Pokok Bahasan:
   A Framework for Systems Analysis and Design

Tujuan Instruksional Khusus:
   Learn step by step building system analysis and design

Referensi:
A transaction processing system (TPS) is an information system that captures and processes data about business transactions.

A management information system (MIS) is an information system that provides for management-oriented reporting based on transaction processing and operations of the organization.

A decision support system (DSS) is an information system that either helps to identify decision making opportunities or provides information to help make decisions.
Object Technologies

Object technology – a software technology that defines a system in terms of objects that consolidate data and behavior (into objects).

– Objects are reusable
– Objects are extensible
– Object-oriented programming languages include C++, java, Smalltalk, and Visual Basic.net

Object-oriented analysis and design – a collection of tools and techniques for systems development that will utilize object technologies to construct a system and its software.

Agile development – a system development strategy in which system developers are given the flexibility to select from a variety of tools and techniques to best accomplish the tasks at hand.
System Development Process Overview

**System initiation** – the initial planning for a project to define initial business scope, goals, schedule, and budget.

**System analysis** – the study of a business problem domain to recommend improvements and specify the business requirements and priorities for the solution.

**System design** – the specification or construction of a technical, computer-based solution for the business requirements identified in a system analysis.

**System implementation** – the construction, installation, testing, and delivery of a system into production.
Project and Process Management

**Project management** – the activity of defining, planning, directing, monitoring, and controlling a project to develop an acceptable system within the allotted time and budget.

**Process management** – the ongoing activity that defines, improves, and coordinates the use of an organization’s chosen methodology (the “process”) and standards for all system development projects.
Life Cycle versus Methodology

• **System life cycle** – the factoring of the lifetime of an information system into two stages, (1) systems development and (2) systems operation and maintenance.

• **System development methodology** – a standardized development process that defines (as in CMM Level 3) a set of activities, methods, best practices, deliverables, and automated tools that system developers and project managers are to use to develop and continuously improve information systems and software.
A System Life Cycle

Conversion

LIFE CYCLE STAGE
A System Development Process
Ideally using a System Development Methodology

Lifetime of a System

Obsolescence

LIFE CYCLE STAGE
System Operation and Maintenance
Using the system's chosen information technology

The “Systems Development Process” and various System Development Methodologies are the focus of this chapter and textbook.
Principles of System Development

- Get the system users involved.
- Use a problem-solving approach.
- Establish phases and activities.
- Document through development.
- Establish standards.
- Manage the process and projects.
- Justify systems as capital investments.
- Don’t be afraid to cancel or revise scope.
- Divide and conquer.
- Design systems for growth and change.
Use a Problem-Solving Approach

Classical Problem-solving approach

1. Study and understand the problem, its context, and its impact.

2. Define the requirements that must be meet by any solution.

3. Identify candidate solutions that fulfill the requirements, and select the “best” solution.

4. Design and/or implement the chosen solution.

5. Observe and evaluate the solution’s impact, and refine the solution accordingly.
Establish Phases and Activities
Overlap of System Development Phases

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Scope Definition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Problem Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Requirements Definition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Logical Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Decision Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Physical Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Construction &amp; Testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Installation &amp; Delivery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Process Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Manage the Process and Projects

**Process management** – an ongoing activity that documents, manages, oversees the use of, and improves an organization’s chosen methodology (the “process”) for system development. Process management is concerned with phases, activities, deliverables, and quality standards should be consistently applied to all projects.

**Project management** is the process of scoping, planning, staffing, organizing, directing, and controlling a project to develop an information system at a minimum cost, within a specified time frame, and with acceptable quality.
Justify Information Systems as Capital Investments

Cost-effectiveness – The result obtained by striking a balance between the lifetime costs of developing, maintaining, and operating an information system and the benefits derived from that system. Cost-effectiveness is measured by a cost-benefit analysis.

Strategic information systems plan – a formal strategic plan (3-5 years) for building and improving an information technology infrastructure and the information system applications that use that infrastructure.

Strategic enterprise plan – a formal strategic plan (3-5 years) for an entire business that defines its mission, vision, goals, strategies, benchmarks, and measures of progress and achievement. Usually, the strategic enterprise plan is complemented by strategic business unit plans that define how each business unit will contribute to the enterprise plan. The information systems plan is one of those unit-level plans.
Don’t Be Afraid to Cancel or Revise Scope

Creeping commitment – a strategy in which feasibility and risks are continuously reevaluated throughout a project. Project budgets and deadlines are adjusted accordingly.

Risk management – the process of identifying, evaluating, and controlling what might go wrong in a project before it becomes a threat to the successful completion of the project or implementation of the information system. Risk management is drive by risk analysis or assessment.
The PIECES Problem-Solving Framework

P  the need to improve performance
I  the need to improve information (and data)
E  the need to improve economics, control costs, or increase profits
C  the need to improve control or security
E  the need to improve efficiency of people and processes
S  the need to improve service to customers, suppliers, partners, employees, etc.
Scope Definition

Problem statement – a statement and categorization of problems, opportunities, and directives; may also include constraints and an initial vision for the solution. Synonyms include preliminary study and feasibility assessment.

Constraint – any factor, limitation, or restraint that may limit a solution or the problem-solving process.

Scope creep – a common phenomenon wherein the requirements and expectations of a project increase, often without regard to the impact on budget and schedule.

Statement of work – a contract with management and the user community to develop or enhance an information system; defines vision, scope, constraints, high-level user requirements, schedule, and budget. Synonyms include project charter, project plan, and service-level agreement.
Logical Design

Logical design – the translation of business user requirements into a system model that depicts only the business requirements and not any possible technical design or implementation of those requirements. Common synonyms include conceptual design and essential design.

System model – a picture of a system that represents reality or a desired reality. System models facilitate improved communication between system users, system analysts, system designers, and system builders.

Analysis paralysis – a satirical term coined to describe a common project condition in which excessive system modeling dramatically slows progress toward implementation of the intended system solution.
Decision Analysis

- Candidate solutions evaluated in terms of:
  - Technical feasibility – Is the solution technically practical? Does our staff have the technical expertise to design and build this solution?
  - Operational feasibility – Will the solution fulfill the users’ requirements? To what degree? How will the solution change the users’ work environment? How do users feel about such a solution?
  - Economic feasibility – Is the solution cost-effective?
  - Schedule feasibility – Can the solution be designed and implemented within an acceptable time?
  - Risk feasibility – What is the probability of a successful implementation using the technology and approach?
Physical Design & Integration

Physical design – the translation of business user requirements into a system model that depicts a technical implementation of the users’ business requirements. Common synonyms include technical design or implementation model.

Two extreme philosophies of physical design

- *Design by specification* – physical system models and detailed specification are produced as a series of written (or computer-generated) blueprints for construction.

- *Design by prototyping* – Incomplete but functioning applications or subsystems (called prototypes) are constructed and refined based on feedback from users and other designers.
System Operation & Maintenance

System support – the ongoing technical support for users of a system, as well as the maintenance required to deal with any errors, omissions, or new requirements that may arise.
Cross Life-Cycle Activities

Cross life-cycle activity – any activity that overlaps many or all phases of the systems development process.

– Fact-finding
  • Fact-finding - the formal process of using research, interviews, meetings, questionnaires, sampling, and other techniques to collect information about system problems, requirements, and preferences.

– Documentation and presentation
  • Documentation – the ongoing activity of recording facts and specifications for a systems for current and future reference.
  • Presentation – the ongoing activity of communicating findings, recommendations, and documentation for review by interested users and managers.
  • Repository – a database and/or file directory where system developers store all documentation, knowledge, and artifacts for one or more information systems or projects.

– Feasibility analysis
– Process and project management
System Development
A Taxonomy for System Development Methodologies &
Model-Driven Development Strategy

• **Model-driven development** – a system development strategy that emphasizes the drawing of system models to help visualize and analyze problems, define business requirements, and design information systems.

  – **Process modeling** – a process-centered technique popularized by the structured analysis and design methodology that used models of business process requirements to derive effective software designs for a system.

  – **Data modeling** – a data-centered technique used to model business data requirements and design database systems that fulfill those requirements.

  – **Object modeling** – a technique that attempts to merge the data and process concerns into singular constructs called objects. Object models are diagrams that document a system in terms of its objects and their interactions.
Model-Driven Development Strategy
Rapid Application Development Strategy

• Rapid application development (RAD) – a system development strategy that emphasizes speed of development through extensive user involvement in the rapid, iterative, and incremental construction of series of functioning prototypes of a system that eventually evolves into the final system.

Prototype – a small-scale, representative, or working model of the users’ requirements or a proposed design for an information system.

Time box – the imposition of a nonextendable period of time, usually 60-90 days, by which the first (or next) version of a system must be delivered into operation.
Rapid Application Development Strategy

START: Problems, Opportunities, and Directives

SCOPE DEFINITION

PROBLEM ANALYSIS + REQUIREMENTS ANALYSIS + DECISION ANALYSIS

1. Initial System Improvement Objectives
   - Initial Business Requirements Statement
   - Initial System Proposal
   - Initial Architectural Architecture

4 + 6 (from Figure 3.5)...

7. Refined System Improvement Objectives and/or Business Requirements

3 + 4 + 5 (from Figure 3.5)...

some more REQTS. & DECISION ANALYSIS

Repository of System Knowledge

NEW

REVIEW THE SYSTEM

Candidate Release Version of the Functional System

DELIVERY of a version
Commercial Application Package
Implementation Strategy

- Commercial application package – a software application that can be purchased and customized to meet the business requirements of a large number of organizations or a specific industry. A synonym is commercial off-the-shelf (COTS) system.

  - Request for proposal (RFP) – a formal document that communicates business, technical, and support requirements for an application software package to vendors that may wish to compete for the sale of that application package and services.

  - Request for quotation (RFQ) – a formal document that communicates business, technical, and support requirements for an application software package to a single vendor that has been determined as being able to supply that application package and services.

  - Gap analysis – a comparison of business and technical requirements for a commercial application package against the capabilities and features of a specific commercial application package for the purpose of defining the requirements that cannot be met.
Commercial Application
A System Maintenance Perspective

1. START: Feedback
2. Life Cycle Stage
3. Operational System
4. Post-Audit Review
5. Training Materials
6. Functional System
7. Physical Design Specifications
8. Physical Design & Integration
9. Design Prototypes
10. System Proposal
11. Application Architecture
12. Decision Analysis
13. Design Flaw or Business Process Issue
14. New Business Requirements
15. New Technical Requirements
16. Software “Bug”
17. System Change Request
18. Statement of Work
19. System Improvement Objectives
20. Business Requirements Statement
21. System Maintenance Perspective

KWIK KIAN GIE
SCHOOL OF BUSINESS
Systems Development Life Cycle

• System Development Methodology
  – Standard process followed in an organization
  – Consists of:
    • Analysis
    • Design
    • Implementation
    • Maintenance
Systems Development Life Cycle

• Series of steps used to manage the phases of development for an information system

• Consists of six phases:
  – Project Identification and Selection
  – Project Initiation and Planning
  – Analysis
  – Design
  – Implementation
  – Maintenance
Systems Development Life Cycle

– Phases are not necessarily sequential
– Each phase has a specific outcome and deliverable
– Individual companies use customized life cycles
Phases of the Systems Development Life Cycle

• Project Identification and Selection
  – Two Main Activities
    • Identification of need
    • Prioritization and translation of need into a development schedule
  – Helps organization to determine whether or not resources should be dedicated to a project.

• Project Initiation and Planning
  – Two Activities
    • Formal preliminary investigation of the problem at hand
    • Presentation of reasons why system should or should not be developed by the organization
Systems Development Life Cycle

• Analysis
  – Study of current procedures and information systems
    • Determine requirements
      – Study current system
      – Structure requirements and eliminate redundancies
    • Generate alternative designs
    • Compare alternatives
    • Recommend best alternative
Systems Development Life Cycle

• Design
  – Logical Design
    • Concentrates on business aspects of the system
  – Physical Design
    • Technical specifications

• Implementation
  – Implementation
    • Hardware and software installation
    • Programming
    • User Training
    • Documentation
Systems Development Life Cycle

• Maintenance
  • System changed to reflect changing conditions
  • System obsolescence
Approaches to Development

- Prototyping
  - Building a scaled-down working version of the system
  - Advantages:
    - Users are involved in design
    - Captures requirements in concrete form

- Rapid Application Development (RAD)
  - Utilizes prototyping to delay producing system design until after user requirements are clear
Approaches to Development

• Joint Application Design (JAD)
  – Users, Managers and Analysts work together for several days
  – System requirements are reviewed
  – Structured meetings
Improving IS Development Productivity

• Computer-aided software engineering (CASE) tools
  – Facilitate creation of a central repository for system descriptions and specifications
Summary

• Information systems analysis and design
  – Process of developing and maintaining an information system

• Modern approach to systems analysis
  – Process-Oriented
  – Data-Oriented
Summary

• Four types of information systems
  – Transaction Processing (TPS)
  – Management Information Systems (MIS)
  – Decision Support (DSS)
  – Expert Systems (ES)
Summary

• Systems Development Life Cycle (SDLC)
  – Project Identification and Selection
  – Project Initiation and Planning
  – Analysis
  – Design
  – Implementation
  – Maintenance
Summary

• Alternatives to Systems Development Life Cycle
  – Prototyping
  – Rapid Application Development (RAD)
  – Joint Application Design (JAD)

• Computer-aided software engineering (CASE) tools