**Enterprise Information System: Micro-Examination 1 Review Summary**

## *Lecture 1:*

*Enterprise Information Systems* (EISs) are software systems for business management, encompassing modules supporting organizational functional areas.

An *information system* (IS) can be viewed from both a technological and business perspective.

- *Technology perspective of IS*: A set of interrelated components that collect, process, store, and distribute information to support decision making and control in an organization.
- *Business perspective of IS*: An important instrument for creating value for the firm, increasing its revenue, or decreasing its costs by providing information that helps managers make better decisions or that improves the execution of business processes.

*Information Technology* (IT) refers to the products, methods, inventions, and standards used for the purpose of producing information.

A *database*, the heart of an information system, is a collection of all relevant data organized in a series of integrated files.

Components of IS – Along with people and procedures, these are the components of information systems:

- *Computer hardware* is the physical equipment used for input, processing, and output activities in an information system.
- *Computer software* consists of the detailed, preprogrammed instructions that control and coordinate the computer hardware components.
- *Data management technology* consists of the software governing the organization of data on physical storage media.
- *Networking and telecommunications technology*, consisting of both physical devices and software, links the various pieces of hardware and transfers data from one physical location to another.

Activities in IS:

- *Input* captures or collects raw data from within the organization or from its external environment.
- *Processing* converts this raw input into a meaningful form.
- *Output* transfers the processed information to the people who will use it or to the activities for which it will be used.

Information vs. Data

- *Information* is data that have been shaped into a form that is meaningful and useful to human beings.
- *Data* are streams of raw facts representing events occurring in organizations or the physical environment before they have been organized and arranged into a form that people can understand and use.

Quality Data Characteristics:

- *Accurate*: Good information is conceived from accurate, correct, and complete data that has been processed correctly as expected.
- *Timely*: Good information requires that data be timely available for its intended use.
- *Relevant*: Data should be relevant both to the context and to the subject.
- *Just barely sufficient*: Data needs to be sufficient for the purpose of which it is generated.
- *Worth its cost*: There are costs for developing an information system, costs of operating and maintain that system, and costs of your time and salary for reading and processing the data the system produces.

Dimensions of IS:

- *Organizations* have a structure that is composed of different levels and specialties. Their structures reveal a clear-cut division of labor. Authority and responsibility in a business firm are organized as a hierarchy, or a pyramid structure.
- *Management*'s job is to make sense out of the many situations faced by organizations, make decisions, and formulate action plans to solve organizational problems.
- *Information Technology* is transforming businesses; you can see the results of this large-scale spending around you every day by observing how people conduct business. Changes in technology and new innovative business models have transformed social life and business practices.

Organization Structure:

- *Senior management* makes long-range strategic decisions about products and services as well as ensures financial performance of the firm.
- *Middle management* carries out the programs and plans of senior management.
    - *Knowledge workers*, such as engineers, scientists, or architects, design products or services and create new knowledge for the firm.
- *Operational management* is responsible for monitoring the daily activities of the business.
    - *Data workers*, such as secretaries or clerks, assist with scheduling and communications at all levels of the firm.

- *Production or service workers* actually produce the product and deliver the service.

What's new in IS:

- *IT Innovation*: A continuing stream of information technology innovations is transforming the traditional business world.
- *New Business Model*: Applications and utilizing of technology innovations in business and organizations
- *E-commerce Expansion*: E-commerce is changing how firms design, produce, and deliver their products and services. It has reinvented itself again, disrupting the traditional marketing and advertising.
- *Management Changes*: The management of business firms has changed by using emerging technologies such smartphones, social media, big data, EIS and AI.
- *Changes in Firms and Organizations*: New fast-growing 21st century business firms put less emphasis on hierarchy and structure and more emphasis on employees taking on multiple roles and tasks.

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

Strategic Business Objectives of IS – Entire sectors of the economy are nearly inconceivable without substantial investments in information systems, as they provide:

- *Operational Excellence*: Businesses continuously seek to improve the efficiency of their operations in order to achieve higher profitability.
- *New Products, Services, and Business Models*: Information systems and technologies are a major enabling tool for firms to create new products and services as well as entirely new business models.
- *Customer and Supplier Intimacy*: When a business really knows its customers and serves them well, the customers generally respond by returning and purchasing more.
- *Improved Decision Making*: Many business managers operate in an information fog bank, never really having the right information at the right time to make an informed decision.
- *Competitive Advantage*: When firms achieve one or more of these business objectives, chances are they have already achieved a competitive advantage.

- *Survival*: Business firms also invest in information systems and technologies because they are necessities of doing business. Sometimes these "necessities" are driven by industry-level changes.

## *Lecture 2:*

*Business processes* refers to the set of logically related tasks and behaviors that organizations develop over time to produce specific business results and the unique manner in which they are organized and coordinated.

*Information systems* are divided into computers (hardware and software) and humans (people and procedures), with data as a bridge in between.

How are business processes and information systems related?

- Information systems make it possible for firms to manage all their information, make better decisions, and improve the execution of their business processes.
- Information systems automate many steps in business processes that were formerly performed manually.

Dimensions of Business Process Quality:

- *Effective* business process enables the organization to accomplish its strategy.
- *Efficient* business process has high ratio of benefits to costs.

Types of IS for different management groups:

- *Transaction processing system*: A computerized system that performs and records the daily routine transactions necessary to conduct business.
- *Business intelligence*: Data and software tools for organizing, analyzing, and providing access to data to help managers and other enterprise users make more informed decisions.
- *Decision-support system (DSS)*: A system that focuses on problems that are unique and rapidly changing, for which the procedure for arriving at a solution may not be fully predefined in advance.
- *Executive support system (ESS)*: A system presenting graphs and data that addresses nonroutine decisions requiring judgment, evaluation, and insight since there are no agreed-on procedures for arriving at a solution.

*Enterprise applications* are systems that span functional areas, focusing on executing business processes across the firm and including all levels of management.

Types of Enterprise Applications:

- *Enterprise Systems*: Integrate business processes of each functional areas into a single software system. Information that was previously fragmented in many

different systems is stored in a single comprehensive data repository. (Also known as *enterprise resource planning (ERP)* systems.
- *Supply Chain Management (SCM) Systems*: Help manage relationships with their suppliers. These systems help share information of products and services so they can source, produce, and deliver goods and services efficiently.
- *Customer Relationship Management (CRM) Systems*: Help manage relationships with customers, providing information to coordinate all of the business processes that deal with to optimize revenue, customer satisfaction, and customer retention.
- *Knowledge Management Systems (KMS)*: Enable organizations to better manage processes for capturing and applying knowledge and expertise about how to create, produce, and deliver products and services.

*E-business* refers to the use of digital technology and the Internet to execute the major business processes in the enterprise.

*E-commerce* is the part of e-business that deals with the buying and selling of goods and services over the Internet.

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

*Collaboration* is working with others to achieve shared and explicit goals.

*Teams* have a specific mission that someone in the business assigned to them. Team members need to collaborate on the accomplishment of specific tasks and collectively achieve the team mission.

Why has collaboration become increasingly important?
- *Changing nature of work.* Today, jobs require much closer coordination and interaction among the parties involved in producing the service or product.
- *Growth of professional work.* Interaction jobs tend to be professional jobs in the service sector that require close coordination and collaboration.
- *Changing organization of the firm.* Today, work is organized into groups and teams, and the members are expected to develop their own methods for accomplishing the task.
- *Changing scope of the firm.* The work of the firm has changed from a single location to multiple locations – offices or factories throughout a region, a nation, or even around the globe.
- *Emphasis on innovation.* Innovation is a group and social process, and most innovations derive from collaboration among individuals in a lab, a business, or government agencies.
- *Changing culture of work and business.* Most research on collaboration supports the notion that diverse teams produce better outputs faster than individuals working on their own.

*Social business* is the use of social networking platforms to engage their employees, customers, and suppliers.

Applications of Social Business:

- *Social networks*: Connect through personal and business profiles.
- *Crowdsourcing*: Harness collective knowledge to generate new ideas and solutions.
- *Shared workspaces*: Coordinate projects and tasks; co-create content.
- *Blogs and wikis*: Publish and rapidly access knowledge; discuss opinions and experiences.
- *Social commerce*: Share opinions about purchasing on social platforms.
- *File sharing*: Upload, share, and comment on photos, videos, audio, text documents.
- *Social marketing*: Use social media to interact with customers; derive customer insights.
- *Communities*: Discuss topics in open forums; share expertise.

Benefits of Social Business:

- *Productivity*: People interacting and working together can capture expert knowledge and solve problems more rapidly.
- *Quality*: People working collaboratively can communicate errors and corrective actions faster than if they work in isolation.
- *Innovation*: There are advantages to diversity and the "wisdom of crowds."
- *Customer service*: People working together using collaboration and social tools can solve customer complaints and issues faster and more effectively.
- *Financial performance*: As a result of all of the above, collaborative firms have superior sales, sales growth, and financial performance.

*Information systems department* is the formal organizational unit responsible for information technology services.

Department Personnel of IS:

- *Programmers*: Highly trained technical specialists who write the software instructions for computers.
- *Systems analysts*: Translate business problems and requirements into information requirements and systems.
- *Information systems managers*: Leaders of teams of programmers and analysts, project managers, physical facility managers, telecommunications managers, or database specialists.
- *Chief Information Officer (CIO)*: A senior manager who oversees the use of information technology in the firm.
- *Chief Security Officer (CSO)*: In charge of information systems security for the firm and is responsible for enforcing the firm's information security policy.

- *Chief Privacy Officer (CPO)*: Responsible for ensuring that the company complies with existing data privacy laws.
- *Chief Knowledge Officer (CKO)*: Help design programs and systems to find new sources of knowledge or to make better use of existing knowledge in organizational and management processes.
- *Chief Data Officer (CDO)*: is responsible for enterprise-wide governance and utilization of information to maximize the value the organization can realize from its data.
- *End users*: Representatives of departments outside of the information systems.

*IT governance* includes the strategy and policies for using information technology within an organization.

An *organization* is a stable, formal social structure that takes resources from the environment and processes them to produce outputs.

Features of Organizations:

- *Routines and Business Processes*: Routines, also known as standard operating procedures, are precise rules, procedures, and practices that have been developed to cope with virtually all expected situations. Business process are collections of such routines. A business firm is a collection of business processes.
- *Organizational Politics*: People in organizations occupy different positions with different specialties, concerns, and perspectives.
- *Organizational Culture*: All organizations have bedrock, unassailable, unquestioned assumptions that define their goals, and products.
- *Organizational Environments*: Organizations reside in environments from which they draw resources and to which they supply goods and services; organizations and environments have reciprocal relationship.
- *Organizational Structures*: The kind of information systems you find in a business firm and the nature of problems with these systems often reflects the type of organizational structure.

*Disruptive technology* is an innovation that significantly alters the way that consumers, industries, or businesses operate. A disruptive technology sweeps away the systems or habits it replaces because it has attributes that are recognizably superior.

## *Lecture 3:*

*Information systems* have become integral, online, interactive tools deeply involved in the minute-to-minute operations and decision making of large organizations.

Impacts of IS on Organizations:

- *Economic Impact*: From the point of view of economics, IT changes both the relative costs of capital and the costs of information.

        - Information technology can be viewed as a factor of production that can be substituted for traditional capital and labor.
        - *Transaction cost theory*: Firms and individuals seek to economize on transaction costs, much as they do on production costs. Information technology, especially the use of networks, can help firms lower the cost of market participation.
        - *Agency theory*: Agents need constant supervision and management; otherwise, they will tend to pursue their own interests rather than those of the owners. With information technology, it becomes easier for managers to oversee a greater number of employees.
- *Organizational and Behavioral Impact*: Theories provide some understanding about how and why firms change with the implementation of new IT applications.
    - *IT Flattens Organization*: Behavioral researchers have theorized that information technology facilitates flattening of hierarchies by broadening the distribution of information to empower lower-level employees and increase management efficiency.
    - *Organizational Resistance to Change*: Implementing information systems has consequences for task arrangements, structures, and people. To implement change, four components must be changed: organizational structure, people, job tasks, and information technology.

The *Internet* increases the accessibility, storage, and distribution of information and knowledge for organizations. In essence, the Internet is capable of dramatically lowering the transaction and agency costs facing most organizations.

Organizational Factors for IS:

- The *environment* in which the organization must function.
- The *structure* of the organization: hierarchy, specialization, routines, and business processes.
- The organization's *culture and politics*.
- The *type* of organization and its style of leadership.
- The principal *interest groups* affected by the system and the attitudes of workers who will be using the system.
- The kinds of *tasks, decisions, and business processes* that the information system is designed to assist.

*Porter's Competitive Forces Model* provides a general view of the firm, its competitors, and the firm's environment.

Components of Porter's Competitive Forces Model:

- *Traditional Competitors*: All firms share market space with other competitors who are continuously devising new, more-efficient ways to produce by introducing new products and services.
- *New Market Entrants*: In a free economy with mobile labor and financial resources, new companies are always entering the marketplace.
- *Substitute Products and Services*: In just about every industry, there are substitutes that your customers might use if your prices become too high.
- *Customers*: A profitable company depends in large measure on its ability to attract and retain customers while denying them to competitors.
- *Suppliers*: The more different suppliers a firm has, the greater control it can exercise over suppliers in terms of price, quality, and delivery schedules.

IS strategies for dealing with competitive forces:

- *Low-cost leadership*: Use information systems to achieve the lowest operational costs and the lowest prices.
- *Product differentiation*: Use information systems to enable new products and services or greatly change the customer convenience in using your existing products and services.
- *Focus on market niche*: Use information systems to enable a specific market focus and serve this narrow target market better than competitors.
- *Strengthen customer and supplier intimacy*: Use information systems to tighten linkages with suppliers and develop intimacy with customers.

*Synergies*: When the output of some units can be used as inputs to other units or two organizations pool markets and expertise, these relationships lower costs and generate profits.

*Core competency*: An activity for which a firm is a world-class leader. Core competencies may involve being the world's best miniature parts designer, the best package delivery service, or the best thin-film manufacturer.

*Network-based strategies*: Internet and networking technology have inspired strategies that take advantage of firms' abilities to create networks or network with each other.

Types of Network-Based Strategies:

- *Network economics* refers to market situations where the economic value being produced depends on the number of people using a product.
- *Virtual company*, also known as a virtual organization, uses networks to link people, assets, and ideas, enabling it to ally with other companies to create and distribute products and services without being limited by traditional organizational boundaries or physical locations.

- *Business ecosystem* is another term for these loosely coupled but interdependent networks of suppliers, distributors, outsourcing firms, transportation service firms, and technology manufacturers.

*Note*: The research on IT and business performance has found that (a) the more successfully a firm can align information technology with its business goals, the more profitable it will be, and (b) only one-quarter of firms achieve alignment of IT with the business.

An *IT infrastructure* consists of a set of physical devices and software applications that are required to operate the entire enterprise.

Services in an IT infrastructure:

- *Computing platforms* used to provide computing services that connect employees, customers, and suppliers into a coherent digital environment,
- *Telecommunication services* that provide data, voice, and video connectivity to employees, customers, and suppliers.
- *Data management services* that store and manage corporate data and provide capabilities for analyzing the data.
- *Application software services*, including online software services that provide enterprise-wide capabilities such as enterprise resource planning, customer relationship management, supply chain management, and knowledge systems that are shared by all business units.
- *Physical facilities management services* that develop and manage the physical installations required for computing, telecommunications, and data management services.
- *IT management services* that plan and develop the infrastructure, coordinate with the business units for IT services, manage accounting for the IT expenditure, and provide project management services.
- *IT standards services* that provide the firm and its business units with policies that determine which information technology will be used, when and how.
- *IT education services* that provide training in system use to employees and offer managers training in how to plan for and manage IT investments.
- *IT research and development services* that provide the firm with research on potential future IT projects and investments that could help the firm differentiate itself in the marketplace.

Components of an IT infrastructure:

- *Computer Hardware Platforms*: Most business computing has taken place using microprocessor chips manufactured or designed by Intel Corporation and, to a lesser extent, AMD Corporation.

- *Operating Systems Platforms*: The leading operating systems for corporate servers are Microsoft Windows Server, Unix, and Linux, an inexpensive and robust open source relative of Unix.
- *Enterprise Software Applications*: The largest providers of enterprise application software are SAP and Oracle. Also included in this category is middleware software supplied by vendors such as IBM and Oracle.
- *Data Management and Storage*: The leading database software providers are IBM (DB2), Oracle, Microsoft (SQL Server), and SAP Sybase (Adaptive Server Enterprise).
- *Networking/Telecommunications Platforms*: Most local area networks, as well as wide area enterprise networks, use the TCP/IP protocol suite as a standard.
- *Internet Platforms*: The Internet hardware server market has become increasingly concentrated in the hands of IBM, Dell, Oracle, and HP, as prices have fallen dramatically.
- *Consulting and System Integration Services*: Leading consulting firms providing this expertise include Accenture, IBM Services, HP, Infosys, and Wipro.

# Lecture 4 – Chapter 9

**Achieving Operational Excellence and Customer Intimacy: Enterprise Applications**

***Chapter 9.1***
***How do enterprise systems help businesses achieve operational excellence?***

Enterprise Systems or Enterprise Resource Planning systems (ERP) provide the integration for connected companies to react instantaneously to situations and know their impact and performance.

Enterprise systems feature a set of integrated software modules and a central database by which business processes and functional areas throughout the enterprise can share data.

The database collects data from business processes and makes the data available for applications that support organizational centralization and internal business activities.

Business processes supported by ERP includes:

- Financial and accounting processes
- Human resources processes
- Manufacturing and production processes
- Sales and marketing processes

Business values of ERP includes:

- Increasing operational efficiency
- Providing wide information to help make better decisions
- Enforce standard practices and data
- Respond rapidly to customer requests

***Chapter 9.2***
***How do supply chain management systems coordinate planning, production, and logistics with suppliers?***

A supply chain is a network of organizations and business processes for procuring raw materials, transforming these materials into intermediate and finished products, and distributing the finished products to customers.

Supply chain management (SCM) systems automate the flow of information among members of the supply chain so they can use it to make better decisions about when and how much to purchase, produce, or ship.

The two portions of the supply chains are:

- Upstream: suppliers and supplier's suppliers
- Downstream: distributors, retailers, and customers

Bullwhip effect is a recurring problem in supply chain management in which information about the demand for a product gets distorted as it passes from one entity to the next across the supply chain.

The bullwhip effect is tamed by reducing uncertainties about demand and supply when all members of the supply chain have accurate and up-to-date information, which can be provided by a supply chain management system.

SCM software includes:

- Planning system: Model the existing supply chain, generate demand forecasts for products, and develop optimal sourcing and manufacturing plans such as demand planning.
- Execution system: Manage the flow of products through distribution centers and warehouses to ensure that products are delivered to the right locations in the most efficient manner.

There are two models in supply chains:

- Push-based model: Production master schedules are based on forecasts or best guesses of demand for products, and products are pushed to customers.
- Pull-based model: Also known as a demand-driven or build-to-order model, actual customer orders or purchases trigger events in the supply chain. This is enabled by SCM systems.

***Chapter 9.3***
***How do customer relationship management systems help firms achieve customer intimacy?***

Customer relationship management (CRM) systems integrate and automate customer-facing processes in sales, marketing, and customer service, providing an enterprise-wide view of customers. Companies can use this to provide customers with better service or sell new products and services in various touch points.

A touch point (also known as a contact point) is a method of interaction with the customer, such as telephone, email, social media, website, wireless device, or retail store.

The CRM software helps firms identify high-value customers for preferential treatment.

There can be two modules in a commercial CRM software:

- Partner Relationship Management (PRM) software enhance collaboration between a company and its selling partners. This module does not sell directly to customers but rather works through distributors or retailers.
- Employee Relationship Management (ERM) software deals with employee issues that are closely related to CRM, such as setting objectives, employee performance management, performance-based compensation, and employee training.

There are three capabilities of CRM:

- Sales Force Automation (SFA) modules in CRM systems help sales staff increase productivity by focusing sales efforts on the most profitable customers.
- Customer Service modules in CRM systems provide information and tools to increase the efficiency of call centers, help desks, and customer support staff.
- Marketing activities are supported by CRM, providing capabilities for capturing prospect and customer data for providing product and service information, qualifying leads for targeted marketing, and scheduling and tracking direct-marketing mailings or email.

There are two aspects of CRM:

- Operational CRM: Includes customer-facing applications, such as tools for sales force automation, call center and customer service support, and marketing automation.
- Analytical CRM: Includes applications that analyze customer data generated by operational CRM applications to provide information for improving business performance. Customer data collected include demographics to pinpoint profitable customers and customer lifetime value (CLTV), the expected life of relationship between the customer and the company.

***Chapter 9.4***
***What are the challenges that enterprise applications pose, and how are enterprise applications taking advantage of new technologies?***

Enterprise applications are difficult to implement. They require extensive organizational change, large new software investments, and careful assessment of how these systems will enhance organizational performance.

Enterprise applications cannot provide value if they are implemented atop flawed processes or if firms do not know how to use these systems to measure performance improvements. Employees require training to prepare for new procedures and roles.

Enterprise applications are now more flexible, web-enabled, and capable of integration with other systems, using web services and service-oriented architecture (SOA). Next-generation enterprise applications can run in cloud infrastructures or on mobile platforms.

Examples of next-generation ERP includes:

- Social CRM: CRM software vendors are enhancing their products to take advantage of social networking technologies. These social enhancements help firms identify new ideas more rapidly, improve team productivity, and deepen interactions with customers.
- Business Intelligence in Enterprise Applications: Enterprise application vendors have added business intelligence features, including data from the Internet of Things (IoT).

# Lecture 5 – Chapter 6

**Foundations of Business Intelligence: Databases & Information Management**

***Chapter 6.1***
***What are the problems of managing data resources in a traditional file environment?***

Business performance depends on what a firm can or cannot do with its data. How businesses store, organize, and manage their data has an enormous impact on organizational effectiveness.

There are three aspects in an effective information:

- Accurate: Information is free of errors.
- Timely: Information is available to decision makers when it is needed.
- Relevant: Information is useful and appropriate.

The file hierarchy can be divided as follows:

- Bit: The smallest unit of data a computer can handle.
- Byte: A group of bits, represents a single character, which can be a letter, a number, or another symbol.
- Field: A grouping of characters into a word, a group of words, or a complete number.
- Record: A group of related fields, such as the student's name, the date, etc.
- File: A group of records of the same type.

In most organizations, the traditional file environment is that systems in each functional areas tended to grow independently without a companywide plan.

The following are problems with the traditional file environment:

- Data Redundancy and Inconsistency: Refers to the same data that are stored in more than one place or location. It wastes storage resources and also leads to data inconsistency, where the same attribute may have different values.
- Program-Data Dependence: Refers to the coupling of data stored in files and the specific programs required to update and maintain those files such that changes in programs require changes to the data.
- Lack of Flexibility: Traditional file system cannot deliver ad hoc reports or respond to unanticipated information requirements in a timely fashion.
- Poor Security: Because there is little control or management of data, access to and dissemination of information may be out of control.
- Lack of Data Sharing and Availability: Because pieces of information in different files and different parts of the organization cannot be related to one another, it is virtually impossible for information to be shared or accessed in a timely manner.

*Chapter 6.2*
***What are the major capabilities of database management systems (DBMS), and why is a relational DBMS so powerful?***

A database is a collection of data organized to serve many applications efficiently by centralizing the data and controlling redundant data.

A database management system (DBMS) is a software that enables an organization to centralize data, manage them efficiently, and provide access to the stored data by application programs. The DBMS relieves the programmer or end user from the task of understanding where and how the data are actually stored.

There are two views in a DBMS:

- Logical View: Presents data, as they would be perceived by end users or business specialists
- Physical View: Shows how data are actually organized and structured on physical storage media.

A DBMS reduces data redundancy and inconsistency by minimizing isolated files in which the same data are repeated. The DBMS enables the organization to centrally manage data, their use, and security.

Relational databases, a type of popular DBMS, represent data as two-dimensional tables (called relations). Tables may be referred to as files. Each table contains data on an entity and its attributes.

The following are components in a relational DBMS:

- Row: The actual information about a single record that resides in a table.
- Primary Key: This key field is the unique identifier for all the information in any row of the table and this primary key cannot be duplicated.
- Foreign Key: This key field is essentially a lookup field to look up data in other tables.

The following are operations used in a relational DBMS:

- Join operation: Combines relational tables to provide the user with more information than is available in individual tables.
- Select operation: Creates a subset consisting of all records in the file that meet stated criteria. Select creates, in other words, a subset of rows that meet certain criteria.
- Project operation: Creates a subset consisting of columns in a table, permitting the user to create new tables that contain only the information required.

The following are capabilities of a relational DBMS:

- Data definition: Specify the structure of the content of the database.
- Data dictionary: Stores definitions of data elements and their characteristics.
- Data manipulation: Used to add, change, delete, and retrieve the data in the database. The most prominent data manipulation language today is Structured Query Language, or SQL.

The following are points to be considered in a database design:

- The conceptual or logical design of a database is an abstract model of the database from a business perspective, whereas the physical design shows how the database is actually arranged on direct-access storage devices.

- Normalization is the process of creating small, stable, yet flexible and adaptive data structures from complex groups of data.
- Referential integrity rules are usually enforced in relational database systems to ensure that relationships between coupled tables remain consistent.
- An entity-relationship diagram is used to document the data model by database designers.

There are needs to store new types of data require database alternatives to the traditional relational model of organizing data in the form of tables, columns, and rows. Companies are turning to non-relational database (NoSQL) technologies for this purpose.

Non-relational database management systems use a more flexible data model and are designed for managing large data sets across many distributed machines and for easily scaling up or down.

A distributed database is one that is stored in multiple physical locations. Parts or copies of the database are physically stored in one location and other parts or copies are maintained in other locations.

Cloud-based data management services have special appeal for web-focused startups or small to medium-sized businesses seeking database capabilities at a lower cost than in-house database products.

# Lecture 6 – Chapter 10

**E-commerce: Digital Markets, Digital Goods**

***Chapter 10.1***
***What are the unique features of e-commerce, digital markets, and digital goods?***

E-commerce refers to the use of the Internet and the web to transact business and the digitally enabled commercial transactions between and among organizations and individuals. E-commerce is composed of three major segments: retail goods, travel and services, and online content.

E-commerce began in 1995 when one of the first Internet portals, Netscape.com, accepted the first ads from major corporations and popularized the idea that the web could be used as a new medium for advertising and sales. In 2018, e-commerce revenues grew at an estimated 12 percent annually.

One of the biggest changes is the extent to which e-commerce has become more social, mobile, and local. Before, the primary measure of success was how many eyeballs a website produced and how many impressions a marketing campaign generated. With social marketing: listening, discussing, interacting, empathizing, and engaging; the emphasis in online marketing has shifted from a focus on eyeballs to a focus on participating in customer-oriented conversations.

As mobile devices become more powerful, they are more useful for accessing social sites. As mobile devices become more widely adopted, customers can use them to find local merchants, and merchants can use them to alert customers in their neighborhood of special offers.

There are eight unique features of e-commerce technology:

- Ubiquity: Internet and web technology is available everywhere; at work, at home, and elsewhere by desktop and mobile devices.
- Global Reach: The technology reaches across national boundaries, around the earth.
- Universal Standards: There is one set of technology standards, namely Internet standards.
- Richness: Video, audio, and text marketing messages are integrated into a single marketing message and consumer experience.
- Interactivity: The technology works through interaction with the user.
- Information Density: The technology reduces information costs and raises quality
- Personalization/Customization: The technology allows personalized messages to be delivered to individuals as well as to groups.
- Social Technology: The technology supports content generation and social networking.

The Internet has created a digital marketplace where millions of people all over the world can exchange massive amounts of information directly, instantly, and free.

The following illustrates differences between digital markets and traditional markets:

- Information asymmetry: The Internet reduces information asymmetry, which is when one party in a transaction has more information that is important for the transaction than the other party.
- Search costs: Digital markets reduce the time, energy, and money that buyers and sellers in a market expend in trying to find one another in order to engage in transactions.
- Transaction costs: Digital markets reduces the expenses incurred when buying or selling a good or service.
- Delayed Gratification: Buying products and services digitally might cause some extra delay in gratification due to shipping times.
- Menu costs: Digital market lowers menu costs, which is the merchants' costs of changing prices.
- Dynamic pricing: Digital market has the ability to change prices dynamically based on market conditions.
- Price discrimination: Customers can easily discriminate prices between different digital retailers.
- Market segmentation: Technology in the digital markets can collect user profiles and demographics with lower cost than traditional markets.
- Switching costs: Digital markets can either reduce or increase switching costs, depending on the nature of the product or service being sold. Switching cost is the cost a consumer pays as a result of switching brands or products.
- Network effects: Customers can more easily influence others on social platforms.
- Disintermediation: Digital markets provide many opportunities to sell directly to the consumer, bypassing intermediaries such as distributors or retail outlets. Eliminating intermediaries in the distribution channel can significantly lower purchase transaction costs.

The Internet digital marketplace has greatly expanded sales of digital goods – goods that can be delivered over a digital network.

For the most part, digital goods are intellectual property, which is defined as "works of the mind." Intellectual property is protected from misappropriation by copyright, patent, trademark, and trade secret laws.

The following illustrates differences between digital goods and traditional goods:

- Marginal cost: In general, for digital goods, the marginal cost of producing another unit is about zero.
- Cost of production: The cost of producing the original first unit is nearly the total cost of the product
- Copying cost: Similar to marginal cost, for digital goods, the copying cost is approximately zero.
- Distributed delivery cost: Costs of delivery over the Internet are very low.
- Inventory cost: Unlike traditional goods, warehouses and labors are not needed.
- Marketing cost: Marketing costs often remain the same.
- Pricing: Pricing can be highly variable. The merchant can change prices as often as desired because of low menu costs.

*Chapter 10.2*
***What are the principal e-commerce business and revenue models?***

There are three major types of e-commerce:

- Business-to-customer (B2C): Involves retailing products and services to individual shoppers.
- Business-to-business (B2B): Involves sales of goods and services among businesses.
- Customer-to-customer (C2C): Involves consumers selling directly to consumers.

There are seven types of business models:

- E-tailer: Sells physical products directly to consumers or to individual businesses. (e.g., Amazon)
- Transaction broker: Saves users money and time by processing online sales transactions and generating a fee each time a transaction occurs. (e.g., Expedia)
- Market creator: Provides a digital environment where buyers and sellers can meet, search for products, display products, and establish prices for those products; generating revenue from transaction fees. (e.g., eBay)
- Content provider: Creates revenue by providing digital content, such as news, music, photos, or video, over the web. (e.g., iTunes)
- Community provider: Provides an online meeting place where people with similar interests can communicate and find useful information. (e.g., Facebook)
- Portal: Provides initial point of entry to the web along with specialized content and other services. (e.g., Yahoo)
- Service provider: Provides applications such as photo sharing, video sharing, and user-generated content as services; provides other services such as online data storage and backup. (e.g., Dropbox)

There are six types of revenue models:

- Advertising revenue model: A website generates revenue by attracting a large audience of visitors who can then be exposed to advertisements. It is most widely used. (e.g., Facebook)
- Sales revenue model: Companies derive revenue by selling goods, information, or services to customers. (e.g., iTunes)
- Subscription revenue model: A website offering content or services charges a subscription fee for access to some or all of its offerings on an ongoing basis. Content providers often use this revenue model. (e.g., Netflix)
- Free/freemium revenue model: Firms offer basic services or content for free and charge a premium for advanced or special features. (e.g., YouTube)
- Transaction fee revenue model: A company receives a fee for enabling or executing a transaction. (e.g., eBay)
- Affiliate revenue model: Affiliate websites send visitors to other websites in return for a referral fee or percentage of the revenue from any resulting sales. Referral fees are also referred to as lead generation fees. (e.g., Amazon)

*Chapter 10.3*
***How has e-commerce transformed marketing?***

The Internet provides marketers with new ways of identifying and communicating with millions of potential customers at costs far lower than traditional media, including search engine marketing, data mining, recommender systems, and targeted email.

The Internet enables long tail marketing, targeting a large number of niche markets with a product or service. It allows marketers to find potential customers inexpensively for products where demand is very low.

The following are marketing formats for e-commerce:

- Search engine: Text ads targeted at precisely what the customer is looking for at the moment of shopping and purchasing. Usually, they are sales oriented.
- Display ads: Banner ads with interactive features; increasingly behaviorally targeted to individual web activity. Used for brand development and sales. Includes social media and blog display ads.
- Video: Fastest-growing format, engaging and entertaining; behaviorally targeted, interactive. Used for branding and sales.
- Classified: Job, real estate, and services ads; interactive, rich media, and personalized to user searches. Used for sales and branding.
- Rich media: Animations, games, and puzzles. Interactive, targeted, and entertaining. Used for branding orientation.
- Lead generation: Marketing firms that gather sales and marketing leads (i.e., potential customers) online and then sell them to online marketers for a variety of campaign types. Used for sales or branding orientation.
- Sponsorships: Online games, puzzles, contests, and coupon sites sponsored by firms to promote products. Usually, they are sales oriented.
- Email: Effective, targeted marketing tool with interactive and rich media potential. Usually, they are sales oriented.

Many e-commerce marketing firms use behavioral targeting techniques to increase the effectiveness of ads. Behavioral targeting refers to tracking the clickstreams of individuals on thousands of websites to understand their interests and intentions and expose them to advertisements that are uniquely suited to their online behavior.

Behavioral targeting takes place at two levels: at individual websites or from within apps and on various advertising networks that track users across thousands of websites. Unfortunately, behavioral targeting of millions of web users also leads to the invasion of personal privacy without user consent.

Advertising networks solve the problem of a large national advertising company or global manufacturer trying to reach millions of consumers by creating a network of several thousand of the most popular websites millions of people visit. In native advertising, content and advertising are in very close proximity or integrated together.

Social e-commerce is commerce based on the idea of the digital social graph, a mapping of all significant online social relationships. The products and services you buy will influence the decisions of your friends, and their decisions will in turn influence you.

In a phenomenon called the wisdom of crowds, some argue that large numbers of people can make better decisions about a wide range of topics or products than a single person or even a small committee of experts. Beyond merely soliciting advice, firms can be actively helped in solving some business problems by using crowdsourcing.

The following are features of social commerce:

- Newsfeed: A stream of notifications from friends and advertisers that social users find on their home pages.
- Timelines: A stream of photos and events in the past that create a personal history for users, one that can be shared with friends.
- Social sign-on: Websites allow users to sign into their sites through their social network pages on Facebook or another social site.
- Collaborative shopping: An environment where consumers can share their shopping experiences with one another by viewing products, chatting, or texting.
- Network notification: An environment where consumers can share their approval or disapproval of products, services, or content.
- Social search: An environment where consumers can ask their friends for advice on purchases of products, services, and content.

***Chapter 10.4***
***How has e-commerce affected business-to-business transactions?***

Electronic Data Interchange (EDI) enables the computer-to-computer exchange between two organizations of standard transactions. Companies use EDI to automate transactions for B2B e-commerce and continuous inventory replenishment.

Private industrial networks or private exchange typically consist of a large firm using a secure website to link to its suppliers and other key business partners. On the other hand, net marketplaces, which are sometimes called e-hubs, provide a single, digital marketplace based on Internet technology for many buyers and sellers.

In net marketplaces, the intermediator gains revenues from transactions and other services provided. Goods exchanges can be direct (i.e., goods for production process) or indirect (i.e., goods for maintenance and repair). Relationship between businesses can be contractual or short-term.

***Chapter 10.5***
***What is the role of m-commerce in business, and what are the most important m-commerce applications?***

Mobile commerce, or m-commerce is the fastest-growing form of e-commerce, expanding at a rate of 30 percent or more per year, and is estimated to grow to $500 billion by 2022.

The following are location-based services available in m-commerce:

- Geosocial service: Can tell you where your friends are meeting.

- Geoadvertising service: Can tell you where to find the nearest businesses.
- Geoinformation service: Can tell you the information of nearby items.

***Chapter 10.6***
***What issues must be addressed when building an e-commerce presence?***

The two most important management challenges in building a successful e-commerce presence are developing a clear understanding of your business objectives and knowing how to choose the right technology to achieve those objectives. It's also very helpful for you to have a rough idea of the time frame for developing your e-commerce presence when you begin.

There are four types of e-commerce presence:

- Websites: Used for search, app display, and for affiliate and sponsorship. Seen in traditional desktops, mobiles, and tablets.
- Email: Used for newsletters, updates, and sales. List of emails can be obtained internally or from old customers.
- Social media: Used for conversation, engagement, and for sharing and advice. Seen in Facebook, Twitter, and blogs.
- Offline media: Used for education, exposure, and branding. Seen in print media, TV, and radio.

# Micro Examination 3 Review Summary

## Chapter 4 – Ethical and Social Issues in Information Systems

### *Section 4.1: What ethical, social, and political issues are raised by information systems?*

*Ethics* refers to the principles of right and wrong that individuals, acting as free moral agents, use to make choices to guide their behavior.

Information systems raise new ethical questions for both individuals and societies because they create opportunities for intense social change and threaten existing distributions of power, money, rights, and obligations.

The ease and anonymity with which information is now communicated, copied, and manipulated in online environments pose new challenges to the protection of privacy and intellectual property.

There are five moral dimensions of the information age:

- *Information rights and obligations*: What information rights do individuals and organizations possess with respect to themselves? What can they protect?
- *Property rights and obligations*: How will traditional intellectual property rights be protected in a digital society in which tracing and accounting for ownership are difficult, and ignoring such property rights is so easy?
- *Accountability and control*: Who can and will be held accountable and liable for the harm done to individual and collective information and property rights?
- *System quality*: What standards of data and system quality should we demand to protect individual rights and the safety of society?
- *Quality of life*: What values should be preserved in an information- and knowledge-based society? Which institutions should we protect from violation? Which cultural values and practices does the new information technology support?

Here are key technological trends that heighten ethical concerns:

- *Computing power doubles every 18 months*: More organizations depend on computer systems for critical operations and become more vulnerable to system failures.
- *Data storage costs rapidly* decline: Organizations can easily maintain detailed databases on individuals. There are no limits on the data collected about you.
- *Data analysis advances*: Companies can analyze vast quantities of data gathered on individuals to develop detailed profiles of individual behavior. Large-scale population surveillance is enabled.
- *Networking advances*: The cost of moving data and making data accessible from anywhere falls
- exponentially. Access to data becomes more difficult to control.
- *Mobile device growth impact*: Individual cell phones may be tracked without user consent or knowledge. The always-on device becomes a tether.

*Profiling* is the use of computers to combine data from multiple sources and create digital profiles of detailed information on individuals.

*Nonobvious Relationship Awareness (NORA)*: A data analysis technology that has given both the government and the private sector even more powerful profiling capabilities by taking information about people from

many disparate sources, such as employment applications, telephone records, customer listings, and wanted lists, and correlate relationships to find obscure connections that might help identify criminals or terrorists.

### *Section 4.2: What specific principles for conduct can be used to guide ethical decisions?*

The following are key concepts for making ethical decisions:

- *Responsibility*: A key element of ethical action. Responsibility means that you accept the potential costs, duties, and obligations for the decisions you make.
- *Accountability*: A feature of systems and social institutions to determine who took action and who is responsible. Systems and institutions in which it is impossible to find out who took what action are inherently incapable of ethical analysis or ethical action.
- *Liability*: A concept of responsibility further to the area of laws. Liability is a feature of political systems in which a body of laws is in place that permits individuals to recover the damages done to them by other actors, systems, or organizations.
- *Due Process*: A related feature of law-governed societies. A process in which laws are known and understood, and ability exists to appeal to higher authorities to ensure that the laws are applied correctly.

This is a five-step process to analyze present ethical issues:

- Identify and describe the facts clearly
- Define the conflict or dilemma and identify the higher-order values involved
- Identify the stakeholders
- Identify the options that you can reasonably take
- Identify the potential consequences of your options

Here are six principles for judging conduct:

- *Golden Rule*: Do unto others as you would have them do unto you.
- *Immanuel Kant's categorical imperative*: If an action is not right for everyone to take, it is not right for anyone.
- *The slippery slope rule*: If an action cannot be taken repeatedly, it is not right to take at all.
- *The utilitarian principle*: Take the action that achieves the higher or greater value.
- *The risk aversion principle*: Take the action that produces the least harm or the least potential cost.
- *The ethical no-free-lunch rule*: Assume that virtually all tangible and intangible objects are owned by someone else unless there is a specific declaration otherwise. If something someone else has created is useful to you, it has value, and you should assume the creator wants compensation for this work.

*Professional codes of conduct* are promulgated by associations of professionals. These professional groups take responsibility for the partial regulation of their professions by determining entrance qualifications and competence.

### *Section 4.3: Why do contemporary information systems technology and the Internet pose challenges to the protection of individual privacy and intellectual property?*

*Privacy* means the claim of individuals to be left alone, free from surveillance or interference from other individuals or organizations, including the state.

*Fair Information Practices (FIP)* is a set of principles governing the collection and use of information about individuals. FIP principles are based on the notion of a mutuality of interest between the record holder and

the individual. After information is gathered, the individual maintains an interest in the record, and the record may not be used to support other activities without the individual's consent.

*Informed consent* can be defined as Consent given with knowledge of all the facts needed to make a rational decision.

In Europe, privacy protection is much more stringent than in the United States, not allowing businesses to use personally identifiable information without consumers' prior consent. Customers must provide their informed consent before any company can legally use data about them, and they have the right to access that information, correct it, and request that no further data be collected.

*General Data Protection Regulation (GDPR)* applies to any firm operating in any EU country. It requires unambiguous consent to use personal data for purposes like tracking individuals across the web and limits the use of data for purposes other than those for which it was collected (such as constructing user profiles).

The internet challenges privacy with these technologies:

- *Cookies*: Small text files deposited on a computer hard drive when a user visits websites. The site that has cookie can customize its content for each visitor's interests.
- *Web beacons*: Tiny software programs that keep a record of users' online clickstreams that report data back to whomever owns the tracking file, which is invisibly embedded in email messages and web pages to monitor the behavior of the user visiting a website or sending email.
- *Spyware*: Once installed, the spyware calls out to websites to send banner ads and other unsolicited material to the user, and it can report the user's movements on the Internet to other computers.

Consent for information sharing comes in two different models:

- An *opt-out model* of informed consent permits the collection of personal information until the consumer specifically requests the data not to be collected.
- An *opt-in model* of informed consent in which a business is prohibited from collecting any personal information unless the consumer specifically takes action to approve information collection and use.

*Intellectual property* is defined as tangible and intangible products of the mind created by individuals or corporations. Information technology has made it difficult to protect intellectual property because computerized information can be so easily copied or distributed on networks.

Intellectual property is subject to a variety of protections under four legal traditions:

- *Copyright*: Copyright is a statutory grant that protects creators of intellectual property from having their work copied by others for any purpose during the life of the author plus an additional 70 years after the author's death.
- *Patent*: Patent grants the owner an exclusive monopoly on the ideas behind an invention for 20 years. The intent behind patent law was to ensure that inventors of new machines, devices, or methods receive the full financial and other rewards of their labor and yet make widespread use of the invention possible by providing detailed diagrams for those wishing to use the idea under license from the patent's owner.
- *Trademarks*: Trademarks are the marks, symbols, and images used to distinguish products in the marketplace. Trademark laws protect consumers by ensuring they receive what they paid for and the investments that firms have made to bring products to market.

- *Trade Secrets*: Software that contains novel or unique elements, procedures, or compilations can be considered a trade secret. Trade secret law protects the actual ideas in a work product, not only their manifestation.

The *Digital Millennium Copyright Act (DMCA)* provides some copyright protection. The DMCA implemented a World Intellectual Property Organization Treaty that makes it illegal to circumvent technology-based protections of copyrighted materials. Internet service providers (ISPs) are required to take down sites of copyright infringers they are hosting when the ISPs are notified of the problem.

*Cyberbullying* has been defined as intentional harmful behavior carried out by a group or individuals, repeated over time, using modern digital technology to aggress against a victim who is unable to defend himself or herself. The aggressor is more powerful in some way than the target.

# Chapter 13 – Building Information Systems

## *Section 13.1: How does building new systems produce organizational change?*

Building a new information system is one kind of planned organizational change.

The introduction of a new information system involves much more than new hardware and software, like changes in jobs, skills, management, and organization. System builders must understand how a system will affect specific business processes and the organization as a whole.

There are four kinds of structural organizational changes:

- *Automation*: Assisting employees with performing their tasks more efficiently and effectively.
- *Rationalization*: Streamlining of standard operating procedures.
- *Business Process Redesign*: Business processes are analyzed, simplified, and redesigned.
- *Paradigm Shifts*: Rethinking the nature of the business and the nature of the organization.

*Business Process Management (BPM)* provides a variety of tools and methodologies to analyze existing processes, design new processes, and optimize those processes. It requires continual change. Many software firms provide tools for various aspects of BPM, including IBM, Oracle, and TIBCO.

The following are steps of BPM:

- Identify processes for change
- Analyze existing processes
- Design the new process
- Implement the new process
- Continuous measurement

## *Section 13.2: What are the core activities in the systems development process?*

*Systems development* activities go into producing an information system solution to an organizational problem or opportunity are called systems development. These activities consist of systems analysis, systems design, programming, testing, conversion, and production and maintenance.

*Systems analysis* is the analysis of a problem that a firm tries to solve with an information system.

Activities in systems analysis includes:

- *Feasibility study*: Determining whether that solution is feasible, or achievable, from a financial, technical, and organizational standpoint.
- *Information requirements*: Identifying who needs what information, where, when, and how.

*Systems design* is the design of an information system is the overall plan or model for that system, like the blueprint of a building or house.

*Programming* use system specifications that were prepared during the design stage to translate into software program code.

*Testing* must be conducted to ascertain whether the system produces the right results. The systems development team works with users to devise a systematic test plan.

*Test plans* includes all of the preparations for the series of tests.

Testing an information system can be broken down into three types of activities:

- *Unit testing / Program testing*: Testing each program separately in the system to guarantee that programs are error free.
- *System testing*: Testing the functioning of the information system as a whole.
- *Acceptance testing*: Providing the final certification that the system is ready to be used in a production setting.

*Conversion* is the process of changing from the old system to the new system. Moving from an old system to a new one requires that end users be trained to use the new system.

Four main conversion strategies can be employed:

- *Parallel:* Both the old system and its potential replacement are run together for a time until everyone is assured that the new one functions correctly.
- *Direct Cutover:* Replace the old system entirely with the new system on an appointed day.
- *Pilot Study:* Introduce the new system to only a limited area of the organization, such as a single department or operating unit.
- *Phased Approach:* Introduce the new system in stages, either by functions or by organizational units.

*Production and maintenance* is when the system is put into scrutiny. The system will be reviewed by both users and technical specialists to determine how well it has met its original objectives and will be fine-tuned and maintained. In some instances, a formal post-implementation audit document is prepared.

### *Section 13.3: What are the principal methodologies for modeling and designing systems?*

*Structured methodologies* are top-down, step by step methodologies that have been used to document, analyze, and design information systems, modeling data flow through a system.

*Data flow diagram* offers a logical graphic model of information flow, partitioning a system into modules that show manageable levels of detail and breaking down the system into successive levels of details.

Here are the elements of a data flow diagram:

- *The rounded boxes* represent processes.
- *The square box* represents an external entity.
- *The open rectangles* represent data stores.
- *The arrows represent* data flows.

*Structure chart* is a top-down chart, showing each level of design, its relationship to other levels, and its place in the overall design structure.

*Object-oriented development* uses the object as the basic unit of systems analysis and design. The system is modeled as a collection of objects and the relationships among them. Object-oriented development is useful for modeling data whereas structured methods are useful for modeling processes.

Object-oriented development is more iterative and incremental than traditional structured development. It features data encapsulation and inheritance.

*Computer-aided software engineering (CASE)* provides software tools to automate the methodologies to reduce the amount of repetitive work in systems development.

### *Section 13.4: What are alternative methods for building information systems?*

The *traditional systems life cycle* is the oldest method for building information systems. It is still used for building large, complex systems, but can be costly, time-consuming, and inflexible.

*Prototyping* consists of building an experimental system rapidly and inexpensively for end users to evaluate. By interacting with the prototype, users can get a better idea of their information requirements.

The following are steps to prototyping:

- Identify the user's basic requirements.
- Develop an initial prototype.
- Use the prototype.
- Revise and enhance the prototype until user is satisfied.

Today many systems are based on commercially available application software packages or cloud software as a service (SaaS). Many applications are common to all business organizations. For such universal functions, a more generic system will fulfill the requirements of many organizations.

If a firm does not want to use its internal resources to build or operate information systems, it can outsource the work to an external organization that specializes in providing these services. Cloud computing and software as a service (SaaS) providers are one form of outsourcing.

### *Section 13.5: What are new approaches for system building in the digital firm era?*

*Rapid application development (RAD)* refers to the process of creating workable systems in a very short period of time with some flexibility to adapt as a project evolves. RAD includes the use of visual programming and other tools for building graphical user interfaces.

*Joint application design (JAD)* brings end users and information systems specialists together in an interactive session to discuss the system's design, using it to accelerate the generation of information requirements and to develop the initial systems design.

*Agile development* focuses on rapid delivery of working software by breaking a large project into a series of small subprojects that are completed in short periods of time using iteration, continuous feedback, and continual user involvement.

*Development and operations (DevOps)* builds on agile development principles by promoting better and more frequent communication and collaboration between systems development and operations groups.

*Web services* are loosely coupled, reusable software components using Extensible Markup Language (XML) and other open protocols and standards that enable one application to communicate with another with no custom programming required to share data and services.

Today, employees and customers expect, and even demand, to be able to use a mobile device of their choice to obtain information or perform a transaction anywhere and at any time.

The following are types of systems in a mobile platform:

- *Mobile website:* A version of a regular website that is scaled down in content and navigation
- *Mobile web app*: Internet-enabled app with specific functionality for mobile devices accessed via a web browser.
- *A native app*: Standalone application designed to run on a specific platform and device, providing fast performance and a high degree of reliability.

# Chapter 14 – Managing Projects

## *Section 14.1: What are the objectives of project management, and why is it so essential in developing information systems?*

Private sectors projects are underestimated by half in terms of budget and time required to deliver the complete system promised in the system plan.

The consequences of system failure are that they:

- Are not used in the way they were intended or not used at all.
- Fail to capture essential business requirements or improve organizational performance.
- Have poor user interface.
- Contain inaccuracy or inconsistency in data.

A *project* is a planned series of related activities for achieving a specific business objective.

*Project management* refers to the application of knowledge, skills, tools, and techniques to achieve specific targets within specified budget and time constraints.

Project management deals with five variables in IS:

- *Scope* defines what work is or is not included in a project.
- *Time* is the amount of time required to complete the project.
- *Cost* is based on the time to complete a project multiplied by the cost of human resources required to complete the project.
- *Quality* is an indicator of how well the end result of a project satisfies the objectives specified by management.
- *Risk* refers to potential problems that would threaten the success of a project.

## *Section 14.2: What methods can be used for selecting and evaluating information systems projects and aligning them with the firm's business goals?*

The following are hierarchies in management structure in IS projects:

- *Corporate Strategic Planning Group*: Responsible for developing the firm's strategic plan, which may require the development of new systems that can improve one or more key performance indicators.
- *IS Steering Committee*: Senior management group with responsibility for systems development and operation.
- *Project Management Group*: Composed of information systems managers and end-user managers.
- *Project Team*: Directly responsible for an individual systems project.

*Information systems plan* describes how information technology supports the attainment of their business goals and documents all their system applications and IT infrastructure components.

*Portfolio analysis* inventories all of the organization's information systems projects and assets, including infrastructure, outsourcing contracts, and licenses, using them to evaluate alternative projects.

Information intensive industries should have a few high-risk, high-benefit projects to ensure that they stay current with technology. Non–information-intensive industries should focus on high-benefit, low-risk projects. Management can determine the optimal mix of investment risk and reward for their firms.

The following are quadrants of risk versus benefit:

- High-benefit, low-risk systems are most desirable.
- High-benefit, high-risk systems should be examined.
- Low-benefit, high-risk systems should be totally avoided.
- Low-risk systems should be re-examined for the possibility of rebuilding and replacing them with more desirable systems having higher benefits.

A *scoring model* is useful for selecting projects where many criteria must be considered. It assigns weights to various features of a system and then calculates the weighted totals, and many qualitative judgments involved in using the scoring model, requiring experts who understand the issues and the technology.

Scoring models are used most commonly to confirm, to rationalize, and to support decisions rather than as the final arbiters of system selection. It is appropriate to cycle through the scoring model several times, changing the criteria and weights, to see how sensitive the outcome is to reasonable changes in criteria.

### *Section 14.3: How can firms assess the business value of information systems?*

To determine whether an information systems project is a good investment, one must calculate its costs and benefits. Tangible benefits are quantifiable, and intangible benefits that cannot be immediately quantified may provide quantifiable benefits in the future.

*Capital budgeting models* are one of several techniques used to measure the value of investing in long-term capital investment projects. The difference between cash outflows and cash inflows is used for calculating the financial worth of an investment.

The traditional focus on the financial and technical aspects of an information system tends to overlook the social and organizational dimensions of information systems that may affect the true costs and benefits of the investment.

### *Section 14.4: What are the principal risk factors in information systems projects, and how can they be managed?*

The following are dimensions of project risk:

- *Project Size*: Very large-scale systems projects have a failure rate that is 50 to 75 percent higher than that for other projects because such projects are complex and difficult to control.
- *Project Structure*: Some projects are more highly structured than others as their requirements are clear and straightforward, so outputs and processes can be easily defined.
- *Experience with Technology*: The project risk rises if the project team and the information system staff lack the required technical expertise.

The introduction or alteration of an information system has a powerful behavioral and organizational impact.

*Change Management* is managing the impact of organizational change associated with an innovation, such as a new information system.

*Implementation* refers to all organizational activities working toward the adoption, management, and routinization of an innovation, such as a new information system. In the implementation process, the systems analyst is a change agent.

*Change agent* the individual acting as the catalyst during the change process to ensure successful organizational adaptation to a new system or innovation.

User participation in the design and operation of information systems has several positive results; incorporating user knowledge and expertise leads to better solutions. Users and information systems specialists tend to have different backgrounds, interests, and priorities.

*User-designer communications gap* leads to divergent organizational loyalties, approaches to problem solving, and vocabularies. Information systems specialists look for elegant and sophisticated technical solutions, while users prefer systems that are oriented toward solving business problems or facilitating organizational tasks.

*Management backing* makes the change more likely to be perceived positively by both users and the technical information services staff and also ensures that a systems project receives sufficient funding and resources to be successful.

There is a very high failure rate among enterprise application and business process reengineering (BPR) projects, which typically require extensive organizational change.

Projects related to mergers and acquisitions have a similar failure rate. Mergers and acquisitions are deeply affected by the organizational characteristics of the merging companies as well as by their IT infrastructures.

Anticipating potential implementation problems and applying appropriate corrective strategies can increase the chances for system success. Success of projects with challenging and complex technology depends on how well their technical complexity can be managed. Project leaders need both heavy technical and administrative experience and must be able to anticipate problems and develop smooth working relationships among a predominantly technical team.

Large projects benefit from appropriate use of formal planning tools and formal control tools for documenting and monitoring project plans. The two most commonly used methods for documenting project plans are Gantt charts and PERT charts.

The following are formal tools for projects:

- *Formal planning tools*: Project management technique that structures and sequences tasks, budgeting time, money, and technical resources required to complete the tasks.
- *Formal control tools*: Project management technique that helps monitor the progress toward completion of a task and fulfillment of goals

Here are points to note for a *Gantt chart*:

- It lists project activities and their corresponding start and completion dates.
- It visually represents the timing and duration of different tasks in a development project as well as their human resource requirements.
- It shows each task as a horizontal bar with length proportional to the time required to complete it.
- Although they show when project activities begin and end, they don't depict task dependencies, how one task is affected if another is behind schedule, or how tasks should be ordered.

Here are points to note for a *PERT chart*:

- PERT stands for "Program Evaluation and Review Technique"
- It graphically depicts project tasks and their interrelationships.

- It lists the specific activities that make up a project and the activities that must be completed before a specific activity can start.
- It portrays a project as a network diagram consisting of numbered nodes representing project tasks. Each node is numbered and shows the task, and the direction of the arrows on the lines indicates the sequence of tasks.
- PERT charts for complex projects can be difficult to interpret, and project managers often use both techniques.

Projects with relatively little structure and many undefined requirements must involve users fully at all stages; however, participation in implementation activities may not be enough to overcome the problem of user resistance to organizational change.

If the use of a system is voluntary, users may choose to avoid it; if use is mandatory, resistance will take the form of increased error rates, disruptions, turnover, and even sabotage. The implementation strategy must not only encourage user participation and involvement, but it must also address the issue of counter-implementation.

*Counter-implementation* is a deliberate strategy to thwart the implementation of an information system or an innovation in an organization. Strategies to overcome user resistance include user participation, user education and training, management edicts and policies, and better incentives for users who cooperate. The new system can be made more user-friendly by improving the end-user interface.

# Mini Exam 4 Review Summary

## Chapter 11: Managing Knowledge and Information Systems

***Section 11.1: What is the role of knowledge management systems in business?***

Knowledge management has become an important theme at many large business firms as managers realize that much of their firm's value depends on the firm's ability to create and manage knowledge.

There are four dimensions of knowledge:

- *Data*: Flows of events or transactions captured by an organization's systems.
- *Information*: Organized data in categories of understanding.
- *Knowledge*: Patterns, rules, and contexts.
- *Wisdom*: Collective and individual experience of applying knowledge to the solution of problems.

*Knowledge* is thought to be situational and contextual.

There are two types of knowledge in terms of storage:

- *Tacit knowledge*: Knowledge residing in the minds of employees.
- *Explicit knowledge*: Knowledge that has been documented.

*Knowledge management* refers to the set of business processes developed in an organization to create, store, transfer, and apply knowledge.

There are four processes in knowledge management:

- *Acquisition*: Building documents, developing expert networks, analyzing and discovering patterns.
- *Storage*: Digitizing, indexing, and tagging documents according to a coherent framework. Expert systems also help preserve knowledge.
- *Dissemination*: Portals, email, instant messaging, wikis, social business tools, and search engine technology. Training programs, informal networks, and shared management experience.
- *Application*: Having knowledge become a systematic part of management decision making. Creating, based on new knowledge, new business practices, new products and services, and new markets for the firm.

*Communities of practice* (COPs) are informal social networks of professionals and employees within and outside the firm who have similar work-related activities and interests. COPs can make it easier for people to reuse knowledge.

There are three types of knowledge management systems:

- *Enterprise-wide knowledge management systems*: General-purpose firmwide efforts to collect, store, distribute, and apply digital content and knowledge.
- *Knowledge work systems* (KWS): Specialized systems built for engineers, scientists, and other knowledge workers charged with discovering and creating new knowledge for a company
- *"Intelligent" techniques*: Data mining, expert systems, machine learning, neural networks, natural language processing, computer vision systems, robotics, genetic algorithms, and intelligent agents.

***Section 11.2: What are artificial intelligence (AI) and machine learning? How do businesses use AI?***

*Artificial intelligence* programs are like all computer programs: they take data input from the environment, process that data, and produce outputs, differing only in techniques and technologies used.

The major forces driving the rapid evolution of AI are the development of Big Data databases generated by the Internet, e-commerce, the Internet of Things, and social media. Secondary drivers include the drastic reduction in the cost of computer processing and the growth in the power of processors.

There are seven major types of AI techniques, excluding genetic algorithms:

- *Expert systems*: Capturing the knowledge of individual experts in an organization through in-depth interviews and representing that knowledge as sets of rules.
- *Machine Learning*: Finding patterns in data and classifying data inputs into known (and unknown) outputs, beginning with very large data sets and automatically finding patterns and relationships.
    - *Supervised Learning*: The system is "trained" by providing specific examples of desired inputs and outputs identified by humans in advance.
    - *Unsupervised Learning*: The system is asked to process the development database and report whatever patterns it finds.
- *Neural networks*: Performing the input and output function of neurons, the system finds patterns and relationships in very large amounts of data while systematically altering the strength of the connections among the neurons to produce the final desired output. The data set is divided into two segments: a training data set, and a test data set.
- *Natural language processing* (NLP): Understanding and analyzing natural language based on machine learning and deep learning.
- *Computer vision systems*: Emulating the human visual system to view and extract information from real-world images. Such systems incorporate image processing, pattern recognition, and image understanding.
- *Robotics*: Deals with the design, construction, operation, and use of movable machines that can substitute for humans along with computer systems for their control, sensory feedback, and information processing.
- *Intelligent agents*: Software programs that work in the background without direct human intervention to carry out specific tasks for an individual user, business process, or software application.

***Section 11.3: What types of systems are used for enterprise-wide knowledge management, and how do they provide value for businesses?***

There are two types of knowledge in terms of structure:

- *Structured knowledge*: Explicit knowledge that exists in formal documents as well as in formal rules that organizations derive by observing experts and their decision-making behaviors.
- *Unstructured knowledge*: Information in folders, messages, memos, proposals, emails, graphics, electronic slide presentations, and even videos created in different formats and stored in many locations.

*Enterprise content management* (ECM) systems help organizations manage both types of information. They have capabilities for knowledge capture, storage, retrieval, distribution, and preservation to help firms improve their business processes and decisions.

Major enterprise content management systems also enable users to access external sources of information, and have capabilities for tagging, interfacing with corporate databases and content repositories, and creating enterprise knowledge portals that provide a single point of access to information resources.

Contemporary enterprise content management systems, along with the systems for collaboration and social business, have capabilities for locating experts and tapping their knowledge.

For knowledge resources outside the firm, social networking and social business tools enable users to bookmark web pages of interest, tag these bookmarks with keywords, and share the tags and web page links with other people.

A *learning management system* (LMS) provides tools for the management, delivery, tracking, and assessment of various types of employee learning and training.

A *massive open online course* (MOOC) is an online course made available via the web to very large numbers of participants.

***Section 11.4: What are the major types of knowledge work systems, and how do they provide value for them?***

*Knowledge workers* include researchers, designers, architects, scientists, and engineers who primarily create knowledge and information for the organization.

Knowledge workers perform three key roles:

- Keeping the organization current in knowledge as it develops in the external world.
- Serving as internal consultants regarding the areas of their knowledge.
- Acting as change agents, evaluating, initiating, and promoting change projects.

Knowledge workers require highly specialized knowledge work systems with powerful graphics, analytical tools, and communications and document management capabilities.

Three examples can be given for knowledge work systems:

- *Computer-aided design* (CAD) automates the creation and revision of designs, using computers and sophisticated graphics software.
- *3-D printing*, also known as additive manufacturing, which uses machines to make solid objects, layer by layer, from specifications in a digital file like from CAD systems.
- *Virtual reality* (VR) systems have visualization, rendering, and simulation capabilities that go far beyond those of conventional CAD systems. They use interactive graphics software to create computer-generated simulations. The users usually don clothing that contains sensors that record the user's movements.

## Chapter 8: Securing Information Systems

***Section 8.1: Why are information systems vulnerable to destruction, error, and abuse?***

*Security* refers to the policies, procedures, and technical measures used to prevent unauthorized access, alteration, theft, or physical damage to information systems.

*Controls* are methods, policies, and organizational procedures that ensure the safety of the organization's assets, the accuracy and reliability of its records, and operational adherence to management standards.

Most common threats against contemporary information systems can stem from technical, organizational, and environmental factors compounded by poor management decisions.

Domestic or offshore partnering with another company contributes to system vulnerability if valuable information resides on networks and computers outside the organization's control.

When the Internet links to the corporate network, the organization's information systems are even more vulnerable to actions from outsider. Vulnerability has also increased from widespread use of email, instant messaging (IM), and peer-to-peer (P2P) file-sharing programs.

Both Bluetooth and Wi-Fi networks are susceptible to hacking by eavesdroppers.

*War Driving* is when eavesdroppers drive by buildings or park outside and try to intercept wireless network traffic. Wireless networks in many locations do not have basic protections against war driving.

The following are malicious software:

- *Computer virus:* A rogue software program that attaches itself to other software programs or data files to be executed, usually without user knowledge or permission. Viruses typically spread when humans take an action
- *Worms*: Independent computer programs that copy themselves from one computer to other computers over a network.
- *Trojan Horse*: A software program that appears to be benign but then does something other than expected. It does not replicate but is often a way for viruses or other malicious code to be introduced into a computer system.
- *SQL Injection Attacks*: Exploit vulnerabilities in poorly coded web application software which fails to validate properly to introduce malicious program code into a company's systems and networks.
- *Ransomware*: Tries to extort money from users by taking control of their computers, blocking access to files, or displaying annoying pop-up messages.
- *Spyware:* Small programs install themselves secretly on computers to monitor user web-surfing activity and serve up advertising.

*Drive-by downloads* are malware that comes with a downloaded file.

According to IT security experts, mobile devices now pose the greatest security risks, outpacing those from larger computers. The *Internet of Things* (IoT) introduces additional security challenges, and new security tools will be required to protect IoT devices and platforms.

A *hacker* is an individual who intends to gain unauthorized access to a computer system by finding weakness in security protections.

*Cybervandalism* is the intentional disruption, defacement, or even destruction of a website or corporate information system.

*Computer crime* is defined as any violations of criminal law that involve a knowledge of computer technology for their perpetration, investigation, or prosecution.

The following are computer crimes:

- *Spoofing*: Involves redirecting a web link to an address different from the intended one, with the site masquerading as the intended destination.
- *Sniffing*: Monitors information traveling over a network.
- *Denial-of-Service* (DoS): Hackers flood a network server or web server with many thousands of false communications or requests for services to crash the network.
- *Distributed Denial-of-Service* (DDoS): A DoS attack which uses numerous computers to overwhelm the network from numerous launch points.
- *Identity theft*: A crime in which an imposter obtains key pieces of personal information to impersonate someone else.
- *Phishing*: Involves setting up fake websites or sending email messages that look like those of legitimate businesses to ask users for confidential personal data.
- *Spear Phishing*: Phishing where messages appear to come from a trusted source, such as an individual within the recipient's own company or a friend.
- *Evil twins:* Wireless networks that pretend to offer trustworthy Wi-Fi connections to the Internet. Fraudsters try to capture passwords or credit card numbers of users who log on to the network.
- *Pharming*: Redirects users to a bogus web page, even when the individual types of the correct web page address into his or her browser. This is possible if pharming perpetrators gain access to Internet Service Providers (ISPs).
- *Click fraud*: Occurs when an individual or computer program fraudulently clicks an online ad without any intention of learning more about the advertiser or making a purchase.

*Social engineering* is when malicious intruders seeking system access sometimes trick employees into revealing their passwords by pretending to be legitimate members of the company in need of information.

Growing complexity and size of software programs, coupled with demands for rapid delivery to markets, have contributed to an increase in software flaws or vulnerabilities.

*Zero-day vulnerabilities* are holes in the software unknown to its creator; it is called zero-day because the author of the software has zero days after learning about it to patch the code before it can be exploited in an attack.

*Patch management* is when users of the software to track these vulnerabilities, test, and apply all patches.

***Section 8.2: What is the business value of security and control?***

Lack of sound security and control can cause firms relying on computer systems for their core business functions to lose sales and productivity.

Laws, such as HIPAA, the Sarbanes-Oxley Act, and the GrammLeach-Bliley Act, require companies to practice stringent electronic records management and adhere to strict standards for security, privacy, and control.

*Computer forensics* is the scientific collection, examination, authentication, preservation, and analysis of data held on or retrieved from computer storage media in such a way that the information can be used as evidence in a court of law.

***Section 8.3: What are the components of an organizational framework for security and control?***

Information systems controls are both manual and automated and consist of general and application controls. It should consider not only how the system will perform under all possible conditions but also the behavior of organizations and people using the system.

*General controls* govern the design, security, and use of computer programs and the security of data files in general throughout the organization's information technology infrastructure. They apply to all computerized applications and consist of a combination of hardware, software, and manual procedures that create an overall control environment.

*Specific controls* are unique to each computerized application, such as payroll or order processing. They can be classified as input, processing, or output control.

A *risk assessment* determines the level of risk to the firm if a specific activity or process is not properly controlled.

A *security policy* consists of statements ranking information risks, identifying acceptable security goals, and identifying the mechanisms for achieving these goals. The security policy drives other policies determining acceptable use of the firm's information resources.

*Acceptable use policy* (AUP) defines acceptable uses of the firm's information resources and computing equipment, including desktop and laptop computers, mobile devices, telephones, and the Internet. A good AUP defines unacceptable and acceptable actions for every user and specifies consequences for noncompliance.

*Disaster recovery planning* devises plans for the restoration of disrupted computing and communications services.

*Business continuity planning* focuses on how the company can restore business operations after a disaster strikes. The business continuity plan identifies critical business processes and determines action plans for handling mission-critical functions.

*Information systems audit* examines the firm's overall security environment as well as controls governing individual information systems. The auditor should trace the flow of sample transactions through the system and perform tests, using, if appropriate, automated audit software.

***Section 8.4: What are the most important tools and technologies for safeguarding information resources?***

*Identity management* software automates the process of keeping track of all these users and their system privileges, assigning each user a unique digital identity for accessing each system.

*Authentication* refers to the ability to know that a person is who he or she claims to be and is often established by using passwords known only to authorized users.

The following are new authentication technologies:

- *Token*: A physical device, similar to an identification card, that is designed to prove the identity of a single user.
- *Smart card*: A device about the size of a credit card that contains a chip formatted with access permission and other data.
- *Biometric authentication:* **U**ses systems that read and interpret individual human traits, such as fingerprints, irises, and voices to grant or deny access.
- *Two-factor authentication:* Increases security by validating users through a multistep process in which to be authenticated, a user must provide two means of identification, one of which is typically a physical token, and the other of which is typically data, such as a password or PIN.

A *firewall* controls the flow of incoming and outgoing network traffic and generally placed between the organization's private internal networks and distrusted external networks. Techniques include static packet filtering, stateful inspection, Network Address Translation, and application proxy filtering.

*Intrusion detection systems* feature full-time monitoring tools placed at the most vulnerable points or hot spots of corporate networks to detect and deter intruders continually.

*Anti-malware software* prevents, detects, and removes malware, including computer viruses, computer worms, Trojan horses, spyware, and adware.

*Unified threat management* (UTM) systems are comprehensive security management products to help businesses reduce costs and improve manageability.

*Encryption* is the process of transforming plain text or data into cipher text that cannot be read by anyone other than the sender and the intended receiver.

*Secure Sockets Layer* (SSL) and its successor, *Transport Layer Security* (TLS), enable client and server computers to manage encryption and decryption activities as they communicate with each other during a secure web session.

*Secure Hypertext Transfer Protocol* (S-HTTP) is another protocol used for encrypting data flowing over the Internet, but it is limited to individual messages.

The problem with all symmetric encryption schemes is that the key itself must be shared somehow among the senders and receivers. A more secure form of encryption called *public key encryption* uses two keys: one shared (or public) and one totally private.

*Digital certificates* are data files used to establish the identity of users and electronic assets for protection of online transactions and uses a trusted third party, known as a *certificate authority* (CA), to validate a user's identity.

*Public key infrastructure* (PKI) is the use of public key cryptography working with a certificate authority.

A *blockchain* is a chain of digital "blocks" that contain records of transactions.  Each block is connected to all the blocks before and after it, and the blockchains are continually updated and kept in sync. Blockchains aren't contained in a central location, they don't have a single point of failure and cannot be changed from a single computer.