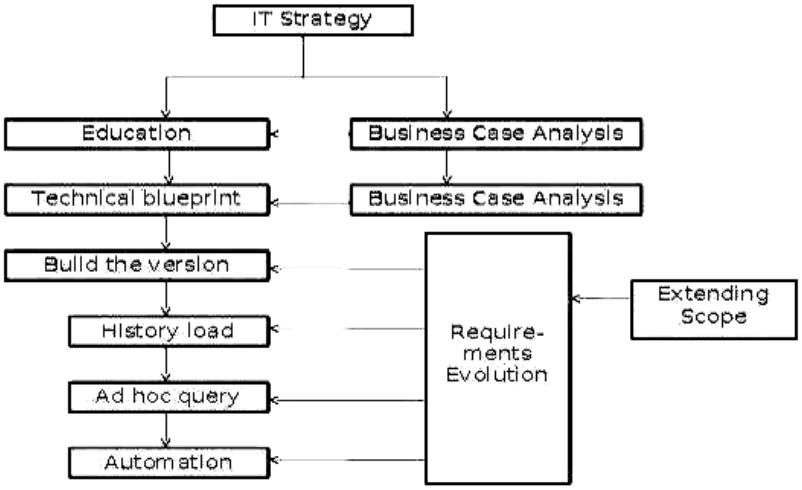
Delivery Method

The delivery method is a variant of the joint application development approach adopted for the delivery of a data warehouse. We have staged the data warehouse delivery process to minimize risks. The approach that we will discuss here does not reduce the overall delivery time-scales but ensures the business benefits are delivered incrementally through the development process.

Note − The delivery process is broken into phases to reduce the project and delivery risk.

IT Strategy

Data warehouse are strategic investments that require a business process to generate benefits. IT Strategy is required to procure and retain funding for the project



.

Business Case

The objective of business case is to estimate business benefits that should be derived from using a data warehouse. These benefits may not be quantifiable but the projected benefits need to be clearly stated. If a data warehouse does not have a clear business case, then the business tends to suffer from credibility problems at some stage during the delivery process. Therefore in data warehouse projects, we need to understand the business case for investment.

Education and Prototyping

Organizations experiment with the concept of data analysis and educate themselves on the value of having a data warehouse before settling for a solution. This is addressed by prototyping. It helps in understanding the feasibility and benefits of a data warehouse. The prototyping activity on a small scale can promote educational process as long as −

- The prototype addresses a defined technical objective.
- The prototype can be thrown away after the feasibility concept has been shown.
- The activity addresses a small subset of eventual data content of the data warehouse.
- The activity timescale is non-critical.

The following points are to be kept in mind to produce an early release and deliver business benefits.

- Identify the architecture that is capable of evolving.
- Focus on business requirements and technical blueprint phases.
- Limit the scope of the first build phase to the minimum that delivers business benefits.
- Understand the short-term and medium-term requirements of the data warehouse.

Business Requirements

To provide quality deliverables, we should make sure the overall requirements are understood. If we understand the business requirements for both short-term and medium-term, then we can design a solution to fulfil short-term requirements. The short-term solution can then be grown to a full solution.

The following aspects are determined in this stage −

- The business rule to be applied on data.
- The logical model for information within the data warehouse.
- The query profiles for the immediate requirement.
- The source systems that provide this data.

Technical Blueprint

This phase need to deliver an overall architecture satisfying the long term requirements. This phase also deliver the components that must be implemented in a short term to derive any business benefit. The blueprint need to identify the followings.

- The overall system architecture.
- The data retention policy.
- The backup and recovery strategy.
- The server and data mart architecture.
- The capacity plan for hardware and infrastructure.
- The components of database design.

Building the Version

In this stage, the first production deliverable is produced. This production deliverable is the smallest component of a data warehouse. This smallest component adds business benefit.

History Load

This is the phase where the remainder of the required history is loaded into the data warehouse. In this phase, we do not add new entities, but additional physical tables would probably be created to store increased data volumes.

Let us take an example. Suppose the build version phase has delivered a retail sales analysis data warehouse with 2 months' worth of history. This information will allow the user to analyze only the recent trends and address the short-term issues. The user in this case cannot identify annual and seasonal trends. To help him do so, last 2 years' sales history could be loaded from the archive. Now the 40GB data is extended to 400GB.

Note − The backup and recovery procedures may become complex, therefore it is recommended to perform this activity within a separate phase.

Ad hoc Query

In this phase, we configure an ad hoc query tool that is used to operate a data warehouse. These tools can generate the database query.

Note − It is recommended not to use these access tools when the database is being substantially modified.

Automation

In this phase, operational management processes are fully automated. These would include −

- Transforming the data into a form suitable for analysis.
- Monitoring query profiles and determining appropriate aggregations to maintain system performance.
- Extracting and loading data from different source systems.
- Generating aggregations from predefined definitions within the data warehouse.
- Backing up, restoring, and archiving the data.

Extending Scope

In this phase, the data warehouse is extended to address a new set business requirements. The scope can be extended in two ways −

- By loading additional data into the data warehouse.
- By introducing new data marts using the existing information.

Note − This phase should be performed separately, since it involves substantial efforts and complexity.

Requirements Evolution

From the perspective of delivery process, the requirements are always changeable. They are not static. The delivery process must support this and allow these changes to be reflected within the system.

This issue is addressed by designing the data warehouse around the use of data within business processes, as opposed to the data requirements of existing queries.

The architecture is designed to change and grow to match the business needs, the process operates as a pseudo-application development process, where the new requirements are continually fed into the development activities and the partial deliverables are produced. These partial deliverables are fed back to the users and then reworked ensuring that the overall system is continually updated to meet the business needs.

Data Warehousing - System Processes

We have a fixed number of operations to be applied on the operational databases and we have

well-defined techniques such as **use normalized data**, **keep table small**, etc. These techniques are suitable for delivering a solution. But in case of decision-support systems, we do not know what query and operation needs to be executed in future. Therefore techniques applied on operational databases are not suitable for data warehouses.

In this chapter, we will discuss how to build data warehousing solutions on top open-system technologies like Unix and relational databases.

Process Flow in Data Warehouse

There are four major processes that contribute to a data warehouse −

- Extract and load the data.
- Cleaning and transforming the data.
- Backup and archive the data.
- Managing queries and directing them to the appropriate data sources.

Extract and Load Process

Data extraction takes data from the source systems. Data load takes the extracted data and loads it into the data warehouse.

Note − Before loading the data into the data warehouse, the information extracted from the external sources must be reconstructed.

Controlling the Process

Controlling the process involves determining when to start data extraction and the consistency check on data. Controlling process ensures that the tools, the logic modules, and the programs are executed in correct sequence and at correct time.

When to Initiate Extract

Data needs to be in a consistent state when it is extracted, i.e., the data warehouse should represent a single, consistent version of the information to the user.

For example, in a customer profiling data warehouse in telecommunication sector, it is illogical to merge the list of customers at

8 pm on Wednesday from a customer database with the customer subscription events up to 8 pm on Tuesday. This would mean that we are finding the customers for whom there are no associated subscriptions.

Loading the Data

After extracting the data, it is loaded into a temporary data store where it is cleaned up and made

consistent.

Note − Consistency checks are executed only when all the data sources have been loaded into the temporary data store.

Clean and Transform Process

Once the data is extracted and loaded into the temporary data store, it is time to perform Cleaning and Transforming. Here is the list of steps involved in Cleaning and Transforming −

- Clean and transform the loaded data into a structure
- Partition the data
- Aggregation

Clean and Transform the Loaded Data into a Structure

Cleaning and transforming the loaded data helps speed up the queries. It can be done by making the data consistent −

- Within itself.
- With other data within the same data source.
- With the data in other source systems.
- With the existing data present in the warehouse.

Transforming involves converting the source data into a structure. Structuring the data increases the query performance and decreases the operational cost. The data contained in a data warehouse must be transformed to support performance requirements and control the ongoing operational costs.

Partition the Data

It will optimize the hardware performance and simplify the management of data warehouse. Here we partition each fact table into multiple separate partitions.

Aggregation

Aggregation is required to speed up common queries. Aggregation relies on the fact that most common queries will analyze a subset or an aggregation of the detailed data.

Backup and Archive the Data

In order to recover the data in the event of data loss, software failure, or hardware failure, it is necessary to keep regular back ups. Archiving involves removing the old data from the system in a format that allow it to be quickly restored whenever required.

For example, in a retail sales analysis data warehouse, it may be required to keep data for 3 years with the latest 6 months data being kept online. In such a scenario, there is often a requirement to be able to do month- on-month comparisons for this year and last year. In this case, we require some data to be restored from the archive.

Query Management Process

This process performs the following functions −

- Manages the queries.
- Helps speed up the execution time of queries.
- Directs the queries to their most effective data sources.
- Ensures that all the system sources are used in the most effective way.
- Monitors actual query profiles.

The information generated in this process is used by the warehouse management process to determine which aggregations to generate. This process does not generally operate during the regular load of information into data warehouse.

Data Warehousing - Architecture

In this chapter, we will discuss the business analysis framework for the data warehouse design and architecture of a data warehouse.

Business Analysis Framework

The business analyst get the information from the data warehouses to measure the performance and make critical adjustments in order to win over other business holders in the market. Having a data warehouse offers the following advantages −

Since a data warehouse can gather information quickly and efficiently, it can enhance business productivity.

A data warehouse provides us a consistent view of customers and items, hence, it helps us manage customer relationship.

A data warehouse also helps in bringing down the costs by tracking trends, patterns over a long period in a consistent and reliable manner.

To design an effective and efficient data warehouse, we need to understand and analyze the business needs and construct a **business analysis framework**. Each person has different views regarding design of a data warehouse. These views are as follows −

The top-down view − This view allows the selection of relevant information needed for a data warehouse.

The data source view − This view presents the information being captured, stored, and managed by the operational system.

The data warehouse view − This view includes the fact tables and dimension tables. It represents the information stored inside the data warehouse.

The business query view − It is the view of the data from the viewpoint of the end-user.

Three-Tier Data Warehouse Architecture

Generally a data warehouses adopts a three-tier architecture. Following are the three tiers of the

data warehouse architecture.

Bottom Tier − The bottom tier of the architecture is the data warehouse database server. It is the relational database system. We use the back end tools and utilities to feed data into the bottom tier. These back end tools and utilities perform the Extract, Clean, Load, and refresh functions.

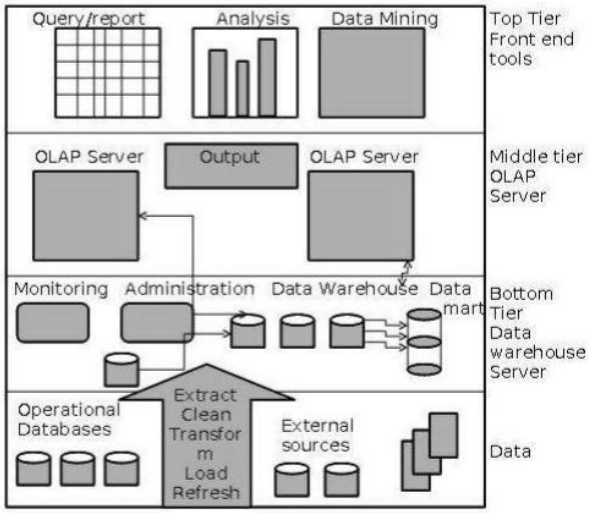
Middle Tier − In the middle tier, we have the OLAP Server that can be implemented in either of the following ways.

By Relational OLAP (ROLAP), which is an extended relational database management system. The ROLAP maps the operations on multidimensional data to standard relational operations.

By Multidimensional OLAP (MOLAP) model, which directly implements the multidimensional data and operations.

Top-Tier − This tier is the front-end client layer. This layer holds the query tools and reporting tools, analysis tools and data mining tools.

The following diagram depicts the three-tier architecture of data warehouse –



Data Warehouse Models

From the perspective of data warehouse architecture, we have the following data warehouse models −

- Virtual Warehouse
- Data mart
- Enterprise Warehouse

Virtual Warehouse

The view over an operational data warehouse is known as a virtual warehouse. It is easy to build a virtual warehouse. Building a virtual warehouse requires excess capacity on operational database servers.

Data Mart

Data mart contains a subset of organization-wide data. This subset of data is valuable to specific groups of an organization.

In other words, we can claim that data marts contain data specific to a particular group. For example, the marketing data mart may contain data related to items, customers, and sales. Data marts are confined to subjects.

Points to remember about data marts −

Window-based or Unix/Linux-based servers are used to implement data marts. They are implemented on low-cost servers.

The implementation data mart cycles is measured in short periods of time, i.e., in weeks rather than months or years.

The life cycle of a data mart may be complex in long run, if its planning and design are not organization-wide.

- Data marts are small in size.
- Data marts are customized by department.
- The source of a data mart is departmentally structured data warehouse.
- Data mart are flexible.

Enterprise Warehouse

An enterprise warehouse collects all the information and the subjects spanning an entire organization

It provides us enterprise-wide data integration.

The data is integrated from operational systems and external information providers.

This information can vary from a few gigabytes to hundreds of gigabytes, terabytes or beyond.

Load Manager

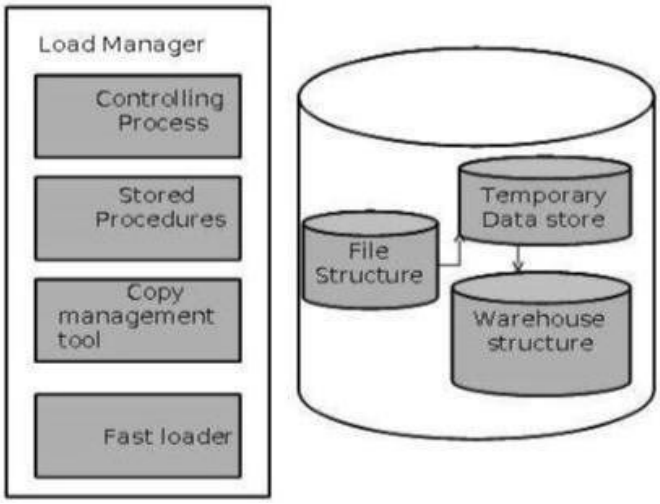
This component performs the operations required to extract and load process.

The size and complexity of the load manager varies between specific solutions from one data warehouse to other.

Load Manager Architecture

The load manager performs the following functions −

- Extract the data from source system.
- Fast Load the extracted data into temporary data store.
- Perform simple transformations into structure similar to the one in the data warehouse.



Extract Data from Source

The data is extracted from the operational databases or the external information providers. Gateways is the application programs that are used to extract data. It is supported by underlying DBMS and allows client program to generate SQL to be executed at a server. Open Database Connection (ODBC), Java Database Connection (JDBC), are examples of gateway.

Fast Load

In order to minimize the total load window the data need to be loaded into the warehouse in the fastest possible time.

The transformations affects the speed of data processing.

It is more effective to load the data into relational database prior to applying transformations and checks.

Gateway technology proves to be not suitable, since they tend not be performant when large data volumes are involved.

Simple Transformations

While loading it may be required to perform simple transformations. After this has been completed we are in position to do the complex checks. Suppose we are loading the EPOS sales transaction we need to perform the following checks:

Strip out all the columns that are not required within the warehouse. Convert all the values to required data types.

Warehouse Manager

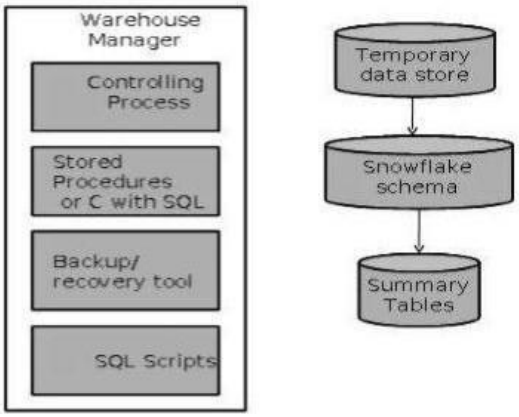
A warehouse manager is responsible for the warehouse management process. It consists of third-party system software, C programs, and shell scripts.

The size and complexity of warehouse managers varies between specific solutions.

Warehouse Manager Architecture

A warehouse manager includes the following −

- The controlling process
- Stored procedures or C with SQL
- Backup/Recovery tool
- SQL Scripts



Operations Performed by Warehouse Manager

A warehouse manager analyzes the data to perform consistency and referential integrity checks.

Creates indexes, business views, partition views against the base data.

Generates new aggregations and updates existing aggregations. Generates normalizations.

Transforms and merges the source data into the published data warehouse.

Backup the data in the data warehouse.

Archives the data that has reached the end of its captured life.

Note − A warehouse Manager also analyzes query profiles to determine index and aggregations are appropriate.

Query Manager

Query manager is responsible for directing the queries to the suitable tables.

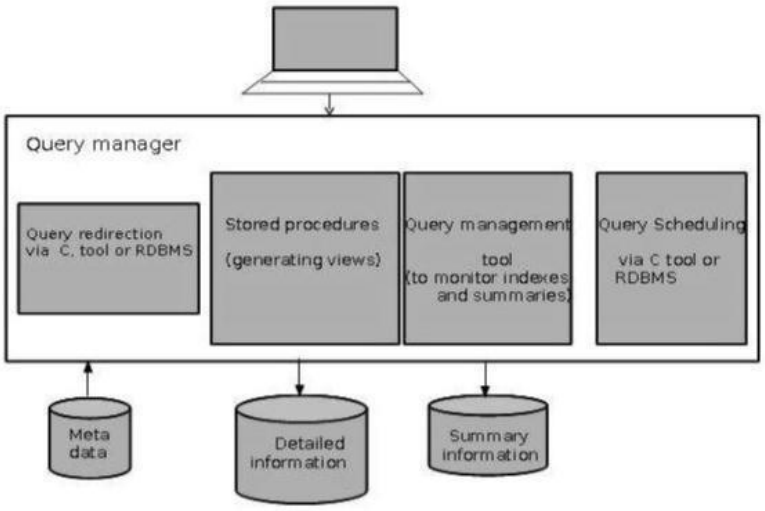
By directing the queries to appropriate tables, the speed of querying and response generation can be increased.

Query manager is responsible for scheduling the execution of the queries posed by the user.

Query Manager Architecture

The following screenshot shows the architecture of a query manager. It includes the following:

- Query redirection via C tool or RDBMS
- Stored procedures
- Query management tool
- Query scheduling via C tool or RDBMS
- Query scheduling via third-party software

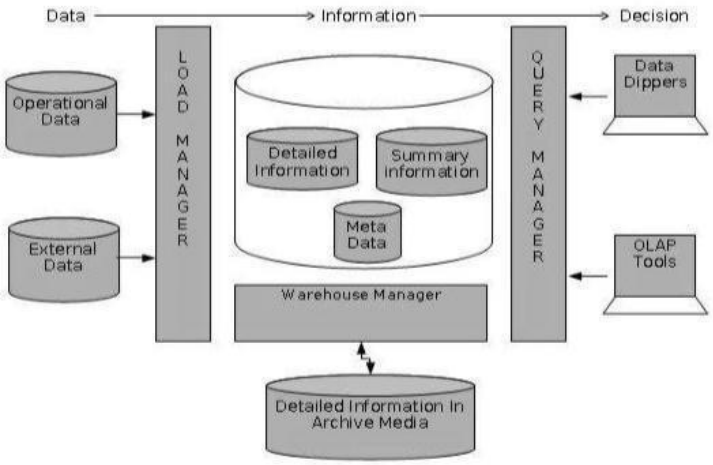


Detailed Information

Detailed information is not kept online, rather it is aggregated to the next level of detail and then archived to tape. The detailed information part of data warehouse keeps the detailed information in the starflake schema.

Detailed information is loaded into the data warehouse to supplement aggregated data.

The following diagram shows a pictorial impression of where detailed information is stored and how it is used.



Note − If detailed information is held offline to minimize disk storage, we should make sure that the data has been extracted, cleaned up, and transformed into starflake schema before it is archived.

Summary Information

Summary Information is a part of data warehouse that stores predefined aggregations. These aggregations are generated by the warehouse manager. Summary Information must be treated as

transient. It changes on-the-go in order to respond to the changing query profiles.

The points to note about summary information are as follows −

- Summary information speeds up the performance of common queries.
- It increases the operational cost.
- It needs to be updated whenever new data is loaded into the data warehouse.
- It may not have been backed up, since it can be generated fresh from the detailed information.

Data Warehousing - OLAP

Online Analytical Processing Server (OLAP) is based on the multidimensional data model. It allows managers, and analysts to get an insight of the information through fast, consistent, and interactive access

to information. This chapter covers the types of OLAP, operations OLAP, difference between OLAP, and statistical databases and OLTP

Types of OLAP Servers

We have four types of OLAP servers −

- Relational OLAP (ROLAP)
- Multidimensional OLAP (MOLAP)
- Hybrid OLAP (HOLAP)
- Specialized SQL Servers

Relational OLAP

ROLAP servers are placed between relational back-end server and client front-end tools. To store and manage warehouse data, ROLAP uses relational or extended-relational DBMS.

ROLAP includes the following −

- Implementation of aggregation navigation logic.
- Optimization for each DBMS back end.
- Additional tools and services.

Multidimensional OLAP

MOLAP uses array-based multidimensional storage engines for multidimensional views of data. With multidimensional data stores, the storage utilization may be low if the data set is sparse. Therefore, many MOLAP server use two levels of data storage representation to handle dense and sparse data sets.

Hybrid OLAP

Hybrid OLAP is a combination of both ROLAP and MOLAP. It offers higher scalability of ROLAP and faster computation of MOLAP. HOLAP servers allows to store the large data

volumes of detailed information. The aggregations are stored separately in MOLAP store.

Specialized SQL Servers

Specialized SQL servers provide advanced query language and query processing support for SQL queries over star and snowflake schemas in a read-only environment.

OLAP Operations

Since OLAP servers are based on multidimensional view of data, we will discuss OLAP operations in multidimensional data.

Here is the list of OLAP operations −

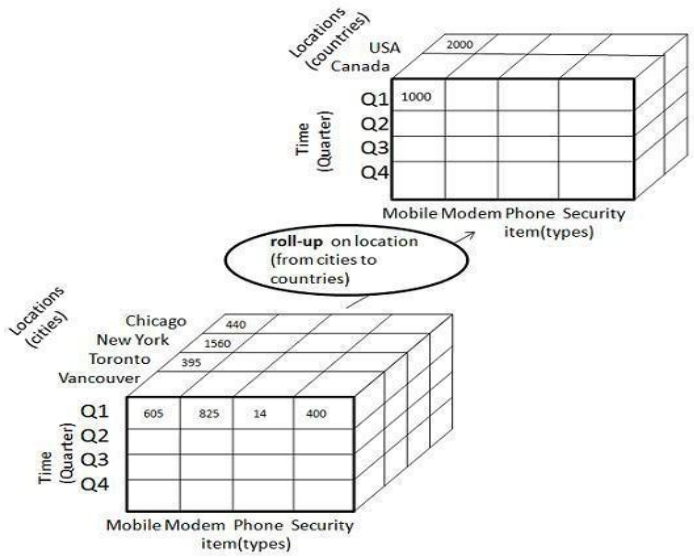
- Roll-up
- Drill-down
- Slice and dice
- Pivot (rotate)

Roll-up

Roll-up performs aggregation on a data cube in any of the following ways −

- By climbing up a concept hierarchy for a dimension
- By dimension reduction

The following diagram illustrates how roll-up works.



Roll-up is performed by climbing up a concept hierarchy for the dimension location. Initially the concept hierarchy was "street < city < province < country".

On rolling up, the data is aggregated by ascending the location hierarchy from the level of city to the level of country.

The data is grouped into cities rather than countries.

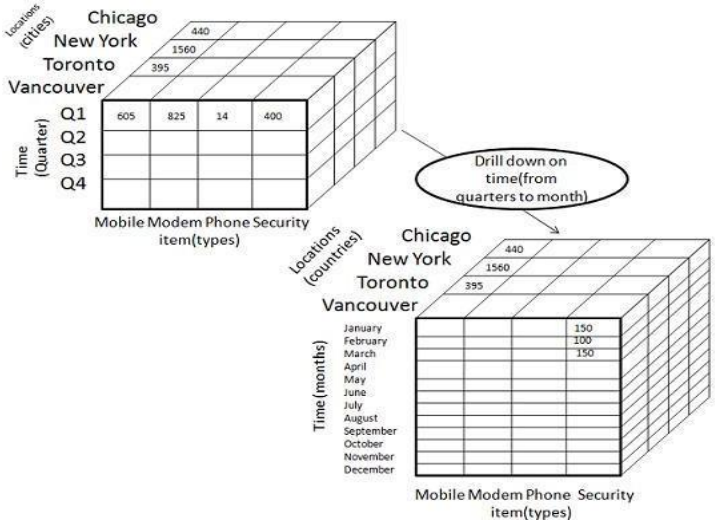
When roll-up is performed, one or more dimensions from the data cube are removed.

Drill-down

Drill-down is the reverse operation of roll-up. It is performed by either of the following ways −

- By stepping down a concept hierarchy for a dimension
- By introducing a new dimension.

The following diagram illustrates how drill-down works −



Drill-down is performed by stepping down a concept hierarchy for the dimension time.

Initially the concept hierarchy was "day < month < quarter < year."

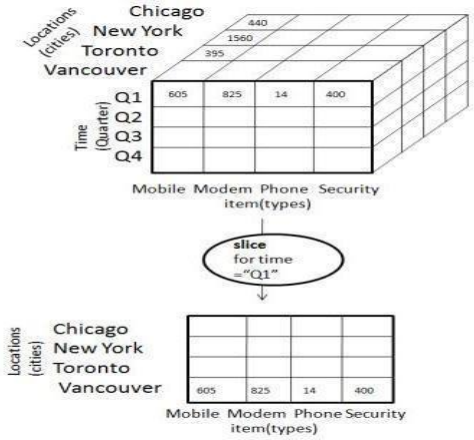
On drilling down, the time dimension is descended from the level of quarter to the level of month.

When drill-down is performed, one or more dimensions from the data cube are added.

It navigates the data from less detailed data to highly detailed data.

Slice

The slice operation selects one particular dimension from a given cube and provides a new sub-cube. Consider the following diagram that shows how slice works.



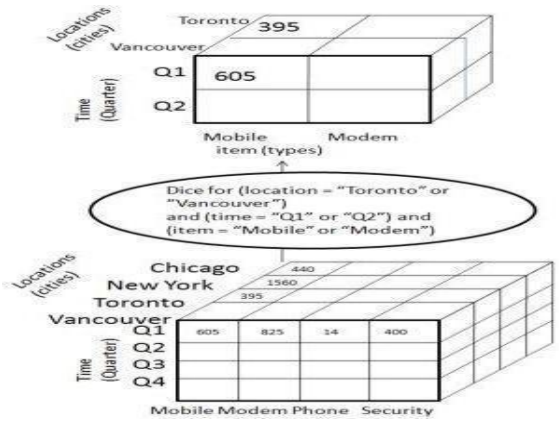
Here Slice is performed for the dimension "time" using the criterion time

= "Q1".

It will form a new sub-cube by selecting one or more dimensions.

Dice

Dice selects two or more dimensions from a given cube and provides a new sub-cube. Consider the following diagram that shows the dice operation.



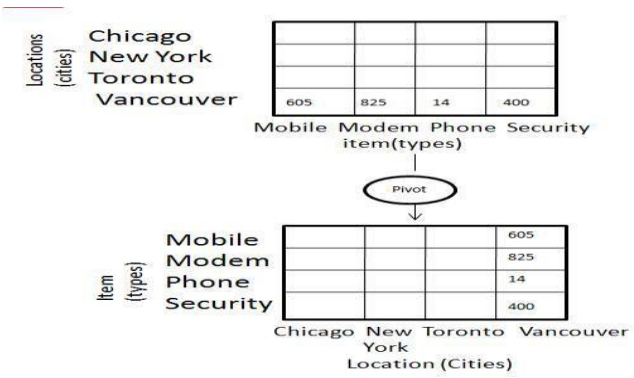
The dice operation on the cube based on the following selection criteria involves three dimensions.

(location = "Toronto" or "Vancouver") (time = "Q1" or "Q2")

(item =" Mobile" or "Modem")

Pivot

The pivot operation is also known as rotation. It rotates the data axes in view in order to provide an alternative presentation of data. Consider the following diagram that shows the pivot operation.



OLAP vs OLTP

Data Warehousing - Relational OLAP

Relational OLAP servers are placed between relational back-end server and client front-end tools. To store and manage the warehouse data, the relational OLAP uses relational or extended-relational DBMS.

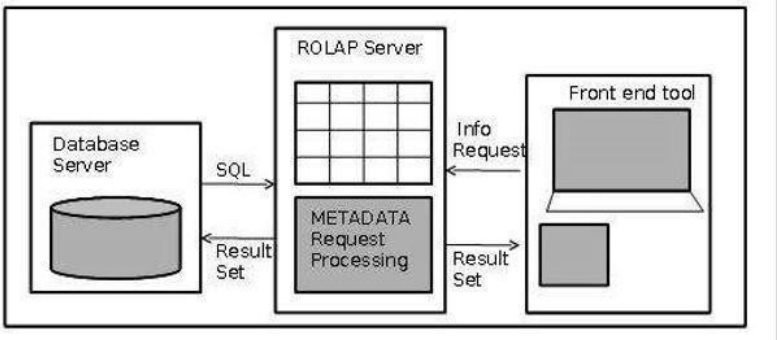
ROLAP includes the following −

- Implementation of aggregation navigation logic
- Optimization for each DBMS back-end
- Additional tools and services Points to Remember
- ROLAP servers are highly scalable.
- ROLAP tools analyze large volumes of data across multiple dimensions.
- ROLAP tools store and analyze highly volatile and changeable data.

Relational OLAP Architecture

ROLAP includes the following components −

- Database server
- ROLAP server
- Front-end tool.



Advantages

ROLAP servers can be easily used with existing RDBMS.

Data can be stored efficiently, since no zero facts can be stored. ROLAP tools do not use pre-calculated data cubes.

DSS server of micro-strategy adopts the ROLAP approach.

Disadvantages

Poor query performance.

Some limitations of scalability depending on the technology architecture that is utilized.

Data Mining

Data mining is a process utilized by companies to transform raw data into valuable insights. By employing software to detect patterns within vast datasets, businesses can gain deeper insights into their customers, refine marketing strategies, boost sales, and reduce costs. Successful data mining relies on efficient data collection, storage, and processing.

Grocery stores are a prominent example of entities employing data mining techniques. Many supermarkets provide loyalty cards to customers, granting access to discounted prices exclusive to cardholders. These cards enable stores to track customers' purchasing behaviors, preferences, and timing, which can then be analyzed for various purposes such as targeted marketing campaigns, personalized promotions, and pricing strategies.

Data mining can raise concerns when selective information, not representative of the overall dataset, is used to support a specific hypothesis.

Data warehousing is the process of centralizing data into a single database or platform. This facilitates easier data access and analysis. Data mining software plays a crucial role in analyzing relationships and patterns within the data based on user queries. For instance, a restaurant may use data mining to identify optimal times for offering specials by analyzing customer visitation patterns and ordering behaviors.

The data mining process typically involves five steps: data collection, storage, management, analysis, and presentation. Initially, organizations gather and load data into their data warehouses. They then manage and organize the data for analysis. Business analysts and IT professionals access the data, determine analytical objectives, and employ application software to extract insights. Finally, the results are presented in a user-friendly format such as graphs or tables.

The abundance of data available today necessitates effective data mining techniques to extract meaningful information from vast datasets. This process of sifting through data to uncover insights is essential for informed decision-making and strategic planning in various industries.

Data mining is a five-step process:

- Identifying the source information
- Picking the data points that need to be analyzed
- Extracting the relevant information from the data
- Identifying the key values from the extracted data set
- Interpreting and reporting the results

Identify source information

As described in Data Mining: Practical Machine Learning Tools and Techniques, 3rd Edition, you need to check different datasets, and different collections of information and combine that together to build up the real picture of what you want:

There are several standard datasets that we will come back to repeatedly. Different datasets tend to expose new issues and challenges, and it is interesting and instructive to have in mind a variety of problems when considering learning methods. In fact, the need to work with different datasets is so important that a corpus containing around 100 example problems has been gathered together so that different algorithms can be tested and compared on the same set of problems.

As from our list above, you need to identify the data, or the sources of information, and from that you should be able to determine what information you should be studying to retrieve data from. This requires building rules and structure around the information to extract the critical elements. You'll find different techniques for building the rules and clustering techniques to concentrate on the information you need

Picking Data Points

This learning structure helps you identify the data that needs to be analyzed. Bayesian techniques rely on building a corpus of data and then working out the probability that data is specifically related to the information that you have extracted. Depending upon the complexity of the data and the information you are working with, the extraction of that information and the calculation of the probability required can be straightforward or complex, but it is easy to determine by calculating the frequency, sometimes based upon the past analysis of similar data sources.

Doing Bayesian Data Analysis, by John Kruschke goes into significantly more detail about the

process of building the rules that ultimately define your Bayesian analysis. The book starts by examining the core data structure, and then covers building rules using the R language to calculate the probabilities. The beauty of the book is the simple way these processes are introduced, first through simpler examples, and then onto forming specific hypotheses using these data points:

> *A crucial application of Bayes' rule is to determine the probability of a model when given a set of data. What the model itself provides is the probability of the data, given specific parameter values and the model structure.* Bayes' rule enables us to move from the probability of observing the data given a certain model to the probability of the model given the observed data.

Clustering involves organizing data into specific clusters by setting up ranges and groups. The challenge lies in determining the size and complexity of clusters and what the groupings ultimately define and describe.

Extracting and Identifying Key Values

Learning techniques are more complex, and they rely on current and past data to produce a structure of past, valid experiences that can ultimately be compared to the new information and then interpreted and extracted. These steps help with both the extraction and identification of the information that is extracted (points 3 and 4 from our step-by-step list).

Clustering, learning, and data identification is a process also covered in detail in Data Mining: Concepts and Techniques, 3rdEdition. This book covers the identification of valid values and information, and how to spot, exclude and eliminate data that does not form part of the useful dataset. For example, when looking at weather data, ignoring values that are outside sensible values is key. Temperature readings above 50C in most regions are probably bogus, but temperatures slightly outside the typical ranges may indicate extreme, rather than impossible weather.

> *As explained one way of handling them is to treat them as just another possible value of the attribute; this is appropriate if the fact that the attribute is missing is significant in some way. In that case, no further action need be taken. But if there is no particular significance in the fact that a certain instance has a missing attribute value, a more subtle solution is needed. It is tempting to simply ignore all instances in which some of the values are missing, but this solution is often too draconian to be viable. Instances with missing values often provide a good deal of information. Sometimes the attributes with values that are missing play no part in the decision, in which case these instances are as good as any other.*

By this point, you should have collated, identified, and extracted the correct information from the

larger corpus of data. Now you need to interpret the results of this collation. There are many different approaches to do this, but all of them build on the previous steps, using further validation and qualification of the information to pick out the key data required. The results also imply a wider role that the extracted data highlights:

> *When wise people make critical decisions, they usually take into account the opinions of several experts rather than relying on their own judgment or that of a solitary trusted advisor. For example, before choosing an important new policy direction.*

Interpreting and Reporting Results

In this final stage of our five-step process, the aim is to transform the information into comparable values, such as basic numerical counts, direct value comparisons, or group comparisons, to identify specific elements. Simple ranking methods, like those used for hotel room ratings, are common, while more complex comparative rankings are employed for products. Products can be compared individually against similar features or against top sellers within their group.

The data extracted in earlier stages is synthesized into the final result. Data mining is far from a straightforward process; it requires a systematic and mathematical approach. However, it also demands flexibility, as it often involves dealing with data that may not neatly fit into an organized or sequential format.

Difference Between Data Warehousing and Data Mining

Corporate data is often dispersed across various databases, each in different formats. Bringing these pieces together to form a comprehensive picture can be challenging without a Data Warehouse. A Data Warehouse serves as a centralized repository where crucial data from multiple sources is stored under a unified schema, primarily for reporting and analysis purposes. Unlike transactional databases, Data Warehouses are relational databases optimized for query and analysis, typically containing historical data derived from transactional data.

While Data Warehouses are tailored to support managerial functions, Data Mining focuses on extracting valuable insights and patterns from data. Although data mining can be conducted with any traditional database, leveraging a data warehouse system is advantageous due to its high-quality data.

Data Mining facilitates knowledge discovery by uncovering hidden patterns and associations, constructing analytical models, and enabling classification and prediction.

Let's delve into a detailed comparison between Data Warehousing and Data Mining:

Key Features:

Data Warehouse:

- Subject-Oriented: Data Warehouses focus on providing insights around specific subjects rather than ongoing organizational operations, such as products, customers, sales, revenue, etc.
- Integrated: They are built by amalgamating data from various heterogeneous sources, including relational databases and flat files.
- Time-Variant: Data Warehouses store data pertaining to specific time periods, offering insights into historical trends.
- Non-volatile: Once data is entered into the warehouse, it remains unchanged.

Benefits of Data Warehouse:

- Consistent and high-quality data
- Cost reduction
- Timely data access
- Enhanced performance and productivity

Data Mining:

- Automatic Discovery of Patterns
- Prediction of Likely Outcomes
- Creation of Actionable Information
- Focus on Large Data Sets and Databases

Benefits of Data Mining:

- Direct marketing optimization
- Trend analysis for strategic advantage
- Fraud detection
- Financial market forecasting

In summary, while Data Warehousing provides a structured framework for storing and managing data, Data Mining extracts valuable insights and patterns from this data to drive informed decision-making.

Data mining VS Data warehousing

Data warehouse	Data mining
Process of storing data in order in given dataset	Process of finding pattern in given dataset.
Data warehousing is the process of extracting and storing data to allow easier reporting.	Data mining is the use of pattern recognition logic to identity trends within a sample data set and extrapolate this information against the larger data pool
The tools in data warehousing are designed to extract data and store it in a method designed to provide enhanced system performance	A typical use of data mining is to create targeted marketing programs, identify financial fraud,
Helps in identifing the certain data in a collection of data	Helps in figuring out a certain pattern of a data or a cluster of data

Key Differences between Data Warehousing vs Data Mining

Here are some key distinctions between Data Warehousing and Data Mining:

1. Data Warehousing involves extracting and storing data to facilitate easier reporting, while Data Mining utilizes pattern recognition to identify trends within a dataset, often used for purposes like fraud detection. For instance, credit card companies employ data mining to detect unusual transaction patterns, such as transactions from unfamiliar geographical locations.
2. Data Warehousing entails compiling and organizing data into a unified database, whereas Data Mining extracts meaningful insights from this database. Data mining typically follows the completion of data warehousing.
3. A data warehouse serves as a repository for storing data, while data mining encompasses activities aimed at uncovering patterns and deriving meaning from this data.
4. Data warehousing involves extracting and storing data from various sources, then cleaning and organizing it. Conversely, data mining entails exploring and analyzing data through queries.
5. Data warehousing is an architectural concept, whereas data mining is a process resulting from various activities aimed at discovering new patterns.
6. Data warehousing emphasizes corporate credibility and data integrity, while data mining focuses on extracting meaningful patterns not necessarily uncovered solely through data processing or querying.
7. Data warehouses contain integrated and processed data, supporting data mining for planning and decision-making. Data mining uncovers patterns useful for future predictions.

8. Data warehouses support basic statistical analysis, while data mining aids in tasks like market segmentation, customer profiling, and fraud detection.
9. Data warehousing consolidates relevant data, while data mining analyzes unknown data patterns.
10. Data warehouses typically store extensive historical data, enabling historical analysis, whereas data mining identifies trends within a sample dataset.

Conclusion – Data Warehousing vs Data Mining

The system designs, methods, and objectives of data mining and data warehousing differ from one another. Before any data mining can happen, a procedure called data warehousing must be completed. The setting in which a data mining procedure might occur is a data warehouse. In conclusion, data warehouses efficiently arrange information to enable data mining.

7.3 Enterprise Resource Planning System What Is ERP?

What is ERP System? (Enterprise Resource Planning)

ERP stands for enterprise resource planning. It refers to the systems and software packages used by organizations of all sizes to manage day-to- day business activities, such as accounting, procurement, project management, and manufacturing.

ERP, short for Enterprise Resource Planning, denotes the systems and software packages adopted by organizations to oversee various day-to-day business activities such as accounting, procurement, project management, and manufacturing.

These systems integrate and define numerous business processes, facilitating the seamless flow of data between them. By gathering an organization's shared transactional data from multiple sources, ERP systems eradicate data duplication and uphold data integrity through a unified source of truth.

In contemporary business operations, ERP systems play a pivotal role in managing businesses of all sizes and across various industries. They have become as indispensable as electricity for many companies.

Key ERP Fundamentals:

ERP systems adhere to a standardized data structure (schema) with a common database, offering access to enterprise data through consistent constructs, definitions, and user experiences.

Centralized data collection is a core ERP principle, replacing standalone databases and disconnected spreadsheets with organized processes and shared data accessible to all users.

With secure and centralized data repositories, ERP ensures data correctness, currency, and completeness across the organization, enhancing data integrity for various tasks, from financial reporting to receivables management.

Business Value of ERP:

ERP systems have a profound impact on modern business operations, aligning separate departments and enhancing workflow efficiency, leading to significant cost savings.

Specific business benefits of ERP include:

- Improved business insight through real-time reporting.
- Lower operational costs via streamlined processes.
- Enhanced collaboration among users through shared data.
- Improved efficiency with a consistent user experience.
- Consistent infrastructure across business functions.
- High user adoption rates due to common user experience.
- Reduced risk through enhanced data integrity and financial controls.
- Lower management and operational costs via integrated systems.

Past: The History of ERP

The origins of Enterprise Resource Planning (ERP) can be traced back over a century. In 1913, engineer Ford Whitman Harris introduced the economic order quantity (EOQ) model, a paper-based manufacturing system for production scheduling, which remained the manufacturing standard for decades. However, the landscape changed in 1964 when Black and Decker became the first company to adopt a material requirements planning (MRP) solution, combining EOQ concepts with mainframe computers.

MRP revolutionized manufacturing until the development of manufacturing resource planning (MRP II) in 1983. MRP II introduced modular architecture and integrated core manufacturing components like purchasing, bill of materials, scheduling, and contract management into a unified system. This marked the first integration of diverse manufacturing tasks into a single system, offering a vision of enhanced operational efficiency through improved production planning, reduced inventory, and minimized waste.

As computer technology advanced in the 1970s and 1980s, similar concepts to MRP II emerged to manage broader business activities, including finance, customer relationship management, and human resources. By 1990, this expanded category of business management software was termed Enterprise Resource Planning (ERP).

In summary, ERP's roots stretch back to the early 20th century, evolving from EOQ and MRP systems to encompass a comprehensive suite of integrated business management solutions, facilitating efficient resource utilization and operational optimization across various organizational functions.

Present: ERP Today

From On Premises to the Cloud

During the late 1990s and early 2000s, there was a significant uptick in ERP adoption, driven by organizations seeking to streamline core business processes and enhance data visibility. However, the costs associated with implementing ERP systems began to rise steeply. On-premises hardware and software were expensive capital investments, and enterprise ERP systems often incurred additional costs for custom coding, consulting services, and training.

As ERP technology evolved to incorporate internet capabilities, new features like embedded analytics emerged. Over time, many organizations found that their on-premises ERP systems struggled to meet modern security requirements or adapt to emerging technologies such as smartphones.

The advent of cloud ERP has democratized access to ERP systems, breaking down barriers for small to medium-sized businesses (SMBs). SaaS solutions allow smaller companies to leverage robust ERP software previously accessible only to larger enterprises. Cloud-based ERP implementations are swift and require no upfront capital investment, offering flexibility to accommodate changing business needs and rapidly onboard new users.

Cloud ERP solutions extend beyond core financial functions to encompass integrated modules such as customer relationship management (CRM), supply chain management (SCM), human capital management (HCM), and enterprise performance management (EPM). By integrating these applications within a single data repository and user interface, an extended cloud ERP system enhances visibility, collaboration, and reporting capabilities across departments. Advanced features like data visualization and analytics empower organizations with real-time insights into business operations, accessible anytime and anywhere via mobile devices and social tools.

Future: ERP Trends

ERP Cloud Embraces the Next-Generation Workforce

ERP has transitioned to the cloud, marking a significant shift that is irreversible. The cloud has become not only the standard for ERP but also the inevitable path forward for the few companies still reliant on on-premises systems. Unlike traditional legacy ERP systems, cloud-based ERP solutions empower companies to adapt to the demands of the digital economy. Today's workforce expects access to cutting-edge technology, such as mobile and social features, coupled with intuitive interfaces that facilitate collaboration and information sharing. Antiquated processes, outdated technologies, and unattractive interfaces are no longer acceptable to employees. Organizations that fail to meet these expectations risk jeopardizing their future success.

Embracing ERP

The Superiority of Suite Solutions over Point Solutions

A fundamental characteristic of modern cloud ERP is its unified suite of applications. In contrast to implementing standalone software applications like human resources or sales automation, an ERP cloud suite offers unparalleled advantages. By encompassing all core business functions, a comprehensive solution integrates operational processes throughout the organization. This integration provides employees with enhanced visibility and insight into every aspect of the business. With an ERP cloud suite, companies can swiftly establish a foundation that addresses immediate needs while retaining the flexibility to adapt to evolving market conditions.

7.4 Knowledge Management System

All the systems discussed fall under the category of knowledge management. A knowledge management system (KMS) doesn't differ radically from other information systems but extends existing ones by assimilating more information.

Data constitutes raw facts, information results from processing and interpreting data, and knowledge comprises personalized information. Knowledge is characterized by:

- Personalized information
- A state of knowing and understanding
- An object to be stored and manipulated
- A process of applying expertise

- A condition of access to information
- Potential to influence action

Organizational knowledge can be sourced from various channels:

- Intranet
- Data warehouses and knowledge repositories
- Decision support tools
- Groupware for supporting collaboration
- Networks of knowledge workers
- Internal expertise

Definition of KMS

A knowledge management system (KMS) encompasses various practices employed within an organization to identify, create, represent, distribute, and facilitate the adoption of insights and experiences. These insights and experiences constitute knowledge, which can either be embodied in individuals or embedded in organizational processes and practices.

The purpose of a KMS includes:

- Improved performance
- Competitive advantage
- Innovation
- Sharing of knowledge
- Integration
- Continuous improvement by:
    - Driving strategy
    - Initiating new lines of business
    - Accelerating problem-solving
    - Enhancing professional skills
    - Attracting and retaining talent

Activities in knowledge management typically involve the following steps:

- Commence with identifying the business problem and the expected business value.
- Determine the appropriate strategy to address the problem and deliver the desired value.
- Consider the necessary systems from both people and process perspectives.

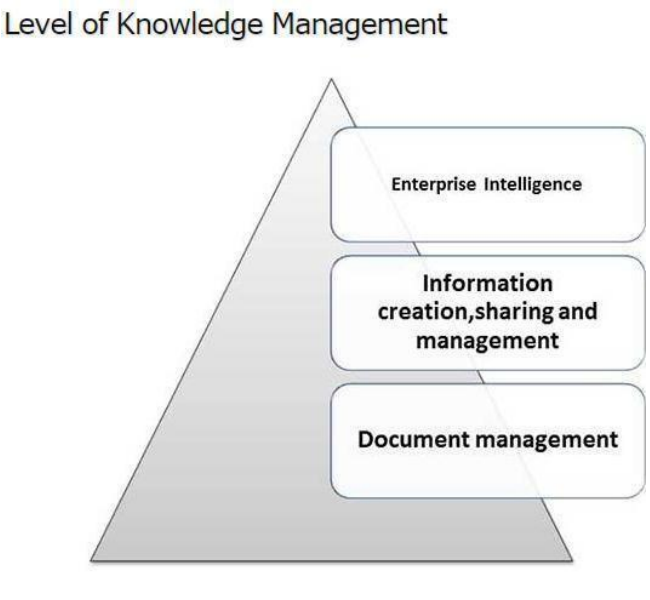
- Evaluate the technical infrastructure needed to support the identified systems and processes.
- Implement the systems and processes with suitable change management practices and through iterative staged releases.

The Origins of KM

The concept and terminology of knowledge management (KM) originated within the management consulting community. With the advent of the Internet, consulting organizations recognized the potential of intranets as tools to facilitate the accessibility and sharing of information among geographically dispersed units within their organizations. These organizations also realized that by developing tools such as dashboards, expertise locators, and best practice databases, they had acquired expertise that could be marketed as a new product to other large, complex, and dispersed organizations.

The term "Knowledge Management" was reportedly first used in its current context at McKinsey in 1987 for an internal study on information handling and utilization. KM gained wider recognition at a conference in Boston in 1993, organized by Ernst and Young. Notably, Davenport, who contributed to defining KM, was associated with Ernst and Young when he formulated his definition.

Consulting organizations played a crucial role in disseminating KM principles and techniques to other organizations, professional associations, and disciplines. This dissemination was timely, coinciding with the growing enthusiasm for intellectual capital in the 1980s, which underscored the importance of information and knowledge as essential assets for organizations.



What is KM trying to accomplish

Rich, Deep, and Open Communication?

Firstly, knowledge management (KM) can be viewed as an endeavor to replicate or create an information environment conducive to successful research and development (R&D). This environment entails rich, deep, and open communication channels and access to information, which are vital for information workers, including researchers. The pharmaceutical industry, in particular, has been extensively studied to identify organizational and cultural factors contributing to successful research. These studies highlight the importance of robust communication within the firm and with external entities. KM seeks to extend these successful environmental aspects to knowledge workers across various domains.

Secondly, the concept of Situational Awareness, while relatively new in the context of KM discussions starting around 2015, has historical roots predating KM. Initially, Situational Awareness gained prominence during the Cold War era when studies aimed to identify the characteristics of effective fighter pilots. Despite significant investment in pilot training, the primary determinant of success was found to be excellent situational awareness. However, developing predictive tests for situational awareness proved challenging. The concept later gained renewed attention in self-defense contexts, emphasizing the importance of vigilance and awareness. Within the KM framework, the goal is to enable organizations to cultivate superior situational awareness to facilitate informed decision-making.

A new definition of KM

A few years after the Davenport definition, the Gartner Group created another definition of KM, which has become the most frequently cited one (Duhon, 1998), and it is given below:

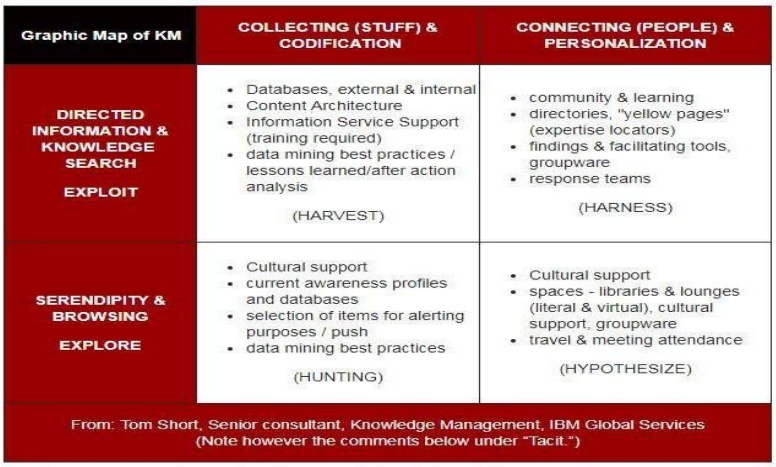
"Knowledge management is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers."

The main drawback of this definition is its narrow focus on an organization's internal information and knowledge assets. While KM initially centered on managing knowledge within organizations, it quickly expanded to encompass relevant information assets from external sources as well. Despite this broader scope, both definitions emphasize an organizational and corporate orientation.

The concept of KM has evolved beyond its original organizational context to encompass a wider range of knowledge-related activities and disciplines.

A graphic map of Knowledge Management

One illustrative depiction of KM is a graphic developed by IBM for their KM consultants, emphasizing the distinction between collecting content and connecting people. This graphic, with its mnemonic of C, E, and H, highlights IBM's approach to KM and underscores the importance of both content management and facilitating connections among individuals.



Graphic Map of KM	COLLECTING (STUFF) & CODIFICATION	CONNECTING (PEOPLE) & PERSONALIZATION
DIRECTED INFORMATION & KNOWLEDGE SEARCH EXPLOIT	• Databases, external & internal • Content Architecture • Information Service Support (training required) • data mining best practices / lessons learned/after action analysis (HARVEST)	• community & learning • directories, "yellow pages" (expertise locators) • findings & facilitating tools, groupware • response teams (HARNESS)
SERENDIPITY & BROWSING EXPLORE	• Cultural support • current awareness profiles and databases • selection of items for alerting purposes / push • data mining best practices (HUNTING)	• Cultural support • spaces - libraries & lounges (literal & virtual), cultural support, groupware • travel & meeting attendance (HYPOTHESIZE)
From: Tom Short, Senior consultant, Knowledge Management, IBM Global Services (Note however the comments below under "Tacit.")		

What does KM actually consist of?

The operational components of a Knowledge Management (KM) system encompass various facets that contribute to effective knowledge sharing and utilization within an organization. These components include:

1. **Content Management:** This involves making organizational data and information accessible to members through dashboards, portals, and content management systems. It encompasses tasks such as organizing, storing, retrieving, and distributing content effectively. Enterprise Search plays a vital role in enabling users to access both internal and external information seamlessly.
2. **Expertise Location:** Since knowledge resides within individuals, expertise locator systems help identify and locate individuals possessing specific knowledge or skills within the organization. These systems utilize data sources such as employee resumes, self-identification of expertise, and algorithmic analysis of electronic communications to connect users with relevant experts.
3. **Lessons Learned:** Lessons Learned databases capture operational knowledge, particularly tacit knowledge that may not be explicitly documented. These databases aim to convert personal expertise into explicit knowledge, allowing organizations to learn from past

experiences, successes, and failures. Successful implementation involves addressing complexities such as submission, vetting, and archival processes.

4. **Communities of Practice (CoPs):** CoPs are groups of individuals with shared interests who come together to share knowledge, discuss problems, exchange best practices, and review lessons learned. They leverage social learning within or across organizations, fostering collaboration and knowledge sharing. Effective CoPs require careful organization, maintenance, and facilitation to ensure ongoing engagement and relevance.

Each of these components contributes to the overall effectiveness of a KM system by facilitating knowledge creation, sharing, and utilization across the organization.

Tacit Knowledge

The term "tacit knowledge" is frequently used in the Knowledge Management (KM) community to refer to knowledge that is not explicitly documented, such as knowledge that is stored in people's thoughts. A more sophisticated classification makes a distinction between information that is tacit, implicit, and explicit. True, someone's mind is the only place where implicit knowledge exists. This is demonstrated by Nonaka's example of creating a bread maker for the house, where engineers had to collaborate with bakers to comprehend the subtleties of kneading dough.

However, the scope of knowledge that is truly tacit—like the physical skill of getting up on water skis—is relatively limited concerning KM systems. Far more extensive is the amount of implicit information that could be made explicit but has not been. This often results from an unconscious, cost-effective decision that formalizing this knowledge isn't worth the effort. The risk lies in assuming that explicit knowledge is managed by "collecting" and tacit knowledge by "connecting," without considering the significant implicit knowledge that could be explicitly documented.

Knowledge Retention and Retirees

Preserving retirees' knowledge is a long-standing problem in knowledge management (KM). This issue has becoming more pressing as the baby boomer generation approaches retirement age. KM strategies provide useful fixes for this issue. One obvious strategy is to put the lessons learned notion into practice by treating the retiree's career as a large project that is almost finished and producing a thorough after-action report or data dump. This strategy, which entails debriefing the retiree and their close associates to pinpoint any problems, makes sense. Although this approach seems like common sense, it is frequently not very useful. The key question is whether or not

current workers will look for this information and whether or not their inquiries will match the facts found in the retiree's lengthy report.

A more practical solution is to keep the retiree engaged, involving them in Communities of Practice (CoPs), and ensuring they are accessible through expertise locator systems. The true value lies not merely in the static information left behind by the retiree but in the dynamic, ongoing interaction between the retiree and current employees. When a retiree, in response to a current issue, comments with "it occurs to me that...," it can spark a meaningful discussion. This interaction, where the retiree provides relevant expertise and collaborates with current employees, often leads to the generation of new knowledge and solutions. The value, therefore, arises not just from the retiree's stored knowledge, but significantly from the interactive process and the new insights that emerge from it.

The Scope of KM

The Scope of KM has evolved significantly beyond its 20th-century definition, which primarily focused on managing an organization's internal knowledge, as outlined by the Gartner Group. Presently, KM is viewed as encompassing a broader spectrum of information and knowledge sources that could benefit an organization. This expansion includes not only internal knowledge but also external knowledge from vendors, suppliers, customers, and the scientific and scholarly community, traditionally managed by libraries. This perspective extends KM into activities such as environmental scanning and competitive intelligence, acknowledging the importance of external knowledge in organizational decision-making and strategy development.

The Origins of KM

The concept and terminology of KM originated within the management consulting community. With the advent of the Internet, consulting organizations recognized the potential of intranets to facilitate information sharing among geographically dispersed units. They developed tools like dashboards, expertise locators, and best practice databases, realizing that their expertise in these areas could be marketed as a new product. This led to the emergence of the term "Knowledge Management," first used in its current context at McKinsey in 1987. KM gained public attention at a conference in Boston in 1993 organized by Ernst and Young. Consulting firms played a significant role in disseminating KM principles and techniques to other organizations, professional associations, and disciplines, capitalizing on the growing recognition of information and knowledge as essential organizational assets, fueled by the enthusiasm for intellectual capital in the 1980s.

What is KM trying to accomplish?

Communication

First, KM can very fruitfully be seen as the undertaking to replicate, indeed to create, the information environment known to be conducive to successful R&D—rich, deep, and open communication and information access—and to deploy it broadly across the firm. It is almost trite now to observe that we are in the post-industrial information age and that we are all information workers. Furthermore, the researcher is, after all, the quintessential information worker. Peter Drucker once commented that the product of the pharmaceutical industry wasn't pills, it was information. The research domain, and in particular the pharmaceutical industry, has been studied in depth with a focus on identifying the organizational and cultural environmental aspects that lead to successful research (Koenig, 1990, 1992). The salient aspect that emerges with overwhelming importance is that of rich, deep, and open communications, not only within the firm, but also with the outside world. The logical conclusion, then, is to attempt to apply those same successful environmental aspects to knowledge workers at large, and that is precisely what KM attempts to do.

Situational Awareness

The concept of Situational Awareness, although recently adopted in the context of Knowledge Management (KM), has roots dating back to the Cold War era. During this period, studies were conducted to identify the characteristics of effective fighter pilots, given the significant costs associated with their training. These studies concluded that one critical trait of a successful fighter pilot was excellent situational awareness. However, developing a reliable test for situational awareness proved challenging.

Following its initial prominence, the term "situational awareness" faded into obscurity until it was reintroduced by Jeff Cooper, a firearms expert, and others in the context of self-defense. Establishing situational awareness became recognized as a crucial step in defending and protecting oneself.

In the realm of Knowledge Management, situational awareness has gained significance as organizations aim to make informed decisions. KM endeavors to equip organizations with the capability to establish and maintain excellent situational awareness, enabling them to make the right decisions based on a comprehensive understanding of their environment and context.

A new definition of KM

A few years after the Davenport definition, the Gartner Group created another definition of KM, which has become the most frequently cited one (Duhon, 1998), and it is given below:

"Knowledge management is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers."

The one real lacuna of this definition is that it, too, is specifically limited to an organization's own information and knowledge assets. KM as conceived now, and this expansion arrived early on, includes relevant information assets from wherever relevant. Note, however, the breadth implied for KM by calling it a ―discipline.

Both definitions share a very organizational and corporate orientation. KM, historically at least, was primarily about managing the knowledge of and in organizations. Rather quickly, however, the concept of KM became much broader than that.

7.5 Decision Making and Support System

A decision support system (DSS) is a computer-based application that collects, organizes and analyzes business data to facilitate quality business decision-making for management, operations and planning. A well-designed DSS aids decision makers in compiling a variety of data from many sources: raw data, documents, personal knowledge from employees, management, executives and business models. DSS analysis helps companies to identify and solve problems, and make decisions.

Decision-making analysis was conducted by the Carnegie Institute of Technology in the late 1950s and early 1960s. The Massachusetts Institute of Technology (MIT) applied computer technology to decision- making theory in the 1960s. By the 1980s, intensive research on DSS was underway, and new theories and concepts emerged from single-user models of DSS, including organizational decision support systems (ODSSs), group decision support systems (GDSSs) and executive information systems (EISs). By 1990 DSS was broadened to include data warehousing and online analytical processing.

Typical information gathered by a DSS may include:

- Projected revenue and sales figures, some based on new productsales projections
- Comparative sales figures between selected time periods
- Inventory data organized into relational databases for timely analysis

In some DSS applications, timely analysis includes the consequences of different decision alternatives.

DSS applications are used in many diverse fields, including medical diagnosis, credit loan verification, evaluating bids on engineering projects, business and business management, agricultural production at the farm and policy levels, forest management and railroad (for evaluation of defective rails).

Types of Decision Support Systems (DSS)

Decision Support Systems (DSS) are a class of computerized information system that support decision-making activities. DSS are interactive Computer-based systems and subsystems intended to help decision makers use communications technologies, data, documents, knowledge and/or models to complete decision process tasks.

A decision support system may present information graphically and may include an expert system or artificial intelligence (AI). It may be aimed at business executives or some other group of knowledge workers.

Typical information that a decision support application might gather and present would be, (a) Accessing all information assets, including legacy and relational data sources; (b) Comparative data figures; (c) Projected figures based on new data or assumptions; (d) Consequences of different decision alternatives, given past experience in a specific context.

There are a number of Decision Support Systems. These can be categorized into five types:

Communication-driven DSS

Most communications-driven DSSs are targetted at internal teams, including partners. Its purpose are to help conduct a meeting, or for users to collaborate. The most common technology used to deploy the DSS is a web or client server. Examples: chats and instant messaging softwares, online collaboration and net-meeting systems.

Data-driven DSS

Most data-driven DSSs are targeted at managers, staff and also product/service suppliers. It is used to query a database or data warehouse to seek specific answers for specific purposes. It is deployed via a main frame system, client/server link, or via the web. Examples: computer-based databases that have a query system to check (including the incorporation of data to add value to existing databases.

Document-driven DSS

Document-driven DSSs are more common, targeted at a broad base of user groups. The purpose of such a DSS is to search web pages and find documents on a specific set of keywords or search terms. The usual technology used to set up such DSSs are via the web or a client/server system.

Examples:

Knowledge-driven DSS

Knowledge-driven DSSs or 'knowledgebase' are they are known, are a catch-all category covering a broad range of systems covering users within the organization setting it up, but may also include others interacting with the organization - for example, consumers of a business. It is essentially used to provide management advice or to choose products/services. The typical deployment technology used to set up such systems could be silent/server systems, the web, or software running on stand- alone PCs.

Model-driven DSS

Model-driven DSSs are complex systems that help analyse decisions or choose between different options. These are used by managers and staff members of a business, or people who interact with the organization, for a number of purposes depending on how the model is set up - scheduling, decision analyses etc. These DSSs can be deployed via software/hardware in stand-alone PCs, client/server systems, or the web.

Decision support systems (DSS) are interactive software-based systems intended to help managers in decision-making by accessing large volumes of information generated from various related information systems involved in organizational business processes, such as office automation system, transaction processing system, etc.

DSS uses the summary information, exceptions, patterns, and trends using the analytical models. A decision support system helps in decision-making but does not necessarily give a decision itself. The decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions.

Programmed and Non-programmed Decisions

There are two types of decisions - programmed and non-programmed decisions. Programmed decisions are basically automated processes, general routine work, where:

- These decisions have been taken several times.
- These decisions follow some guidelines or rules.

For example, selecting a reorder level for inventories, is a programmed decision.Non-programmed decisions occur in unusual and non-addressed situations, so:

- It would be a new decision.
- There will not be any rules to follow.
- These decisions are made based on the available information.
- These decisions are based on the manger's discretion, instinct, perception and judgment. For example, investing in a new technology is a non-programmed decision.

Decision support systems generally involve non-programmed decisions. Therefore, there will be noexact report, content, or format for these systems. Reports are generated on the fly.

Attributes of a DSS

- Adaptability and flexibility
- High level of Interactivity
- Ease of use
- Efficiency and effectiveness
- Complete control by decision-makers
- Ease of development
- Extendibility
- Support for modeling and analysis
- Support for data access
- Standalone, integrated, and Web-based

Characteristics of a DSS

- Support for decision-makers in semi-structured and unstructured problems.
- Support for managers at various managerial levels, ranging from top executive to line managers.
- Support for individuals and groups. Less structured problems often requires the involvement ofseveral individuals from different departments and organization level.
- Support for interdependent or sequential decisions.
- Support for intelligence, design, choice, and implementation.
- Support for variety of decision processes and styles.
- DSSs are adaptive over time.

Benefits of DSS

- Improves efficiency and speed of decision-making activities.
- Increases the control, competitiveness and capability of futuristic decision-making of the organization.
- Facilitates interpersonal communication.
- Encourages learning or training.
- Since it is mostly used in non-programmed decisions, it reveals new approaches and sets up newevidences for an unusual decision.
- Helps automate managerial processes.

Components of a DSS

Following are the components of the Decision Support System:

Database Management System (DBMS): To solve a problem the necessary data may come from internal or external database. In an organization, internal data are generated by a system such as TPS and MIS. External data come from a variety of sources such as newspapers, online data services, databases (financial, marketing, human resources).

Model Management System: It stores and accesses models that managers use to make decisions. Such models are used for designing manufacturing facility, analyzing the financial health of an organization, forecasting demand of a product or service, etc.

Support Tools: Support tools like online help; pulls down menus, user interfaces, graphical analysis, error correction mechanism, facilitates the user interactions with the system.

Classification of DSS

There are several ways to classify DSS. Hoi Apple and Whinstone classifies DSS as follows:

Text Oriented DSS: It contains textually represented information that could have a bearing on decision. It allows documents to be electronically created, revised and viewed as needed.

Database Oriented DSS: Database plays a major role here; it contains organized and highly structured data.

Spreadsheet Oriented DSS: It contains information in spreadsheets that allows create, view, modify procedural knowledge and also instructs the system to execute self-contained instructions. The most popular tool is Excel and Lotus 1-2-3.

Solver Oriented DSS: It is based on a solver, which is an algorithm or procedure written for performing certain calculations and particular program type.

Rules Oriented DSS: It follows certain procedures adopted as rules.

Rules Oriented DSS: Procedures are adopted in rules oriented DSS. Export system is the example.

Compound DSS: It is built by using two or more of the five structures explained above.

Types of DSS

Following are some typical DSSs:

Status Inquiry System: It helps in taking operational ,management level, or middle level management decisions, for example daily schedules of jobs to machines or machines to operators.

Data Analysis System: It needs comparative analysis and makes use of formula or an algorithm, for example cash flow analysis, inventory analysis etc.

Information Analysis System: In this system data is analyzed and the information report is generated. For example, sales analysis, accounts receivable systems, market analysis etc.

Accounting System: It keeps track of accounting and finance related information, for example, final account, accounts receivables, accounts payables, etc. that keep track of the major aspects of the business.

Model Based System: Simulation models or optimization models used for decision-making are used infrequently and creates general guidelines for operation or management.

7.6 Summary

An efficient information system creates an impact on the organization's function, performance, and productivity.

Nowadays, information system and information technology have become a vital part of any successful business and is regarded as a major functional area like any other functional areas such as marketing, finance, production and human resources, etc.

Thus, it is important to understand the functions of an information system just like any other functional area in business. A well maintained management information system supports the organization at different levels.

Many firms are using information system that cross the boundaries of traditional business functions in order to re-engineer and improve vital business processes all across the enterprise. This typical hasinvolved installing −

- Enterprise Resource Planning (ERP)
- Supply Chain Management (SCM)
- Customer Relationship Management (CRM)
- Transaction Processing System (TPS)
- Executive Information System (EIS)
- Decision Support System (DSS)
- Knowledge Management Systems (KMS)
- Content Management Systems (CMS)

The strategic role of Management Information System involves using it to develop products, services, and capabilities that provides a company major advantages over competitive forces it faces in the global marketplace.

We need an MIS flexible enough to deal with changing information needs of the organization. The designing of such a system is a complex task. It can be achieved only if the MIS is planned. We understand this planning and implementation in management development process.

Decision support system is a major segment of organizational information system, because of its influential role in taking business decisions. It help all levels of managers to take various decisions.

7.7 Self-Assessment Questions:

1. What is an ERP system? How does an ERP system enforce best practices for an organization?
2. What is one of the criticisms of ERP systems?
3. Explain Enterprise Resource Planning (ERP)
4. Explain Supply Chain Management (SCM)
5. Explain Customer Relationship Management (CRM)
6. Explain Transaction Processing System (TPS)
7. Explain Executive Information System (EIS)
8. Explain Decision Support System (DSS)

Unit - 8

MIS The factors of Success and Failure

Learning Objective :

After completing this unit you will be able to

- Understanding of **Factors Affecting IT Success and Failure**
- Understanding of **Proposal of Method Development**
- Narrate using of system development model

Structure :

8.1 Introduction

8.2. Factors Affecting IT Success and Failure

8.3. Proposal of Method DevelopmentSummary

8.4. Summary

8.5. Self-Assessment Questions

8.1 Introduction

Companies face with many challenges in the industry, in order to keeping up those, companies need aligning their business strategies with Information Systems. Information Systems often provides competitive advantage to firms and also properly implemented Information Technology is one of the key success factors in their business area. Benefits that can be derived from IT investments are productivity improvements and cost reduction. Does IT implementation increase the productivity in manufacturing and service industries? This question is usually asked and many surveys and researcheswere done about it. In the first part of our survey, we began the search this question's answers. This survey is concluded as; success and competitive advantage do not come from sophisticated and high- end IT implementation; instead they are result of the skilled management and proper implementation of Information Technologies' both tangible and intangible assets.

The impact of Information Systems on quality performance is studied in one of the out of scope papers. Hypothesis which are derived from the subject, are proved by a specific reference model. Sample is used to collect data via questionnaires. Results are achieved by testing these hypotheses

by using F-test and canonical correlation analysis to determine statistical significance. The paper argues that there is no relationship between quality performance and the combination of quality management practices, quality information flows and information technologies for quality (Forza, 1995).

The role of Information Systems and assessing their relative importance to a range of management activities is examined by the second paper that is out of scope. To reach their assertion they designed questionnaires and evaluated the results that are obtained from the predefined sample. The paper generally focuses on the factors affect the strategic flexibility of companies by using the questionnaire results. The paper argues that the factors that make the firms strategically flexible are (Beach, Muhlemann, Price, Paterson and Sharp, 2000);

- Respondent's descriptions of their business strategies
- Part played by manufacturing
- The interfaces with the customers

The role of information system and its contribution to manufacturing:

However IT part in the paper is very short and paper focuses on effects of IT on strategy of company. It does not give information about factors affecting IT success and failure.

Next paper tries to find out that how computer based technologies support production and operations management in Hong Kong? Two surveys were done in order to reach this question's answer. In the first survey the key objective is to examine the statuses of computer-based technology and to uncover extent to which it is being used to support quality such as; quality control, quality assurance, quality management (Cheng and Ngai, 1998). The objective of the second one is to investigate the average level of IT applications of SME (small and medium enterprises) with a view to understanding the existing operation problems and needs of SME's in regard to communication, information access and dissemination and the difficulties of applying IT in these areas (Cheng and Ngai, 1998). This paper especially focuses on the IT and business interactions in Hong Kong and does not examine the IT success and failure

Perceived the importance of internet as an information channel for OM professionals (White and Jacobs, 1998) is the other out of scope paper. Internet and other information channels such as; books, papers, periodicals, conferences are used as an information channel by operations management professionals. The weights of the usage of these sources are founded by a questionnaire that is distributed via e-mail and US postal service to the respondents. Chi-square test is applied as a statistical method. Researchers find out that the usage of internet is continuously increased and internet is used by academicians and students extensively.

The last out of scope paper is examined the aligning IT applications with manufacturing strategy

(Kathuria and Igbaria, 1997). The paper is stated that the competitive advantage that is gained by IT implementation can only be achieved by matching IT applications with firms' manufacturing tasks according to their priorities and process structures. Paper recommends different tools for different manufacturing processes such as if product and volume flexibility is pursued by a firm, ATO demand management system can be used.

8.2. Factors Affecting IT Success and Failure

The first paper by Sohal and Moss (2001) compares the success of IT implementation in Australian manufacturing and service industries. The study collected data through a questionnaire survey conducted among Australia's top 500 businesses, resulting in 81 responses. Regression analysis was employed as the methodology to investigate variables related to IT success evaluation, including benefits provided by IT implementation, integration of IT within the company, impediments to IT success, and factors facilitating IT implementation. The study identified success factors such as system implementation, software package usage, quality of IT staff, software support, user training, system testing, system planning, and system design/analysis. It concluded that IT has been applied across all areas of companies' business processes, yet companies typically achieve only moderate benefits from their IT investments, primarily in productivity improvements and cost reduction.

The second paper by Mandal and Baliga (2000) introduces a framework for developing Management Information Systems (MIS) user interfaces to enhance their usefulness in managerial decision-making. Twenty interfacing programs were developed and implemented to address information requirements at operational, planning, and strategic levels. The paper argues that the poor utilization of MIS as an IT project stems from inadequate emphasis on interfacing software by MIS designers. It suggests that for successful IT projects, companies should identify software requirements for their business needs and select flexible packages for customization.

Choe's (2003) paper explores the effects of environmental uncertainty and strategic applications of Information Systems (IS) on firm performance. The study empirically examines the relationships among perceived environmental uncertainty, the level of strategic IS applications, and facilitators of IS strategic alignment. Data were collected from a survey of IS usage in Korean business firms. The study identifies internal and environmental factors affecting IT success, including environmental dynamism, competition, IS manager involvement in strategic planning, upper management commitment to IS, and user participation in IS planning.

Ho (1996) discusses information technology implementation strategies for manufacturing organizations, proposing a strategic alignment model integrating manufacturing activities and IT. Although no specific methodology is mentioned, the paper emphasizes achieving functional integration between manufacturing and IT domains to strategically manage IT within the firm.

The last paper by Peterson et al. (2002) investigates the perception of information system designers from the United States, Japan, and Korea on success and failure factors. The study surveyed IS designers from various companies in these nations and used ANOVA for statistical analysis. Eighteen factors were identified and grouped into five categories: organizational integration, communication of goals, project leader, IS designer, and development techniques. Differences in perception among designers from the three nations were attributed to cultural differences, with American designers prioritizing communication of goals and shared decision-making responsibility, while Japanese designers emphasized management and project leadership. Korean designers' perceptions fell between those of American and Japanese designers due to their cultural positioning.

8.3. Proposal of Method Development

Under the lights of literature survey, we propose a new model to help companies in their decision processes when they are implementing a new information systems project. During the literature survey it has been inferred that there are some critical factors that directly affect the success and failure of the IS projects. Factors affecting the success and failure of IT implementation are almost common for all companies. However priority and importance of factors may differ from company to company based on their culture, region, organizational structure, environment and main business they deal with. The proposed model simply gives the weights to the factors to reveal their priorities and importance and ranks all the factors according to their priorities in ascending order. This process determines the vital factors that must be taken into consideration at first glance when implementing the IS project. In the worst case project’s goals and company’s goals conflict, project teams do not capable of doing the project and technology and method are inaccurate, project becomes infeasible and company must decide to give up the project. Otherwise company may decide to do the project but it must be careful about the factors that have higher priorities. The weights of the
factors will be determined via questionnaires that will be filled up by stakeholders of the system. All factors can be grouped under five main headings. These are;
Environmental factors a. Globalization b. Environmental dynamism c. Competition

Factors about internal organizational structure

- Strategic alignment between organizational structure infrastructure and IT structure infrastructure
- Top management support and commitment to IS
- User participation in IS project d. Matching IT capabilities to organizational needs and goals etc.

Organizational structure context f. enough managerial and technical skills Factors about project team structure

a. Project leader feedback to team

b. Experience of project leader c. Project monitoring and control

d. Adequate training for team members

e. Peer review on project progress

f. Experience of team members

g. Team member commitment

h. Team member self-control

Appropriate technology and project methodology

a. Clearly stated objectives

b. Detailed project plan

c. Proper project scope

d. Utilizing effective methodology

e. Use of appropriate technology

f. Effective system implementation after project support

Post-implementation activities

a. Training of users

b. Software support

c. Training of it staff

d. On time help to users

The relationship between environmental factors and IT success or failure in companies is significant. External environments often necessitate firms to utilize strategic IS (Information Systems) applications to survive. Environmental dynamism, characterized by uncertainty, impacts the firm's IS applications. In stable environments, firms tend to pursue defensive strategies

focusing on efficiency and cost-effectiveness. Conversely, in uncertain environments, firms need high levels of strategic applications to succeed. These applications influence or shape the company's strategy and play a direct role in its implementation (Choe, 2003).

Global companies must adjust IS projects to fit their subsidiaries' conditions. Failure to do so increases the likelihood of project failure. Companies implement IS projects to gain competitive advantages such as differentiation, cost reduction, innovation, and growth. In competitive environments, the inability to develop and implement effective IS projects can lead to failure.

Internal organizational structure also affects IS project success. High harmony between the company's structure and IS infrastructure is crucial. If the IT capabilities of the firm do not match its organizational needs and goals, the IS project may either be inadequate or overly complex, leading to failure. Traditional hierarchical organizations often struggle to respond to new business demands due to outdated structures.

Managerial and technical skills are critical. Lack of managerial skills can lead to improper project goals, scope definition, and inadequate monitoring, which can cause project failure. Technical skills, including technical knowledge, investment, and capabilities, are also essential. Insufficient technical skills can result in a failed project. Top management support is vital, providing necessary resources such as money, time, and human power, ensuring the project stays within budget and schedule.

User participation is another critical factor. IS projects are designed for end users, and their needs and expectations must be considered, especially during requirement collection and user interface design. User feedback is essential for the project's success. The structure and experience of the project team, particularly the project leader, significantly impact the project's outcome. Experienced leaders and members, coupled with adequate training and periodic feedback, enhance the chances of success.

Selecting the right technology and methodology is vital. Companies must clearly define objectives and project scope to choose appropriate technology and methodology. A well-defined project plan is necessary to reach predefined objectives within the planned duration. Even with proper methodology, success depends on the firm's ability to implement it. Flexible technologies that can adapt to changing needs are advantageous.

The life cycle of an IS project includes post-implementation support and training. Proper training ensures users understand and utilize the new system, preventing resistance and rejection.

Continuous updates and bug fixes are necessary to maintain the system's relevance and effectiveness. The IT staff must be capable of providing ongoing support to end users.

In summary, the success of IS projects in companies is influenced by environmental factors, organizational structure, managerial and technical skills, user participation, project team experience, appropriate technology and methodology selection, and post-implementation support and training.

8.4. Summary

Information processing and information technology are essential components for companies of all sizes, from global enterprises to small and medium-sized enterprises (SMEs). For successful IT implementation, organizations must understand the strategic changes required, which can be identified using a model of success and failure factors. While companies are generally open to implementing information systems (IS) projects, there is a significant concern about the potential for failure. Research indicates that nearly eighty percent of IS projects fail. However, using the recommended model can substantially reduce this risk.

The model's success depends on accurately determining the weights and priorities of various factors. Although the factors influencing the success and failure of IS projects are generally common across different organizations, the specific weights and priorities assigned to these factors will vary based on the company's structure, culture, region, and the scope of the IS project. Properly setting these weights allows companies to identify project risks more effectively.

To establish appropriate weights, companies can conduct a survey at the project's outset and distribute it to all stakeholders. By analyzing the survey results, the company can assess the project's feasibility. If the project is deemed infeasible, it can be aborted. If feasible, the company can identify and address the riskier factors, adjusting the project accordingly based on the survey results.

This model serves as an excellent guide for companies to identify the success and failure factors of an IS project and to tailor their projects based on these insights. By following the model, companies can significantly reduce the likelihood of project failure.

8.5 Self-Assessment Questions:

1. Explain Factors Affecting IT Success and Failure
2. Explain Proposal of Method Development