Digital INFORMATION SYSTEM

Dr. Hj. Nur Aisyah. SE., MM.

CV. AA. RIZKY

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In the ever-evolving digital era, understanding and managing digital information systems is becoming increasingly crucial for organizations and individuals who want to remain competitive and relevant. The book "Digital Information Systems" is presented as a comprehensive guide that explains the basic principles, technology and practical applications of digital information systems.

This book is designed to provide readers with an in-depth understanding of the various components that make up a digital information system, including hardware, software, networks, data, and users. With language that is easy to understand and accompanied by real examples, this book bridges theory and practice in the world of digital information systems.

Iis This book consists of:

By reading this book, readers will be equipped with the knowledge and skills necessary to design, implement, and manage effective and secure digital information systems, and be ready to face a technological future full of opportunities.

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Penerbit : CV. AA. RIZKY
Alamat : Jl. Raya Ciruas Petir,
Puri Citra Blok B2 No. 34 Pipitan
Kec. Walantaka – Serang Banten
E-mail : aa.rizkypress@gmail.com
Website : www.aarizky.com

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Dr. Hj. Aisyah. SE., MM.

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Authors:
Dr. Hj. Aisyah. SE., MM.

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Especially for my beloved grandchildren

SHAKA and BIYAN

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PREFACE

In this day and age, technological progress is progressing so rapidly. One of the technological advances that we can feel today is progress in the field of communication and information systems. Everyone can easily communicate and convey information from one place to another over quite a long distance. Developments occur in the fields of hardware and software. The benefits of technological developments have been widely felt in human civilization in the millennial era. However, the negative impact is also not small. Knowledge and understanding are required to utilize technology optimally.

The use of information technology can be applied to various branches of science, which is designed to help in understanding several topics, including: basic introduction to internet information systems, electronic commerce (e-commerce), graphic design applications, online research, security and ethics in using the internet and cloud storage. Each topic will be divided into several more detailed topic subchapters.

The author is very aware of the various limitations in preparing this book. With all these limitations, the author hopes that this textbook will be able to help increase understanding of digital information systems and be able to apply them in everyday life as well as in the academic and professional world.

Medan, July 2024
Writer

Dr. Hj. Nur Aisyah, SE., MM.

TEXTBOOKS USE INSTRUCTIONS

So that the learning process runs smoothly and learning objectives are achieved well, it is recommended to:

1. Read the existing material carefully and understand the learning objectives listed at the beginning of each chapter, if there are things that are not clear, you can conducting questions and answers with the facilitator in classroom learning activities;
2. Do the exercises and evaluations at the end of each chapter in this book;
3. Form discussion groups to discuss certain material and case studies given to deepen understanding of the material;
4. Study material from other sources as listed in the bibliography the end of this book to broaden your horizons
5. Relate the material obtained to working environmental conditions and try it plan its implementation if necessary.

Learning Objectives

Information system is a term which is used for the framework that provides us information for decision making process. Information systems have a very important role to play in any business and successes of a business organization also depend on the timeliness, accuracy, and quality of information which is the output of an information system.

Information system is important at each level of business management. It supplies information from Strategic management team to middle management and it is very crucial for business successes. The importance of information system in a business management is for following reasons

- An aid in operational excellence
- Helpful in improved decision making
- Necessary for day to day survival
- Competitive Advantage
- Helpful in Cost Management

After going through this lesson the student should be able to:

- Understand the basics of information system
- Importance of Information systems in decision making process.

Lesson Outline

- Systems
- An Overview
- Information and Data: Definition and Distinctions
- Features and Qualities of Information
- Types of Information
- Process of Generating Information
- Value and Cost of Information
- Information as a Corporate Resource
- Information Needs at Various Levels of Management
- Factors Influencing Information Needs
- Information Systems: Definition and Elements
- Information System Activities
- Types of Information Systems
- Information Systems in Business Management
- Recent Trends in Information Systems

"What information consumes is rather obvious: it consumes the attention of its recipients. Hence, a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it."
Herbert Simon

*****

INTRODUCTION

Information system is a term use for the combination of networks of hardware and software, people, procedures, and organizations use to collect, filter, process, create, and distribute data, so that something meaningful can be extracted. It is playing a crucial role in everyone's life, as we all depend on information for better decision making. Information systems may be different for different types of people as the information need of different users are different; and it is difficult for a single information system to cater all users. Depending on the type of information requirement there are different information systems that exist. An information system which provides accurate, timely and reliable information is the key for an organization success. Here we will discuss:

- Systems
- An Overview
- Information and Data: Definition and Distinctions
- Information as a Corporate Resource
- Features and Qualities of Information
- Types of Information
- Process of Generating Information
- Value and Cost of Information
- Information Needs at Various Levels of Management
- Factors Influencing Information Needs
- Information Systems: Definition and Elements
- Information System Activities
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System Overview

A system is defined as multiple parts working together for a common purpose or goal. The term system is derived from the Greek word System, which means an organized relationship among functioning units or components. A system exists because it is designed to achieve one or more objectives. We come into daily contacts with the transportation system, the telephone

system, the accounting system, the production system, and for over three decades, the computer system.

Characteristics of A System

1. Organization of interrelated elements:
   Organization implies structure and order. It is the arrangement of components that help to achieve objectives. For example, a computer system is designed around an input device, a central processing unit, an output device, and one or more storage units. When linked together they work as a whole system for producing information.
2. Interrelated components interaction:
   Interaction refers to the manner in which each component functions with other component of the system. In a Lesson 2 Information Systems 25 computer system, for example, the central processing unit must interact with the input device to solve a problem. In turn, the main memory holds the program and data that the arithmetic unit uses for computation. The interrelationship between these components enables the computer to perform smooth functions.
3. Interdependencies among system's parts
   Interdependence means that parts of the system depend on one another. They are coordinated and linked together according to a plan. One subsystem depends on the input of another subsystem for proper functioning; i.e. the output of one subsystem is, the required input for another subsystem. This interdependence is crucial in systems work.
4. Common objectives
   The last quality is central objective. Objectives may be real or stated. It is very common for an organization to state one objective and operates to achieve another. This important point is that users must know the central objective of a computer application early in the analysis for a successful design and conversion.

Different Types Of System

Systems are classified in different ways. Depending on their characteristics system can be classified in number of ways. The following classifications are worth mentioning.

1. Large and Small systems

   This classification is based on the system size. Large complex systems can be the air traffic control system or our global telecommunication network. For small systems, small devices can also be considered as systems: such as a pocket calculator, alarm clock, or 10-speed bicycle.

2. Physical or Abstract systems

   Systems can also be classified as physical and Abstract depending on whether they can be touched/seen or not. Examples are solar system and judicial system respectively.

   Physical systems are tangible entities and may be static or dynamic in operation. For Example, the physical parts of the computer center are the offices, desks, and chairs that facilitate operation of the computer. They can be seen and counted, they are static. In contrast, programmed computer is a dynamic system. Data, programs, output and application changes as the user's demand or the priority of the information requested changes.

   Abstract systems are conceptual or nonphysical entities. They may be models-the abstract conceptualization of physical situations such as traffic system. An abstract system can be a representation of a real or a planned system.

3. Open or Closed systems

   Open systems refer to systems that interact with other systems or the outside environment. For example living organisms are considered open systems because they take in substances from their environment such as food and air and return other substances to their environment

   Closed systems refer to systems having relatively little interaction with other systems or the outside environment. A watch is an example of a closed system in that it is a relatively self-contained, self-maintaining unit that has little interacts or exchange with its environment.

4. Natural or Manmade System

   By virtue of their creation, this classification applies. For instance, ecosystems and the respiratory system in the human body are examples of natural systems. On the other hand, computer systems and electoral systems are examples of manmade systems. Within this classification framework,

information systems are categorized as large, manmade, open, and abstract systems.

Natural systems, like ecosystems, consist of living organisms and their physical environment interacting as a unit. The respiratory system in humans involves a complex set of organs and structures responsible for the intake and exchange of oxygen and carbon dioxide. These systems evolved through natural processes and operate according to the laws of nature.

In contrast, manmade systems are human-engineered constructs designed to perform specific functions. A computer system is an arrangement of hardware and software designed to process and store data. An electoral system encompasses the rules and procedures used to conduct elections, ensuring the democratic process within a society.

Information systems, specifically, are designed to collect, process, store, and disseminate information. They are manmade due to their development by humans to fulfill particular needs. These systems are open, meaning they interact with their environment and can adapt to changes. Additionally, they are abstract because they deal with the processing and management of data rather than physical entities.

In summary, the classification into natural and manmade systems highlights the origin and purpose of various systems. Information systems, being manmade, open, and abstract, play a crucial role in modern society by facilitating the efficient handling of information.

Information And Data: Definition And Distinctions

1. Meaning of Data and its characteristics

   Data in Noun form means

   - Facts and figures collected together for reference or analysis.
   - The quantities, characters, or symbols on which operations are performed by a computer, being stored and transmitted in the form of Information.

   Data is a collection of facts, such as values or measurements. It can be numbers, words, measurements, observations or even just descriptions of things.

2. Data characteristics
   a. Data means Facts, statistics used for reference or analysis.
   b. Data comprises Numbers, characters, symbols, images etc., which can be processed by a computer.
   c. Data must be interpreted, by a human or machine, to derive meaning.
   d. Data is a representation of information. Data is derived from Latin word 'datum' which means "that which is given".
3. Meaning of Information and its characteristics
   Information is Facts provided or learned about something or someone. It can be defined as data that:
   - Has been verified to be accurate and timely
   - Is specific and organized for a purpose
   - Is presented within a context that gives it meaning and relevance, and
   - That can lead to an increase in understanding and decrease in uncertainty.

   In simple words it means processed data that has some meaning. Data alone are insufficient unless they are processed. Once converted in to information becomes directly applicable. The value of information lies solely in its ability to affect a behavior, decision, or outcome. A piece of information is considered valueless if, after receiving it, things remain unchanged
   a. Information is the useful knowledge derived from the data
   b. Information is knowledge derived from study, experience (by the senses), or instruction.
   c. Informationisanykindofknowledgethatisexchangeableamongstpeople,aboutthings,facts,concepts, etc.

Features And Qualities Of Information

1. Relevancy: The information so generated should be relevant to the context for which it is collated. Too much irrelevant information may confuse the intended user so it is necessary o generate only relevant information. No information should be generated only because it can be generated by Information System. A good way of ensuring relevance is to closely define the objectives of any information reports. Another way to improve relevance is to produce information that focuses on

"exceptions" - e.g. problems, high or low values, where limits have been exceeded.

2. Up-to-date: Information needs to be timely if it is to be actioned upon. For example, a professional need updated information about applicable laws so that he may give relevant advice to his clients. To improve the speed with which information is produced, businesses usually need to look at upgrading or replacing their information systems.
3. Accurate: As far as possible, information should be free from errors (e.g. the figures add up; data is allocated to the correct categories). The users of information should be informed whenever assumptions or estimates have been used.
4. Meet the needs of the User: Since different users have different information needs The managing director doesn't have time to trawl through thick printouts of each week's production or sales listings - he or she wants a summary of the key facts while the quality control supervisor will want detailed information about quality testing results rather than a brief one-line summary of how things are going. It is a good idea to encourage users to help develop the style and format of information reporting that they require.
5. Concise and User Friendly: Information should be clearly presented (e.g. use summaries, charts) and not too long. It also needs to be communicated using an appropriate medium (e.g. email, printed report, presentation. Businesses should also consider developing "templates" which are used consistently throughout the organization - so that users get used to seeing information in a similar style.
6. Worth the cost: Often forgotten. Information costs money. Data is costly to collect, analyze and report. Information takes time to read and assimilate. All users should question whether the information they receive/ have requested is worthwhile.
7. Reliable: Information should come from authoritative sources. It is good practice to quote the source used - whether it is internal or external sources. If estimates or assumptions have been applied, these should be clearly stated and explained.

Types Of Information

There may be different types of information classifications such as: Factual vs. Analytical.
Objective vs. Subjective

Primary vs. Secondary

1. (A) Factual Information: These are just the facts. These information are very objective and real. Something that actually exists, reality, truth is a factual information. Examples of factual information are like; Temperature in a city, winner of academy award etc.
   (B) Analytical Information: Interpretations, Analysis, Criticism constitute analytical information. To examine critically, so as to bring out the essential elements or give the essence of something, analysis is required. Examples include; Increase of drug use in the 2013, growth in crime rate etc.
2. (A) Objective Information: Without Bias Non-judgmental "not influenced by personal feelings, interpretations, or prejudices; based on facts". It is to the point, clear cut without any personal projection. Examples of objective information needs: Chronology of the Feminist movement, the eight stages of development according to Erik Erikson
   (B) Subjective Information: It includes opinions, personal viewpoints, and evaluations existing in the mind. Examples of subjective information needs include; Criticism of O'Neill's play, Evaluation of a course based on class comments. Book review or movie reviews etc.
3. (A) Primary Information: Information in its original form, not translated by anyone else, has not been published elsewhere, is termed as primary. Examples of primary information needs: Explanation or instructions from an employer or teacher, an eyewitness account of a house fire, etc.
   (B) Secondary Information: It is repackaged examination, restatement or interpretation of primary information already collected by someone. Examples of secondary information needs: Notes borrowed from a classmate for a missed class, a bibliography on the letters of Ernest Hemingway and so on.

Based on it is meant for information may be Personal Information, or Business Information. There can be other

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classifications as well like, formal vs informal, confirmed vs tentative etc.

Process Of Generating Information

The goal of information generation is to generating information which is reliable, timely, user friendly and meeting the intended user objectives. If it fails to meet the stated objectives it is considered poor in quality. Therefore information generation requires careful steps so that it serves it purpose. The process basically involves the following steps.

1. Understanding the user need in general
2. Create framework for generating intended information
3. Collecting the data.
4. Process or analyze data.
5. Collate the result from data, interpret, evaluate.
6. Communicate the result of interpretation, evaluation of data in form of Information to intended user.

Value And Cost Of Information

Information is of value to decision makers if it is accurate, timely, complete, and relevant. If it is poor on any o these criteria, it will be less useful hence may not have that value. These four criteria are used to distinguish valuable information from information that is of less value.

Accurate information provides a reliable and valid representation of reality. The cost of inaccurate or distorted information can be extremely high. Consider the demise of the multimillion dollar Mars Climate Orbiter launched by NASA in 1998. The tragic outcome of this mission was blamed on the failure of one scientific team to recognize and correct an error in information from another team. Findings indicate that one team used English units (e.g., inches, feet and pounds) while the other used metric units for key spacecraft operations affecting navigation. This oversight caused the orbiter to burn up in Mars atmosphere before it could deploy to the surface. Oops.

Timely information is information that is available when it is needed. When information is needed almost always depends on the situation. In the fast-paced world of air travel, commercial airlines need virtually daily updates on what other commercial airlines are doing with their ticket prices. If one airline reduces

its airfares from Mumbai Airport to New Delhi Airport, other airlines flying the same route would find out quickly about it and respond in a similar manner.

Complete information tends to be comprehensive in covering the issue or topic of interest. Complete information tells a complete story. Without complete information, a decision maker will get a distorted view of reality. Incomplete market information can lead businesses to introduce products and services that customers don't want.

Information is relevant if it has significance or can be applied to a specific situation, problem, or issue of interest. Here are some examples of relevant information. Human resource managers need information on hiring and employee turnover; operations managers need information on costs and productivity; marketing managers need information on sales projections and advertising rates; top executives need information on the strategic actions of their competitors. In contrast, product inventory information is not very relevant to a computer programmer.

Information As A Corporate Resource

Generally human, financial, physical and knowledge factors that provide a corporate the means to perform its business processes are considered as corporate resources.

Information can be considered as the raw material used in producing each and every decision taken in an organization. Organizations need to decide regularly on what objectives to be achieved, what actions to be taken to achieve these objectives, how and when these actions are to be taken, and the resources to be used for all these activities. These decisions are taken by all the people in the organization who work at different level of organizational hierarchy and handle different aspect of the organizational work.

The exact decision that in individual takes varies from person to person and from time to time, depending on nature of organizational tasks being performed. Also some people need to do more of decision making as compared to implementing the decisions. But everyone in the organization needs has to takes some decisions for which availability of adequate information is critical.

Information is also required to convey decisions taken to the people responsible for implementing the decisions taken, and for monitoring the actual results achieved as the work progresses. In want of information many decisions cannot be taken and in some cases it results into poor decisions. Therefore information is acting as a resource, which should be managed, so that needy people may get it in time when required. In this way information plays a role of corporate resource in every organization. Like any other resource it need to be formalized, must have some identified and systematize way of generation and dissemination.

Information Needs At Various Levels Of Management

Information is needed for decision making at all levels of management. Managers at different organizational levels make different types of decisions, control different types of processes, and have different information needs.

Three classical levels of management include

1. Top Management or Strategic Management
2. Middle Management or tactical management
3. Low Level Management or Operational Management

Strategic Management includes directors/owner that make decisions which affect the entire organization, or large parts of it, and leave an impact in the long run. The decision making at this level is highly unstructured. By this we mean, there may not be a proper format for decision making. It requires lot of inputs in terms of information, but there is no fixed way of mixing those inputs.

Middle, or tactical, management receive strategic decisions from strategic management as general directives. Using those directives as guidelines, they develop tactics to meet those strategic directives. The decision making at this level is semi structured. Some pieces of information can be mixed to get some conclusion but some amount of ambiguity is always there.

Operational managers are responsible for daily operations. They make decisions concerning a narrow time span about the deployment of small groups of clerical and/or shop floor workers. Generally the decisions at this level are structured in nature.

People in different management levels have different information needs. Most of the information that managers require is used to make decisions. The decision making process of middle managers and above is less structured than that of operational managers; In general, strategic decisions have no proven methods for selecting a course of action that guarantees a predicted outcome.

Information needs of top or Strategic Management

Strategic management or TOP management of a company comprises the owners/managing director of a company. They are responsible for taking strategic decisions for a company which has long term bearing on company policies and perspectives. Strategic management is responsible for making strategic plan which is necessary to take the company on growth path. To prepare strategic Plan, Top management is not concerned about day to day information of company operations. They do the macro analysis and their decisions are based on macro analysis. Generally the Strategic Management information needs comprises

1. Information about market trend- Macro analysis.
2. Information about Government Policies.
3. Information about Competitors policies and tactics
4. Information about Major exceptions in implementing the company policy at tactical/operation level.
5. Analysis about major happening/event which may have a long term bearing on the strategic decisions of the company

The information need of TOP management is generally unstructured and it not easily defined.

1. Information needs of Middle Level Management/Tactical Management

   Tactical management/Middle Management comprises those who are responsible for preparing annual business plan to achieve the strategic Plan objectives of a company. Tactical Managers prepare Annual Business Plan on the basis of directs received from TOP management. The Information need of middle management comprises

   a. Information about Strategic Decisions/Plan of the organization for which they have been working.

b. Information about Latest Technologies in the area they have been working.
c. Information about problems faced by operational management in getting the things implemented.
d. Information about best practices adopted by different organization in the same industries or different industries.

The information need of Middle level management is structured in comparison to TOP management and it can be developed in form of template in some cases.

2. Information needs of Low Level or Operational Management

Operation management is responsible for implementing the policies framed by tactical management to achieve the business plan of the organization. They are generally responsible for the operational part of the organization. The information need of Operational management is limited but very structured in nature. The information need of Operation management needs to be very accurate and it can be easily developed in the form of template.

Factors Affecting Information Needs

There are various factors which affected the information need of him. Some of them are explained as below

1. Management Hierarchy: Management Hierarchy plays an important role in deciding the information need of a user. Information need of TOP management will be entirely different from the information needs of Operational Management.
2. Purpose of seeking information: The information needs will be depend on the purpose of seeking information. If a person wants to investment in a company, he/she will be interested about the financial statement of the company. He/she will have no interest in knowing about the past directors of the company.
3. RoleintheOrganization:Informationneedofapersonalsodepend ontheroleoftheconcerneduser. The information needs of different stakeholder in the organization will be different. For example, an employee of the organization will be interested in knowing about the company wage policy. They will have no interest in knowing company policy on market segmentation.

Information Systems: Definition And Elements

An information system can be defined as:

All people, machines and activities aimed at the gathering and processing of data to supply the information need of people inside and outside the organization. In other words it can be defined as combination of people, hardware, software, communication devices, network and data resources that processes (can be storing, retrieving, transforming information) data and information for a specific purpose.

From the above definition we may observe following elements of an information system:

- People
- Hardware
- Software
- Communication devices – Network
- Data resources

Information System Activities

The major activities of an information system are:

1. Input of data resource: Input of data resources is prime and an important activity of an Information System. In this activity data about business transactions and other events is captured and prepared for processing. In this activity data entry activities such as recording and editing are covered.
2. Processing of data into information: Data is typically subjected to processing activities such as calculating, comparing, sorting, classifying, and summarizing. These activities organize, analyze and manipulate data, thus converting them into information for end users. The quality of any data stored in an information system must also be maintained by a continual process of correcting and updating activities.
3. Output of information products: Information in various forms is transmitted to end-users and made available to them in the output activity. The goal of information systems is the production of appropriate information products for end users. Common information products messages, reports, forms, and graphic images, which may be provided by video displays, audio responses, paper products, and multimedia.

4. Storageofdataresource:Storageisabasicsystemcomponentofinformationsystems.Storageisthe information system activity in which data and information are retained in an organized manner for later use. For example, just as written text material is organized into words, sentences, paragraphs, and documents; stored data is commonly organized into fields, records, files, and database. This facilitates its later use in processing or its retrieval as output when needed by users of a system.
5. Control of system performance: An important information system activity is the control of its performance. An information system should produce feedback about its input, processing, output, and the system is meeting established performance standards. Then appropriate system activities must be adjusted so that proper information products are produced for end users.

Types Of Information System

1. Executive Support Systems (EIS)

   An executive information system (EIS) is a type of management information system intended to facilitate and support the information and decision-making needs of senior executives by providing easy access to both internal and external information relevant to meeting the strategic goals of the organization. It is commonly considered as a specialized form of decision support system (DSS).
2. Management Information Systems (MIS)

   An organized approach to the study of the information needs of an organization's management at every level in making operational, tactical, and strategic decisions. Its objective is to design and implement procedures, processes, and routines that provide suitably detailed reports in an accurate, consistent, and timely manner.

   It is mainly concerned with internal sources of information. MIS usually take data from the transaction processing systems and summarize it into a series of management reports. MIS reports tend to be used by middle management and operational supervisors.

3. Decision-Support Systems (DSS)

   Decision-support systems (DSS) are specifically designed to help management make decisions in situations where there is uncertainty about the possible outcomes of those decisions. DSS comprise tools and techniques to help gather relevant information and analyze the options and alternatives. DSS often involves use of complex spreadsheet and databases to create "what-if" models.

4. Knowledge Management Systems (KMS)

   Knowledge Management Systems (KMS) exist to help businesses create and share information. These are typically used in a business where employees create new knowledge and expertise - which can then be shared by other people in the organization to create further commercial opportunities. Good examples include firms of lawyers, accountants and management consultants.

   KMS are built around systems which allow efficient categorization and distribution of knowledge. For example, the knowledge itself might be contained in word processing documents, spreadsheets, PowerPoint presentations, Internet pages or whatever. To share the knowledge, a KMS would use group collaboration systems such as an intranet.

5. Transaction Processing Systems (TPS)

   As the name implies, Transaction Processing Systems (TPS) are designed to process routine transactions efficiently and accurately. A business will have several (sometimes many) TPS; for example: Billing systems to send invoices to customers. Systems to calculate the weekly and monthly payroll and tax payments, Production and purchasing systems to calculate raw material requirements, Stock control systems to process all movements into, within and out of the business etc.

6. Office Automation Systems (OAS)

   Office Automation Systems are systems that try to improve the productivity of employees who need to process data and information. Perhaps the best example is the wide range of software systems that exist to improve the productivity of employees working in an office (e.g. Microsoft Office XP) or systems that allow employees to work from home or whilst on the move.

Information Systems In Business Management

Information system has been playing a pivotal role in Business Management nowadays. A good information system may be termed as the backbone of business management. In today scenario, it is imperative to say that an Information system is the key to success of a business. A good information system is essential for midsize business to large business. The massive data and increasing volumes of data needs organized storing and fast and effective processing for variety of purposes from decision making to risk management, from transaction processing to state-the art products. This is possible only with the help of an effective information system.

Now the business has become global and most of the businesses are global distributed across the world. These businesses require stable and reliable network infrastructure which can run and handle simultaneous and real time fast processing. Now with the advancement of information technology, simultaneous processing of data on 24x7 bases has got possible. This has increased the efficiency of business. Here we can say that the more businesses grow the more dependent they become of Information Systems Information system is important at each level of business management. It supplies information from Strategic management team to middle management and it is very crucial for business successes. The importance of information system in a business management is for following reasons

a. An aid in operational excellence
b. Helpful in improved decision making
c. Necessary for day to day survival
d. Competitive Advantage
e. Helpful in Cost Management

It cannot be denied that public demands for timely, straightforward and transparent government services have become the government's obligation to realize them. One factor that can answer this challenge is the use of information technology. Utilization of this technology to optimize operational activities can help the process of collecting, processing and analyzing data, so that it can speed up the decision-making process. Because information technology plays a role in cutting down complicated bureaucracy, the effectiveness and efficiency

of organizational work will increase. With technology, measurable standards of service certainty can be realized. The rapid progress of information technology and its massive use means that the public has a lot of user experience regarding ease of access to information and ease of receiving services. This user experience is also shared by internal bureaucratic circles who always compare internal services with their experience when using services outside the bureaucracy, such as email, chat, marketplace, online buying and selling, or eBanking. The experience of both of them is a pressure in itself so that the digital information system can be realized immediately.

Short Descriptiones

Learning Outcomes

Upholding human values in carrying out duties based on religion, morals and ethics. (S2)
Demonstrate a responsible attitude towards work in their field of expertise independently. (S9)
Mastering theory, conceptual framework in sustainable management practices (Mastering theory, and conceptual framework in management practices with continuous development); (PP1)
Able to build, develop, and maintain a business organization that is always proactive-adaptive to changes in the business environment (Able to build, develop, and preserve a business organization that has the ability to adopt with business changes); (PP3)
Able to build, develop, and use networking in the world of business and management (Able to build, develop, and use networking in business and management); (KK1)
Able to apply logical, critical, systematic and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise (Able to apply logical thinking, critical, systematic and innovative in the context of the development or implementation of science and technology that takes into account and applies the values of the humanities in accordance with the areas of expertise); (KU1)

This digital information system book will explain:

In this course students learn about the scope of basic concepts of digital information systems, information technology for company competitive advantage, company management strategies that focus on the future, information technology from a company perspective, TQM applications in company management, team frameworks in companies, the role of systems. digital information in Decision Making, Implementation of digital information systems, and Audit of Information Systems and Technology.

Study Materials

Learning materials

1. Basic Concepts and Scope of Digital Information Systems
2. Information Technology for Competitive Advantage
3. Company Management Strategy that Focuses on the Future
4. Information Technology in Corporate and Educational Perspectives
5. Use of TQM Applications in Company Management
6. Team Framework in Companies
7. The Role of Digital Information Systems in Decision Making
8. Implementation of Digital Information Systems
9. Information Systems and Information Technology Audit

*****

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CHAPTER 1
THE BASIC CONCEPTS AND SCOPE OF DIGITAL INFORMATION SYSTEMS

Course Learning Outcomes :

- *Upholding human values in carrying out duties based on religion, morals and ethics*
- *Able to analyze the basic concepts and scope of digital information systems.*

In this topic, we provide an explanation of the definitions and concepts relating to digital information systems as well as a scope that provides an explanation of digital information systems.

1. Defenition Information Systems

Information Systems means all computer hardware, databases and data storage systems, computer, data, database and communications networks (other than the Internet), architecture interfaces and firewalls (whether for data, voice, video or other media access, transmission or reception) and other apparatus used to create things.

Digital information systems cannot be separated from data as supporting information as shown in the following Pigure:

Pigure 1.1 Data Quality Dimensions

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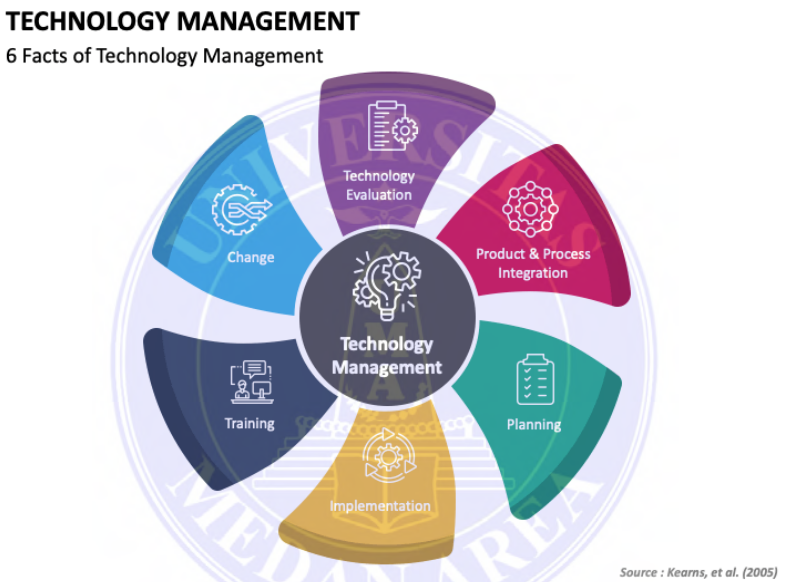
The information system is realized in a data quality dimension which provides a description of information about the basis of the information system in providing usefulness in information about completeness and provides meaning that the data meets criteria such as consistency, uniqueness, accuracy and validity so that it has a meaningful meaning in the information system.

This data does not provide an overview of information systems, but as technology is developing, management technology is needed as shown in the following image:



Pigure 1.2 Technology Management

To achieve a goal in management technology, 6 (six) accurate facts are needed to support it in order to achieve a goal in the company, namely starting with careful planning of a goal and interacting with the desired products and processes in the vision, mission and goals, and using technology is ready to be re-evaluated, then when it is evaluated it is necessary to change the operational mindset related to it through training and socialization, so that it can be realized in accordance with the needs and desires of the company to achieve its goals.

2. Other system information definitions

An information system (IS) is an interconnected set of components used to collect, store, process and transmit data and digital information. At its core, it is a collection of

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hardware, software, data, people and processes that work together to transform raw data into useful information. An IS supports a variety of business objectives such as improved customer service or increased efficiency.

There are six kinds of information system

a. Broadly speaking, there are six kinds of information system:
b. Service delivery systems:
c. Client/case management systems: help provide services to people in need and report to funders
d. Constituent relationship management (CRM) systems:track communications with constituents, fundraising activity, donors and/or membership status (important for peak bodies and membership-based organisations)
e. Another more specialised (and often unique) system to track and manage specific items, such as flora, fauna, historical artifacts, environmental conditions, etc. These systems don't generally exist 'off the shelf' and often need to be built (or heavily customised).

3. Learning Objectives

Upon successful completion of this chapter, you will be able to:

a. Describe the differences between data, information, and knowledge;
b. Define the term *database* and identify the steps to creating one;
c. Describe the role of a database management system;
d. Describe the characteristics of a data warehouse; and
e. Define data mining and describe its role in an organization.

4. Introduction

Introduction : You have already been introduced to the first two components of information systems: hardware and software. However, those two components by themselves do not make a computer useful. Imagine if you turned on a computer, started the word processor, but could not save a document. Imagine if you opened a music player but there was no music to play. Imagine opening a web browser but there were no web pages. Without data, hardware and software are not very useful! Data is the third component of an information system.

5. Data, Information, and Knowledge

Data, Information, and Knowledge : The final step up the information ladder is the step from knowledge (knowing a lot about a topic) to *wisdom*. We can say that someone has wisdom when they can combine their knowledge and experience to produce a deeper understanding of a topic. It often takes many years to develop wisdom on a particular topic, and requires patience.

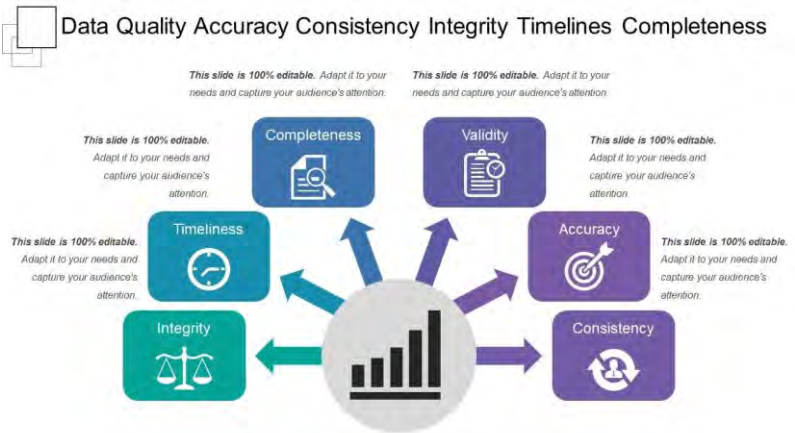
6. Examples of Data

Examples of Data : Almost all software programs require data to do anything useful. For example, if you are editing a document in a word processor such as Microsoft Word, the document you are working on is the data. The word-processing software can manipulate the data: create a new document, duplicate a document, or modify a document. Some other examples of data are: an MP3 music file, a video file, a spreadsheet, a web page, and an e-book. In some cases, such as with an e-book, you may only have the ability to read the data.

7. Databases

The goal of many information systems is to transform data into information in order to generate knowledge that can be used for decision making. In order to do this, the system must be able to take data, put the data into context, and provide tools for aggregation and analysis. A database is designed for just such a purpose.

A database is an organized collection of related information. It is an *organized* collection, because in a database, all data is described and associated with other data. All information in a database should be *related*as well; separate databases should be created to manage unrelated information. For example, a database that contains information about students should not also hold information about company stock prices. Databases are not always digital – a filing cabinet, for instance, might be considered a form of database. For the purposes of this text, we will only consider digital databases.



Pigure 1.3 Data Quality

8. **How does an information system work?**

An IS is a powerful tool that can bring many different functions together. By connecting system components, it enables IT departments to collect, store and process information in an efficient way and distribute it for a variety of purposes. The system can also produce reporting in different formats and to a variety of devices. Reports can include text files, spreadsheets, graphics and complex data visualizations. This comprehensive platform streamlines internal operations and allows businesses to access data quickly and accurately.

9. **The basic process an IS follows includes the following steps:**
   a. Input. The system collects data and information from various sources, such as sensors, keyboards, scanners or databases.
   b. Processing. The system transforms the raw data into meaningful information by applying various operations, such as sorting, classifying, calculating, analysing or synthesizing.
   c. Storage. The system stores the processed information in a structured and secure way, such as in a database, a file system or in cloud storage.
   d. Output. The system presents the information to the users in a usable format, such as reports, graphs, charts or dashboards.

e. Feedback. The system collects feedback from users and other stakeholders to evaluate its performance and improve its design and functionality.

10. Typical components of information systems

An IS is composed of a variety of components, from physical hardware to software and data. Each component serves an important role in the overall functioning of the system:

a. Hardware for an IS includes computers and servers. Computer hardware is essential for providing users with access to the system, while servers provide storage space for data, programs and applications that make up the system.
b. Networks such as local area networks (LANs), wide area networks (WANs), intranets and cloud networks are important for interconnecting different components and allowing user access from anywhere in an organization.
c. Software is an integral part of an IS. Operating systems such as Windows or Linux provide underlying platforms, while databases allow users to store and retrieve large amounts of data. An enterprise may run on hundreds of different software applications, as well as large software packages that integrate multiple applications.
d. Data is another important component. This includes structured data stored in databases, as well as unstructured data such as text documents, images or audio files. Users can access this data through various applications within the system for reporting or analysis purposes.
e. People play a key role in any IS, from administrators who manage the system itself to users who interact with it daily. Administrators must understand how to configure hardware and software and troubleshoot issues. Meanwhile, end users must become familiar with interfaces and learn to perform tasks within the system to get work done.
f. Processes governing how components work together within an IS are critical. IT leaders must define procedures for everything from setting up secure user accounts to creating emergency backup plans. Understanding how all these pieces fit together is essential for an IS to meet a company's needs effectively.

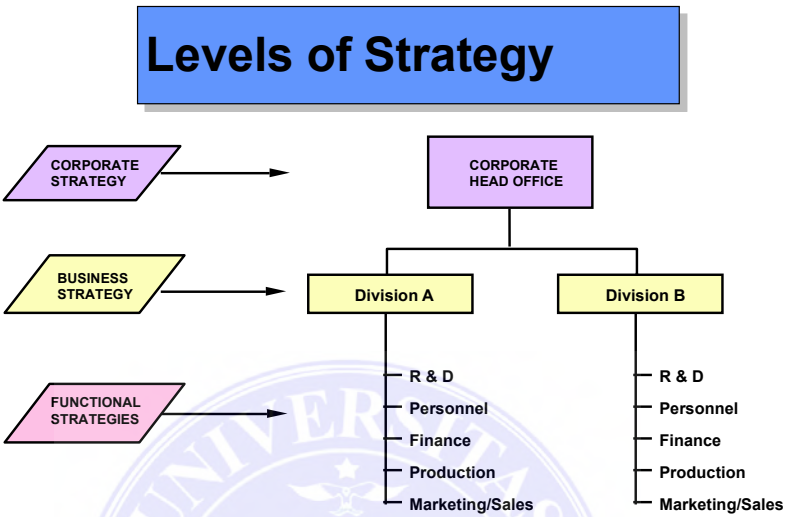
g. Management information systems (MIS) are computerized systems that collect, store, process and present data to support management decision-making. For example, an MIS in a hospital may collect data on patient admissions, treatments and outcomes to help its administrators make decisions about resource allocation and process improvements.
h. Knowledge work systems (KWS) are computer-based systems that support knowledge workers, such as researchers, analysts and consultants, by helping them create reports and presentations. For example, a KWS used by a marketing team may help create marketing materials, analyze customer data and track marketing campaigns.
i. Decision support systems (DSS) and business intelligence (BI) provide users with the ability to explore and analyze data to gain insights into business performance. For example, a system used by a retail chain may collect and analyze data on customer demographics, buying behavior and sales performance to guide changes in inventory management and marketing campaigns.
j. Transaction processing systems (TPS) support operational processes that produce and consume data. For example, a TPS used by a bank may process customer transactions, such as deposits and withdrawals, and maintain account balances.
k. Executive information systems (EIS), a type of DSS, provide senior executives with access to high-level information about the organization. EIS provides executives with real-time information and analytical tools to support strategic decision-making. For example, an EIS intended for a CEO may provide information on the company's financial performance, market trends and competitive landscape.
l. Managing information systems: Effective management and maintenance of an IS requires a deep understanding of the system's capabilities, as well as the needs and requirements of the users who rely on it. Professionals working in IS must become experts in the existing system and adapt to changing technologies and business needs. In order to run the system effectively, they must understand the disciplines included in managing the IS, and often hire specialists for each area.

m. System security is critical for an IS because it is vulnerable to threats such as hacking, viruses, malware and unauthorized access. IS administrators must implement and maintain a wide range of tools and measures, including access control, firewalls, intrusion detection and prevention systems, antivirus software and data encryption. They must also make sure they apply security patches and updates promptly to fix any vulnerabilities in the system. Regular security audits and vulnerability assessments should also be conducted to identify and mitigate any potential security risks.

11. Data management

Data management involves maintaining the accuracy, consistency and integrity of the data stored in the system. IS administrators must develop and implement data backup processes to prevent data loss in case of system failures or disasters. They must also ensure that data is stored in a structured and organized manner so that it can be easily accessed and analysed . Data security is another key aspect of data management, and administrators must ensure that data access controls and encryption mechanisms are in place to prevent unauthorized access and data breaches. Network management involves monitoring and maintaining the network infrastructure to keep it functioning correctly. IS administrators must ensure that network devices such as routers, switches and servers are correctly configured and the network is working at optimal performance levels. They must also troubleshoot network issues as they arise and manage traffic to avoid congestion and delays. In addition, network management involves implementing network security devices and measures, such as firewalls and intrusion detection and prevention systems, to prevent unauthorized access and attacks. IS administrators must make sure that the system is running smoothly by performing regular maintenance tasks such as system updates and hardware upgrades, as well as implementing a patch management process. They must also monitor system performance metrics, such as CPU and memory usage, to identify and troubleshoot performance issues.

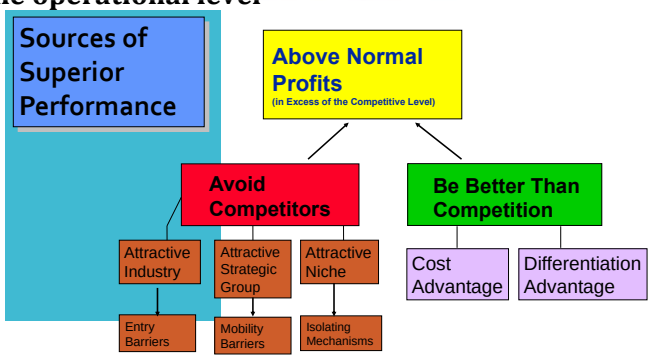
12. The Concept of Strategy and the Pursuit of Sustainable Above-Normal Profits



Pigure 1.4 Levels of Strategy

Levels of Strategy : Corporate strategy defines the scope of the business in terms of the industries and markets in which it competes includes decisions about diversification, vertical integration, acquisitions, new ventures, divestments, allocation of scarce resources between business units. Business strategy is concerned with how the firm competes within a particular industry or market to win a business unit must adopt a strategy that establishes a competitive advantage over its rivals.

13. Functional strategy the detailed deployment of resources at the operational level



Pigure 1.5 Sources of superior Performance

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Example :

The World's Most Valuable Brands, 2006

Rank	Company	Brand value ($bn.)	Rank	Company	Brand value ($bn.)
1	Coca-Cola	67.5	11	Mercedes Benz	20.0
2	Microsoft	59.9	12	Citi	20.0
3	IBM	53.4	13	Hewlett-Packard	18.9
4	GE	47.0	14	American Express	18.6
5	Intel	35.6	15	Gillette	17.5
6	Nokia	26.5	16	BMW	17.1
7	Disney	26.4	17	Cisco	16.6
8	McDonald's	26.0	18	Louis Vuitton	16.1
9	Toyota	24.8	19	Honda	15.8
10	Marlboro	21.2	20	Samsung	15.0

http://www.interbrand.com/best_brands_2007.asp *Source*: Interbrand

Pigure 1.6 The World's Most Valuable Brands

Exercise

1. Explain the meaning of information system.
2. Name and explain the divisions of information systems.
3. How do information systems work?
4. State and explain the concept of information system strategy.
5. Explain with several examples about Information Systems and digital information systems found in your work environment.

*****

CHAPTER 2
THE ROLE OF INFORMATION TECHNOLOGY FOR COMPETITIVE ADVANTAGE

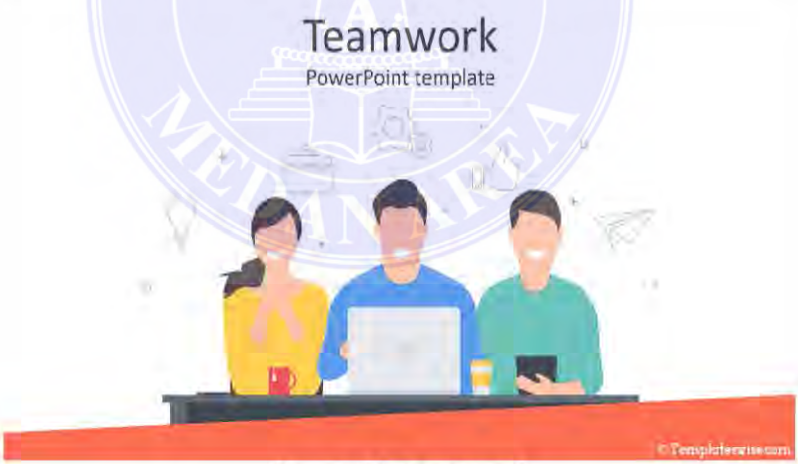
Course Learning Outcomes :

- *Upholding human values in carrying out duties based on religion, morals and ethics*
- *Able to analyze the role of information technology for competitive advantage.*

1. Defenition

Information technology for competitive advantage is digital service delivery systems (remote program delivery): systems enable services that do not require in-person participation such as webinar platform, online event systems, videoconferencing platforms.

Information technology for competitive advantage is part of information and communication in one team.



Pigure 2.1 Teamwork

The following image provides an explanation of the types of teamwork.

Pigure 2.2 Types of Teamwork

Digital information systems must demonstrate the existence of solid teamwork to make it easier to achieve goals. This is in accordance with the Pigure above and cannot be separated from the problem solving of the team itself. Because the more people who provide input to solve the problem, the more solid it will be. Then have a self-managed team, as a decision maker who provides solutions to these problems. So that a cross-functional team is formed whose decisions can be prioritized and at the same time can be realized in a virtual team.

What to do? the imperative global competition a more perfect market for information, customers, suppliers, competitors , investors, transformation from industrial to information economy. Flattening the hierarchy, decentralization, driving decision making down ward, collaborative working, downsizing and outsourcing moving more rapidly.

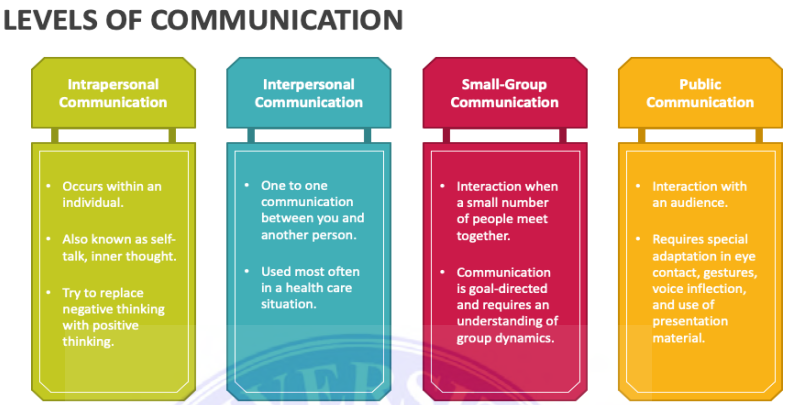
Information Systems can do computation and manipulation, this is supported by the following:

a. Communication
b. Data storage
c. Data access
d. Data organization
e. Data presentation

Types of information systems used in a service-delivery not-for-profit. For an organisation whose focus is service delivery, the chart below illustrates the various information

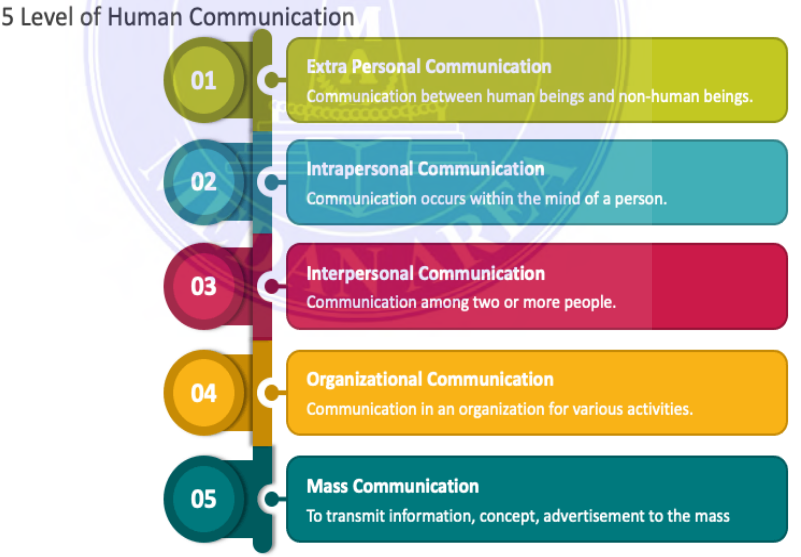
systems that help it run effectively. They are shown from the executive to operational levels.

2. Leves of communication



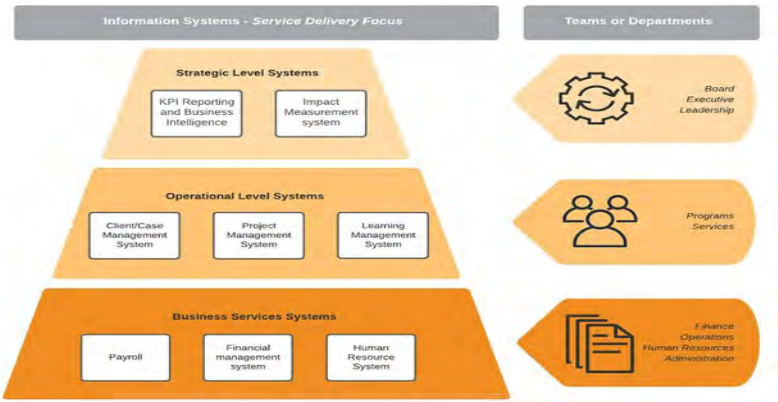
Pigure 2.3 Leves of communication

Levels of communication



Pigure 2.4 Levels of Communication

3. DATA

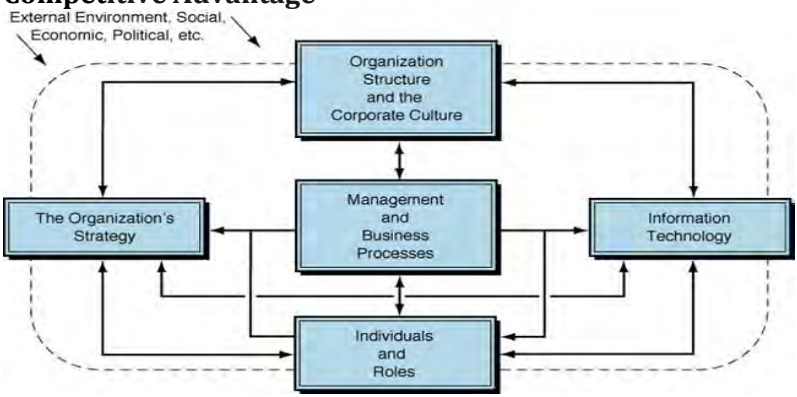


Pigure 2.5 Data in Organization

Competitive Advantage

Pigure 2.6 Competitive Advantage in Organizations

4. Competitive Advantage



Pigure 2.7 Competitive Advantage in Organizations

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Competitive Advantage

Organizations' Major Responses: Strategic systems for competitive advantage, Continuous improvement efforts, Business process reengineering (BPR), Business alliances, Electronic commerce

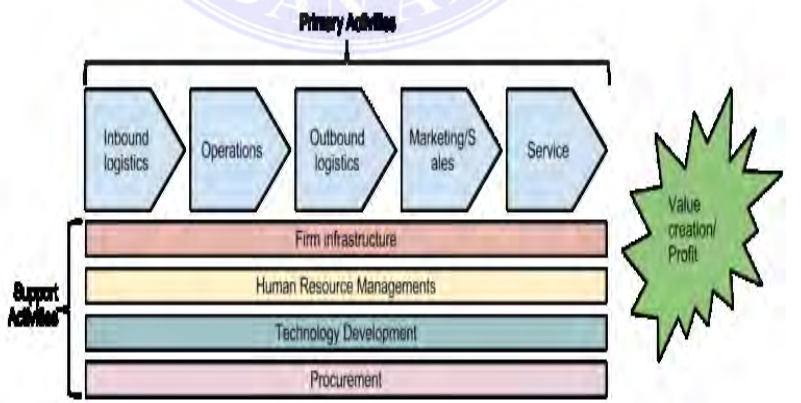
Creating competitive advantage. In any company, information technology has a powerful effect on competitive advantage in either cost or differentiation. The technology affects value activities themselves or allows companies to gain competitive advantage by exploiting changes in competitive scope. Lowering cost.

Problems in competitive advantage

- Supply Chain ProblemsUncertainty of demand
- Coordination problems
- Product shortages
- Too much (or the wrong kind of) inventory
- Quality problems (caught late)
- Poor customer service

Early SolutionsVertical integration

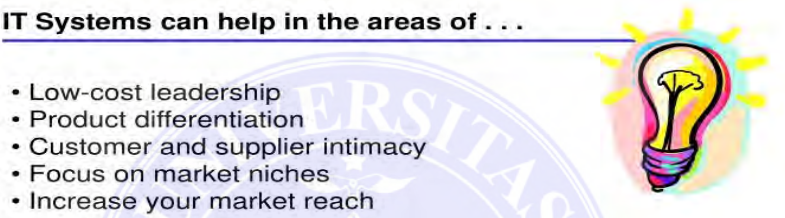
- Control of the entire chain
- Can be costly, distracting
- Building inventories
- Just in case vs. just in time
- Also costly
- No guarantees



Pigure 2.8 Profit competitive Advantage in Organizations

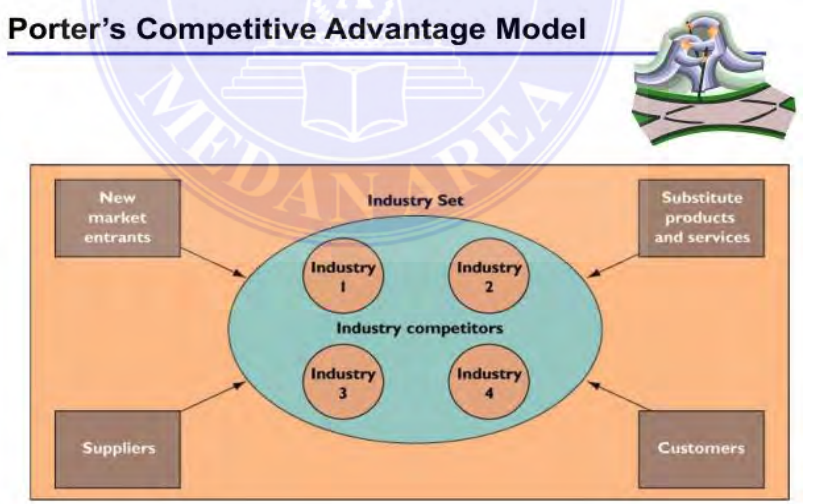
5. **Profit**
   - Primary activities are the functions that directly impact the creation of a product or service. The goal of a primary activity is to add value that is greater than the cost of that activity. The primary activities are:
   - Inbound logistics. These are the processes that bring in raw materials and other needed inputs. Information technology can be used to make these processes more efficient, such as with supply-chain management systems which allow the suppliers to manage their own inventory.
   - Operations. Any part of a business that converts the raw materials into a final product or service is a part of operations. From manufacturing to business process management (covered in Chapter 8), information technology can be used to provide more efficient processes and increase innovation through flows of information.
   - Outbound logistics. These are the functions required to get the product out to the customer. As with inbound logistics, IT can be used here to improve processes, such as allowing for real-time inventory checks. IT can also be a delivery mechanism itself.
   - Sales/Marketing. The functions that will entice buyers to purchase the products are part of sales and marketing. Information technology is used in almost all aspects of this activity. From online advertising to online surveys, IT can be used to innovate product design and reach customers as never before. The company website can be a sales channel itself.
   - Service. Service activity involves the functions a business performs after the product has been purchased to maintain and enhance the product's value. Service can be enhanced via technology as well, including support services through websites and knowledge bases.
6. **Advantage with IT**

Pigure 2.9 Achieving competitive advantage with IT



Pigure 2.10 IT Systems

7. Model competitive Advantage Porter's



Pigure 2.11 Porter's competitive advantage model

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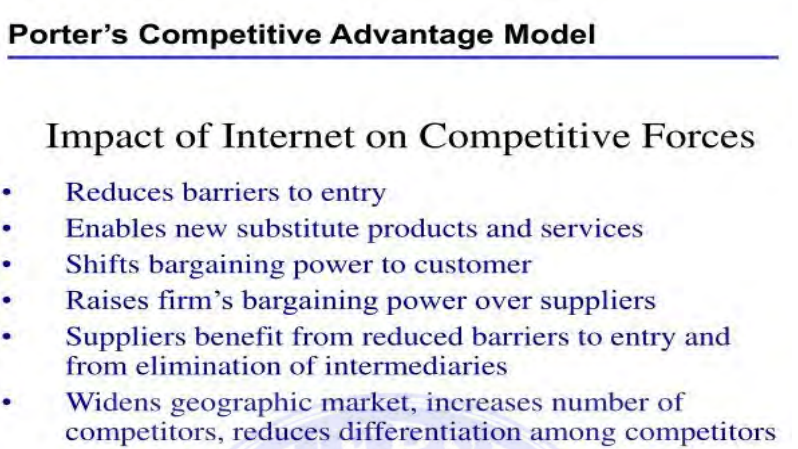
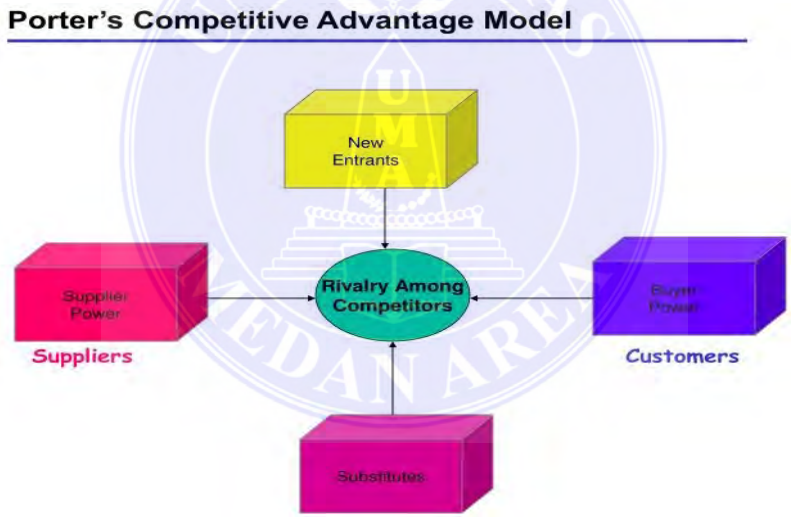
Model competitive Advantage Porter's

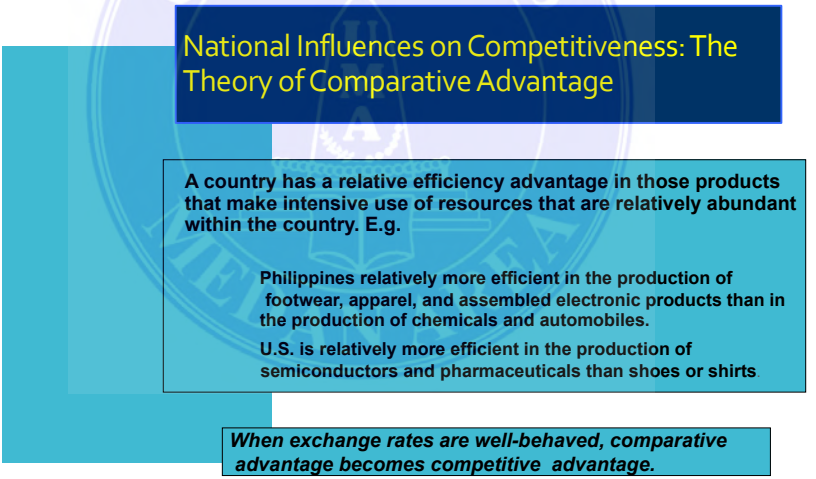


Pigure 2.12 Porter's competitive advantage model

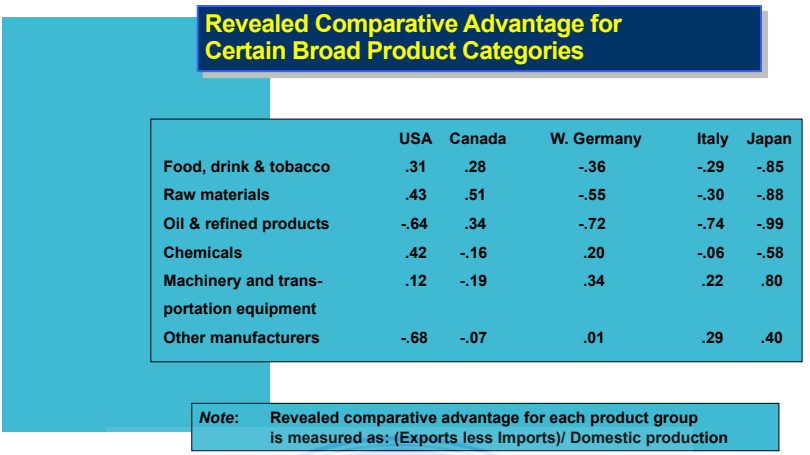


Pigure 2.13 Porter's competitive advantage model

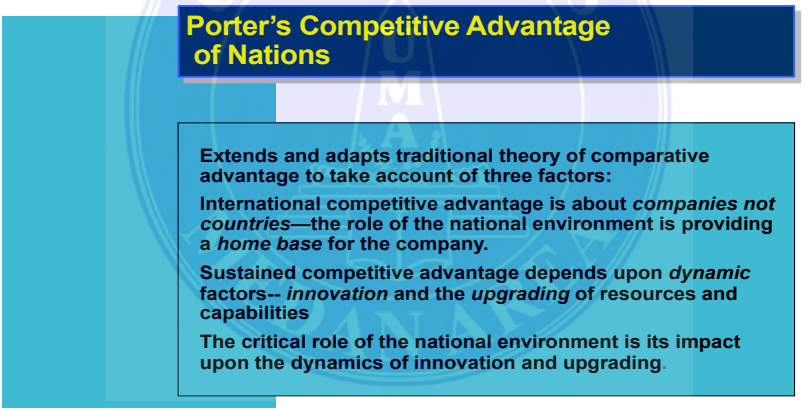
Pigure 2.14 Competitive advantage within an International



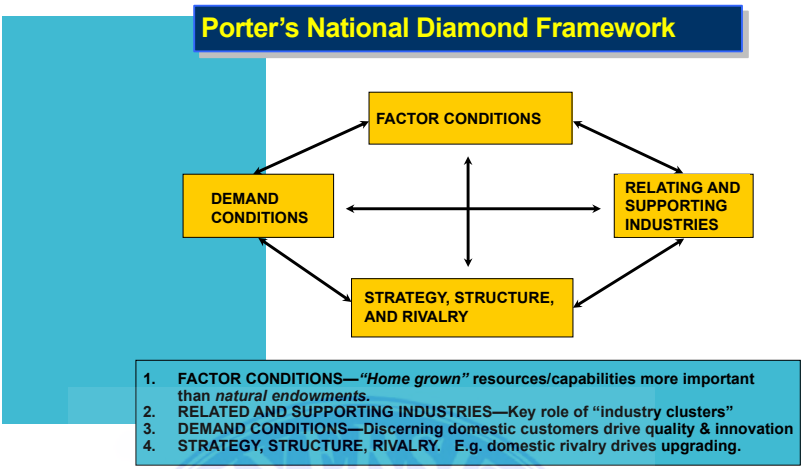
Pigure 2.15 Competitive advantage within an International



Pigure 2.1
Revealed Omparative advantage for Broad Product Categories

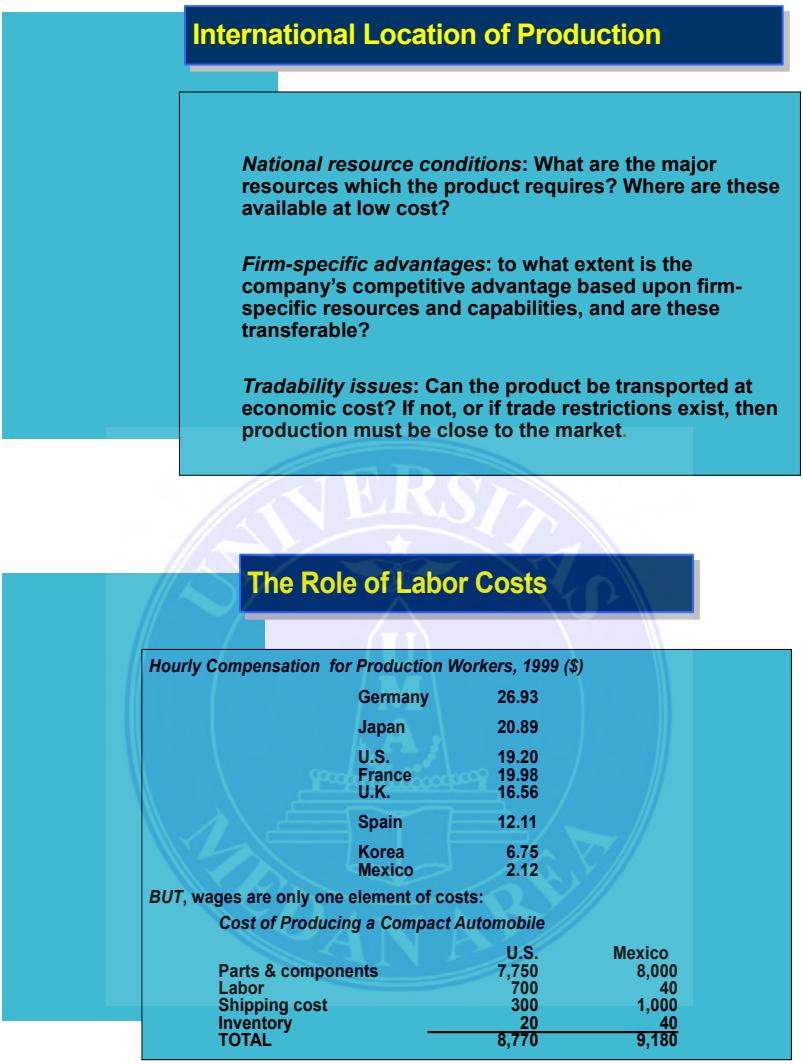


Pigure 2.17 Porter's competitive advantage of Nations

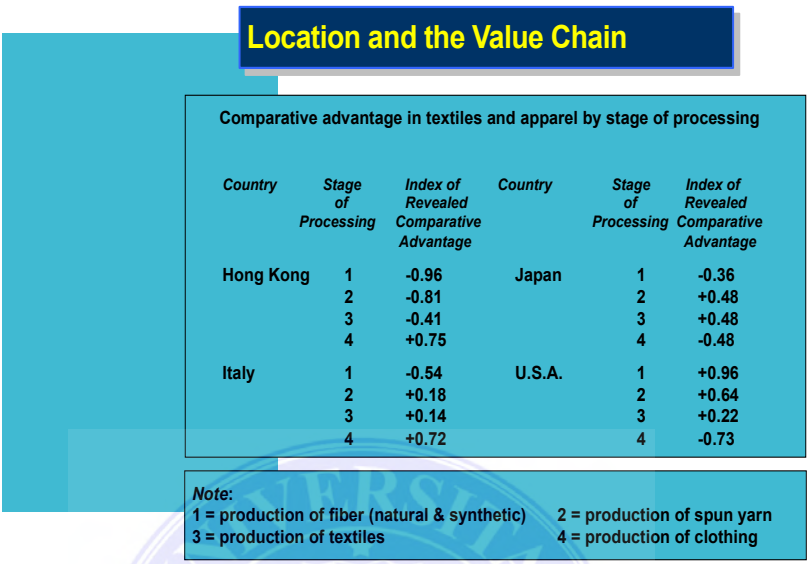


Pigure 2.18 Porter's Diamond Framework

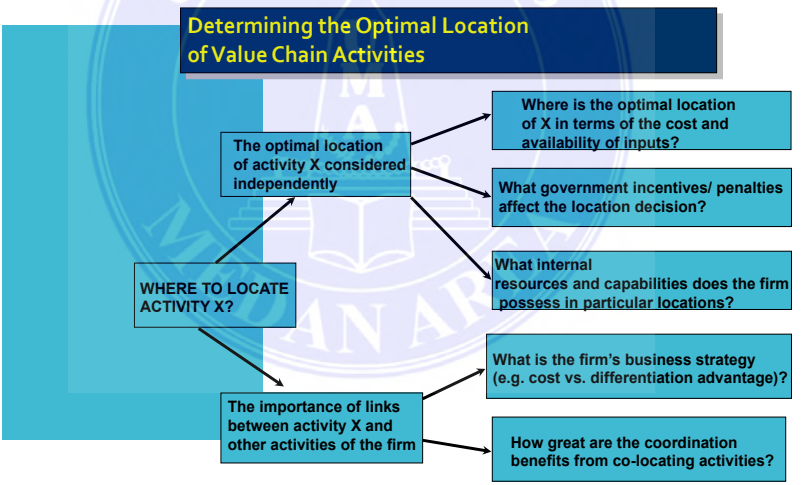
Pigure 2.19
Consistency between Strategy and National Conditions



Pigure 2.21 The Role of Labor Costs



Pigure 2.22 Location and the Valuse Chain



Pigure 2.23
Determining the Optimal Location of Value Chain Activitie

Exercise

1. Explain the meaning of information technology competitive advantage.
2. Explain how a team makes a decision based on the types of Teams!

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3. How are the levels of communication divided?
4. Can it be applied in an organizational theme?
5. Name and explain competitive advantage in an organization.

*****

CHAPTER 3
COMPANY MANAGEMENT STRATEGIES THAT FOCUS ON THE FUTURE FOCUS AND FUTURE

Course Learning Outcomes :

- Demonstrate a responsible attitude towards work in their field of expertise independently.
- Able to analyze company management strategies that focus on the future.

Pigure 3.1 Illustration Strategig Management

How to use strategic management to make your future a success:

1. Marketing
2. Accounts payable
3. Accounts receivable
4. Production
5. Sales
6. Human resources
7. Other departments

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Listen link:
https://online.hbs.edu/courses/business-strategy/?c1=GAW_SE_NW&source=INTL3_STRATEGY_BSTR&cr2=search__-__nw__-__international__-__tier_3__-__strategy__-__audience&kw=business_strategy&cr5=681592470477&cr7=c&gad_source=1&gclid=EAIaIQobChMI9bn5yfv3hAMVgoxLBR2bsQ1jEAAYAyAAEgKvk_D_BwE

Best cup of coffee

For example, did you know that the mission statement for starbucks is not 'One expensive cup of coffee every day'? It actually reads 'Our Mission: To inspire and nurture the human spirit – one person, one cup, and one neighborhood at a time.'

Your strategy

Now as it relates to you, we know you want to use strategic management in everything you do. That might mean that for yourself you're going to make a plan. You're also going to have a mission statement. You might say what you're going to do for the next year, or for the next 10 years. Maybe your goal and your mission statement is that you want to inspire and encourage people through the arts. You may want to be the best student that you can and these are all great ways that you can come up with a mission statement.

Team Class Assignment

1. Agile management and remote work in company management strategies that focus on the future
2. Remote work, ai and diversity and inclusion sustainability in company management strategies that focus on the future
3. Employee well-being and in company management strategies that focus on the future data driven decision making
4. Continuous learning and in company management strategies that focus on the future purpose driven business

Presentation

Company Management Strategies That Focus On The Future

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CHAPTER 4
INFORMATION TECHNOLOGY FROM A CORPORATE AND EDUCATIONAL PERSPECTIVE

Course Learning Outcomes :

- Mastering theory, conceptual framework in sustainable management practices (Mastering theory, and conceptual framework in management practices with continuous development.
- Able to explain information technology from a corporate and educational perspective

Definition of Information Technology

Information technology is a combination of computer technology (hardware and software) to process and store information with communication technology to transmit information (Martin, Brown, De Hayes, Hoffer, Perkins, 2005). Information technology is closely related to computer technology and communication technology.

The word computer (computer) is taken from the Latin word computere which means to calculate (to compute or to reckon). According to the original spelling computer can be defined as a calculating device. There are several definitions of computers. A computer according to Larry Long and Nancy Long is an electronic calculating device capable of interpreting and executing programmed commands for input, output, calculation, and logical operations. Robert H. Blissmer defines a computer as an electronic device capable of carrying out tasks including receiving input, processing input according to the program, storing commands and processing results, providing output in the form of information. Meanwhile, according to Williams, Sawyer (2003) computers are multipurpose machines that can be programmed, receive data (facts and rough images) and process or manipulate them into information that we can use. So a computer is a multipurpose electronic device that can receive data input, process data, store programs and data processing results (information), present information, whose work is controlled by programs stored in its storage and work automatically.

Communication technology consists of electromagnetic systems and equipment for communicating over long distances. Examples are telephone, radio, television, and cable TV. With the combination of computer technology and communication technology people can go online on the internet. On line is the use of computers or information equipment connected via a network to access information and services from other information equipment or computers.

Information system process

Burch & Grudnitski (1989:6) mention three main pillars that determine the quality of information, namely: Accurate, Timely and Relevant.

System Definition:

1. System according to Jogianto (2005), the system is a collection of elements that interact to achieve a particular goal. This system describes a real event and entity, such as places, objects and people that actually exist and occur. Indrajit (2001: 2), the system is a collection of components that have elements of connection between one another.
2. Lani Sidharta (1995: 9), System is a set of interconnected parts, which together achieve the same goals.
3. Murdick, R. G (1991: 27), System is a set of elements that form a collection or procedures or processing charts that seek a part goal or a common goal by operating data and / or goods at certain reference times to produce information and / or energy and / or goods.
4. Davis, G. B (1991: 45), System is a collection of elements that operate together to accomplish a goal.

Information systems are always a consideration for making decisions in an organization. By using the Information System, various kinds of work related to management analysis can always be completed quickly. Information systems can run well when supported by qualified technology. Quality human resources and organizational commitment. Information systems are very useful for supporting management, operational and decision-making functions.

The purpose of the system

To help companies/institutions process data or create business processes using information technology in order to

achieve optimal results in the decision-making process. To provide information used in a planning, control in business processes. To provide information that is used in the company's administration/management process in an automated manner.

The system can be described as follows

Pigure 4.1 Information System Elements

The image above shows the relationship between one system element and another to create synergy, an information system used by an organization to manage all transactions that support management functions, and can be useful for decision making. Or a management information system, namely an information system that produces output with input input and various other processes whose results are needed for certain purposes in management activities.

Examples of Applicable Information Systems

Enterprise Resource Planning (ERP) This ERP system is usually used by a number of companies to manage management and carry out integrated supervision of work units, for example the finance department, accounting department, human resources bureau, marketing department, operations department and inventory management.

1. Supply Chain Management (SCM) The SCM system is useful for company/institution management where the data presented is integrated regarding, for example, raw material supply

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management, starting from suppliers, producers, retailers to final consumers.

2. Transaction Processing System (TPS) This TPS is useful for processing routine business transaction data. This program is usually applied for various kinds of transactions. Examples include supply or inventory system applications and many other things.
3. Transaction Processing System (TPS) This TPS is useful for processing routine business transaction data. This program is usually applied for various kinds of transactions. Examples include supply or inventory system applications and many other things.
4. Office Automation System (OAS) This application system is useful for facilitating communication between departments in a company by integrating computer servers for each user in the company. Examples include an intranet for sharing data or office email in order to save costs.
5. Knowledge Work System (KWS) This KWS information system integrates new knowledge into the organization. With this, it is hoped that experts will be able to apply it in their work.
6. Informatic Management System (IMS) IMS functions to support a spectrum of tasks within the organization, which can also be used to help analyze decision making. This system can also combine several information functions with computerized programs, such as e-procurement.
7. Decision Support System (DSS) This system helps managers make decisions by observing the environment within the company. For example, the sales results of an item are compared with the sales results of similar items. If the results of reports printed in a certain period have decreased then based on these results you can find out why sales have decreased.
8. Expert System (ES) and Artificial Intelligence (A.I.) This system basically uses artificial intelligence to analyze problem solving using expert knowledge that has been linked to a database of expertise owned by an expert.
9. Group Decision Support System (GDSS) and Computer-Support Collaborative Work System (CSCWS) Similar to DSS, but GDSS seeks solutions through gathering knowledge in a group, not per individual. Usually in the form of questionnaires,

consultations and scenarios. An example is a service from a department.

10. Executive Support System (ESS) This system helps managers interact with the company environment by using graphics and other communication supports. Usually ESS is the result of other system processing required by the executive. The results of the system are usually provided in excel format so that the executive can change it to the graphic form desired by an executive.

System components or characteristics are the parts that make up a system, including:

1. Objects are parts, elements or variables. They can be physical, abstract or both.
2. Attributes, which determine the quality or nature of ownership of the system and its objects.
3. Internal relationships, are connections between objects contained in a system.
4. Environment, is the place where the system is located.
5. Goals, Every system has a goal and this goal is the motivation that directs the system. Without goals, the system becomes uncontrollable.

Of course the goals between one system and another system are different.

1. Input is something that enters the system and then becomes material for processing. These inputs can be things that are physically visible (raw materials) or invisible (services).
2. Process, is the part that changes input into output that is useful and more valuable (information) or useless (waste)
3. Output, is the result of the process. In an information system in the form of information or reports, etc
4. Boundaries are the separation between the system and areas outside the system. The limits here determine the configuration, scope or capabilities of the system. Limits can also be changed or modified so that they can change the behavior of the system.
5. Control and feedback mechanisms, used to control input or processes. The aim is to ensure that the system runs according to its objectives.

System Components (Components)

1. A system consists of a number of components that interact with each other, which means they work together to form a single unit. System components or system elements can be in the form of a subsystem or parts of the system. Every system, no matter how small, always contains components or subsystems. Each subsystem has the characteristics of the system to carry out a certain function and influence the system process as a whole. So, you can imagine if in a system there is a subsystem that is not running/functioning as it should. Of course, the system will not run smoothly or perhaps the system is damaged so that the system's goals cannot be achieved.
2. System Boundaries

   It is an area that limits a system to other systems or the external environment. Or according to Azhar Susanto, system boundaries are lines of abstraction that separate the system and its environment. The limits of this system for each person are very relative and depend on the level of knowledge and conditions felt by the person who sees the system. This system boundary allows a system to be viewed as a single unit. The boundaries of a system indicate the scope of the system.
2. Environment Outside the System (Environments)

   The external environment of a system is anything outside the boundaries of the system that affects system operation. The external environment of the system can be beneficial and can also be detrimental to the system. The favorable external environment is the energy of the system and as such must be maintained and maintained. Meanwhile, the adverse external environment must be restrained and controlled, otherwise it will disrupt the survival of the system.
3. System Interface

   The system liaison is a connecting medium between one subsystem and another subsystem. This link allows resources to flow from one subsystem to another. The output from one subsystem will become input for another subsystem through a link. By connecting one subsystem, it can be integrated with other subsystems to form a single unit.
4. System Input

   System input is the energy put into the system. Input can be in the form of maintenance input and signal input. Maintenance input is the energy entered so that the system can

operate. The input signal is the energy that is processed to obtain the output. For example, in a computer system, the program is the maintenance input used to operate the computer and data is the input signal to be processed into information.

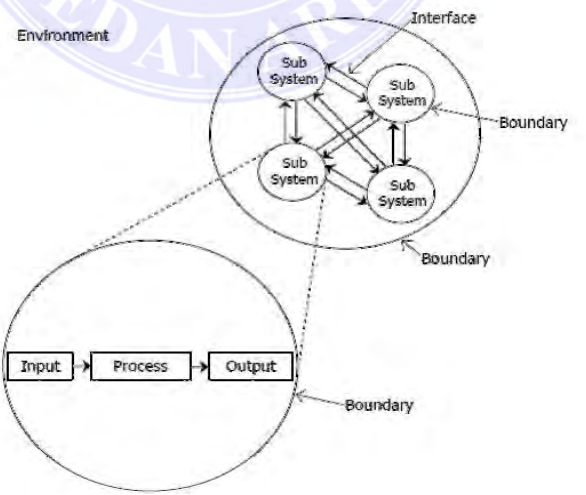
5. System Output

   The system output is the result of energy that is processed and classified into useful output and waste side. Output can be input to other subsystems or to the supersystem. For example, for a computer system, the heat produced is a useless output and is the result of waste disposal, while information is a required output Processor (Process) System

   A system can have a processing part that will convert input into output. A production system will process inputs in the form of raw materials and other materials into outputs in the form of finished goods. The accounting system will process transaction data into financial reports and other reports required by management.

6. Goals

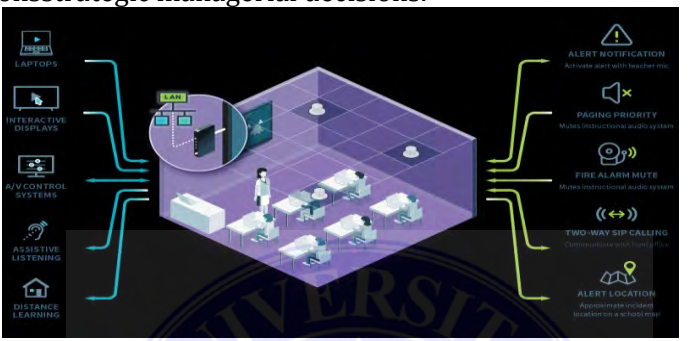
   System Goals are targets or final targets that a system wants to achieve. A system must have a goal or target. If a system does not have a goal, then the system's operation will be useless. The goals of the system really determine the input the system needs and the output the system will produce. A system is said to be successful if it reaches its target or objective.



Pigure 4.2 Goals

Information Cycle

Data is a raw form that cannot tell much, so it needs to be processed further. Data is processed through a model to produce information. Existing information is needed as a basis for consideration by organizational managers in making decisionsstrategic managerial decisions.



Pigure 4.3 Information Cycle

Exercise

Explain the meaning of information technology

1. How information technology provides policy results in management
2. Explain the relationships that occur in Enterprise Resource Planning
3. Give an explanation of the information cycle in the company where you work
4. Explain the meaning of the system according to one of the experts and how the system works according to you.

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CHAPTER 5
THE USE OF TQM APPLICATIONS IN COMPANY MANAGEMENT

Course Learning Outcomes :

- Able to build, develop, and use networking in the world of business and management (Able to build, develop, and use networking in business and management); (KK1)
- -Able to explain the use of TQM applications in company management

Defenition

Total quality management is used to streamline supply chain management, improve custumer service, and ensure that employess are properly trained. The focus is to improve the quality of an organization's outputs, including goods and services, through the continual improvement of internal practices.

Total quality management (TQM) is the continual process of detecting and reducing or eliminating errors in manufacturing. It streamlines supply chain management, improves the customer experience, and ensures that employees are up to speed with training. Total quality management aims to hold all parties involved in the production process accountable for the overall quality of the final product or service.

1. Total quality management (TQM) is an ongoing process of detecting and reducing or eliminating errors.
2. Total quality management is used to streamline supply chain management, improve customer service, and ensure that employees are properly trained.
3. The focus is to improve the quality of an organization's outputs, including goods and services, through the continual improvement of internal practices.
4. Total quality management aims to hold all parties involved in the production process accountable for the overall quality of the final product or service.
5. There are often eight guiding principles to TQM that range from focusing on customers, continually improving, and adhering to processes.

7. Total quality management is a structured approach to overall organizational management. The focus of the process is to improve the quality of an organization's outputs, including goods and services, through the continual improvement of internal practices. The standards set as part of the TQM approach can reflect both internal priorities and industry standards currently in place.
8. Industry standards can be defined at multiple levels and may include adherence to various laws and regulations governing the operation of a particular business. Industry standards can also include the production of items to an understood norm, even if the norm is not backed by official regulations. Acceptance sampling might be used to check the progress toward the TQM goal.

Pigure 6.1 Total Management Quality

Example of Total Quality Management

Perhaps the most famous example of TQM is Toyota's implementation of the *kanban* system. A *kanban* is a physical signal that creates a chain reaction, resulting in a specific action. Toyota used this idea to implement its just-in-time (JIT) inventory process.

The company decided to keep just enough inventory on hand to fill customer orders as they were generated to make its

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assembly line more efficient. All parts of Toyota's assembly line are therefore assigned a Physical card that has an assotiated inventory number. The card is removed and moved up the supply chain right before a part is installed in a car, effectively requesting another of the same part. This allows the company to keep its inventory lean and not overstock unnecessary assets. Effective quality management resulted in better automobiles that could be produced at an affordable price.

History of Total Quality Management

TQM's history often dates back to the early 1900s when Walter A. Shewhart introduced modern quality control. Shewhart produced a landmark piece of industrial work entitled *Economic Control of Quality of Manufactured Product* in 1931. This exposition is considered one of the founding and basic principles of manufacturing quality control.

Further developments in Shewhart's work introduced new standards in quality management decades later. Joseph M. Juran published a book called *What Is Total Quality Control? The Japanese Way*. in 1954. The work was based on Juran's experience of being invited to Japan by Japanese scientists and engineers.

Another prominent figure in TQM history is W. Edwards Deming. Also posted in Japan after the Second World War, Deming became involved with the Union of Japanese Scientists and Engineers (JUSE). His career work included several TQM frameworks (Deming's 14 Points, Deming's Seven Deadly Diseases of Management, and The Deming Wheel).

Primary Principles of Total Quality Management

TQM is considered a customer-focused process that focuses on consistently improving business operations management. It strives to ensure that all associated employees work toward the common goals of improving product or service quality, as well as improving the procedures that are in place for production. There are several guiding principles that define TQM.

Focus on Customers

Under TQM, your customers define whether your products are high quality. Customer input is highly valued because it allows a company to better understand the needs and requirements in the manufacturing process. Customer surveys

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may reveal insufficient durability of goods. This input is then fed back into TQM systems to implement better raw material sourcing, manufacturing processes, and quality control procedures.

1. Commitment by Employees
   Employees must buy into the processes and system if TQM is going to be successful. This includes clearly communicating across departments and leaders what goals, expectations, needs, and constraints are in place. A company adopting TQM principles must be willing to train employees and give them sufficient resources to complete tasks successfully and on time. TQM also strives to reduce attrition and maintain knowledgeable workers.
2. Improve Continuously
   A company should gradually evolve and strive for incremental, small improvements as it learns more about its customers, processes, and competition. This concept of continuous improvement helps a company adapt to changing market expectations. It allows for greater adaptability to different products, markets, customers, or regions. Continuous improvement also drives and widens the competitive advantage that a company has built over related companies.
3. Adherence to Processes
   TQM's systematic approach relies heavily on process flowcharts, TQM diagrams, visual action plans, and documented workflows. Every member engaged in the process must be aware and educated on their part of the process to ensure proper steps are taken at the right time of production. These processes are then continually analysed to better understand deficiencies in the process.
4. Strategic and Systematic Approach
   A company's processes and procedures should be a direct reflection of the organization's vision, mission, and long-term plan. TQM calls for a system approach to decision making that requires that a company dedicate itself to integrating quality as its core component and making the appropriate financial investments to make that happen.
5. Data Utilization
   The systematic approach of TQM only works if feedback and input is given to evaluate how the process flow is moving. Management must continually rely on production, turnover, efficiency, and employee metrics to correlate the anticipated outcomes with the actual results.

Integrate Systems

One way to utilize data is to integrate systems. TQM strategies believe systems should talk to each other, conveying useful information across departments and making smart decisions. When goods or inventory are used in one area, another department should have immediate access to that ERP information. TQM strives to allow everyone to be on the same page at the same time by linking data sources and sharing information across systems.

Communication

Data may transfer between departments freely, but there is a human element to coordinating processes and making sure an entire production line is operating efficiently. Effective communication plays a large part in TQM to motivate employees, educate members along a process, and avoid process errors whether it is normal day-to-day operations or large organizational changes.

Successful TQM requires a company-wide buy-in of every principle. The benefits of TQM quickly diminish if a company does not receive complete buy-in.

How to Implement Total Quality Management

TQM is a unique process. There is not a specific formula for implementing a system that suits every business and each type of industry. But you can create a checklist of issues that might suit your enterprise and proceed with them in chronological order. Some may suit your business while others will not. Select those that you think will provide an advantage.

- Identify your company's existing culture, its core values, and its systems.
- Use this information to create a system that will serve as your master plan.
- Establish what your customers and clients want and what they expect from your business. Determine how to best meet these expectations and needs.
- Create a team of management and employees to guide and implement your goals and include these efforts in your daily business management process.
- Consistently gather feedback from both employees and customers to gauge your progress.

TQM is not a speedy process. Expect to dedicate an extended period of time to your efforts.

Advantages and Disadvantages of TQM

TQM results in a company making a product for less when it's implemented correctly. Companies that engage in TQM provide more consistent products that yield stronger customer loyalty when they emphasize quality and minimize waste.

As TQM touches every department across an organization, a company may reap substantial savings from materials sourcing, production, distribution, or back-office functions. Companies that successfully implement TQM can usually react more quickly to change and proactively plan ahead to avoid obsolescence.

A company must fully engage TQM principles to fully reap the benefits of TQM. This requires substantial buy-in from every department across an organization. This level of commitment is very difficult to achieve, requires substantial financial investment, and necessitates all levels of management to engage in TQM.

The conversion to TQM may be lengthy, and workers may feel resistant to change. A company may be required to replace processes, employees, equipment, or materials in favor of an untested, partially developed TQM plan. More skilled workers may decide to leave the company if they feel TQM processes don't appropriately utilize their skill sets.

Total Quality Management

1. **Pros**
   - Delivers stronger, higher quality products to customers
   - Results in lower company-wide costs
   - Minimizes waste throughout the entire production and sale process
   - Enables a company to become more adaptable
2. **Cons**
   - May require substantial financial investment to convert to TQM practices
   - Often requires conversion to TQM practices over a long period of time
   - May be met with resistance to change
   - Requires company-wide buy-in to be successful

Pigure 6.2 Total Quality Mangement

Industries Using Total Quality Management

TQM originated in the manufacturing sector, but its principles can be applied to a variety of industries. It provides a cohesive vision for systemic change with a focus on long-term change rather than short-term goals. TQM is used in many industries with this in mind, including but not limited to manufacturing, banking and finance, and medicine.

These techniques can be applied to all departments within an individual organization. This helps ensure that all employees are working toward the goals set forth for the company and improving function in each area. Involved departments can include administration, marketing, production, and employee training.

1. What Does Total Quality Management Do?
   TQM oversees all activities and tasks that are necessary to maintain a desired level of excellence within a business and its operations. This includes the determination of a quality policy, creating and implementing quality planning and assurance, and quality control and quality improvement measures.
2. What Are the Principles of TQM?
   Various iterations of TQM have been developed, each with its own set of principles. Certain core elements persist nonetheless. These include good leadership, emphasis on quality, customer priority, error correction and improvement as an ongoing process, and job training.

3. What Is a TQM Diagram?
   A TQM diagram is a visual depiction of the business and process layout. The diagram usually shows different processes or steps, allowing management to see a process, analyze weaknesses or risks in the flow, and strategically adjust how things are done.

The Bottom Line

Total quality management is the strategic framework that encourages everyone in an organization to focus on quality improvement. The theory holds that customer satisfaction will increase by being operationally excellent. Many principles drive TQM, but the overall purpose is to eliminate errors, streamline processes, and maximize efficiency.

Pigure 6.3 Quality Assurance

Pigure 6.4 Seven types of Quality Metrics

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Total Quality Management (TQM) Systems

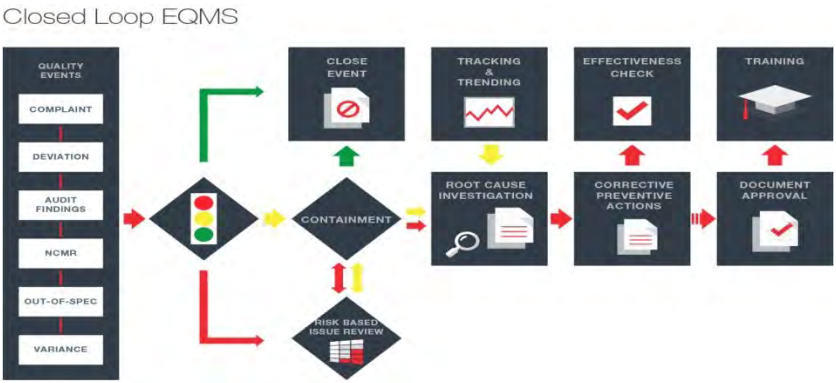
TQM Software is an Offshoot of Total Quality Management Philosophy. Total Quality Management (TQM) is a widely used philosophy and business approach that requires all departments in an organization to participate in continuous quality improvement efforts. A TQM workplace values high performance and avoids, or at least minimizes, waste. Most companies, especially manufacturers in regulated environments, use TQM software (or TQM system) to help them instill total quality management procedures in all aspects of their operations. TQM software that exists in the market today is designed based on total quality management principles that can be found in quality standards and regulations.

Using TQM Software in FDA-Regulated Environment

FDA-regulated companies are required to implement total quality management software in accordance with regulations such as 21 CFR Part 211 (pharmaceutical companies), 21 CFR Part 820 (medical device companies), and 21 CFR Part 606 (blood establishments). TQM software designed for these companies typically address these regulations and related standards.

A voluntary recall of Tylenol children's liquid products in 2010 shows how the FDA applies and enforces TQM principles. In a report pertaining to the recall, the FDA criticized the manufacturer for deficiencies in its TQM system. The FDA said that the responsibilities and procedures applicable to the manufacturer's quality control unit were not followed. Almost all violations cited were related to the total quality management system.

This voluntary recall demonstrates that the FDA considers total quality control and a compliant TQM system as inherently integral to Good Manufacturing Practices, which manufacturers are required to follow. When evaluating Total Quality Management software solutions, be sure to look for features that address GMP regulations and standards.



Pigure 6.5 Total Quality Management Software Solutions

Using TQM Software in Other Regulated Environments

In addition to FDA regulations, there are other regulations and standards that have resulted in the increasing use of TQM software. Many companies, especially manufacturers, adhere to these standards to acquire certification and to show their clients that they are compliant. Here some of the widely used international standards:

- SO 9000:
  Many manufacturers seek ISO certification to position their products and services in the global market more competitively. The ISO 9000 series for general manufacturers and other business is perhaps one of the most popular quality standards today. The series is composed of ISO 9000, ISO 9001, and ISO 9004.
- ISO 13485:
  This quality standard applies to medical device firms. It provides a framework and specifies requirements for establishing a total quality management system, which is key to producing safe and high quality medical devices.
- ISO 14971:
  This standard specifies a process for identifying risks in all stages of a life cycle of a medical device. It offers guidelines for controlling those risks and monitoring the effectiveness of the controls. While manufacturers can build their own TQM systems, most of them are taking advantage of TQM software designed for ISO and risk management compliance.

- ICH Guidelines:
  The International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH) brings together regulatory experts and pharmaceutical industry experts from Europe, Japan and the U.S. This entity is responsible for more than 50 harmonized guidelines for new medicinal products that are widely applied worldwide. TQM software solutions targeting the pharmaceutical industry typically cover ICH standards.

Master Control's TQM Software Solutions for Regulated Industries

Master Control Total Quality Management software solutions were designed to address the unique compliance needs and business challenges of life science and other regulated companies. Master Control TQM system covers requirements that can be found in FDA, MHRA, and EMA regulations; ISO and GMP standards; ICH guidelines; and EU directives.

Master Control offers the following TQM software solutions:

- Master Control Documents:
  This book automates and streamlines all documents-based processes, from routing to follow-up to approval. It provides robust document control capability, an essential requirement for any compliant TQM system.
- Master Control Process:
  One of the most popular Master Control TQM software solution, Master Control Process gives process designers to configure all aspects of workflows, including users, tasks, tracking, escalation, and approval.
- Master Control Training:
  An integral part of Master Control TQM software, this book automates distribution and monitoring of training tasks. It provides the capability for online grading of tests and sequencing of courses, which means that upon completion of a prerequisite course, the next course in the sequence will be automatically launched.
- Master Control CAPA:
  This book offers industry best-practice forms that help reduce error in data entry. It streamlines the CAPA process by giving

users the capability to launch a CAPA form another form, such as deviation or customer complaints.

- Master Control Audit:
  This book streamlines the audit process by automating all audit-related tasks and schedules. MasterControl's advantage over other TQM software is its robust reporting tools and its capability to connect the audit management process with all critical TQM system processes.
- Master Control Supplier:
  Dubbed as a "one-stop shopping" solution, this book integrates supplier management with other critical quality processes within a total quality management system. Users can access all supplier quality data and documentation from a single repository. This TQM software solution provides the capability to create scorecards for effective evaluation of suppliers.

Digital Organization Approaches

1. Digital Transformation

   Digital Transformation according to *kbbi.kemendikbud.go.id*, transformation is a change in form, nature, function, and so on. Regarding organizations, changes in form can take the form of changing processes from manual to non-manual or changing organizational structure. For changes that are in the form of changes in efficiency, efficiency or process transparency. The government is required to apply the principles of justice in carrying out its functions of service, development and protection to the public in an accountable manner.

   Digital transformation is defined as adjustments or new forms of investment in technology, business models and business processes that encourage the creation of new value for consumers and employees to be more effective in competing in the era of fast-paced digital economic change (Brian Solis).

   Digital transformation is part of a larger technological process, and this is a change related to the application of digital technology in all aspects of life in society. Digital Transformation can be considered the third stage of digital technology adoption: digital competence → digital use → digital transformation, with use and transformative capabilities informing digital awareness. The transformation stage means

that the inherent use of digital technology enables new types of innovation and creativity in a particular domain, rather than simply enhancing and supporting traditional methods. Digital transformation, as defined by Constellation Research, is a methodology that organizations use to change and create new business models and cultures with technology. In simple terms, there are 2 things behind digital transformation. The first is the presence of the internet, the second is the emergence of a series of new technologies that are accelerating this transformation rapidly. This transformation also changed the implementation of manual processes in government to digital ones.

With the explanation above, it seems that digital transformation is no longer an option, but a necessity. This applies to all industrial sectors and almost every region in the world. The choice is digital transformation or sinking or being disrupted.

2. Important elements driving Digital Transformation

When discussing industrial revolution 4.0, we are talking about rapid technological changes. Therefore, it is necessary to anticipate the use of opportunities from developments in digital technology. Some digital technologies that are driving elements include:

a. Internet of Things (IoT)
   Internet of Things is a technology that allows objects around us to be connected to the internet. This technology allows certain objects to have the ability to transfer data over a network without requiring interaction from human to human or from human to computer device.
b. Big Data
   The private sector or businesses provide largely free services needed by society in return for which they get Big Data. With the same pattern, all public services provided by Ministries/Agencies or Departments are sources of Big Data for the government which can be used for various purposes related to improving the quality of public services.
c. Cloud Computing
   Cloud computing is a technology that makes the internet a data and application management center, where computer users are given access rights (login).

There are 3 (three) delivery models in cloud computing: (1) Software as a Service (SaaS), (2) Platform as a Service (PaaS), and (3) Infrastructure as a Service (IaaS). SaaS is a service that uses applications that have been provided, the service provider manages the platform and infrastructure that runs the application. PaaS is a service for using a platform that has been provided, developers focus on the applications they create without thinking about platform maintenance. IaaS is a service for using the infrastructure that has been provided.

4. Artificial Intelligence (AI)

Artificial Intelligence or artificial intelligence is intelligence added to a system that can be managed in a scientific context. With this intelligence, a system is expected to have human intelligence, such as being able to provide, analyze and also develop data.

Robotics

The application of robotic technology in an industry will have a major impact on a country's economy. Therefore, many countries are taking advantage of this technology to improve the economy. Robotic technology is used because it can increase the quality and quality of products, as well as make work easier. However, many people are worried about facing the industrial revolution 4.0, due to the threat of job loss due to many companies replacing human resources with robots.

Blockchain

All of them have something in common, namely needing and having data. Without data, there would be no big data. Without data there will be no information that can be processed to create AI. And without data, IoT will not accurately meet human needs

National Digital Transformation Strategy based on the 2020-2024 RPJMN, the formulation of a national digital transformation strategy include s three elements, namely:

Figure 6.6
Elements in the National Digital Transformation Strategy

1. Digital Service Setup
   - Prepare space regulations regarding digital transformation
   - Preparing an institution that specifically coordinates the implementation of digital transformation
   - Building supporting networks and infrastructure
   - Building a digital literacy education system
   - Increasing capacity HR in digital skills Collaborating with all parties in providingdigital services.
2. Digital Service Fulfillment
   - Implementing Electronic Based Government System (SPBE) regulations
   - Inventory of government services for digital service development
   - Integration of all digital systems in the government into one system
   - Cooperating with all parties in fulfilling digital services
3. Big Data Management
   - Research Big Data sources both provided by government and private services
   - Building Big Data sources
   - Develop Big Data Analysis skills
   - Developing decision-making systems at various bureaucratic levels

- •Maintain security and confidentiality of personal and business entity data

Policies related to Government Digitalization

1. Presidential Instruction Number 3 of 2003 concerning National e-Government Policy and Strategy

The policy on the use of information and communication technology in government agencies (e-Government) was initiated by this Presidential Instruction. This policy instructs ministers, heads of institutions and regional heads to develop e-Government in accordance with their duties, functions and authority and in accordance with the capacity of their resources.

At that time, Indonesia was experiencing changes in national and state life towards a transparent democratic government system and a desire to establish the supremacy of law, so that smooth communication between government agencies was needed. On the other hand, it is feared that developments in information technology will bring the Indonesian nation to the brink of digital divide. These two reasons encourage the government to immediately carry out the transformation process towards e-government so that there is a common understanding, synchronization of actions and integrated steps from all elements of government institutions towards good governance and improving effective and efficient public services.

For this reason, all heads of ministries, institutions and regional governments were instructed to formulate and take the necessary steps in accordance with their respective duties, functions and authorities in order to implement e-Government development nationally. In this Presidential Instruction, the role of the Ministry of Communication and Information is strategic in coordinating the formulation and implementation of action plans.

The development of e-Government is an effort to develop government administration based on (using) electronics in order to improve the quality of public services effectively and efficiently. Through e-Government development. structuring management systems and work processes within the government by optimizing the use of information technology. This utilization includes data processing, information

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management, electronic management systems and work processes, as well as improving public services that can be accessed easily and cheaply by people in all regions of the country.

One of the interesting contents of the president's instructions is the importance of data integration in government agencies because the public service initiatives that have emerged have not shown the direction of establishing a good e-Government, as written in Appendix number 11.c, namely "These initiatives are the agency's own efforts -Alone; Thus, a number of factors such as standardization, information security, authentication, and various basic applications that enable interoperability between sites reliably, safely, and reliably to integrate management systems and work processes in government agencies into integrated public services, receive less attention.

Thus, the government must immediately carry out the transformation process towards e-Government. Through this transformation process, the government can optimize the use of advances in information technology to eliminate bureaucratic organizational barriers, as well as form a network of management systems and work processes that enable government agencies to work in an integrated manner to simplify access to all information and public services that must be provided by government. In this way, all state institutions, society, the business world and other interested parties can make optimal use of government information and services at all times. For this reason, strong leadership is needed in each institution or government unit so that the transformation process towards e-Government can be carried out as well as possible.

The use of information technology is generally viewed from a number of aspects as follows:

a. E-Leadership; This aspect relates to the country's priorities and initiativesin anticipating and utilizing advances in information technology.
b. Information Network Infrastructure; This aspect relates to the condition of telecommunications infrastructure as well as access, quality, scope and cost of services access.

c. Information Management; This aspect relates to quality andinformation management security, starting from the formation, processing,storage, to delivery and distribution.
d. Business Environment; This aspect is related to market conditions, systemstrade, and regulations that form the context for the development of information technology businesses, especially those that influence the smooth flow of information between government and society and the business world, between business entities, between business entities and society, and between communities.
e. Society and Human Resources, this aspect is related to the diffusion of information technology in community activities, both individuals and organizations, as well as the extent to which information technology is disseminated to society through the educational process.

To ensure the integration of electronic document and information management and processing systems in developing transparent public services, e-government development in each agency must be oriented towards the architectural framework below.

The architectural framework consists of four structural layers, namely:

a. Access, namely telecommunications networks, internet networks and other communication media that can be used by the public to access public service portals.
b. Public Service Portals, namely internet sites for certain public service providers that integrate the processing and management of information and electronic documents in a number of related agencies.
c. Information Management and Processing Organization, namely a supporting organization (back-office) that manages, provides and processes information transactions and electronic documents.
d. Basic infrastructure and applications, namely all infrastructure in the form of hardware and software needed to support the management, processing, transactions and distribution of information. both between back-offices, between the Public Service Portal and the back-office, or between the Public Service Portal and the internet network, reliably, safely and reliably.

This structure is supported by 4 (four) pillars, namely structuring the management system and work processes, understanding public needs, strengthening the policy framework, and establishing regulations and legislation.

2. Presidential Regulation Number 95 of 2018 concerning Electronic-Based Government Systems (SPBE)

The development of information and communication technology (ICT) provides opportunities for the government to improve public services and carry out good governance through the implementation of an Electronic-Based Government System (SPBE) or e-Government, namely government administration that utilizes ICT to provide services to government agencies, state civil servants, business people, the community and other parties. SPBE provides an opportunity to encourage and realize responsible government administration, increase collaboration between government agencies, improve the quality and reach of public services, and reduce the level of abuse of authority.

One of the considerations for issuing a policy regarding the need for governance and management of an electronic-based government system is to create clean, effective, transparent and accountable government governance, as well as quality and trustworthy public services. This consideration is in line with the spirit of Presidential Instruction number 3 of 2003. The compatibility of these two policies is very important because it will make it easier to see progress in implementing both. The next consideration - increasing the integration of the government system - is still "homework". This work raises problems in the implementation of ICT nationally. Excerpted from the Attachment to this Presidential Regulation, the first problem is that there is no nationally integrated SPBE governance. Total government ICT spending on software continues to increase from year to year, where 65 percent of software (application) spending including software licenses is used to build similar applications between government agencies. Meanwhile, based on a data center infrastructure survey conducted by the Ministry of Communication and Information in 2018, there were 2,700 data centers in 630 central agencies and regional governments. Which means that on average there are 4 data centers in each government agency. Nationally, data center and hardware utilization only

reaches an average of 30 percent of its capacity. This fact indicates that there is a lack of coordination between government agencies in the development of SPBE, resulting in duplication of ICT budgets and ICT capacity that exceeds needs. The second problem is that SPBE has not been applied to the implementation of government administration and public services in a comprehensive and optimal manner so that the public has not experienced an increase in the performance of government administration.

To overcome the problems of implementing SPBE in the implementation of government administration, the government's challenge is to integrate planning services, budgeting services, procurement services and electronic-based performance management services, both internal integration of K/L/D and integration between K/L/D nationally. . Meanwhile, to overcome problems in public services, national integration is needed regarding public complaint services, licensing services and other public services which are a common challenge for the Central Government and Regional Governments.

The scope of this presidential regulation includes

1. SPBE Governance

   SPBE Governance is a framework that ensures that the regulation, direction and control of SPBE elements will be integrated with each other. These elements are the National SPBE Master Plan, SPBE Architecture, SPBE Plan Map, SPBE Plan and budget, Business Processes, Data and information, SPBE Infrastructure, SPBE Applications, SPBE Security, and SPBE Services.
2. SPBE Management

   SPBE management is a series of processes to achieve effective, efficient and sustainable SPBE implementation, as well as quality SPBE services. The series of processes in question include risk management, information security management, data management, information and communication technology asset management, human resource management, knowledge management, change management and SPBE Service management.

3. Information and Communication Technology Audit

Information and Communication Technology Audit is a systematic process for objectively obtaining and evaluating evidence of information and communication technology assets with the aim of determining the level of conformity between information and communication technology and established criteria and/or standards.

There are three scopes of SPBE audits, namely infrastructure, applications and information security. All three involve technical examinations of the implementation of governance and management of information and communication technology, the functionality of information and communication technology, the performance of the resulting information and communication technology, and other aspects of information and communication technology.

4. SPBE organizer

This organizer was formed to improve the integration of SPBE implementation - starting from management to monitoring and evaluation - by coordinating and implementing SPBE policies in Central Agencies and Regional Governments. This team is directly responsible to the president.

5. SPBE acceleration

Accelerating the implementation of SPBE for central and regional government agencies is needed so that improvements in the quality of government administration and public services can be immediately measured. Acceleration is carried out by building General Applications and National SPBE Infrastructure to provide better SPBE services.

General Applications are SPBE applications that are the same, standard, and used on a shared basis by central agencies and/or regional governments, whose development and development is aimed at supporting government activities in the fields of planning, budgeting, procurement of government goods and services, performance accountability, monitoring and evaluation, archiving, personnel and public service complaints. The definition of sharing is joint use of applications by the central and regional governments. So agency leaders must stop building and developing applications that are similar to general applications. National SPBE Infrastructure is SPBE Infrastructure that is connected to the SPBE Infrastructure of

central agencies and regional governments and is used on a shared basis by central agencies and regional governments.

6. Monitoring and evaluation of SPBE.

   SPBE monitoring and evaluation aims to measure progress and improve the quality of SPBE in Central and Regional Government Agencies which is carried out by the SPBE Coordination Team on a regular basis.

Exercise

1. Provide an explanation regarding the meaning of Total Quality Management
2. What are the main principles of total quality management, how do they affect the company
3. Explain Master Control offers the following TQM software solutions

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CHAPTER 6
THE TEAM FRAMEWORK WITHIN THE COMPANY

Course Learning Outcomes :

- *Able to build, develop, and use networking in the world of business and management (Able to build, develop, and use networking in business and management); (KK1)*
- *Able to explain the team framework within the company*

Companies no longer have the luxury of being complacent if they want to remain competitive. It's either disrupt or be disrupted in today's changing business landscape. That's why so many companies have started to invest in digital transformation.

As part of a digital transformation, businesses now leverage technology, such as CRM platforms, marketing automation tools, and artificial intelligence to grow and prosper within their respective markets. These technologies are accessible to both small and large businesses and, when implemented correctly, help them to deliver better value to their customers, increased revenue, improved customer satisfaction results, and improved employee productivity. By envisioning usability from the end-user side, companies can create customizable solutions that promote design, agility, and a culture that embraces digital transformation.

As you may have already realized, digital transformation is more about people than machines, which means it can't be done in a department silo, but rather as an entire organizational effort. As technology continues to shape the way businesses run, placing trust in people first is one of the best strategies for your company's success. In order to appoint the right people to lead the transitions, your leadership team will need to assess your employee's capabilities and opportunities for improvement.

Your Digital Transformation Success Team

True digital transformation touches nearly every aspect of an organization. Without support and contribution from all levels of the company, a digital transformation can't be executed successfully. From [illegible] level management, to lower level employees,

digital transformation initiatives are a unified effort. Although the roles may differ depending on your specific company or project size, here are the primary roles you might consider when assembling your core digital transformation team.

Pigure 6.1 Digital Transformation Success Team

1. **Executive Sponsors**

   As the MOST IMPORTANT part of the team, executive sponsors are a strategic alliance that can help ensure your initiatives are funded, utilized, and run smoothly. These senior-level finance, IT, risk, and security executives have a vested interest in helping the organization reach its full potential. With a deep understanding of the organization's culture and its customers, the executive sponsor should be fully aware of how each transformative project is meant to help meet the organization's goals. Without an established leader to provide strategic direction, authority, credibility, and support, digital transformation projects often fail.

2. **Chief Executive Officer (CEO)**

   It is the duty of the CEO to make valuable decisions that steer the company towards its business goals. One of the most critical mandates of a CEO is to communicate the company's business strategy and how that relates to the company's digital transformation. After developing the overall strategy, it is the duty of the executive sponsors to ensure the team understands and implements that strategy throughout the organization.

3. **Chief Information Officer (CIO)**

The CIO's objective is to consult, guide, and work in tandem with the CEO on how to leverage technology to benefit the company as a whole. They are faced with the continuous challenge to bring agility to their business processes, while driving technology improvements. This technology leader inspires the other executives on the leadership team to join in the movement. The CIO must also ensure that each transformation projects are in line with the company's goals. Having a CIO on board is a vital component to digital transformation success.

4. **IT Director**

During a digital transformation, the IT director collaborates with multiple business owners to ensure IT systems are not only available to users, but are also in line with business requirements. During a digital transformation, the IT director make sure the applications, networks, development, systems, and disaster recovery processes are running smoothly. This person is also the advocate for establishing a solid data protection strategy. It is the IT Director's responsibility to both make the leadership team aware of the best strategies for data protection. The IT director manages the project manager, solution architect, programmer, and Salesforce Admin.

5. **Marketing Operations Lead**

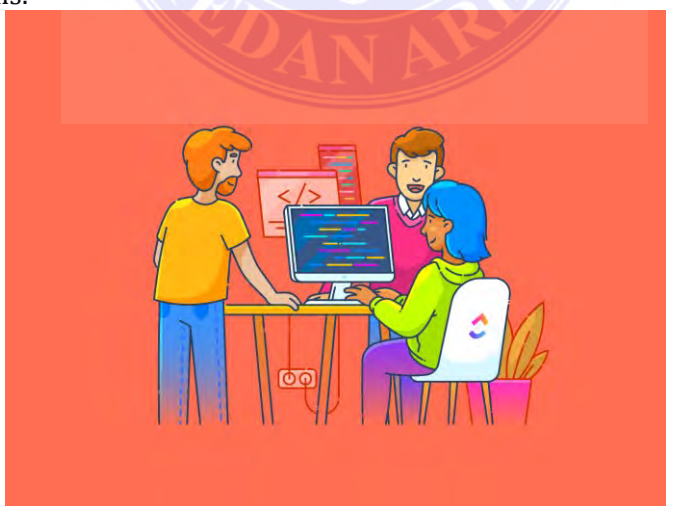
The marketing operations lead is an expert in implementing the appropriate tactics for each stage of the customer journey. This role is also responsible for continuously improving the efficiency and effectiveness of digital processes during a transformation. This individual will be the central point of contact for global marketing, sales, IT, and design teams during the rollout and ongoing management of various automations and integrations, via Pardot, Hubspot, or Marketo, in conjunction with the company's Salesforce platform. This role works directly with project team end users to plan and implement lead generation campaigns and to improve conversion and sales rates. The marketing operations lead is responsible for creatively incorporating the right technology and data to help the company reach its digital transformation goals. Agility is key when it comes to staying ahead of the competition in 21st-century marketing.

6. Sales Operations Lead

The sales operations lead is tasked with optimizing all moving parts of the sales process to increase win rates and drive revenue. This role leverages new technologies, like cloud and mobile applications, to increase effectiveness and eliminate sales team inefficiencies. The sales operations lead plays a pivotal role in the integrations, implementations, and automations of various systems available to the sales team. They decide which platforms or applications will be most effective during various sales-related digital transformation projects.

In an article on *Enterprisers Project*, John Marcante, CIO at Vanguard, points out that "companies are being replaced on the S&P 500 approximately every two weeks. Technology has driven this shift, and companies that want to succeed must understand how to merge technology with strategy."

Creating a concrete team of people to immerse themselves in a world of digital change is one sure way to become top-line industry disruptors. Whether your organization is in the beginning stages of its digital transformation journey or is well on its way to digital transformation success, keep in mind that digital transformation is never a singular effort. As you map out your digital transformation strategy, remember that building a successful team is a key component to reaching your business goals.



Picture 6.2 Business Team

What Is the Right Team Structure for Your Company? 4 Types to Pick from

Step 1: Encourage collaboration

Encourage team members to work together and use their strengths and skills within the team structure.

For example, a software development team could have a front-end developer, a back-end developer, and a UX designer.

By collaborating, they can ensure the final application is easy to use and works well. Provide them with the necessary tools to ensure seamless collaboration.

Step 2: Implement effective leadership

Good leaders guide, inspire, and support their teams, setting clear expectations and holding them accountable. Here's how:

- **Articulate a clear and inspiring vision:** Paint a Pigure of the team's goals, not just tasks. Inspire them with a purpose they believe in
- **Create a safe space for open communication:** Encourage team members to share ideas, concerns, and feedback without fear of judgment
- **Build trust through empathy and active listening:** Understand their perspectives and concerns, and address them with genuine care.
- **Delegate tasks and empower them:** Give them ownership and decision-making power within their areas of expertise.
- **Offer regular feedback:** Provide constructive criticism and mentorship to help team members grow and develop. Show gratitude and celebrate their wins, too
- **Invest in training and development:** Equip them with the necessary skills and knowledge to excel in their roles and be a learning facilitator
- **Be accountable for your own actions:** Admit mistakes and take responsibility for your decisions

For example, in a sales team, the leader sets sales targets, provides training, and motivates team members to reach their goals.

Step 3: Provide the necessary tools and resources

Give your team the tools and resources to do their tasks efficiently. It's also essential to clearly outline the objectives,

guidelines, and purpose for a team working on a project to ensure a smooth workflow.

For example, providing detailed project request forms will help your development team understand the requirements of any feature they are to build.

On the other hand, your customer service team might need a reliable CRM system, communication tools, and access to customer feedback and analytics to do their jobs well.

Pro tip: ClickUp's CRM system is an excellent tool for bringing your marketing and sales efforts together. Manage leads, campaigns, deals, and communication in one place with customizable Kanban boards that make pipeline tracking and management smoother.

Communicate, share files, and assign tasks within deals, fostering teamwork across marketing and sales. You can also use custom automation sequences and gain data-driven insights with real-time performance metrics tailored to your goals.

Step 4: Create a positive team culture

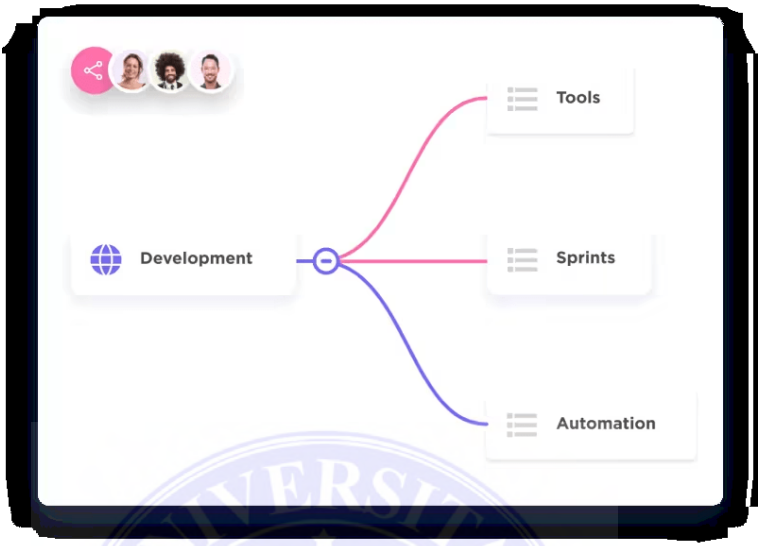
Developing a positive, nurturing workspace culture enhances team performance. It makes everyone feel valued and part of a community working toward collective goals.

ClickUp's project management tool helps create a positive team culture by streamlining workflows, facilitating collaboration, and assigning ownership. As an all-encompassing project management tool, it helps your team be more productive and goal-oriented.

You can effortlessly use ClickUp for managing tasks, tracking time, setting goals, sharing documents, and creating custom workflows. It's easy to use, even for the less tech-savvy team members, and integrates well with other tools.

Here's how ClickUp can boost teamwork:

1. Connected workflows:
    - The various members of your team can all use the same platform and customize it as they see fit
    - Changes made by one member are immediately visible to the rest of the team, promoting seamless collaboration
    - You can break down silos with collaborative features like ClickUp Mind Maps and ClickUp Whiteboards, encouraging knowledge sharing and joint problem-solving



Pigure 6.3 Connected Workflow

Here's what else to consider

A high performance team framework is a set of principles, practices, and tools that help you create and sustain a team that delivers exceptional results. Whether you are leading a project, a department, or an organization, you can benefit from applying a high performance team framework to your work. In this article, you will learn what makes a high performance team framework work for you, and how to implement it in your context.

2. The benefits of a high performance team framework

Using a high performance team framework can offer several benefits, such as improved collaboration and communication, enhanced alignment and clarity, increased accountability and ownership, higher levels of creativity and innovation, greater engagement and motivation, and reduced conflicts, errors, and waste. By relying on this framework, you can foster a culture of excellence, trust, and learning in your team.

3. The elements of a high performance team framework

A high performance team framework consists of four main elements: purpose, people, process, and performance. Each element has a set of sub-elements that define the key aspects of a high performance team. To better understand each

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element, let's explore them in more detail. The purpose element helps the team align on a common direction and meaning for their work by covering the why and what of the team - including vision, mission, values, goals, and strategy. The people element focuses on the who and how of the team - such as composition, roles, responsibilities, skills, behaviors, and relationships - to leverage diversity and strengths and build trust and collaboration. The process element covers the how and when of the team - methods, tools, standards, practices, and routines - to optimize workflow and deliver quality results. Finally, the performance element looks at the what and how much of the team - outcomes, metrics, feedbacks, recognition, and improvement - to measure progress and impact and celebrate achievements.

4. The steps to implement a high performance team framework

   To implement a high performance team framework, you need to follow four steps: assess, design, execute, and review. Each step requires engaging the team members and stakeholders in a collaborative and iterative process. To begin, the assessment step involves collecting and analyzing data on the current state of the team and its context. This can be done through surveys, interviews, observations, or other methods to identify the strengths and gaps of the team in relation to the four elements of the framework. Additionally, opportunities and challenges in the environment should be identified. The design step then involves creating and refining a plan for the team based on the data from the assessment step. This includes workshops, brainstorming sessions, or other methods to co-create a vision, goals, roles, processes, and metrics for the team. Actions, resources, and timelines should also be defined for implementation of the plan. The execute step involves implementing the plan while monitoring results through tools, checklists, dashboards, reports or other methods to track and evaluate performance and impact. Lastly, the review step requires reflecting on experience and outcomes with feedback, debriefing sessions or other methods to collect lessons learned. Recognition and rewards should also be used to appreciate and celebrate achievements and contributions.

5. The best practices for a high performance team framework

   To make the most of a high performance team framework, you need to involve the team members and

stakeholders in every step of the framework to increase their engagement. Additionally, you should adapt the framework to your specific context and needs, as there is no one-size-fits-all approach. It's also important to ensure that all four elements of the framework are balanced and given equal attention. Finally, you should review and improve the framework regularly to keep it updated and relevant to the changing needs and expectations of the team and its stakeholders. Seeking feedback and embracing continuous improvement are key for a successful high performance team framework.

6. The challenges of a high performance team framework

A high performance team framework is not a sure-fire solution for success, but rather a guide to help navigate the complexities and uncertainties of teamwork. Despite this, there may still be resistance and skepticism from some members or stakeholders, conflicts and disagreements among those with different opinions or interests, ambiguity and confusion about purpose, goals, roles, or processes, distractions and disruptions that can affect focus, motivation, or productivity, as well as errors and failures that can undermine confidence, reputation, or results. To tackle these challenges effectively, it is important to communicate openly and frequently, listen actively and empathetically, negotiate fairly and respectfully, clarify expectations and assumptions, and learn from mistakes and setbacks.

The General Team Role Framework

Teams are use within projects to design, create and deliver a result to an organization. Teams are generally role and skill diverse to ensure all aspect of a project deliver success to the end result.

Sub-Teams are used on larger projects to define tasks into smaller working groups with specific skills. Sub-teams often have their own team meetings, working sessions, and progress reporting.

Sub-team reports are consolidated into the PMO's Project reporting to the Project Manager, Sponsor, and Steering Committee. These sub-teams roles, responsibilities, and skills focus on a single aspect of the work to allow for more effective and efficient effort. Sub-teams generally have:

1. Role specialization with their subgroups and

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2. Report to a Lead of the sub-team
3. Focus on an specific set of task types

Team Roles and Responsibilities - Skill Set driven

A Traditional team is a hierarchical top-down team run to maximize results on large and complex projects. These include projects with government oversight, regulatory requirements, and high capital investments where documentation milestones and process rigor is needed.

The Sponsor's role is to act as the overall customer of the Project. They are responsible for:

- Ensuring the Project meets the needs of the organization
- The target user group's requirements are met, and the solution is adopted
- The Project Business Case Return on Investment (ROI) is realized
- The Project budget, solution, time requirements are within agreed metrics
- The Project outcome is compliant with policies and regulation

The Sponsor is a member of the steering committee and reports to senior management. The Project Manager is the leader of the Project and oversees the execution of a project. They are responsible for:

- Managing project scope and deliverables, compliance with internal project processes
- Certifying adherence to staff management protocols
- Overseeing overall project scope, timelines, and budgets
- Ensuring the solution quality meet agreed expectations
- Managing direct reports and coaching as needed
- Assuring Compliance related to regulatory requirements
- Confirming project activities are executed correctly

The Project Manager reports to the Project Sponsor and the Steering Committee. And, if the Project Manager is an external contractor, they also have reporting lines to their own organization. Project Management Office (PMO) Lead is responsible for:

- Consolidating cross Project processes
- Creating and distributing the Project Plan and staff updates
- Coordinating with the other leads to update the Project Plan
- Flagging issues in Scope or Timeline to the Project Manager and Sponsor

- Preparing special reports as needed for the Project
- Managing and Coaching the PMO team

This role reports to the Project Manager

Communications is responsible for:

- Ensuring internal and external Project Communication planning and quality
- Creating managing and delivering Communication content for the Project
- Using the organization's communication protocols
- Controlling external communication from the Project Team
- Managing the Communication Project planning

This role reports to the PMO Lead. But may also report plans, progress, and results to the Project Manager and Project Sponsor. They may also report to the organization's communications group, external to the Project. Financial reporting is responsible for:

- Managing the budget and cost actuals for the Project
- Calculating the cost and cost variances
- Addressing accounting issues
- Flagging Project under or overruns
- Creating the Financial DashBoard to the Project Manager and Sponsor

This role often reports directly to the Project Manager and Sponsor. And may have Financial group reporting lines outside of the Project. Training is responsible for:

- Designing, Creating, and delivering team training
- Onboarding team members with training for the Project and their role
- Ensuring that all team members have the training needed to execute their jobs
- Designing and creating End-User Training
- Running the Train-the-trainer event for user learning sessions

This role reports to the PMO Lead

Project Support is responsible for:

- Maintaining project documents, including version control change requests
- Creating Project Internal process revisions
- Managing on and off-boarding staffing processes, such as badges, desk allocation, and time reporting.

- Team Structure
- Have you ever thought about why we study atomic structures in chemistry? Well, we study them to understand their arrangements and how they function. We know how they combine to form compounds. Similarly, we study organizational structures to understand their functionality. This explanation covers one of the essential organizational structures, i.e., team structure.

Team Structure Definition

An organization needs a structure to function on a day-to-day basis. It helps the employees understand their roles, culture, and flow of communication within an organization. The clarity in roles and smooth communication ensure efficient decision-making. Organizational structure helps create clearly defined responsibilities, performance, and evaluation standards in the organization. There are many types of organizational structures, and team structure is one of them.

Team Structure in Management

As mentioned earlier, team structure replaces the functional departments with more empowered teams. Therefore, it eliminates the vertical and horizontal hierarchy in the organization. As a result, there is less focus on ranks and more on the teams' performance. The teams coordinate with each other and work towards attaining the organization's objectives.

Team structure enables an organization to reduce barriers with its customers and suppliers. This ensures smooth communication and transparency with them. As a result, the organization can satisfy the customers' demands and enjoy strong relations with its suppliers.

Team Structure Organization

We have established that team structure provides more control and flexibility to the employees. It enables teams to make timely decisions and improve their performance. The question is, how can we organize a team structure in a company? Let's go through the steps that can help a company implement a team structure.

1. Identify the right structure: Many organizational structures are available to a company. The priority should be on identifying

the right team structure. The management should research the structures and take input from industry leaders if needed. Selecting the right team design depends on the organizational goals, objectives, and mission.

2. Align the goals: Once you have selected a team structure, it's time to align the organizational goals. You must set clear objectives to align the goals with the team structure. The team members should sit together to decide the best way forward for implementation.
3. Set clear responsibilities: At this point, you clearly understand the structure and goals. You should assign clear roles and responsibilities. It helps determine the team's performance expectations, which is essential for evaluation and supervision.
4. Ensure open communication: To make team structure work efficiently, fostering open communication in the teams is crucial. When employees feel free to share ideas and concerns with others in their team, it helps resolve issues in a timely manner and improves the teams' overall performance.

Team Structure Examples

Some companies have fully adopted the team structure. Let's discuss some of them.

1. Basecamp

   Basecamp is a software company based in Chicago, Illinois. The company has small teams to carry out each project. These teams are empowered to make their decisions. As for performance accountability, the focus is on completing the tasks in the allotted time. The communication channels are accessible to everyone. The teams coordinate with each other to keep track of performance and to share information/ feedback.[1]

2. Study Smarter

   Study Smarter is an Edtech company that develops content for study purposes. The company has operations in multiple countries, such as Germany and the United Kingdom. It has a team-based organizational structure. There are several teams, such as content, design, marketing, etc. Each team has a manager and a team lead. The team members report to the manager, who then reports to the team lead. Due to the team structure, there is open communication across teams.

3. Team Structure Types

There are different types of team structures. A company decides on a type of team structure based on its objectives. We briefly discuss each of them in the following section.

a. Functional team: In this type of team structure, the employees with similar job functions are grouped. This team division is based on the tasks and skills of the employees. For instance, content creators work in the content team. It allows employees to collaborate and improve the organization's performance. This type is suitable for teams that want to develop experts in the field.
b. Cross-functional team: This type of team has employees belonging to different areas of a business. This team is assembled to perform tasks that require diverse expertise. For instance, a company plans a project to develop a website. They need to employ a content creator, front-end and back-end developers, and designers. The manager's task is to ensure a healthy and collaborative working environment in cross-functional teams.
c. Market-based team: In this type of team structure, the teams are assembled based on markets. It is suitable for companies that target specific markets. The members of these teams have a comprehensive understanding of particular markets. For example, a multinational corporation might have different marketing teams for North and South America.
d. Virtual team: As the name suggests, this type of team is for people who work from different locations and employ technology to work together. The team members are connected through a communication channel. They constantly communicate through online platforms such as Google Workplace, Slack, or Zoom. In the aftermath of Covid-19, this structure has become more widely used.

Team Structure Advantages and Disadvantages

Team structure provides many benefits to the organization. However, there are some issues that organizations could face by adopting this structure. Here are some common advantages and disadvantages of team structure. Team Structure Advantages:

1. Good communication flow: Team structure allows employees to use different communication channels. They can choose them according to the demands of a situation. It ensures a good flow of communication among team members. It enables them to resolve issues promptly and improve the company's performance.
2. Enhanced efficiency & productivity: Team structure ensures good communication flow, which means employees can collaborate to complete the projects. They can share ideas, resolve issues, provide feedback, and finish tasks promptly to increase output. It enhances the efficiency and productivity of the company.
3. Empowered employees: Team structure allows employees to learn and grow. When team members work on a project, they exchange knowledge and ideas. It enables them to develop as professionals. As a result, they feel empowered.
4. Innovation: When employees feel empowered, they do not shy away from bringing new ideas to the table. It creates an environment where they feel encouraged to innovate. These innovative ideas could improve the organization's performance, develop new products/services, and reach new markets.
5. Sense of community: Team structure provides a sense of community to the employees. They understand that there is a common goal, and each one of them is working hard to achieve it. As a result, they realize that they have formed a community.

Team Structure Disadvantages:

1. Conflicts: When employees work in teams, conflicts could arise due to personal or professional reasons. Conflict can negatively affect team dynamics, resulting in a lack of harmony. This issue could be detrimental to the success of the team. The manager or team leader's job is to ensure that each team member respects one another.
2. Lack of compatibility: Another disadvantage of team structure is the lack of compatibility among the team members. Some employees prefer to work alone than in a team. Such employees could show a lack of effort and participation in teamwork. This situation could hamper the performance of the whole team.

Team Structure

- Organizational structure helps the employees to understand the roles, culture, and flow of communication within an organization.
- In a team structure, there is less focus on ranks and more on the teams' performance.
- Team structure enables an organization to reduce barriers with its customers and suppliers.
- Team structure enables an organization to maintain smooth communication and transparency with its stakeholders.
- Team structure provides employees the opportunity to learn and grow along the way.
- Team structure provides a sense of community to the employees.

A Team Development Framework

1. Why teams don't work

   A well-functioning team can create magic, but here are some disturbing facts from teamwork in the real world:

   - Research that compares the performance of teams with what is produced by an equivalent number of individuals who work by themselves almost always find that the individuals outperform the teams.
   - In practice five out of nine interventions/attempts to improve team performance have no positive effect whatsoever!
   - There is much agreement in the research community on what works and not when it comes to helping teams get to high performance.

   So, in theory we do know how to make things work. In practice, organizations do not apply this knowledge when starting and developing teams. Thus, they fail to get the full benefits from organizing in teams.

   To help with this situation, we decided to put this simple guide together. It contains a framework and some hands-on exercises that you can use to start and support the agile teams in your organization. We created it to support Scrum Masters, Line Managers, Agile coaches and others that want to create great teams.

   To avoid falling into the trap of the five out of nine techniques that sounds good but actually do not help at all, we

based this guide on principles well grounded in the research. This is not only a theoretical framework though. We have used it at ProAgile for more than ten years of helping agile teams to get started and keep improving. For us it has helped to create good results in practice. We hope you will find it useful too.

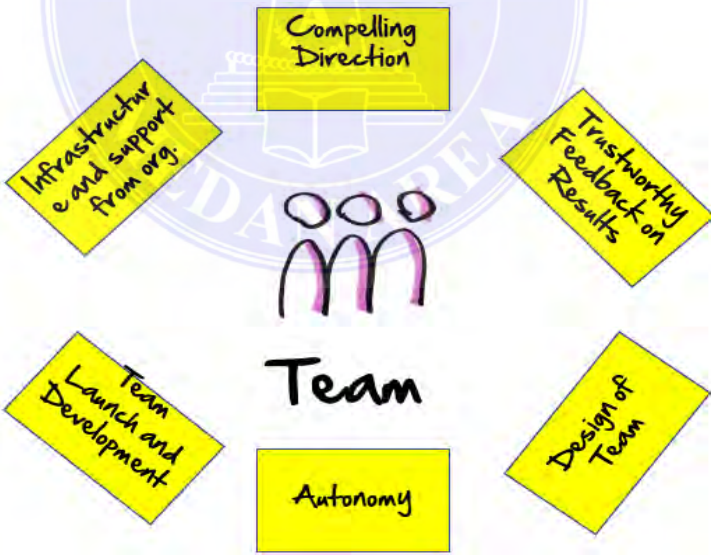
2. What is a successful team?

Before we go into describing how to create a successful team, let's agree what we mean with "a successful team". Below you can see a proposed definition from Richard Hackman. A successful team:

- Actively shape stakeholder expectations and then exceed them
- Grow as team, becoming more and more capable of taking on greater challenges together
- Grow as individuals, increasing individual skills, both soft and hard

Relative weight of these bullets differs depending on the purpose of the team. For a team that will work together a lot over a long time, all bullets are important. If you are interested in a team like that, this booklet may be for you!

3. The Framework



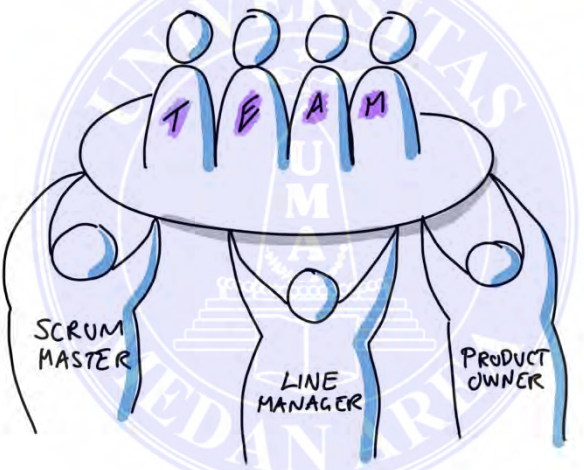
Pigure 6.4 Framework Team

Above you can see a visualization of a framework that has been proven useful for us when thinking about how next

we best can help a team on their journey. The six areas shown with the yellow postits above is a slightly different way of viewing the five conditions that well renowned team researcher Richard Hackman uses to discuss team performance in his work.

Hackman states that evaluating a teams environment and setup, using these areas, can explain 90% of the variation you see in team performance! This is great news since it also means that by focusing on these areas, by improving the working conditions of your teams step by step, you can have a huge impact on the performance of the teams that you care about team.

How to use this framework



Pigure 6.5 How to use Framework

Here is one suggestion on how to use the framework:

- Identify the leaders that most closely care about/can influence the conditions of performance for a team. In a classic agile context this may be the Product Owner, Scrum Master and Line Manager of the team.
- Schedule regular get-togethers of these leaders.
- At these gatherings, use the framework to systematically examine the working conditions of your team. What is in place already? What would be a next step to enable even greater team performance within each area?

- Pick at least one area where you would like to make an improvement, plan and execute an experiment to make the improvement. The exercises later in this paper can be useful to make some of these improvements.
- Repeat.

In the next sections we will examine each of the conditions/areas one by one. This is for you to use as a reference when you evaluate the conditions for each team and think about next steps as descibed above.

This is the most important of the various factors you should consider when thinking about what conditions you can help create for your teams. It is one out of five factors identified by Hackman as enabling team performance. Wheelan found that this was one out of three factors that really mattered when examining effective team interventions. In the Google Aristotele research [4], three out of five key conditions found to affect performance, was goal related.

Thus, a team need somewhere to go, a direction that they feel compelled to travel together in!

A team may have many different types of goals that serves to set this compelling direction. They can be:

- Product development related
- Organizational development related
- Team related
- Individual related

Creating and processing these goals is one of the very first steps to help any team reach high performance. In the second part of this booklet there are many exercises to help you do this in a good way.

What we are looking for is a direction that:

- Requires the whole team to work together. If the team does not need to work together to reach the goals, there is no need for a team. If you give goals to teams that individuals can reach individually, you should not expect teamwork to emerge.
- Is conceived by the team as quite challenging, but possible.
- Will fuel the intrinsic motivation in the individual team members.

Some techniques that are useful in this context

- Impact mapping
- Value Proposition Canvas

- Business Model Canvas
- Sprint Goals
- Helping the team to be close to and empathize with the people that will benefit from the solution/service they are delivering. In a Scrum context this may be reached by encouraging close collaboration between team and stakeholder and avoiding go-between behavior from roles such as Product Owners.
- Individual Goals
- Organizational Goals for Teams
- Product Goals for Teams
- Team Vision

Timely and Trustworthy Feedback

Pigure 6.6 Timely and Trustworthy Feedback

This is also one of the top three important aspects to consider when trying to create the conditions for team performance.

I once worked with a team that seemed to have a pretty good time at work, but when it came to the work itself, I felt that their hearts were not really in it. At the end of sprints they shipped whatever they had without worrying so much if what they shipped was of sufficient quality, if it really worked or if it was of value.

Now this team were a part of a larger organization and did not have all the equipment they needed to test if what they had created actually worked or not. At the end of sprints they simple shipped stuff off to another team that would test it. So I asked them, “how long does it take before you get feedback from the test team?”. The answer I got was that “It can take up to 18 months!”

Clearly waiting so long for feedback on what you are doing is not the most inspiring working environment. Basically, you get

the feeling nobody cares what you do and that it doesn't matter anyway. What looked like disengaged, somewhat irresponsible, individuals was merely a logical result of setting up an environment that created that behavior!

Some techniques to address this condition

- Create real potentially releasable increments of your product/service as frequent as possible. At least every sprint.
- Slicing stories vertically so that even each releasable increment is created in many smaller steps, each giving technical feedback about working integrations etc.
- Making sure teams have frequent stakeholder, customer and end-user contact. In Scrum this can be during Sprints and at Sprint Reviews.
- Techniques such as impact mapping from the compelling direction section that makes sure the team actually know what the purpose of the work is. Without that, any measure of progress is less meaningful.

Clear and Significant Autonomy

Pigure 6.7 Clear and Significant Autonomy

Here is a pattern I keep running into when I work with aspiring agile organizations:

After some initial agile training, teams assume that they now are self-managing and happily set out to decide various things. Shortly after, their initiatives will be shot down by managers that still have the perception that whatever was decided is still their responsibility, not the teams'. The teams then realizes that all this talk about agile and empowerment was all BS. They understand that nothing has really changed and swiftly return to their previous level of disengaged compliance. The

organization fails to be more agile since agility really depends on the engagement and initiative from each individual.

So, what we need is for teams to know what they can decide and what not. Don Reinertsen stated it well when he said that people should not walk into invisible electric fences.

Note, it needs to be a significant amount of things that teams can decide. People in general enjoy if they can have a say in HOW the work that they do should be performed. Also, the people doing the work probably have some skills and knowledge about the work, so also from that point of view it seems reasonable that they can decide how to do things.

I find defining key decision areas as suggested by Don Reinertsen and using the delegation level approach from Jürgen Appello useful techniques.

Some techniques to address this condition

- Delegation poker and delegation boards.
- Agile Leadership training for involved managers. Especially focus on need for decentralization and how to, step by step, restore the motivation and initiative that was destroyed by the classic hierarchical management model.
- Clarifying Team Mandate

Design of Team

Pigure 6.8 Design of Team

This is also one of the top aspects to consider when trying to create the conditions for team performance.

Behavioural Styles

Perhaps one of the most popular beliefs about teams is that considering personalities or behavioural styles of team members are useful when designing and developing teams. There seems to be no evidence of this belief. Google in their Aristotle study examined this and found the mix of personalities to have no

impact on team performance. Richard Hackman debunks this belief also. His work emphasizes that with the right conditions, a team will able to work through difficulties caused individual differences. Not to mention that most common tools to work with personality styles actually have little more predictive power than horoscopes. But no need to get into that since the framework covered here has actual scientific backing and it does not rely on any tools to classify personalities.

What matters then when you design a team? Let's have a look at what the research says in the following sections!

Team Size and Clear Boundaries

Let's say that you have some really interesting but very challenging work coming up. You have created a plan as a team, and you notice that as you are about to get started you feel energized and that you were actually looking forward to it. A week into the project one of your teammates is suddenly missing and you find out he is taking a month off at the Bahamas and it seems that chances of meeting your goals are now close to zero. Most people will have a very hard time to keep contributing at their fullest potential in a situation like that. Why would you give it your best shot when the people that are jointly responsible clearly does not?

Indeed, as pointed out by Christopher Avery: The motivation of a complete team is usually set by the least invested/motivated team member. The least inspired person tends to drag everyone else down to the same low level of engagement. Hackman also mentions the related phenomena of "Social Loafing", someone "free riding" along and not contributing their share of the work.

A common cause for this problem is the habit in many organizations of assigning people part time to several teams, or to set things up so that teams are dependent on external experts with no commitment to the team.

The way to prevent this is to set clear boundaries for the team. A team need to know who is on the team and who is not. Who can I count on when going gets tough and who may have other priorities?

Basically, to get this working in a software development context, we need teams with full time team members. To make this easier to achieve, you may want to consider keeping teams

intact and letting existing teams take on whatever projects/work that comes up rather than starting up a new team for each new project.

To avoid “Social Loafing”, also try to make the team as small as possible. If a team have barely enough people to manage finish their task, the likelihood of anyone “free riding” decreases. Coordination is also much easier than on a large team. If a handful of persons can get the job done, this is a good size to aim for.

Interdependence

Surprising to some, the ideal in an agile team may not be that everyone is able to perform every task. From a teamwork perspective it is actually better if people have different skills, so that they will actually have to work together to accomplish the team goals.

This also aligns nicely with the idea of “T-shaped” people. We want people that have deep expertise in some area. This is what enables us to create products with great performance. Only relying on experts tend to take too long though. There will be lots of waiting times as they pass work between each other, and the opportunity may be gone as we finally manage to get the product out the door. If instead people are experts, but also are willing to help out with things that they do not master so well every now and then, we can achieve speed in development also.

The way to get this working is to assign sufficiently big things to teams so that a multitude of skills is needed to perform the work. Ideally teams should not just “implement requirements”. They should have the greater task of creatively striving to solve some customer problems, or to optimize value to customers in some area. Stability over time Team development models usually include some kind of phases, such as “Forming, Storming, Norming and Performing” by Bruce Tuckman, or the phases 1-4 as defined by Susan Wheelan. They indicate that it takes a bit of time to get a new team going. In the beginning the team will be struggling with everyone finding their roles and ways working together. As you sort that out the team will eventually be able to deliver more value than what the team members were able to do if they had been working as individuals. This can easily take 6 months or even a year.

So, you may want to consider keeping teams together for longer times. To make this possible, think about assigning

projects/work to existing teams rather than forming a new team for each new endeavor.

Some techniques to address this condition

- Team self-selection
- Move from project teams to stable teams with full time team members
- Assigning larger, value/effect based, goals to teams, see compelling directions chapter.

Activities for Teambuilding

Pigure 6.9 Design of Team

Perhaps the most common activities for team building are going bowling and then continuing with dinner & drinks. Or perhaps solving a puzzle such as an “Escape room”, trying to instill teamwork by doing something completely different than regular work. This can be fun and all, but these activities probably fall into the category of 5/9 activities that produce no measurable improvement in teamwork according to Susan Wheelan. So feel free to keep offering fun stuff like this to employees, but do not count of this as the foundation for team building.

What works then?

Well, some of the activities from previous sections, such as processing and agreeing on direction/goals on product-, organization, team and individual levels are major team building activities. The team cannot self-manage if they do not feel the direction is motivating. Also, team members will only contribute to their full potential when they feel the direction is compelling.

An agile team also needs to learn some new skills in order to be self-managing/self-organizing. Especially they need to learn how to:

- Quickly make good enough decisions as a team
- Solve problems as a team
- Navigate conflict as a team

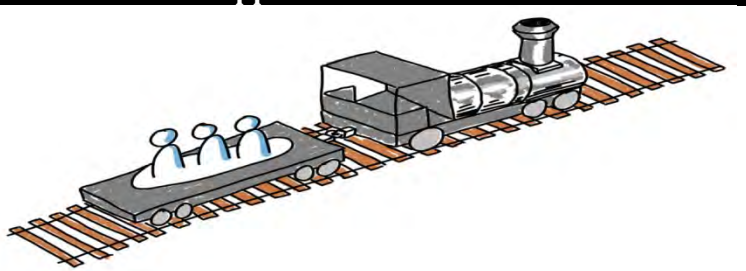
Having some of these skills is of help since teams also need to decide

- Ground rules for working together
- Specific ways of working that all team members at least agree to. (Consent decision making is enough here, not consensus)

In the Google Aristotele team-research they found "Emotional Safety" (aka trust) to be the best predictor of team performance. Emotional safety basically means that you can show up as your full self at work. You can be yourself and do not have to put on a mask or protective armor because you know that nobody will try to hurt you. This is probably factors that most team building activities tries to address with various social off-work social activities. Maybe that even helps a little, but by using job focused specific activities, some listed below, this can be taken to a completely different level.

- Individual Goals
- Organizational Goals for Teams
- Product Goals for Teams
- Team Vision
- Ground Rules & Decision Making
- Journey Lines
- Roles-and-Expectations
- Appreciation Cards
- Balancing Team- and Individual work
- Market of skills
- Repairing Broken Agreements

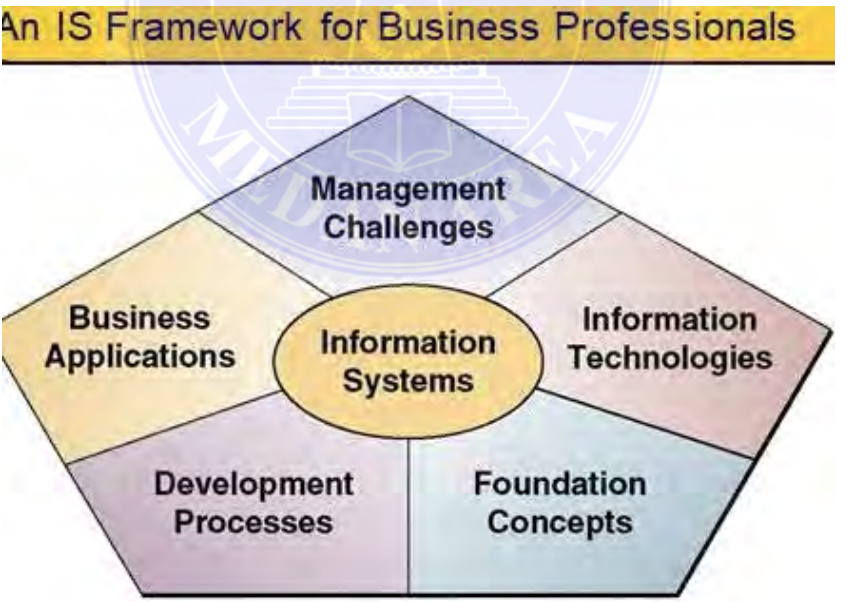
Infrastructure and support



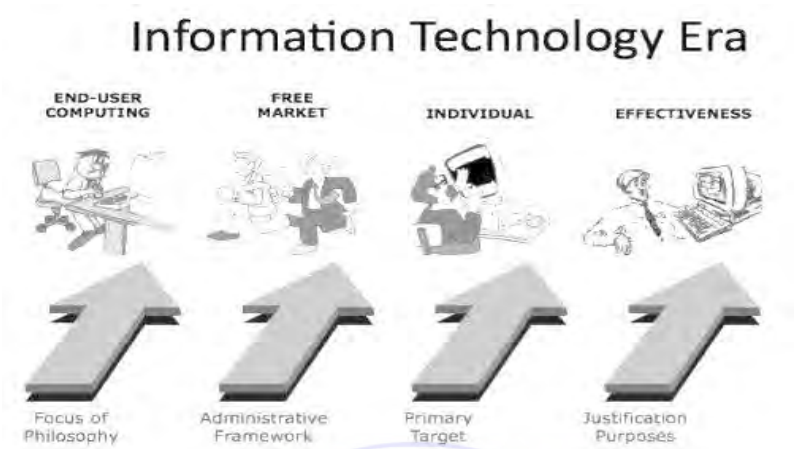
Pigure 6.10 Infrastructure And Support

Here are some ideas on question you can ask to check the level of infrastructure and support you currently have for your teams:

- Do they have easy access to all information they could use to maximize the value of their work?
- Do they have the tooling they need and is tool-performance top class?
- Do they have the personnel and physical space needed?
- When there is tooling or infrastructure problems, how quickly can the team get help?
- When the team discover a need for learning, can they quickly get the resources needed to do so?
- Do the reward system of the company encourage teamwork or individual hero behavior?
- Do the organizational design foster collaboration between groups and departments?
- When the organizational design creates conflict between organizational parts, do managers have the sophisticated political and interpersonal skills, persistence, inventiveness and sense of timing to help resolve this?



Pigure 6.11 Framework for Cusiness Professionals



Pigure 6.12 Information Technology Era

1. Digital Information Business

   In 2018 and the following years, the internet is increasingly getting the attention of every individual. Whenever and wherever there are always activities that require everyone to be connected to the internet, use social media such as Facebook, Instagram, browsing on Google, and so on. Plus, the use of smartphones for daily needs is increasingly widespread nowadays. Of course, what internet users are looking for is information. The information they are looking for can be in the form of writing, photos or videos. Everything on the internet is information. Facebook offers information wrapped in a status name, Twitter in a tweet name, and so on. Whatever we do now cannot be separated from information. Media has only one source, namely the Internet. Seeing this situation, we should already know that society has now become a society that is hungry for information. Starting from information about sports, education, automotive, or other information. No matter where the information comes from, people will start online-based businesses.

2. The influence of information technology on the business world

   Currently, information technology is experiencing very rapid development where its development cannot be avoided. The development of information technology can not only help our way of life become more modern in everyday life, the business world is also helped by current technological

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developments. Various things that used to cost a lot of money and take a long time, can now be completed in a short time, even in seconds.

Positive impact

The development of information technology has been widely applied to national and private companies. This implementation causes changes in habits or new habits in the business sector. such as the influence of technology in the business world which utilizes E-Commerce as a trading medium using internet media which is currently not difficult for all groups to reach. Advances in technology, computers and telecommunications support the development of internet technology. Through the internet, business people no longer experience difficulties in obtaining any information to support their business activities, and now they tend to be able to obtain various kinds of information.

Electronic Commerce (E-Commerce) is the process of buying, selling, or exchanging products, services and information via computer networks. E-Commerce is part of E-Business, where the scope of E-Business is broader, not just commerce but also includes collaboration with business partners, customer service.

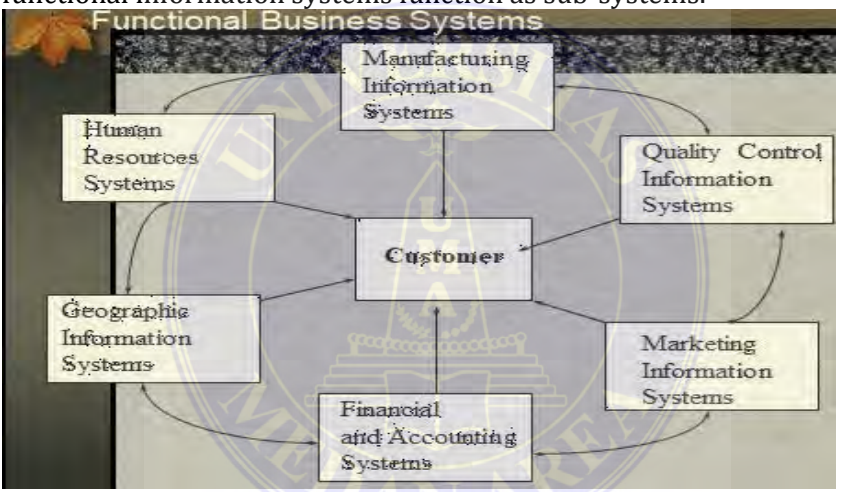
Pigure 6.13 Use InformationTechnology

Figure 6.13. Positive use of Information Technology Based on the functional areas of information systems, they can be divided as follows:

Accounting information system (accounting information system) Financial information system (Finance information system) Manufacturing information system Marketing information system (Marketing information system or MKIS) HR information system (Human resource information system or HRIS)

The types of functional Information Systems available from one company to another vary. For example, a distribution company does not have a production information system.

Please note that functional information systems do not physically stand alone. These information systems are various resources in the organization. In the company information system, these functional information systems function as sub-systems.



Pigure 6.14 Functional Business Systems

Information systems utilize human resources, hardware, software, data and networks to carry out input, processing, output, storage and control activities. Changing organizational processes Information systems perform three important roles in business enterprises.

Execise

1. Provide an explanation about the digital transformation success team
2. Provide an explanation of how ClickUp can boost teamwork
3. Explain how to use the framework

*****

CHAPTER 7
THE IMPLEMENTATION OF DIGITAL INFORMATION SYSTEMS

Course Learning Outcomes :

- *Able to build, develop, and use networking in the world of business and management (Able to build, develop, and use networking in business and management); (KK1)*
- *Able to analyze the role of digital information systems in decision making*

The authors found that the use of IT can have a positive impact on the efficiency and effectiveness of decision-making in organizations, through improved data collection, analysis, and dissemination for more informed and strategic decision-making, as well as facilitation of communication and collaboration.

Pigure 7.1 Decision Making

Decision-Making in the Digital Age: How Technology Is Transforming Our Choices

Information technology has transformed the way we make decisions in every aspect of our lives. From personal to business decisions, technology has enabled us to collect and analyze data,

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creating new opportunities for informed decision making. With the help of big data analytics, machine learning algorithms, and decision support systems, organizations can identify patterns and trends to gain insights that can drive innovation and increase profitability. Additionally, technology can help individuals make better-informed decisions by providing access to relevant and accurate information that was previously inaccessible. Therefore, understanding the role of technology in decision making is essential for individuals and organizations to stay competitive and achieve success.

Decision making process

The decision-making process involves several steps that can be broken down as follows:

- Identifying the problem or situation that requires a decision
- Gathering relevant information related to the problem or situation
- Identifying possible solutions or alternatives
- Evaluating and analyzing each alternative based on predetermined criteria
- Selecting the best alternative based on the analysis
- Implementing and monitoring the chosen solution

Gathering and analyzing relevant information is a crucial step in the decision-making process. It enables decision-makers to assess the situation, identify potential risks and opportunities, and develop viable alternatives. Technology plays a significant role in facilitating the gathering and analysis of data. For instance, data analytics tools can help analyze large datasets to uncover trends and insights that are not immediately apparent. Additionally, artificial intelligence and machine learning algorithms can identify patterns and relationships in data that may not be visible to humans. By using technology to gather and analyze information, decision-makers can make more informed decisions that are based on reliable and accurate data.

Technology in decision-making

Technology tools have transformed the way decision-making is done in the field of IT. Here are some ways technology tools can enhance decision-making in IT:

- **Data analytics**: Technology tools such as data analytics can help decision-makers analyze large datasets and identify

patterns and trends that may not be visible through traditional methods. This can help in better risk assessment, resource optimization, and performance analysis.

- **Predictive analytics software**: Predictive analytics software uses statistical algorithms and machine learning techniques to analyze historical data and make predictions about future events. This can be useful in IT decision-making as it can help identify potential risks, forecast demand, and optimize resource allocation.
- **Artificial intelligence (AI)**: AI can be used to automate certain decision-making processes and can provide insights that would have been impossible for humans to uncover. This can help in making more informed and accurate decisions.
- **Machine learning algorithms**: Machine learning algorithms can be trained to learn from data and improve over time. This can help in predicting future outcomes and making better-informed decisions.

In addition to these benefits, the importance of data quality, accuracy, and security cannot be overstated in technology-assisted decision-making. The quality and accuracy of data used in decision-making are crucial in ensuring the validity of the insights and conclusions drawn. Security is also a vital aspect, as breaches or theft of data can compromise the accuracy and confidentiality of decision-making processes. Therefore, it is essential to have proper data governance policies and security measures in place to ensure the integrity of technology-assisted decision-making in IT.

The benefits of these technology tools in IT decision-making include:

- Processing large amounts of data quickly and accurately
- Analyzing data to identify patterns and trends
- Providing insights that can aid decision-making
- Creating visualizations to better communicate complex data
- Automating certain decision-making processes

Overall, the use of technology tools in IT decision-making can help organizations make better-informed decisions, reduce risk, and optimize resources. It is important to carefully evaluate the needs of the organization and select the most appropriate technology tools to ensure successful implementation and maximum benefits.

Introduction: decision-making, the central issue of decision support

In an engineering approach to decision support systems (DSS), the technical aspects, however complex, must never forget that decision- making is the central issue of decision support. This chapter will explore the different dimensions of decision-making so that we can understand its content, its sense.

It is worth reiterating that decision-making is the prerogative of mankind and that a "decision" made by a digital machine is not a decision (however, complex, it is nothing but the result of a line of calculations).

Every human being, in their personal and professional life and in their life as a citizen, is almost constantly making decisions of varying degrees of importance. To illustrate (basic) decision-making, let us consider the following: a pedestrian walking from one place to another will decide which route to take, during the journey they will choose which pavement to walk on, where and when to cross the road, how fast to walk, etc., until they decide to stop when they think they have arrived at their destination.

Similarly, decision-making is an integral part of the life of human organizations (authorities, enterprises, the State, etc.). Complex systems are immersed in moving environments, and they must indeed be managed. Managing takes various forms, but in the end it always results in individuals or groups making decisions. Enterprises must, for example, choose suppliers, organize production, set the price of products, define a client segment, redistribute the tasks of an absent worker, recruit employees and define the axes of research and development,

Organizational Decision-Making

1. Introduction to decision-making

   Social science theories have greatly supported the idea that a vast majority of all human actions are a result of decision-making (Brunsson, 2007). Cyert et al. (1956) defined decision-making as being the process of "choosing one course of action rather than another, finding an appropriate solution to a new problem posed by a changing world". This cognitive process is often claimed to be "the heart of executive activity" in business (Cyert et al., 1956). In the past century, a large number of studies have laid the foundation for managerial decision making (eg. Harrisson and March, 1984; Simon, 1990;

Mintzberg, 1989). Mintzberg (1973) presented three modes of decision-making made in business organisations which are: entrepreneurial, adaptive, and planning.

Organisational decisions greatly vary on the ways in which decision-making processes (or procedures) are implemented (Cyert et al., 19 6). Grunig u hn (2 13) define decision-making procedure as 'a system of intersubjectively comprehensible rules for obtaining and analyzing information, which can be applied to resolve a certain type of decision problem'. Organisations often neglect the importance of implementing an efficient decision-making process, despite it having the potential of highly benefiting productivity and profit (Schank et al., 2010). Cyert et al. (1956) throughout their research, described the various types of decision-making processes that occur in business contexts. The authors find that search processes (or information seeking processes) and information-gathering processes represent significant elements of decision- making.

2. Complexity of decision-making

In order to understand why digital technologies can help to improve decision making, it is essential to understand the complexity for humans to make decisions. The decision-making perspective looks at organisations as being systems that foster rational decision making, however, individuals as decision makers are often limited by their cognitive abilities (Choo, 1981). Simon (199) introduced his theory of "bounded rationality" which discusses the ways in which decisions are made, and addresses the impact of limitations of the human cognitive ability to achieve rational decision-making. Simon (1990) argued that complex circumstances, insufficient mental capabilities, and limited time result in decision makers facing "bounded rationality".

Moreover, an important contribution to the decision-making field was made by Kahneman (2011). The psychologist and economist theorized the concept that people often make decisions that are more emotional than rational. The author explains that people activate different systems in their mind depending on the situation they are facing. 'System 1' is the automatic, intuitive, and unconscious thinking mode, while 'System 2' is more of the slow, controlled, and analytical thinking mode (Kahneman, 2011). Additionally, Kahneman

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(2011) notes that executives are constantly faced with different types of biases that can distort their reasoning in business decisions. Confirmation bias, anchoring, loss aversion and other types of biases are a constant challenge to managers when making decisions (Kahneman, 2011). The author explains that in order to avoid these biases, decision makers should aim to use their 'System 2' thinking.

3. The role of information in decision-making

Previous studies have established the importance of information in decision making. Mintzberg (1989) described information as "the basic input to decision making". Moreover, Saaty (2008) stated that information is important to understand occurrences, to develop adequate judgement, and be able to make rational decisions regarding particular situations. The author mentions that it is easy to believe that all information is valuable, and that the more information we gather, the better it is to make good decisions. However, organisations need a formulated way of making decisions, and collect information that is relevant to their purpose (Saaty, 2008). Galbraith (1974) indicates that the more uncertainty there is, the greater the amount of information needs to be gathered in order to achieve the highest level of performance.

Several studies have suggested that if people could collect enough information, they would make economically rational decisions (e.g. Simon, 1990; Saaty, 2008). However, Kahneman and Tversky (2013) argue that people tend to often discard certain components that are shared with them, leading to non-rational decision making. This argument follows Essen et al. (2 21)'s idea that people often tend to ignore information. These various arguments present multiple rationales for why digital technology can play an important role in the decision-making process.

In the field of decision-making, understanding that the world is becoming increasingly complex and that more and more elements need to be considered is essential. Berger and Johnston (2015) explained how the world has become more complex, and that it is changing more rapidly than ever. The authors stated that decision making is no longer a linear cause-and-effect process, which has major implications on the ability for executives to make the right decisions. In their book, Berger and Johnston (2015) emphasise the importance of gathering as

much information as possible. Furthermore, Adeosun et al. (2008) did some research on the importance of information and communication technology in the banking industry for effective service delivery. The authors state that information is not only needed but plays a vital role in decision making. Moreover, Adeosun et al. (2008) explain that banks are more and more dependent on information and that it is needed in every stage of their decision-making processes.

Digital Technology and Decision-Making Processes

1. The use of digital technology in decision-making processes

A great deal of previous studies has looked into the topic of digitalisation and its relation to the business environment. According to Carlsson (2018), digitalisation, which is also sometimes described as "the digital revolution", is a key component in understanding today's business and industrial trends. The author states that digitalisation will have a considerable effect on the overall business world: changing organisational structures, business models, how companies cope with competition, and affecting productivity and profit. Carlsson (2018) also describes that digitalisation might become a solution to greater requirements in terms of efficient planning, problem-solving and decision-making. Colson (2019) mentions in his article that decision-making models have changed a lot throughout the years. Fifty to seventy years ago, the main decision- maker was human judgement (Colson, 2 19). The author describes a shift from fully "human" driven decision making, to an increased use of data and digital technologies to improve decision making.

In more recent years, there has been a large volume of published studies describing more specifically the role of digital technology in decision-making processes. Hoßfeld (2017) aimed to assess the implications of digitalization on decision making in organisational contexts. The author found that digital technology (more specifically automated systems) will ameliorate results emerging from decision making, due to a decrease of non-accurate human judgment.

Previous research has also explored the potential of digital technology to solve the issue of complexity surrounding decision making. Qudrat-Ullah et al. (2008) studied complexity in the field of decision-making and stated that decision makers

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now face issues that are more and more complex, interrelated, and are within an environment that continuously changes. According to the authors, acquisition of new managerial capabilities (human expertise) to cope with continuously changing and complex issues is a common move made by firms, but presents many barriers. Qudrat-Ullah et al. (2008) mention that new advances in computer technology and the development of new simulations tools may become a solution to this managerial problem, being the increased complexity of decision making.

A number of other studies have assessed the benefits of using digital technology to assist people in their decision making. Turpin and Marais (2004) did some research on decision-making styles and how decision support technology is used by managers. According to the authors, considering a few aspects such as understanding the business environment, recognizing the decision-making context, knowing how to package the huge amount of information, and using help from analytical decision support tools, might be beneficial when making decisions (Turpin and Marais, 2004). Furthermore, Cherviakov et al. (2020) undertook research regarding the digitalization of strategic decision-making processes. The authors state that the use of digitalisation creates the foundation for a rapid analysis of a current situation, and decreases the possibilities of errors, which overall improves the quality of decisions. The authors also add that while the use of intelligent analyzers helps to reduce processing time, the presence of human expertise is still required to verify the collected results.

While much study has looked at the benefits of using digital technology in decision making, it is important to understand what influences firms to invest in new digital systems. Corrigan (2008) talks about the factors that influence the use of digital technologies in decision-making processes. The author states that organizations are dominated by one factor, which is money. Therefore, firms generally perform what is called a 'cost-benefit analysis', in which they assess how much implementing new technologies will cost, and how much these technologies will make them save money (Corrigan, 2008).

2. Colson's framework

A recent article, written by Colson (2019) looks at the different ways in which organisations use digital technology towards their decision making. The author describes the various levels of digitalisation that organisations go through regarding their data manipulation and technology implementation in their decision-making processes. Colson (2019) touches upon different models of decision making and provides different levels of human, data and AI assistance in the process.

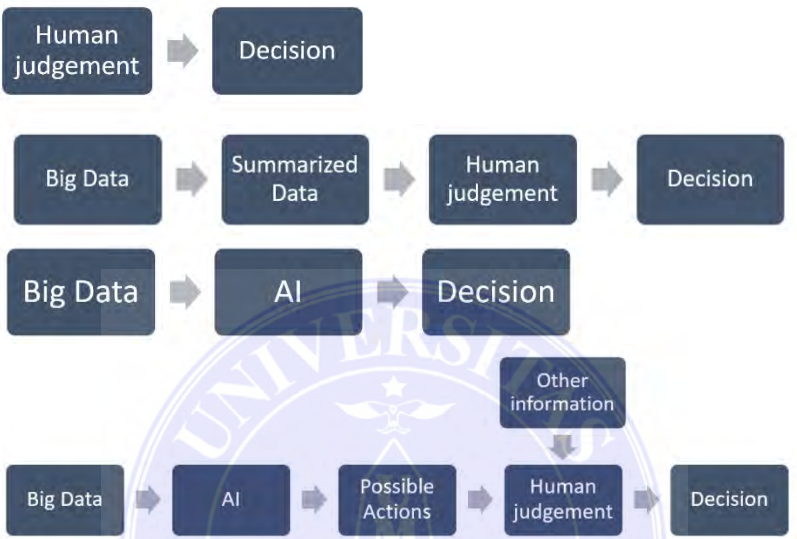
The first stage is a decision-making model based on human judgement. According to Colson (2019), human judgement was seen, around five to seven decades ago, as the main processor for decision making in businesses. Experts turned towards their professional experience, knowledge, and intuition to direct their decision making (Colson, 2019). However, the author believes that human judgement alone is not ideal, that cognitive biases can impair human judgement, and that making quick decisions is not optimal.

The next type of decision making presented by Colson (2019) is the data supported (or data-driven) model. In this form, the central decision-maker remains the human, but decisions are supported by using data as an input. This data is generally processed by humans using the help of external tools (Colson, 2019).

The final decision-making model, presented by Colson (2019) in two different variations, is AI infused. The first variation involves implementing AI as the sole decision-maker, assuming that this technology is less prone to cognitive biases (Colson, 2019). However, the second model includes AI in the workflow as an assistance to human judgement. According to Colson (2019), businesses sometimes depend on more than just pure structured data. Some aspects such as vision statements or corporate values only remain in people's minds and are conveyed through culture or other means of 'non-digital communication'. In addition, Colson (2019) notes that "AI can be used to generate possibilities from which humans can pick the best alternative given the additional information they have access to".

The author believes that in order to fully take advantage of the value of data, organisations must aim to bring Artificial

Intelligence into their workflows. While our paper does not necessarily focus on AI specifically, this framework is useful to assess the level at which an organisation utilises digital technology in its decision-making process.



Pigure 7.2 Process Decision Making in System

Real-World Examples and Best Practices

Case studies provide real-world examples of how technology tools are used in IT decision-making scenarios. Three common scenarios include cybersecurity threat detection, network performance monitoring, and software development.

- In cybersecurity, tools such as firewalls, intrusion detection systems, and security information and event management (SIEM) software can be used to detect and respond to threats. For example, a large financial institution used a SIEM system to detect and respond to a large-scale cyber attack. The system identified the attack early, allowing the organization to contain the threat and minimize the impact.
- In network performance monitoring, tools such as network analyzers, network performance monitors, and packet sniffers can be used to identify and troubleshoot network issues. A global retailer used a network performance monitor to identify a bottleneck in their network that was impacting the performance of their e-commerce website. After identifying

and resolving the issue, the company saw a significant increase in website performance and customer satisfaction.

- In software development, tools such as version control systems, issue tracking software, and continuous integration/ continuous delivery (CI/CD) pipelines can be used to improve software development processes. A software development company used a CI/CD pipeline to automate their software testing and deployment processes. This reduced the amount of time and effort required to release new software updates, while also improving the quality of the software.

Overall, technology-assisted decision-making can provide significant benefits, including improved efficiency, better decision-making, and reduced costs. However, organizations may face challenges in implementing technology tools for decision-making in IT.

- Skill shortages may make it difficult to find and train staff with the necessary expertise to use and maintain technology tools.
- Data management issues, such as data quality and data security, may also pose challenges.
- Ensuring that technology tools are integrated with existing processes and systems can be a challenge.

To overcome these challenges and ensure successful implementation of technology tools in IT decision-making processes, organizations can follow some best practices, such as:

- Investing in training and development programs to ensure staff have the necessary skills to use and maintain technology tools.
- Establishing data management policies and procedures to ensure data quality and security.
- Ensuring that technology tools are compatible with existing systems and processes.
- Establishing clear objectives and metrics for evaluating the effectiveness of technology tools.

By following these best practices, organizations can overcome the challenges of implementing technology tools in IT decision-making and realize the benefits of improved efficiency, better decision-making, and reduced costs.

The article underscores the significance of technology tools in augmenting the decision-making processes within the realm of IT. It brings to light the difficulties that IT professionals face in making crucial decisions and how technology tools can alleviate those challenges. The crux of the article is that the

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expeditious pace of technological advancement and the intricacies of IT systems pose a daunting task for IT professionals to make informed decisions. To overcome these challenges, technology tools like AI, machine learning, and analytics are vital, as they offer valuable insights that facilitate well-informed decision-making. These tools are adept at scrutinizing large volumes of data, identifying patterns, and predicting outcomes, which enable IT professionals to arrive at data-driven decisions. Additionally, these tools can automate repetitive tasks, which allows IT professionals to dedicate their time to more intricate decision-making. Ultimately, the adoption of technology tools can elevate the efficiency and effectiveness of decision-making processes, enabling organizations to remain competitive amidst the rapidly-evolving technological landscape. Hence, the article advocates for the integration of technology tools into the decision-making processes of IT professionals and organizations to enhance their capabilities and stay ahead of the curve.

Document Information

Management information systems combine hardware, software, and networks to provide managers with data suitable for analysis, decision-making, and reporting. The system collects data from inside and outside the organization, stores it centrally, and makes it accessible over a secure network. This allows for rapid access to up-to-date information from any location, enabling quicker, more accurate decisions. Management information systems also help interpret data patterns, allow teams to collaborate, and facilitate presenting information tailored to different audiences.

Exercise

1. Explain the meaning of decision making information technology
2. Explain the role of information in decision-making and its impact on organizations
3. How to make decisions from Colson's framework
4. What is your conclusion regarding decision making involving company decision making?
5. Explain the Document Information.

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CHAPTER 8
THE IMPLEMENTATION OF DIGITAL INFORMATION SYSTEMS

Course Learning Outcomes :

- Able to apply logical, critical, systematic and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise (Able to apply logical thinking, critical, systematic and innovative in the context of the development or implementation of science and technology that takes into account and applies the values of the humanities in accordance with the areas of expertise); (KU1)
- Able to explain the implementation of digital information systems.

Defenition

Management information systems combine hardware, software and network products in an integrated solution that provides managers with data in a format suitable for analysis, monitoring, decision-making and reporting. The system collects data, stores it in a database and makes it available to users over a secure network.

1. Rapid access to information

   Managers need rapid access to information to make decisions about strategic, financial, marketing and operational issues. Companies collect vast amounts of information including customer records, sales data, market research, financial records, manufacturing and inventory data and human resource records. However much of that information is held in separate departmental databases, making it difficult for decision-makers to access data quickly.A management information system simplifies and speeds up information retrieval by storing datain a central location that is accessible via a network. The result is decisions that are quicker and more accurate.

2. Decisions based on latest information

   Management information systems bring together data from inside and outside the organization. By setting up a network that links a central database to retail outlets, distributors and members of a supply chain, companies can collect sales and production data daily, or more frequently, and make decisions based on the latest information.

3. Teams can collaborate.

   In situations where decision-making involves groups, as well as individuals, management information systems make it easy for teams to make collaborative decisions. In a project team, management information systems enable all members to access the same essential data even if they are working in different locations or departments.

4. Interpret results efficiently.

   Management information systems help decision-makers understand the implications of their decisions. The systems convert raw data into reports in a format that enables decision-makers to quickly identify patterns and trends that would not have been obvious in the raw data.Decision-makers can also use management information systems to understand the potential effect of change. A sales manager can make predictions about the effect of a price change on sales by running simulations within the system and asking a number of "what if the price In the computerized part of IS – IT system – the effects of reducing the real, and performativity, are further accentuated. In view of these effects, we will question the role of DSS in decision-making, in general, and then for the specific type of DSS that constitute Big Data.

The active role of DSS in decision-making will then lead us to consider the risks related to their use. A number of types of risks will be studied: data or processing errors, the risk of confusing the real and its digital representation, the risk of feedback which the performativity of these systems involves and the risk of the loss of diversity in the way problems being asked in organizations are tackled. The biggest danger, which is a result of the aforementioned risks, is that of limiting organizations' ability to innovate, as innovation requires new ideas about the organization, its environment and the organization's connection with the latter to be developed. Inscribing in IT system and DSS a unique world view, which is highly restrictive yet undebated (as it

is for the most part implicit), also poses the problem of the democracy in the life of organizations.

Finally, the uncontrolled quest for predictive and even prescriptive decision support (which would replace the decision-maker) results, via certain aspects of Big Data and its present or future uses, in disturbing problems at the epistemological and democratic levels. A general and worrying Pigure is being drawn in the discourse of a number of promoters of Big Data [AND 08, MAY 13]: the refusal of the irreducible diversity of the real, the denial of the necessary complexity of human thought and the devaluation of experience as a primary source of knowledge.

Toward ethical DSS design

The recognization of this moral responsibility – which is also economic and social – and its accompaniment are the subject of the fourth and final chapter of this book.

This question, which, strangely, is mentioned very seldom in the literature in the domains of IT systems and DSS, falls into the category of computer ethics. Although there has been a concern about ethics since the dawn of cybernetics [WIE 48], computer ethics remains largely absent from IT research and teaching.

A quick state of the art about computer ethics, in general, the ethical theories on which it is based, its objects, the list of values supported, and also its production with regard to IT systems design methods, therefore seemed necessary. From this review, it can be considered that research into computer ethics mostly remains a topic for philosophers, and that research focuses a great deal on topics concerning the individuals (and not organizations) and their use of IT systems in their private life (and not in their professional life). Privacy, accessibility, transparency and non-discrimination are, therefore, the most frequently defended values. With some rare exceptions [STA 10], economic and social questions are not discussed.

Although the ethics of decision-making has resulted in a significant volume of literature, in particular in medicine and in the domain of management sciences, the ethics of DSS remains largely unexplored, in keeping with the computer profession's indifference to ethical questions. Some researchers have got upset about this, such as Meredith and Arnott [MER 03], who note that it is "unfortunate that the ethics of decision support as a specific

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topic has received very little attention in comparison to the issues of privacy and other general IT ethics issues". The arrival of Big Data has, however, sparked a new interest in the consequences of its use on both individuals and (particularly public) organizations. With regard to the aforementioned issues, particularly the limitation of decision-makers' and organizations' abilities by inscribing one single worldview in DSS, which are reinforced by the effects of feedback and the distance from the real, the ethical value we are looking to promote is democracy. For us, this involves producing DSS which meet the requirements of democracy, especially the ability to access multiple worldviews.

If we decide to consider the designers and all the stakeholders as morally, economically and socially responsible for how DSS are used, our position can only be upheld if this responsibility is assisted.

As such, we support the creation of engineering of responsibility and, with this aim, we will present a methodological tool: the doxai- principles-norms (DPN) model. This model unveils the chain starting with representations (worldviews) and ending with norms (the most operational level), passing through an intermediary level (the structuring principles). The model is destined to accompany the highest phase of engineering requirements – the analysis of early requirements – when the global aim of the future DSS is aligned with the overall objectives of the organization. This phase is essential as it sets the representations (about the organization, its players, objects, etc.), which will form the framework in which the features of the DSS and the ethical values to be integrated will be inscribed. An illustration of the DPN model will conclude this chapter.

Internet

1. Defenition

   The Internet is a computer network established by the United States Department of Defense in 1969, through an ARPA project called ARPANET (Advanced Research Project Agency Network) to communicate without distance limitations via telephone lines using computer hardware and software based on the UNIX Operating System. The initial purpose of building ARPA was for military purposes. Furthermore, this project grew rapidly, making it difficult for ARPANET to manage it. Because of this, ARPANET was split into two, namely "MILNET"

for military purposes and the new, smaller "ARPANET" for non-military purposes such as universities. The combination of the two networks eventually became known as the DARPA Internet, which was later simplified to the Internet.Internet (*interconnected-networking*) ialah sistem global dari seluruh jaringan komputer diseluruh penjuru dunia yang saling terhubung menggunakan str *Internet Protocol Suite* (TCP/IP) untuk melayani miliaran pengguna di seluruh dunia. Internet berfungsi sebagai media komunikasi, akses informasi berbagi sumber data, dan sebagai media untuk menyiarkan dan mengakses secara langsung dan bertukar data dengan akses internet online ke seluruh penjuru dunia tanpa ada batasan wilayah geografis dari setiap penggunanya.

2. IP Address (Internet Protocol Address)

   IP Address (Internet Protocol Address) is a series of binary numbers between 32 bits and 128 bits which is used as an identification address for each host computer on the internet network. The 32 bit number is used for the IPv4 version of the IP Address and the 128 bit number is used for the IPv6 version of the IP Address to indicate the address of the computer on a TCP/IP based internet network. IP addresses are unique, because they are not allowed to use the same IP address on one network. IP Address Function: 1). As a means of identifying hosts or interfaces on a network. This function can be illustrated as a person's name which is used to identify who that person is. In computer networks, the same thing applies, namely the unique IP address will be used to identify a computer or device on the network. 2). IP Address is used as the network location address. This function is illustrated like our home address which shows where we are. To make it easier to send data packets, the IP Address contains information about its whereabouts. There is a route that must be followed so that data can reach the destination computer.

3. Domain

   A domain is a unique name given to identify the name of a computer server such as a web server or email server on the internet. Domains make it easy for users on the internet to access servers and remember the servers they visit rather than having to recognize a series of numbers or what is known as an IP. Top Level Domain (TLD) is a series of words behind a domain name or website address which is located on the right

until the dot. Top Level Domains are divided into two, namely Global Top Level Domains (gTLD) and Country Code Top Level Domains (ccTLD).

For example, a Global Top Level Domain (gTLD) is a general TLD. Here's an example of a gTLD: .com (dot commercial) for commercial; .net (dot network) is used for telecommunications service providers; .org (dot organization) for organizations; and .edu (dot education) for academics, and the like. Meanwhile, Country Code Top Level Domain (ccTLD) is a TLD intended for each country, for example in Indonesia: .co.id which is used for commercial purposes; .net.id for licensed telecommunications service providers; and .mil.id for military agencies. Examples of Top Level Domains (TLD) for the names of several countries are shown in Table.

Second Level Domain (SLD) is a registered domain name. For example, for the website www.utopicomputers.com the SLD is "utopicomputers". Third Level Domain is the name after Second Level Domain (SLD). For example, if we want to create a website for email purposes, we can add webmail.namadomain.com then for search purposes we can add search before namadomain.com *(search.namadomain.com).* Third Level Domains are usually also called Subdomains.

Table 8.1
Examples of Top Level Domain TLDs for 10 countries

Nomor	TLD	Negara
1	.id	Indonesia
2	.au	Australia
3	.uk	United Kindom (Inggris)
4	.sa	Saudi Arabia
5	.ca	Canada (Kanada)
6	.cn	Chian
7	.fr	France (Prancis)
8	.jp	Jepang
9	.th	Thailand
10	.vn	Vietnam

Connection to the Internet

1. ADSL (*Asymmetric Digital Subscriber Line*)

ADSL (Asymmetric Digital Subscriber Line) is a modern technology designed to provide high-speed digital data

transmission over ordinary telephone cables. To get an ADSL internet connection, we have to contact each ISP's customer service to order the installation. ADSL has access speeds between 350-600 Kbps. ADSL has several advantages including: high connection speed, can use a telephone during the connection, cost effective, does not require extra wiring (ADSL uses existing telephone lines), and the connection is guaranteed. However, ADSL also has disadvantages, namely that the service is still limited (not available in all areas), ADSL works more optimally if it is closer to the ISP head office, speed is variable (depending on time and day).

2. GSM (Global System for Mobile Communication)

   GSM (Global System for Mobile Communication) is a technology for mobile communications. GSM technology is widely used for mobile communications, especially mobile phones. GSM technology uses microwaves and sends signals that are divided based on time, so that the information signal sent will reach its destination. GSM is the global standard for cellular communications and is the most widely used cellular technology throughout the world. GSM as a telecommunications system has many advantages, namely:

   a. The system capacity is greater because it uses digital technology.
   b. Its nature as an international standard allows international roaming.
   c. Provides voice, text, image and video services.
   d. Better system security.

3. GPRS (*General Packet Radio Service*)

   GPRS (General Packet Radio Service) is a packet-based transmission system for GSM that uses the tunneling principle. GPRS has technology that allows sending and receiving data faster when compared to using Circuit Switch Data (CSD) technology. The GPRS system can be used to transfer data in the form of data packages related to email, image data (MMS), and internet browsing. In theory, GPRS has a speed of 56 Kbps to 115 Kbps, making it possible for internet access, sending multimedia data to a computer or notebook. However, in reality GPRS speed is influenced by the following factors: configuration and allocation of time slots at the BTS (Base Transceiver Station) level, the software used, as well as the support for the mobile phone features and applications used.

4. Wireless

Wireless is a transmission medium without cables, which is classified as an un-guided transmission medium. An example of the application of wireless in everyday life is a wireless LAN which uses radio frequencies, infrared for communication between devices, Bluetooth and so on. Transmission and capture on wireless media is carried out via antennas. An antenna is an electrical conductor or system used for electromagnetic radiation or collecting electromagnetic energy. Access speed using wireless LAN is 54 Mbps but the actual speed depends on the service provider

3G dan 4G

From 1999 to 2010, cellular telecommunications telephone networks have developed towards the use of 3G. 3G is a development of GPRS which has high access speeds. 3G services are able to provide greater final results because of the use of spread spectrum technology which allows the input data to be transmitted to be spread across the entire frequency spectrum. 3G services are on the 1,900 Mhz frequency. 3G is capable of providing access speeds of 144 Kbps for fast moving conditions (mobile), speeds of 384 Kbps for walking conditions (pedestrian), and speeds of 2 Mbps for static conditions in a location.

4G is a development of 3G network technology which is a fully integrated IP-based system. According to IEEE (Institute of Electrical and Electrical Engineers) the official name of 4G is 3G and Beyond. The 4G system provides a comprehensive IP solution where voice, data and multimedia streams can reach users anytime and anywhere and have a higher data rate than previous generations. Every 4G handset will immediately have an IP v6 number which is equipped with the ability to connect to internet telephony based on Session Inititation Protocol (SIP).

Web Browser dan *Search Engine*

1. Web Browser

A web browser is software that functions to display and interact with documents provided by a web server. The web browser is included in the application layer, which is used as a display. With a web browser, we can see the data we need and obtain information from a server. Examples of popular web

browsers are Google Chrome, Mozilla Firefox, Internet Explorer, Opera, and Safa.

2. Google Chrome

Pigure 8.1 Google Chrome

Google Chrome is a web browser developed by Google using the WebKit rendering engine. Google Chrome is a web browser that is in great demand by users because it is considered to have a minimalist appearance and has a faster loading speed than other web browsers. Google Chrome is available for Windows, Mac, and Linux computers in beta for Microsoft Windows.

3. Mozilla Firefox

Mozilla Firefox is a free cross-platform web browser developed by the Mozilla Foundation and hundreds of volunteers. The Mozilla Foundation's goal in developing Mozilla Firefox was to create a small, fast, simple, and highly extensible web browser (separate from the larger Mozilla Suite). Examples of popular Firefox features are a built-in pop-up blocker, and a development mechanism for adding additional functionality.

4. Internet Explorer

Internet Explorer is a web browser and free software from Microsoft, created by Microsoft Corporation. This means that if we already use the Windows operating system (OS), then we don't need to install Internet Explorer again, because it was already there when you installed Windows on your computer. Internet Explorer is fully supported by Microsoft, so it routinely provides the latest security patches for its web browser updates.

Pigure 8.2 Internet Explorer

5. *Opera*

Pigure 8.3 Opera

Opera is a cross-platform web browser and Internet software package. Opera consists of a collection of software for the Internet such as a web browser, as well as software for reading and sending electronic mail. Opera can run on a variety of operating systems, including Microsoft Windows, Mac OS X, Solaris, FreeBSD and Linux.

6. Safari

Safari is a web browser made by Apple Inc. which was originally intended specifically for the Mac OS operating system. Safari is installed with Mac OS.

Search Engine

Search engines are computer programs designed to search for information available in cyberspace. Search engines are widely used to find information based on keywords. To enter the search engine, we first have to enter a web browser (for example using Google Chrome), the second step is to write down the keywords we want to search for, then the search engine will provide websites that are relevant to the keywords we entered.

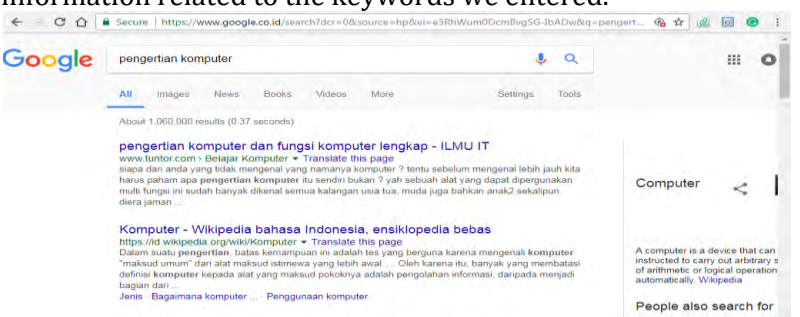
Pigure 8.4 Search Engine

1. Google

   Google is the most popular search engine and is widely used in cyberspace to find the information you want, whether searching for website addresses, images, files, or finding out the most popular sites and topics that people visit through Google Trends. The form of Google's display can be seen in Figure. If we enter a keyword, several alternative options will appear related to the keyword we entered and on the right side (which is indicated by the arrow) the general understanding or information about the keyword we entered will appear. For example, if we enter the keyword "computer" then the general definition of a computer will appear on the right.

2. Ask

   Ask is a search engine that allows users to get answers to every question. Ask functions to search for information in the form of images, documents, videos, references and news. This site can be an alternative because it can still find sites that are buried due to spam on other search engine networks. The form of the Ask display can be seen in Figure 2.2. Slightly different from the display on Google. Ask has a display on the right (as shown by the arrow) which provides several alternative information related to the keywords we entered.



Pigure 8.5 Google View

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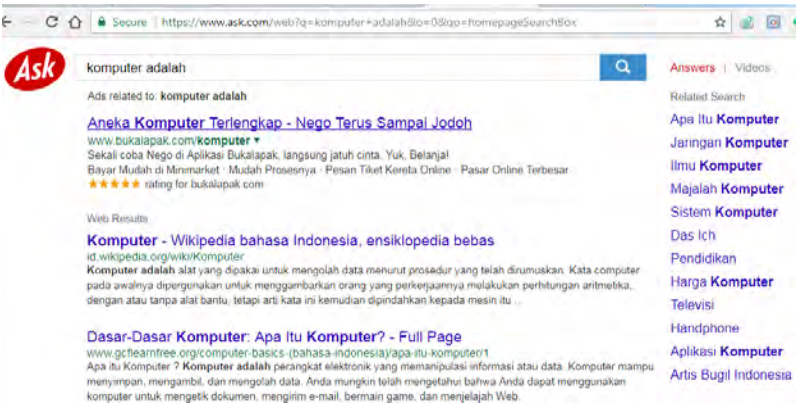


Pigure 8.6 Ask View

3. Bing

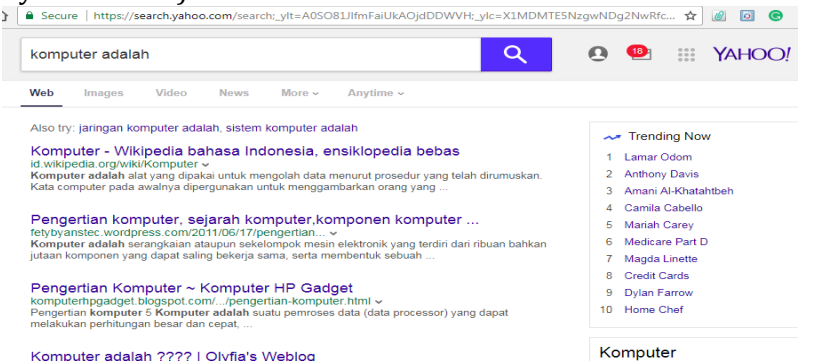
Bing is able to provide powerful search results because it uses PowerSet technology. Bing comes with the ability to store and share historical searches via Windows Skydrive, Facebook and e-mail. The Bing display form is shown in Figure 2.3. The appearance is almost similar to Ask, on the right it provides information related to the keywords we provide.

Pigure 8.7 Bing View

4. Yahoo!

Apart from being a search engine, Yahoo also provides a free email service, which allows users to search various categories such as for example websites, images, news, video and audio. Yahoo's display form is shown in Figure 2.4. As with other search engines, if we enter keywords, Yahoo will provide information that matches the keywords we provide. Apart from providing information related to the keywords that we provide,

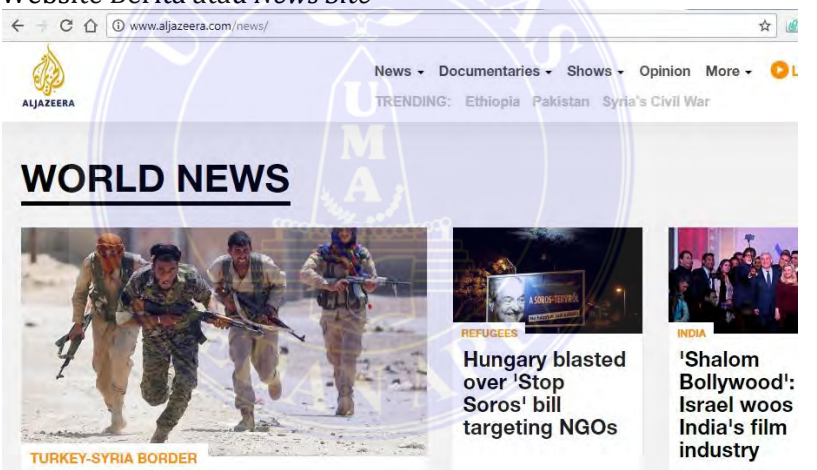
Yahoo also provides information on trending topics (as shown by the arrow).



Pigure 8.8 Yahoo View

Website Type

1. Website Berita atau *News Site*



Pigure 8.9 New Site View

The websites we can visit range from local, national and international news. For example, in Indonesia there are thejakartapost, merdeka6, and detiknews. Meanwhile, for overseas sites there are BBC and Aljazeeranews. An example of a news website display is shown in the image beside (aljazeeranews).News Site (News Site) is a site that contains articles or news that are updated regularly. On some sites, visitors or users can leave comments. Many choices of news sites.

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2. Website Search Engine (Search Engine)

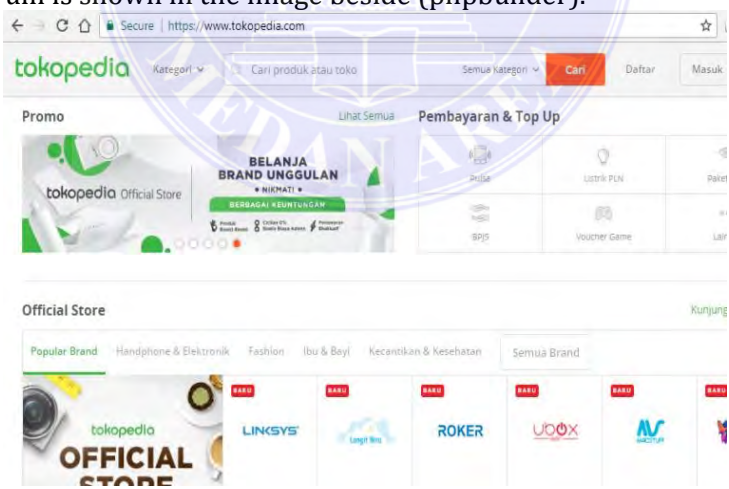
   Website Search Engine (Search Engine) is a computer program designed to search for information available in cyberspace. For example: Google, Yahoo, Bing, Altavista, and others. Discussion of search engines as in the previous discussion point.

3. Online Shop Website

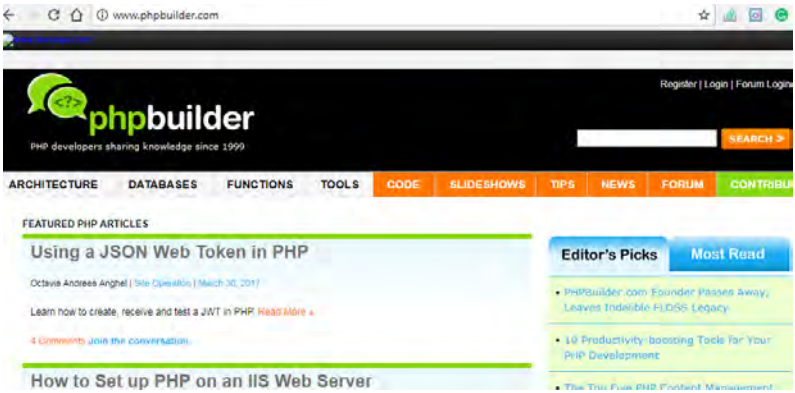
   An online shop is a site created specifically to sell products online. Generally equipped with a shopping cart or shopping basket to make it easier for users/visitors to shop, there is also an online catalog complete with product details and prices, You can make purchases via email, chat and telephone. Examples of online websites are Tokopedia, Blibli.com, and Bhinneka. The appearance of one example of an online shop (tokopedia) is shown in the image below.

4. Website for Forums

   The website for the Forum is a site created specifically so that members can discuss according to predetermined topics. For example: kaskus, detik forum, phpbulider, and others. To create a discussion forum, you usually use platforms that are already available, either paid ones like Bulletin or free ones like phpBB, SMF and others. An example of a website display for a forum is shown in the image beside (phpbuilder).



Pigure 8.10 Platform View



Pigure 8.11 Phpbuildre View

5. Social Network Sites are sites created specifically for certain communities to share information and interact with each other. For example: Instagram, Twitter, MySpace, Facebook, Tagged, and others.
6. Archive Site is a special site where users can share information and store it in electronic archives. Examples: Yahoogroups, Google Groups, Wikipedia, and Archive.
7. Blogs and WordPress are sites used by owners (individuals or groups) to update articles, whether written, images or other multimedia files on a regular basis, where all entries are arranged sequentially and have comment facilities for visitors.
8. Corporate/Company Website is a site that contains general information and activities of a company.

Electronic Commerce (e-Commerce)

1. Definition of Electronic Commerce (e-Commerce)

   Electronic commerce (EC) or abbreviated as e-Commerce is a new concept which can be described as the process of buying and selling goods or services on the Internet (Shim, Qureshi, Siegel, 2000). It can also be interpreted as the process of buying and selling or exchanging products, services and information through information networks including the internet. e-Commerce more broadly is not only about selling and buying, but also includes customer service and collaboration with business partners, as well as carrying out electronic transactions within an organization.

   Along with the development of the era, traditional direct marketing, which is carried out by mail order (catalogue) and

telephone (telemarking), must compete with the concept of electronic commerce (EC), which presents new sales methods. Using the e-Commerce concept can improve marketing directly. As a result, buying and selling of information products and services on the internet and other online services has increased. The following is an example of the stages of the electronic marketing process:

a. Buyers use computers to enter the market.
b. Buyers search for products by entering the product seller's homepage.
c. Buyers select products through the catalog provided.
d. The buyer orders the product and fills the selected order.
e. Purchase order is sent to the seller.
f. The seller confirms the order.
g. Buyer makes payment (can use several payment options).
h. Payment information is sent to the bank.
i. Credit checked at the buyer's bank.
j. Credit is approved, paid to the seller's bank.
k. Products are sent by the seller
l. The product is received by the buyer.

2. Advantages and Disadvantages of e-Commerce Advantages of using e-Commerce
   a. Product promotion: EC can increase the promotion of products and services through contactsdirect, rich in information, and interactive with customers.
   b. Direct savings: costs of sending information to customers via the internetresulting in substantial savings for shippers. Examples of the biggest savings occur when sending digitized products (such as music and software) rather than having to send them in physical packages.
   c. Reduction of cycle time: delivery of digital products and services can be reduced even to within seconds of reaching their destination. An example is TradNet in Singapore, which was able to reduce the administrative time for port-related transactions from days to minutes.
   d. Customer service: customer service can be improved by enabling customers to find detailed information online. For example, there are intelligent agents that are able to answer standard e-mail questions in just a few seconds.
      Disadvantages of using e-Commerce:

- Customers cannot see or touch the goods being sold directly on line. For example, for clothes, sometimes there are customers who want to touch them directly to confirm exactly the items you want to buy.
- There are unresolved legal issues, regarding regulations and standards the government is not yet established enough. For example, the case of online and conventional motorcycle taxis.
- Lack of support services. For example, there is no copyright information center for EC transactions, and high-quality evaluators or EC tax experts are still rare.

3. Market Segmentation and Marketing Mix

Market segmentation variables are based on geography, psychographics, behavior and benefits. Geographic segmentation is the division of the market into different geographic units. For example regions, countries, states, provinces and cities. For example, Coca-Cola markets products under the Sokembicha, Lactia brands only in Japan. Demographic segmentation is a market division based on the variables of gender, education, population, age, income, religion, race, nationality and social class. For example, Swatch targets the global youth segment aged 12 to 24 years who are fashion-oriented. Psychographic segmentation groups markets based on lifestyle, values and personality variables. For example, Porsche AG (a German sports car manufacturing company) is targeting the lifestyle market in the Top Gun category. Internet community segmentation is the segmentation of online communities of people who interact with each other. For example, based on interest communities (e.g. muikamu.com for those with an interest in music), relationships, fantasies, transactions and communities.

Exercise

1. Explain the meaning of the internet and its divisions
2. How to connect to the internet, please explain
3. What are the operations on the internet?
4. What is the Definition of Electronic Commerce
5. Give an example of using Electronic Commerce

*****

CHAPTER 9
INFORMATION SYSTEMS AUDIT AND INFORMATION TECHNOLOGY

Course Learning Outcomes :

- *-Able to apply logical, critical, systematic and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise (Able to apply logical thinking, critical, systematic and innovative in the context of the development or implementation of science and technology that takes into account and applies the values of the humanities in accordance with the areas of expertise); (KU1)*
- *-Able to explain information systems audit and information technology.*

Definition

Technology and Science are transforming our world, changing the way we do business, the way we learn, the way we communicate, and even the way we entertain ourselves. Success in any field – law, medicine, business, education, entertainment, finance and investment – requires a command of technology. As the convergence of Telecommunications and Computing, Information Technology is the foundation of the 21st Century Economy. Company Secretaries Professionals also does not differs from it. In the age of e-filling and XBRL, It is very difficult for a corporate professional like Company Secretaries to survive without knowing the basics of Information Technology and Systems Audit.

Keeping the above in view, the subject Information Technology and Systems Audit have been incorporated at Professional Program. Studying Information Technology and Systems Audit will equip you to understand the basics of Information Technology, E-governance and Information Technology Act. The entire paper has been discussed in eleven study lessons. Every efforts has been made to give a comprehensive coverage of all the topics relevant to the subject

and lists, diagrams and examples have been added in the study lesson to make the study easy and understandable.

In order to supplement the information/contents given in the study material, students are advised to refer to the Suggested Readings mentioned in the study material, Student Company Secretary, Business Dailies and Journals. In the event of any doubt, students may write to the Directorate of Academics in the Institute for clarification.

Although care has been taken in publishing this study material, yet the possibility of errors, omissions and/or discrepancies cannot be ruled out. This publication is released with an understanding that the Institute shall not be responsible for any errors, omissions and/or discrepancies or any action taken in that behalf.

Should there be any discrepancy, error or omission noted in the study material, the Institute shall be obliged if the same are brought to its notice for issue of corrigendum in the e-bulletin Student Company Secretary. Students may send their queries at the mail id academics@icsi.edu. An information technology audit, or information systems audit, is an examination of the management controls within an Informationa technology (IT) infrastructure and business application.

Scope of Inforation System Audit

The scope of systems audit covers the entire IS management process. The scope includes review of the entire design & development process, the review of technology choice, the processes employed to assess risks and losses that could accrue to the system, the possibility of computer frauds, the care taken in managing changes to the system, extent of testing and reliability of the system. It also cover Senior management involvement, review applicable minutes Network, workstation, Internet, disaster recovery, and other IT security policies, Overall security procedures, Segregation of IT duties, Internal quality and integrity controls, Data communication security, User identification authorization, User level of accessibility, Restricted transactions, Activity and exception reports, Backup procedures, Other operational security controls, Insurance coverage, Network security including the

Lesson 11 Systems Audit – An Overview 207 internet, Internal auditing procedures, Contingency planning and disaster recovery, Internet security procedures, Vendor due diligence etc.

What is an Information Technology (IT) audit?

An Information Technology audit is the examination and evaluation of an organization's information technology infrastructure, applications, data use and management, policies, procedures and operational processes against recognized standards or established policies. Audits evaluate if the controls to protect information technology assets ensure integrity and are aligned with organizational goals and objectives.

Pigure 9.1 IT Audit

Information system audit: its relevance and value to organizations

1. Introduction

As reliance on IT systems continues to increase, so does the variety of internal and external threats. The continuous integration between Information technology and business constantly puts CIOs/CTOs under extraordinary pressure. As this continuous integration persist and business is being solidified by IT systems, some risks originally associated with other business units are transferred to IT departments and CIO. To alleviate this pressure, potential risks in the IT system must be discovered to a feasible extent as these risks can result in financial loss, reputational damage, and more.

Hence one of the most important responsibilities of the Information system audit function is to help discover these potential risks, as the effectiveness of an information systems control is evaluated through information system audit.

Information system audit cuts across a variety of Information technology processes, communication and infrastructure which include operating systems, databases, servers, web services, software applications, security systems, datacenters, business continuity, networks etc. Carrying out this audit helps to ensure that there are no errors within the IT system, hence sealing up lapses and vulnerabilities that could be leveraged on for attack.

In terms of responding to IT risks, the importance of IT audits can be categorized into two extents:

- To prevent risks: Information system audits could assist companies in identifying and preventing risks within the Information technology systems that support the business. Also, it could help organizations configure their Information technology systems to avoid possible risks from external/internal compliance.
- Effective Management of risk: This involves collaboration between the IS Audit unit and the technology department/CIO to effectively manage or mitigate identified risks, utilizing detective and corrective measures.

Some benefits of Information system audit are:

- Reduces risks related to Information Technology: It helps to tackle risks related to the availability, integrity, and confidentiality of IT processes and infrastructure. Risk identification and assessment which are core processes in detecting threats and vulnerabilities would help improve the reliability, effectiveness, and efficiency of Information Technology systems within a defined scope.
- Improves security of data: Having identified risks around business controls/objectives. Organizations can redesign, adjust or strengthen poorly designed or implemented controls. This then helps to improve the security of IT data.
- Enhances IT Governance: Information system audit is a critical function that helps in ensuring adherence to business laws, regulations, best standards, and policies, as strong governance is deemed important in improving the

long-term value of stakeholders within an organizational sphere.

- Fraud detection and prevention.
  The goal of information system audit is basically to provide reasonable assurances to management on the adequacy and effectiveness of controls around business processes/ objectives while making sure risks identified are mitigated. It also helps to assist the organization's information technology personnel to effectively fulfill their responsibilities towards the achievement of defined Information technology goals set by management. These goals/objectives set by management are strategic decisions to ensure that the organization's information technology strategy reflects the organization's business strategy, therefore improving the stability, security, reliability, integrity of the data and information which the organization depends on to make critical decision, furthermore the goals set help improve the effectiveness and efficiency of information system operations which promotes strict compliance of information system with relevant laws and regulations. Therefore, the reason why Information systems audit is becoming more important in businesses is that it facilitates business stability by relying on information systems to achieve management goals and objectives as well as identify and recommend adequate controls for IT risk considerations.

The need for audit, security, and control is critical in all areas of IT and remains one of the biggest challenges to be addressed for now and in the future. Everyone must work together to design, implement, and safeguard the integration of various technologies deployed in the workplace. With respect to this, the importance of Information system auditors cannot be overstated and every organization should have IS auditors in their workforce.

2. What is an IT audit (information technology audit)?

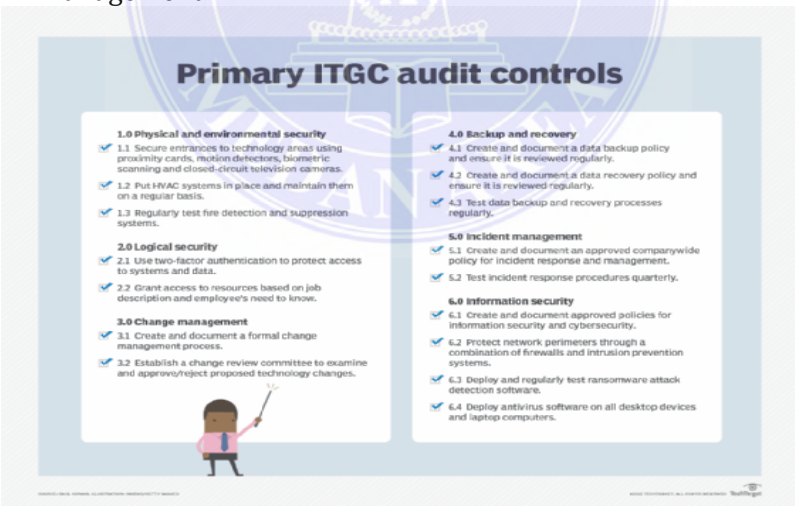
   An IT audit is the examination and evaluation of an organization's information technology, operations and controls.

What does an IT audit do?

Information technology audits determine whether IT controls protect corporate assets, ensure data integrity and are aligned with the business's overall goals. IT auditors examine not only logical and physical security controls but also overall business and financial controls that involve information technology systems.

Because operations at modern companies are increasingly computerized, IT audits are used to ensure information-related controls and processes are working properly. The primary objectives of an IT audit include the following:

- Evaluate the systems and processes in place that secure company data.
- Verify that IT controls are being regularly practiced and maintained.
- Determine risks to a company's information assets and identify methods to minimize them.
- Ensure information management processes are in compliance with IT-specific laws, policies and standards.
- Determine inefficiencies in IT systems and associated management.



Pigure 9.2 Primary ITGC Audit Controls

The six ITGC audit controls include physical and environmental security, logical security, change management, [illegible] and IT security, incident management and information

security. Considering how complex information systems and operations are today, IT leaders want to demonstrate that their IT infrastructures are running smoothly, performing according to business processes and expectations, minimizing cybersecurity threats, and in compliance with standards, regulations and other requirements.

Periodic audits ensure an IT organization is following accepted standards,best practise, regulations, legislation and other requirements. IT audits provide important evidence of such compliance to an organization's customers as well as regulatory and government agencies.

Audits are also beneficial because auditors are considered independent of the IT organization and are expected to examine controls carefully and impartially, identifying what is working and what is not, reporting their findings and providing recommendations for remediation. Savvy IT leaders recognize the importance of periodic IT audits as an important benchmark for validating what is working and what is not meeting expectations.

Who needs an IT audit?

Virtually any IT organization can benefit from periodic IT audits because they provide an independent assessment of how well IT systems are being managed, how their security resources are performing and how well IT controls are being handled. Audits can examine general IT controls or focus on specific attributes such as cybersecurity and environmental management.

What happens in an IT audit?

An IT audit uses a framework of general controls in several areas such as access control, physical access security cybersecurity, environmental management, risk management, operational performance, emergency response and disaster recovery. Auditors examine how well the IT organization complies with the aims and requirements associated with each control. They collect evidence in support of the controls and of how they are performed. In situations where a control is not being performed or is not being performed properly, auditors compile those findings into an audit report that lists the findings and recommended

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remediations. The report often includes an agreed-upon timeframe for resolution of the findings.

3. An IT audit generally has these steps:
   - Secure approval. Senior management must approve the audit and its funding.
   - Create a plan. Identify IT elements to audit and types of controls to examine as well as audit scope, objectives and timeframes.
   - Start preparations. Determine who will perform the audit. It may be an internal IT audit team, the company's internal audit department or a third-party audit firm experienced in IT auditing. These are referred to as first-party, second-party and third-party audits respectively.
   - Secure a work area. This can be a conference room set up for the audit team where they can conduct interviews, examine evidence received from the IT department and prepare audit work papers.
   - Launch the audit. Brief the IT department team on audit discovery processes, expectations, timeframes, evidence types and interview schedules.
   - Prepare work papers. These may be interview notes, computer screenshots, policy documents, procedures, various reports, prior audit reports and other relevant materials.
   - Prepare and deliver the audit report. An audit report summarizes the controls examined, evidence obtained, analysis of IT department compliance with the controls, areas where controls were not achieved, and recommendations for mitigating deficiencies. The report usually has a proposed timeframe for remediating deficient areas.
4. The value of a certified IT audit professional

   When preparing for an IT audit, it may be useful to ask if at least one of the auditors -- especially in an outside audit firm has an IT audit certification. One widely accepted IT audit credential is the Certified Information Systems Auditor (CISA), available from ISACA. CISA-certified professionals must pass a rigorous exam to obtain the designation and must annually submit evidence of continuing education and participation in relevant activities and organizations.

An information technology audit, or IT audit, is the process of examining an organization's information technology infrastructure to ensure that it is functioning properly and securely. This assessment can be conducted internally by a company's own IT staff or externally by an independent third party. There are many reasons why businesses and government agencies may choose to audit their IT systems. Some organizations do so on a regular basis as part of their overall risk management strategy, while others may only conduct an audit in response to a specific incident or concern.

There are several kinds of IT audits, each with different focuses and goals. Some of these include security audits, compliance audits, operational audits, IT governance audits, and software development audits. The specific type of audit conducted will depend on the needs of the organization being examined. Organizations may choose to conduct IT audits for a variety of reasons, including the following:

- To ensure that information systems are being used effectively and efficiently.
- To detect potential security vulnerabilities.
- To identify compliance risks.
- To assess the impact of new technology initiatives.
- To evaluate the effectiveness of IT governance processes.

5. IT Audit Process

Depending on the area of the business being investigated, auditors have different kinds of guidelines and accompanying checklists that help them make their inspections. In its entirety, IT audits can generally be said to inspect three things: people, processes, and technology.

- People: The auditor needs to understand who has access to systems and data, what their roles are, and how they might misuse their privileges.
- Processes: The auditor needs to understand how information flows through the company, what controls are in place to protect data, and how well these controls are working.
- Technology: The auditor needs to understand what technologies are in use, how they are configured, and how they interact with other systems.

During the audit, the auditor will typically interview employees, review documentation, and observe processes in

action. After the audit is complete, the auditor will prepare a report detailing their findings and recommendations. The focus of what the auditor is inspecting can vary depending on what aspect of IT they are looking into. For example, during an audit of IT controls, auditors may be most interested in personnel related to change management, asset management, and access management. In this case, the auditor will seek to understand if the organization maintains correct oversight over any changes in the IT systems (change management processes), control of the administration of the technology itself (asset management), and who may utilize managed assets (access management).

Another example is informational security. An audit of information security will usually include a review of the security system's weaknesses and vulnerabilities. The auditors will look for any weaknesses and vulnerabilities in the IT systems themselves, as well as the information-handling processes that are in place. With all that being said, there is a general audit process that most auditors follow, which can be separated into five steps:

IT Audit Examples

It can be useful to work through some examples of what an IT audit is and how the process works. The following will showcase one example of a company conducting a compliance-related IT audit and another example of a company conducting an operations-related IT audit.

Example 1

Company XYZ is a small business that is planning to implement a new customer management (CRM) system. The company has decided to use an off-the-shelf software package but is concerned about the potential compliance risks. As part of the planning process, the company decides to conduct an IT audit. The scope of the audit is limited to compliance with data privacy laws. The auditor begins by interviewing company officials and reviewing relevant documentation. Based on this information, the auditor identifies a number of compliance risks, including the potential for unauthorized access to customer data. The auditor then recommends a number of corrective actions, including the implementation of security controls to mitigate the risks.

An information technology audit, or IT audit, is the process of assessing an organization's information technology infrastructure to identify areas where improvements can be made. The goal of an IT audit is to identify inefficiencies, assess compliance risks, and recommend corrective actions. Some common examples of IT audits include reviews of project management, software development, data privacy, and security. Generally speaking, IT audits evaluate risks associated with IT systems involving people, processes, and technology. As what the auditors are investigating becomes more specific, their focus may change or narrow. For example, if an auditor is looking into IT controls, they may be most interested in inspecting change management, asset management, and access management. If instead the auditor is performing an audit of information security, they will often conduct a review looking for any weaknesses and vulnerabilities in the IT systems and informational handling processes.

IT audits are conducted by specialists referred to as auditors. They can be internal to the company being audited or external. There are several large parts of businesses that IT audits cover, such as business continuity, IT controls, and data security. IT audits do not review many other parts of businesses, such as website color schemes. The audit process is important because it helps to ensure that businesses are using best practices when it comes to their IT systems. By identifying potential riss and vulnerabilities , businesses can take steps to mitigate these risks and protect their data and IT systems.

Information Technology Audits

In today's technical environment, it's possible to move millions of dollars, securities, or commodities at the click of a button. Further, more and more sensitive information, such as health and financial records, are being stored in online-accessible repositories. Information technology provides great advantages but also creates huge risks due to ever-growing complexity. Businesses and governments need a way to ensure that they identify, understand, and maintain these risks. One of the primary ways in which they do so is through a type of audit.

Information technology audits (IT audits) are formal, documented processes whereby organizations evaluate their technology for compliance with the organization's policies and

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procedures. This technology might include hardware, software, operations, and processes. IT audits can be performed in conjunction with other organizational audits, such as financial and accounting, but can also be performed on a stand-alone basis.
Let's take a better look at the necessity of IT audits, how they're performed, and several key types of IT audits.

Importance of IT Audits

As the use of information technology by consumers, businesses, and governments has become more widespread, so has our dependence upon those systems. At a macro level, our national commerce, international trade, and government operations have come to rely more and more on technology. Over the past few years, government agencies at the local, state, and federal levels have spent hundreds of millions on IT systems (billions in commercial enterprises).

Because of this reliance on IT systems and processes, organizations need a way to ensure they can have faith in the systems operation and be able to trust their output. The best way to ensure reliability is to inspect the systems, measure the impact, and report on these findings. That's the purpose of IT audits, and their role continues to grow in all organizations as the need for security, privacy, and confidentiality increases.

Understanding the growing importance of technology, the federal government, along with most states, have created Chief Information Officer (CIO) positions that are specifically charged with executing the IT strategies of the organization. An important part of the strategy is the creation of requirements and standards for creation and use of IT systems, which becomes the guidelines for IT Audits.

Performance of an IT Audit

IT audits are typically performed by specially-trained (and often certified) personnel. Those who perform the review, known as auditors, can either be internal staff who are called upon to do the audit or external personnel who perform the audits as a service. As noted, the IT audit can be part of an all-encompassing organization-wide audit or just the IT systems. Further, it can also be broken down into smaller assessments, with only specific systems or operations within the IT organization inspected.

No matter who performs the IT audit or the extent of what they audit, they all follow a well-documented set of rigid procedures and processes in order to ensure all areas are covered and are reviewed completely. Using these guidelines and accompanying checklists, the auditors inspect the people, processes and controls, and technology involved in the scope of the audit. During this review, the auditors evaluate compliance with organization policies and/or government regulations, along with identification of risks from non-conformance. They will also evaluate inefficiencies in the IT systems, processes, and procedures and recommend steps to minimize the risks and correct any sub-par performance.

Examples of IT Audits

Due to the complexity of IT systems, most IT audits are typically non-standardized and are very customized to the needs of the organization. However, there are many sub-components that are frequently incorporated into organizations' IT audits and serve as a good example of these type of reviews.

IT/IS Audit is a process of monitoring and controlling the overall Infrastructure related to Information Technology in the company. IT Audit usually run together with financial audit and internal audit. IT audit focuses on the computer-based aspects of an organization's information system; and modern systems employ significant levels of technology.

For example : transaction processing is automated and performed in large part by computer programs. Similarly source documents, journals, and ledgers that traditionally were paper-based are now digitized and stored in relational databases. As we will see later, the controls over these processes and databases become central issues in the IT audit process.

IT/IS Audit Objectives

Companies which Data is stored in the relational database need an IT Audit to make sure that the information stored in the database is accurate. Therefore there are 3 main objectives of IT/IS Audit :

1. Ensure the System have the adequate Security to support the Infrasturctures in the Company. There are a few components in the system that are needed to be audit such as 1. System

Operating System Security The System Operating System Security must be able to :

- Protect the System from user.
- Protect user from each other.
- Protect user from themselves.
- Protected from itself.
- Protected from its enviroment.

2. Network Security

System Network consists of Intranet and Internet, both of them need to protected from their own risk.

a. Intranet Risk :
   - ⇘ Interception of Network Messages
   - ⇘ Unathorized Access to Corporate Database
   - ⇘ Privelege abuse

b. Internet Risk :
   - ⇘ IP Spoofing
   - ⇘ Denial of Service Attack
   - ⇘ Syn Flood Attack
   - ⇘ Smurf Attack
   - ⇘ DDOS

3. Database Security

To ensure the Database Security several controls need to be performed such as :

a. Concurency Control :
   - o Ensure Database atomicity
   - o Ensure Database isolation
   - o Serializability of concurrent transactions

b. Access Control :
   - o Control User View
   - o Protect Database authorization table
   - o Data Encryption
   - o Biometric Devices
   - o Inference Control

2. Ensure the System Design and Implementation Suitable to Business Objectives in the Company.

Auditor will seek the most efficient way to Design a new System and Implementation without reducing the quality of the System, also they need to maintain the System to servers the company business objectives. Therefore several part of System Development Life Cycle (SDLC) need to be controlled.

a. Controlling New System Development
   - System Authorization Activities
   - User Specification Activities
   - Technical Design Activities
   - Internal Audit Participation
   - User Test and Acceptance Procedures
   - Audit Objectives Related to New Systems Development
   - Audit Procedures Related to New Systems Development

b. The Controlling Systems Maintenance
   - Maintenance Authorization, Testing, and Documentation
   - Source Program Library Controls
   - The Worst-Case Situation: No Controls
   - A Controlled SPL Environment
   - Audit Objectives Related to System Maintenance
   - Audit Procedures Related to System Maintenance

c. Controlling new System Development
   - Systems Authorization Activities
   - User Specification Activities
   - Technical Design Activities
   - Internal Audit Participation
   - User Test and Acceptance Procedures

d. Controlling System maintenance
   - Maintenance Authorization, Testing, and Documentation
   - Source Program Library Controls

3. Determine the Accuraccy and Integrity from Transaction Process,Report and Record

   To Determine the Accuracy and Integriy, there are 2 types of tests that are needed to be performed.

   a. Test of Control
      - The objective of the tests of controls phase is to determine whether adequate internal controls are in place and functioning properly.
      - Consists of manual techniques and specialized computer audit techniques
      - Assess the quality of the internal controls by assigning a level for control risk

   b. Substantive Test
      - Substantive Test involves a detailed investigation of specific account balances and transactions through.

- These tests are needed as evidence to support the assertion that the financial records of an entity are complete, valid, and accurate.
- Substantive tests can be physical, labor-intensive activities, such as counting cash, counting inventories in the warehouse, and verifying the existence of stock certificates in a safe.

Overall the IT/IS Audit will determine the quality of the services that are given to users and the company can give their best support quality that will affect company's profit directly or indirectly so it will support the growth of the company.

Increasing competition in business has driven companies to compress their internal processes and focus more on the customers and external business environment. In the process, more and more of business processes have been brought under the purview of systems based on information technology. There has been an increase in complexity by several orders of magnitude. The arrival of the World Wide Web and the shift of traditional computer systems into their "web-based" avatar have only added new dimensions in the form of threats to security.

A Company Secretary cannot function effectively in this information age without adequate knowledge of the benefits and demerits of information systems. The Company Secretary addresses the vital areas of good corporate governance and compliance within the regulatory framework of the applicable laws. S/he is also a custodian and user of the top level MIS that goes to the Board of Directors, besides the Secretarial Systems. This study lesson has been prepared to provide an insight into the subject of Systems Audit in the modern context of enterprise systems and connectivity with Buyers, Suppliers and other Stakeholders.

1. What is system Audit?

   50 years ago most of our information & data processing needs were fulfilled manually; today computers are used extensively to process data and to provide decision-making. The information system does not necessarily mean the computer based information system. The Information Technology is a major component of Information System and in itself not a solution. Nowadays, with the widespread availability of powerful microcomputers and packaged software, the Information Technology is the backbone of

information system. Because computers play a large part in assisting us to process data and to take decisions. It is important that their use be controlled. The uncontrolled use of computers can have a widespread impact on society. For example, inaccurate information causes misallocation of resources within the economy and fraud can be perpetrated because of inadequate system controls.

Information systems audit has been focused on whether the systems safeguard the assets, maintain data integrity, and facilitate the achievement of objectives of the company.

2. Infotmation System Auditing Defined

Information systems auditing or systems audit is the process of collecting and evaluating evidence to determine whether a computer system safeguards assets, maintains data integrity, allows organizational goals to be achieved effectively, and uses resources efficiently. Thus, information systems auditing supports traditional audit objectives; attest objectives (those of the external auditor) that focus on asset safeguarding and data integrity, and management objectives (those of the internal auditor) that encompass not only attest objectives but also effectiveness and efficiency objectives.

Sometimes information systems auditing has another objective-namely, ensuring that an organization complies with some regulation, rule or condition. For example, a bank might have to comply with a government regulation about how much it can lend;

3. Asset Safeguarding Objectives

The information system assets of an organization include hardware, software, facilities, people (knowledge), data files, system documentation, and supplies. Like all assets, they must be protected by a system of internal control. Hardware can be damaged maliciously. Proprietary software and the contents of data files can be stolen or destroyed. Supplies of negotiable forms can be used for unauthorized purposes. These assets are often concentrated in one or a small number of locations, such as a single disk. As a result, asset safeguarding becomes an especially important objective for many organizations to achieve.

4. Data Integrity Objectives

Data integrity is a fundamental concept in information systems auditing. It is a state implying data has certain

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attributes: completeness, soundness, purity, and veracity. If data integrity is not maintained, an organization no longer has a true representation of itself or of events. Moreover, if the integrity of an organization's data is low, it could suffer from a loss of competitive advantage. Nonetheless, maintaining data integrity can be achieved only at a cost. The benefits obtained should exceed the costs of the control procedures needed.

5. Why Data integrity is Important?

   Three major factors affect the value of a data item to an organization and thus the importance of maintaining the integrity of that data item:

   a. Thevalueoftheinformationalcontentofthedataitemforindividualdecisionmakers:Theinformational content of a data item depends on its ability to change the level of uncertainty surrounding a decision and, as a result, to change the expected payoffs of the decisions that might be made. These notions have been well developed within statistical decision theory.
   b. Theextenttowhichthedataitemissharedamongdecisionmakers:Ifdataisshared,corruptionofdata integrity affects not just one user but many. The value of a data item is some aggregate function of the value of the data item to the individual users of the data item. Thus, maintenance of data integrity becomes more critical in a shared data environment.
   c. The value of the data item to competitors: If a data item is valuable to a competitor, its loss might undermine an organization's position in the marketplace. Competitors could exploit the informational content of the data item to reduce the profitability of the organization and to bring about bankruptcy, liquidation takeover, or merger.

6. System Effectiveness Objectives

   An effective information system accomplishes its objectives. Evaluating effectiveness implies knowledge of user needs. To evaluate whether a system reports information in a way that facilitates decision making by its users, auditors must know the characteristics of users and the decision-making environment.

   Effectiveness auditing often occurs after a system has been running for some time. Management requests a post audit to determine whether the system is achieving its stated

objectives. The evaluation provides input to the decision on whether to scrap the system, continue running it, or modify it in some way.

Effectiveness auditing also can be carried out during the design stages of a system. Users often have difficulty identifying or agreeing on their needs. Moreover, substantial communication problems often occur between system designers and users. If a system is complex and costly to implement, management might want auditors to perform an independent evaluation of whether the design is likely to fulfill user needs.

7. System Efficiency Objectives

An efficient information system uses minimum resources to achieve its required objectives. Information systems consume various resources: machine time, peripherals, system software, and labor. These resources are scarce, and different application systems usually compete for their use.

The question of whether an information system is efficient often has no clear-cut answer. The efficiency of any particular system cannot be considered in isolation from other systems. Problems of sub-optimization occur if one system is "optimized" at the expense of other system. For example, minimizing an application system's execution time might require dedication of some hardware resource (e.g., a printer) to that system. The system might not use the hardware fully, however, while it undertakes its work. The slack resource will not be available to other application system if it is dedicated to one system.

System efficiency becomes especially important when a computer no longer has excess capacity. The performance of individual application systems degrades (e.g., slower response times occur), and users can become increasingly frustrated Management must then decide whether efficiency can be improved or extra resources must be purchased. Because extra hardware and software is a cost issue, management needs to know whether available capacity has been exhausted because individual application systems are inefficient or because existing allocations of computer resources are causing bottlenecks. Because auditors are perceived to be independent, management might ask them to assist with or even perform this evaluation.

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8. General objectives of System Auditing

The general information system auditing objectives are as follows:

- Validation of the organizational aspects and administration of the information service function.
- Validation of the controls of the system development life cycle.
- Validation of access controls to installations, terminals, libraries, etc.
- Automation of internal auditing activities.
- Internal training.
- Training members of the information service function department

Management should be primarily interested in information system audit auditing in order to prevent:

- Excessive time and development costs.
  Unrealistic or impossible objectives to comply with.
  Rigid systems when they become operational.
- Non-compliance with value added benefits.
- Costly methods and systems.

The lack of control involves many risks. Many systems fail because of some of the following reasons:

- Lack of management technical capacity.
- Lack of management support in system development.
- Inexperience of employees or lack of training.
- Unrealistic expectations with wrong orientations.

9. Information System Audit Plan

To approach an information system, a plan has to be developed, similar to the ones used in financial auditing. Some of the tasks involved are as follows:

- Definition of scope and objectives.
- Analysis and understanding of standard procedures.
- Evaluation of system and internal controls.
- Audit procedures and documentation of evidence.
- Analysis of facts encountered.
- Formation of opinion over the controls.
- Presentation of report and recommendations.

One of the most difficult things in drawing the information system audit plan is to determine the objectives and scope of the audit. As guidance, one can take into account the following variables to determine such scope:

- Extension and scope of the financial audit taking place.
- Duration and nature of the review, internal and external audit.
- Dimension of the installation and level of complexity.
- Level of both centralization and distribution of systems and integration of databases.
- Existence of procedures and norms for the development and production environment.

10. Foundations of Information Systems Auditing

Information systems auditing is not just a simple extension of traditional auditing. Recognition of the need for an information systems audit function comes from two directions. First, auditors realized that computers had affected their ability to perform the attest function. Second, both corporate and information systems management recognized that computers were valuable resources that needed controlling like any other key resource within an organization.

The discipline of information systems auditing has been shaped by knowledge obtained from four other disciplines which are described below

Foundation Of Information Systems Auditing

1. Traditional Auditing

Traditional auditing brought to information systems auditing a wealth of knowledge and experience with internal control techniques. This knowledge and experience has had an impact on the design of both the manual and machine components of an information system.

For example, in a computer system, clerical activities, such as data preparation activities, are often a critical component of the system. As with manual systems, these activities should be subject to internal control principles such as separating incompatible duties, having competent and trustworthy personnel, and establishing clear definitions of duties. By applying these principles, management seeks to ensure that the integrity of data is maintained before it is entered into the computer-based components of the information system.

Similarly traditional auditing concepts like control totals are also relevant to the update and maintenance of files by computer programs. Computer programs must ensure that all

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transactions data are processed and that they are processed correctly. Control totals have had long-standing use in information systems because these concerns also exist when humans (rather than programs) update and maintain files.

The general methodologies for evidence collection and evidence evaluation used by information system auditors are also based on traditional auditing methodologies. The long evolution of an extensive experience gained in traditional auditing highlight the critical importance of having objective, verifiable evidence and an independent evaluation of information systems.

Perhaps most important, traditional auditing brings to information systems auditing a control philosophy. It is difficult to articulate the nature of this philosophy. One can glean elements, however, by reading auditing literature or examining the work of auditors. The philosophy involves examining information systems with a critical mind, always with a view to questioning the capability of an information system to safeguard assets, maintain data integrity, and achieve its objectives effectively and efficiently.

2. Information Systems Management

The early history of computer-based information systems shows some spectacular disasters. Massive cost overruns occurred, and many systems failed to achieve their stated objectives. As a result, for many years researchers have been concerned with identifying better ways of managing the development and implementation of information systems.

Some important advances have been made. For example, techniques of project management have been carried across into the information systems area with considerable success. Documentation, standards, budgets, and variance investigation are now emphasized. Better ways of developing and implementing systems have been developed. For example, object-oriented analysis, design, and programming have enabled programmers to develop software faster, with fewer errors and easier maintenance characteristics. These advances affect information systems auditing because they ultimately affect asset safeguarding, data integrity, system effectiveness, and system efficiency objectives.

3. Behavioral Science

Computer systems sometimes fail because their designers do not appreciate the difficult human issues that are often associated with the development and implementation of a system. For example, behavioral resistance to an information system can seriously undermine efforts to meet asset safeguarding, data integrity, system effectiveness, and system efficiency objectives. Disgruntled users could try to sabotage the system or to circumvent controls. Similarly, designers and users could have difficulty communicating with one another because they have different conceptions of the meaning inherent in an application domain. Because of these difficulties, a system's requirements might be poorly formulated.

Auditors must understand the conditions that can lead to behavioral problems and, as a result, possible system failure. Behavioral scientists, especially organization theorists, have contributed much to our understanding of the "people problems" that can arise within organizations. For some time, several researchers have been applying the findings of organisation theory to information systems development and implementation. For example, some researchers now emphasize the need for systems designers to consider concurrently the impact of a computer system on task accomplishment (the technical system) and the quality of work life of persons (the social system) within the organization. Other emphasize the need for information systems designers to understand how users socially construct" the meaning of the domains in which they work.

4. Computer Science

Computer scientists also have been concerned with how asset safeguarding, data integrity, system effectiveness, and system efficiency objectives might be better achieved. For example, they have conducted research on how to prove the correctness of software formally, built fault-tolerant computer systems, design secure operating systems, and transmit data securely across a communications link.

The in-depth, technical knowledge that has been developed with the discipline of computer science provides both benefits and problems for auditors' work. On the one hand, they can now be less concerned about the reliability of certain components in a computer system. On the other hand, if

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this technical knowledge is used improperly, they might have difficulty detecting the abuse. For example, if a skilled systems programmer decides to perpetrate a fraud, it might be almost impossible for auditors to detect the fraud unless they have extensive knowledge of information systems technology.

Nature, Significance And Scope Of Systems Audit

1. Nature of System Audit

It has been the practice in Industry to carry out Financial, Managerial and Technical audits. The oldest and most prevalent audit has been the Financial Audit. Traditionally, financial auditors have been going by the paper- based book of accounts. They have been focusing mainly on ensuring internal controls and compliances with the laws of the land, and thereby, good governance.

Managerial audit has been focusing on the basic Management policies and practices, with the aim of determining whether the enterprise is in good shape, has good processes and has a good feedback framework for managerial effectiveness and performance.

Technical audit has been focusing more on the shop floor details, such as, whether the manufacturing and maintenance functions are performing efficiently.

With the increasing use of computer-based systems in the enterprise, the complexity of systems and risk of errors, sabotage and fraud have increased manifold. In a network setup, a transaction is initiated in a physically different location, posted in the books elsewhere and the management information aggregated from the data viewed somewhere else. Because of the number of agencies involved and the increased risk exposure of mechanized systems, it is no longer sufficient to go by auditing of the book-based accounts. One has to see the vulnerability of the IT setup to external “crackers” and “hackers”.

There is an example of a company which co hosted its server in the Data Center of a Service Provider. The necessary security precautions were not taken, as a result of which a cracker could get into the Mailing system and use the server to send unsolicited spam mail to tens of thousands of addressees all over the world. The identity of the server figured in the entire watchdog lists of the Internet. The result was, several

sites blocked the server. Isolated from the rest of the world, the company was forced to request the service provider to give a new set of IP addresses. It had to hire experts on an emergent basis to reinstall the server after plugging the security loopholes. In the process it had to suffer a week of isolation from the outside world. After the reinstallation, it took another 72 hours for all sites to remove the name of the site from their blacklist. Conventional audit would not normally be addressing such issues.

The nature of systems audit, unlike the other audits, is not restricted to audit of reported items only. It has to take into cognizance the choice, use and risk of Technology. It has to look at the realities of business processes and constantly changing legal framework.

2. Significance of System Audit

The significance of systems audit is sharply highlighted by the way businesses are changing. For any business (for profit or for nonprofit) to survive, it must have an adequate information security system in place. How to know that a system is secured is when an audit is carried out on the system.

In a nut shell, the world would be a worry free place if we have the assurance that are information (trade secrets, private information, personal identity, etc) are safe, hence, the importance of auditing an information system. The system audit is mainly getting importance for various reason but few of them are explained as below:

a. To Ensure the Security of Information

Information is a vital asset of any entity that needs to be seriously secured or face the consequence of not doing so. Information security has become so vital that many large organizations have full-fledged department that handles the inflow and outflow of information. Information security is not all about securing the data in your data warehouse, it goes beyond that. By information security audit, the activities of actors in the information domain need to be monitored more than ever. The advent of mobile computing and Smartphone created a new loophole in the business of handling information which the information audit must track down and proffer solution to.

b. To Filter out Noise in the System
Noise in any information system is a key factor that causes mistakes, misunderstandings and misrepresentation of facts which has proved to be fatal over the period of time. It is by auditing the system that carries the information flow that such noises are identified and corrective action taken to either remove or ameliorate their effects on the organization.

c. Building Confidence and Public Reputation
The general public would rather go with a secured system with lesser benefit than with an unsecured system with more benefits. This is more pronounced in the world of business and investment where investors seek the safety of their capital first before profit. This is a rational thing to do as the number one tenet of investing and financial management is to ensure the safety of your capital. The general idea behind any form of auditing of any kind is to render credibility to a piece of information

The role of information auditing also include improving the general standard of living in an economy. Through adequate information audit, treats to human lives and properties are identified and remove if possible. This will also go a long way in preventing these cycles of global financial crisis that we face these days

3. Scope of Information System Audit

The scope of systems audit covers the entire IS management process. The scope includes review of the entire design & development process, the review of technology choice, the processes employed to assess risks and losses that could accrue to the system, the possibility of computer frauds, the care taken in managing changes to the system, extent of testing and reliability of the system. It also cover Senior management involvement, review applicable minutes Network, workstation, Internet, disaster recovery, and other IT security policies, Overall security procedures, Segregation of IT duties, Internal quality and integrity controls, Data communication security, User identification authorization, User level of accessibility, Restricted transactions, Activity and exception reports, Backup procedures, Other operational security controls, Insurance coverage, Network security including the

Information System Audit Process

IS Audit is an evaluation of adequacy of controls. In a computerised environment, controls can be classified as under, which are verified by the IS Auditor:

1. Management Controls
   a. Security Policy and Standards
   b. Constitution of Steering Committee 3. Business Continuity Planning
   c. Systems Development Methodology
2. Operational Controls
   a. Monitoring physical assets
   b. Ensuring adequate environmental controls such as Air-conditioning (dust, temperature & humidity controls), Power Conditioning (Online UPS functioning all the time with backups, proper earthing)
3. Organizational Controls
   a. Defining roles, responsibilities and duties of User Departments and IT Department
   b. Defining roles, responsibilities and duties within IT Department – such as developers, operators and administrators
4. Application Controls
   a. EachoftheComputerSystemsandsubsystemsmusthaveitsown setofcontrolsforInputs,Processing & Outputs. Processing controls should also ensure checks for legal compliance.
   b. While performing the audit, each of the controls needs to be studied for its existence and adequacy.

Audit Of Management Controls

1. Security Policy and Standards

   The IS auditor should first verify whether the organization has a Security Policy. If it does not exist, the auditor needs to point this out, unless the management has a corporate IS Security policy and follows standard implementation of IS Security across all units and divisions. If a security policy exists, it needs to be examined for currency and adequacy in proportion to the risk. The security policy has to be always dynamically updated.

2. Steering Committee for Security

   The formulation and implementation of a sound security policy should not be the handiwork of just the IT Department.

It should be a team effort, brought into effect by a committee in which there is at least one member of the Board of Directors apart from the CIO and User HoDs. The auditor should point out the absence of such a committee.

Without such a committee having regular planned meetings with agenda and action points, the implementation of security policy would be in jeopardy. The auditor needs to stress upon the possible benefits of a properly functioning steering committee or conversely, the disbenefits of not having such a committee. In recommending the constitution and functioning of the committee, the auditor should be specific about composition, individual roles and responsibilities and monitoring/ escalating mechanism.

3. Business Continuity Planning

Business Continuity is a very important aspect of Information Systems. It encompasses all aspects that can result in usage discontinuity. As a simple example, let us say that a company has three servers connected to a single UPS. The UPS is not under Annual Maintenance Contract. Its batteries may be dying out. Since there is no mechanism to look into the health of the UPS, it can go down without a warning, resulting in a server tripping. All work halts till the UPS can be set right. If such a catastrophe occurs in a remote place, then the time to repair/ replace the UPS can be longer.

The IS Auditor should examine all such possibilities by which the availability of Computer Systems is threatened with temporary or permanent breakdown. In sensitive areas, even proofing against mob violence/terrorist strikes should be kept in view.

4. Systems Development Methodology

In most companies Systems Development is badly handled. And proper documentation is not maintained. The code is developed in great hurry and control aspects are given the go by. The accuracy of the processing and the legal compliance are left as open questions.

The IS auditor should verify whether following documents exist or not:

a. Functional requirement Specifications
b. Software requirement Specification
c. Design Description
d. Software code

e. Test Plan
f. Unit test results
g. Integration test results
h. Acceptance test results

The documentation should be properly cross-indexed. The effect of a change made in the system should be well understood. It should not happen that, due to ignorance of the entirety of the business process and its ramifications, a change made in one area affects other areas, that too after a lapse of time.

Every time a change is made, a thorough testing should be done and documented. The IS Auditor should get necessary evidence and comment on the lack of proper adherence to procedure.

Audit of Operational Controls

The Auditor should observe the operations and comment on the drawbacks. Some of the possible scenarios are:

1. Anybody walks into the server room and has access to documents/media/ machines.
2. Backup media not labeled properly and kept under lock and key.
3. One set of backup not regularly kept at another location
4. No documented and organized change control process. Software and data are arbitrarily changed.
5. Correction of errors not done by reversal of entry but by running dangerous script on the database backend.
6. Administrator passwords freely floating around and used by developers, operations staff and administrators.
7. Dirty network cabling with loose cables hanging around, hand crimped cables, cables not tagged for easy identification.
8. Switches/hubs lying loose on tables/hanging on walls.

Data controls not properly checked and filed.

1. Preventive Maintenance of Servers not done.
2. Machines working with covers kept off.
3. Media not properly labeled and recorded in media register.
4. Absence of gate pass culture: machines arbitrarily taken from/into computer rooms.
5. Unknown and untrusted floppies directly used without checking for virus.

The above scenarios speak of a very casual IT setup. Such carelessness can result in serious downtime. Sensitive data can be pilfered from the servers. The IS auditor needs to highlight these flaws as serious lapses.

Audit Of Environmental Controls

The following environmental factors need to be checked and commented upon by the auditor:

1. Online UPS not used; either line-interactive UPS or Offline UPS used, or CVT used.
2. Electrical cabling loose / points having loose contact.
3. No separate earth pit for the Computing equipment.
4. Switches/Hubs/Routers not fed UPS power.
5. Server room door kept open.
6. AC not functioning properly, especially in summer.
7. In winter AC set at 29 Deg C instead of 22 Deg C.
8. No pest control measures taken.
9. Eatables taken into server room/ Smoking in the server room.
10. Heavy duty printer kept inside server room: scope for dust.
11. UPS, AC, other electricals not under regular AMC.
12. No genset backup in case City power supply fails for long hours.
13. No smoke detectors/fire alarms in server room area.
14. Fire extinguishers not kept filled and ready.
15. No fire drill carried out to make people aware of dos and don'ts The above are serious lapses that can seriously affect the functioning of the IT Setup and cause work stoppages.

Audit Of Organizational Controls

There needs to be an effective Organization Chart for the IT function. In some Organizations, IT is treated as a technician's job. A very junior person is made the head of IT. He/she will be unable to hold his own when powerful functional heads as the Finance Head or the Production head keep breathing fire. It is best to have the IT function reporting to the CEO. The Head of IT is the Chief Information Officer or CIO.

The CIO should have three reportee managers – one for taking care of the development team, one for ensuring Information System / IT Center security and another for managing the facilities (i.e., operations and maintenance of hardware, OS, database administration, vendor management, service providers,

etc.) It is advisable not to club IS security with operations or development.

The IS auditor should look for a succession plan for the IT Management team. The main concern here is that a few persons may be knowing the ins and outs of the software. They may be fixing problems because of their deep knowledge of the code. Other than in their minds, there is no documentation of what they know. Either because of their leaving the organization or their disgruntlement, they may not keep doing the good work. Such an event would compromise the functioning of the systems and emergent solution to the problem may be very expensive.

The IS Auditor should check for clear-cut definition of User role, IT Role so that there are no ambiguous overlaps. For example, it should be clear that the Wage Administration section would advise tax rate changes, etc. to the development and maintenance team member concerned. Under the formal authorization of the user HoD, such changes should be carried out. Deciding which data should be kept and which should not be kept is the responsibility of the User and not IT Department. Making a final pronouncement on the correctness of processing by software is again the concerned User Department responsibility.

There are companies in which there is no specific duty allocation to IT Staff members. This is not desirable, since everybody escapes accountability. One section of IT Department must take the responsibility for developing and maintaining the software. They should have nothing to do with the Hardware upkeep, System, Network and Database administration. This should be looked after by another set of people. Systems security was earlier the purview of the system administration staff. Given the increasing dependence on computer systems and the ever-increasing security risks, it is necessary to ensure that no person who has executive responsibility should have anything to do with an audit type of function. This is the reason why Security and Audit of systems should be the responsibility of a different section. This group needs to have a very good technical knowledge of IT and security risks. It would only audit and report findings to the management without getting into actual solution implementation. Any deviation in this regard needs to be pointed out by the IS Auditor, including an impact analysis.

Steps Involved In Conducting Is Audit

1. Purviewing the environment

   The auditor must understand which applications are running on which machines, etc. S/he must meet the IT and Users to get a complete Pigure. S/he meets and discusses with the Development and maintenance staff as well as the facilities management people. In case the auditor decides to use any Audit software, s/he must decide whether the given environment would support it. S/he must also assess her/his own technical knowledge specific to the system and enhance it as necessary. The Auditor thus:

   a. Understands the audit objectives in specific terms such as areas covered in the past, areas to be revisited, etc.
   b. Defines the scope clearly
   c. Gathers necessary background information through interviewing the people concerned.

2. Understanding the Information Systems

   The auditor should go through the system documentation to understand the overall framework and individual subsystems. S/he should start with inputs originating in the user department and walk through the entire system to understand how it gets processed. Any deficiencies or hurdles faced – such as non-availability of the documentation – should be straightaway recorded. The auditor then makes her/his own short notes on the system functioning. Particular attention is given to the control aspects, such as assuring completeness of inputs, correctness of inputs, how correctness of processing is ensured and how completeness and correctness of reports, especially the infrequent but important ones. The job of understanding Application Systems can be made easier and faster by preparing a flow chart and verifying the same.

3. Identifying the Audit Risks

   Risks in the context of Auditing Systems are of two kinds:

   a. Risk of loss, non-compliance with laws, etc. which arise from the system and its usage.
   b. Detection risks arising out of the inadequacies and problems in the audit process itself.

   The first task before the Auditor is to assess the risks and prioritize the same. The commonly associated risks are:

a. Unreasonable processing (e.g., system accepts a salary rate for a Peon higher than that of a General Manager).
b. (Repetition of errors – one error in the processing logic leads to a large volume of errors.
c. Cascadingoferrors integratedsystems,theoutputofonesubsystemgoesasinputto another,and so on. Propagation of error from one subsystem can thus cascade into several errors in the linked subsystems.
d. Incorrect data entry – while amounts and other numerical entries may be brought under the purview of control/hash totals and thus detected, entries such as Product type (which may determine the Excise duty, Sales Tax, etc.) can only be detected if the code is out of range or of a different type. If A and B are valid codes and B is entered for A, then the error could go unnoticed.
e. Concentrationofcontrolresponsibility– inmanualsystems,sametransactionisseenbyseveralpersons, increasing the chances of detection of errors. In Information systems, since so much of integrated processing takes place, the error control has to be much more rigorous.

The next step is to see which of the risks can have serious adverse outcomes and assign higher priority to them. Some of the risks may be trivial and hence dropped from the list.

4. Identifying Audit Evidence

The IS Auditor has to make an exhaustive list of evidence to be gathered from the flow chart and the risk analysis. The audit evidence is then documented in terms of the medium of data, data format and structure, database used, backup period, frequency of updates. etc.

This would enable the auditor to decide on the methodology to be used for verifying the veracity of the evidence.

5. Identify Key Control Points

Based on the risk prioritization, the auditor looks for those control points that control maximum risks. This is not an easy task, since there are very many technical and functional factors to be understood before the key control points can be pinned down. The risks range from human error to error in programming logic as well as intentional fraud.

Exercise

1. Explain the meaning of system audit
2. Explain what is meant by an environmental control audit, whether it can be applied in a company
3. Explain how the steps involved in conducting an audit are carried out

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BIOGRAPHY

Dr. Hj. Nur Aisyah, SE., MM.

The author is a Permanent Lecturer at the Postgraduate Management Masters and Head of the Postgraduate Management Masters Study Center, Medan Area University, Medan, North Sumatra. Functional Position of III D/Academic position of Head Lector; Lecturer with Educator Certificate, born in South Tapanuli, 09 October 1967, and completed his education at SD Negeri 3 Sibuhuan in 1980, graduated from SMP Negeri 1 Kotanopan in 1983, completed SMA Negeri Kotanopan in 1986, continued his Bachelor's degree majoring in Management at STIE Independent Higher Education, graduated in 1990, completed postgraduate program STIE-Bisnis Indonesia Jakarta Human Resources Management study program in 2006, 2019 Completed the Educational Management Doctoral Program at the Medan State University Postgraduate Program.

E-mail: *aisyah415@yahoo.co.id/nuraisyah@staff.uma.ac.id.*

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Book Resume:

This textbook was written by the author to complement the teaching material contained in the Semester Learning Plan (RPS) for Master of Management Postgraduate students.

In this book, learning materials are presented, including:

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2. Information Technology for Competitive Advantage
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6. Team Framework in Companies
7. The Role of Digital Information Systems in Decision Making
8. Implementation of Digital Information Systems
9. Information Systems and Information Technology Audit

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