Principles and Learning Objectives

• Effective systems development requires a team effort of stakeholders, users, managers, systems development specialists, and various support personnel, and it starts with careful planning
  – Identify the key participants in the systems development process and discuss their roles
  – Define the term information systems planning and discuss the importance of planning a project
Principles and Learning Objectives (continued)

• Systems development often uses different approaches and tools such as traditional development, prototyping, rapid application development, end-user development, computer-aided software engineering, and object-oriented development to select, implement, and monitor projects
  – Discuss the key features, advantages, and disadvantages of the traditional, prototyping, rapid application development, and end-user systems development life cycles
Principles and Learning Objectives (continued)

– Discuss the use of computer-aided software engineering (CASE) tools and the object-oriented approach to systems development

• Systems development starts with investigation and analysis of existing systems
  – State the purpose of systems investigation
  – Discuss the importance of performance and cost objectives
  – State the purpose of systems analysis and discuss some of the tools and techniques used in this phase of systems development
Principles and Learning Objectives (continued)

• Designing new systems or modifying existing ones should always be aimed at helping an organization achieve its goals
  – State the purpose of systems design and discuss the differences between logical and physical systems design
  – Discuss the use of environmental design in the systems development process
Principles and Learning Objectives (continued)

• The primary emphasis of systems implementation is to make sure that the right information is delivered to the right person in the right format at the right time
  – State the purpose of systems implementation and discuss the various activities associated with this phase of systems development
Principles and Learning Objectives (continued)

- Maintenance and review add to the useful life of a system but can consume large amounts of resources, so they benefit from the same rigorous methods and project management techniques applied to systems development
  - State the importance of systems and software maintenance and discuss the activities involved
  - Describe the systems review process
Why Learn About Systems Development?

• In this chapter:
  – You will see how you can initiate the systems development process and analyze your needs with the help of IS personnel
  – You will learn how your project can be planned, aligned with corporate goals, and rapidly developed
An Overview of Systems Development

• In today’s businesses:
  – Managers and employees in all functional areas work together and use business information systems

• This chapter will:
  – Provide you with a deeper appreciation of the systems development process for individuals and organizations
Participants in Systems Development

• Development team:
  – Determines objectives of the information system
  – Delivers system that meets objectives

• Project:
  – Planned collection of activities that achieves a goal

• Stakeholders:
  – People who ultimately benefit from project
Participants in Systems Development (continued)

• Users:
  – People who will interact with the system regularly

• Systems analyst:
  – Professional who specializes in analyzing and designing business systems

• Programmer:
  – Responsible for modifying or developing programs to satisfy user requirements
Figure 8.1

Role of the Systems Analyst

The systems analyst plays an important role in the development team and is often the only person who sees the system in its totality. The one-way arrows in this figure do not mean that there is no direct communication between other team members. These arrows just indicate the pivotal role of the systems analyst—a person who is often called on to be a facilitator, moderator, negotiator, and interpreter for development activities.
Individual Systems Developers and Users

- Individual systems developer:
  - Person who performs all of the systems development roles

- Individual users:
  - Acquire applications for both personal and professional use

- End-user systems development:
  - Describes any systems development project in which business managers and users assume the primary effort
Information Systems Planning and Aligning Corporate and IS Goals

• Information systems planning:
  – Translating strategic and organizational goals into systems development initiatives

• Aligning organizational goals and IS goals:
  – Critical for successful systems development effort
Information Systems Planning and Aligning Corporate and IS Goals (continued)

Figure 8.2
Information Systems Planning
Information systems planning transforms organizational goals outlined in the strategic plan into specific systems development activities.
Systems Development Life Cycles

• The life of the system continues as it is maintained and reviewed

• A new project will be initiated and the cycle will start over:
  – If the system needs significant improvement beyond the scope of maintenance
  – If it needs to be replaced because of a new generation of technology, or
  – If the IS needs of the organization change significantly
The Traditional Systems Development Life Cycle

• Systems investigation:
  – Identifies problems and opportunities and considers them in light of business goals

• Systems analysis:
  – Studies existing systems and work processes to identify strengths, weaknesses, and opportunities for improvement

• Systems design:
  – Defines how the information system will do what it must do to obtain the problem’s solution
The Traditional Systems Development Life Cycle (continued)

• Systems implementation:
  – Creates or acquires various system components detailed in systems design, assembles them, and places new or modified system into operation

• Systems maintenance and review:
  – Ensures the system operates as intended
  – Modifies the system so that it continues to meet changing business needs
Figure 8.3
The Traditional Systems Development Life Cycle

Sometimes, information learned in a particular phase requires cycling back to a previous phase.
Prototyping

- An iterative approach
- During each iteration:
  - Requirements and alternative solutions to the problem are identified and analyzed
  - New solutions are designed, and a portion of the system is implemented
Figure 8.4

Prototyping

Prototyping is an iterative approach to systems development.
Refining during Prototyping

Each generation of prototype is a refinement of the previous generation based on user feedback.
Rapid Application Development, Agile Development, and Other Systems Development Approaches

• Rapid application development (RAD):
  – Employs tools, techniques, and methodologies designed to speed application development

• Other approaches to rapid development:
  – Agile development
  – Extreme programming (XP)
Outsourcing and On-Demand Computing

• Reasons for using outsourcing and on-demand computing approaches:
  – To reduce costs
  – To obtain state-of-the-art technology
  – To eliminate staffing and personnel problems
  – To increases technological flexibility
Factors Affecting Systems Development Success

• Successful systems development:
  – Delivers a system that meets user and organizational needs on time and within budget

• Critical for most systems development projects:
  – Getting users and stakeholders involved
Degree of Change

- Continuous improvement projects versus reengineering:
  - Continuous improvement projects have a high degree of success
  - Reengineering projects tend to have a high degree of risk but also a high potential for benefits

- Managing change:
  - Essential to recognize and deal with existing or potential problems
The Importance of Planning

• The bigger the project:
  – The more likely that poor planning will lead to significant problems

• Important factor for systems development success:
  – Organizational experience with the systems development process
Use of Project Management Tools

• Project schedule:
  – Detailed description of what is to be done
• Project milestone:
  – Critical date for completion of a major part of the project
• Project deadline:
  – Date that the entire project is to be completed and operational
• Critical path:
  – Activities that, if delayed, would delay the entire project
Use of Project Management Tools (continued)

- Program Evaluation and Review Technique (PERT)
  - Creates three time estimates for an activity
    - Shortest possible time
    - Most likely time
    - Longest possible time

- Gantt chart
  - Graphical tool used for planning, monitoring, and coordinating projects
Use of Computer-Aided Software Engineering (CASE) Tools

• CASE tools
  – Automate many tasks required in a systems development effort
  – Encourage adherence to SDLC

• Upper-CASE tools
  – CASE tools that focus on activities associated with the early stages of systems development
Object-Oriented Systems Development

- Combines logic of systems development life cycle with power of object-oriented modeling and programming
- OOSD tasks
  - Identifying potential problems and opportunities that would be appropriate for OO approach
  - Defining what kind of system users require
Object-Oriented Systems Development (continued)

• OOSD tasks (continued):
  – Designing the system
  – Programming or modifying modules
  – Evaluation by users
  – Periodic review and modification
Systems Investigation

- What primary problems might a new or enhanced system solve?
- What opportunities might a new or enhanced system provide?
- What new hardware, software, databases, telecommunications, personnel, or procedures will improve an existing system or are required in a new system?
- What are the potential costs (variable and fixed)?
- What are the associated risks?
Initiating Systems Investigation

- Systems request form:
  - Filled out by someone who wants IS department to initiate systems investigation
  - Information included:
    - Problems in or opportunities for system
    - Objectives of systems investigation
    - Overview of proposed system
    - Expected costs and benefits of proposed system
Feasibility Analysis

• Assesses:
  – Technical feasibility
  – Economic feasibility
  – Legal feasibility
  – Operational feasibility
  – Schedule feasibility
Figure 8.9
Technical, Economic, Legal, Operational, and Schedule Feasibility
Object-Oriented Systems Investigation

• Object-oriented approach
  – Can be used during all phases of systems development

• Use case diagram
  – Part of the Unified Modeling Language (UML) that is used in object-oriented systems development
Figure 8.10
Use Case Diagram for a Kayak Rental Application
The Systems Investigation Report

- Summarizes results of systems investigation
- Summarizes the process of feasibility analysis
- Recommends a course of action:
  - Continue on into systems analysis
  - Modify the project in some manner
  - Drop the project
- Reviewed by steering committee
CONTENTS

EXECUTIVE SUMMARY
REVIEW of GOALS and OBJECTIVES
SYSTEM PROBLEMS and OPPORTUNITIES
PROJECT FEASIBILITY
PROJECT COSTS
PROJECT BENEFITS
RECOMMENDATIONS

Figure 8.11
A Typical Table of Contents for a Systems Investigation Report
Systems Analysis

• Overall emphasis of analysis:
  – Gathering data on existing system
  – Determining requirements for new system
  – Considering alternatives
  – Investigating feasibility of solutions

• Primary outcome of systems analysis:
  – Prioritized list of systems requirements
Data Collection

• Identifying sources of data:
  – Internal and external sources

• Collecting data:
  – Interviews
  – Direct observation
  – Questionnaires
<table>
<thead>
<tr>
<th>Internal Sources</th>
<th>External Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users, stakeholders, and managers</td>
<td>Customers</td>
</tr>
<tr>
<td>Organization charts</td>
<td>Suppliers</td>
</tr>
<tr>
<td>Forms and documents</td>
<td>Stockholders</td>
</tr>
<tr>
<td>Procedure manuals and policies</td>
<td>Government agencies</td>
</tr>
<tr>
<td>Financial reports</td>
<td>Competitors</td>
</tr>
<tr>
<td>IS manuals</td>
<td>Outside groups</td>
</tr>
<tr>
<td>Other measures of business process</td>
<td>Journals, etc.</td>
</tr>
<tr>
<td></td>
<td>Consultants</td>
</tr>
</tbody>
</table>
Figure 8.13
The Steps in Data Collection

1. Identify data sources
2. Data collection
3. Follow-up and clarification
Data Analysis

• Data modeling:
  – Accomplished through the use of entity-relationship (ER) diagram

• Activity modeling:
  – Accomplished through the use of data-flow diagrams
  – DFDs:
    • Describe the activities that fulfill a business relationship or accomplish a business task
Requirements Analysis

• Purpose is to determine user, stakeholder, and organizational needs
• Techniques used to capture systems requirements:
  – Asking directly
  – Critical success factors (CSFs)
  – The IS plan
  – Requirements analysis tools
Requirements Analysis (continued)

Figure 8.15

Converting Organizational Goals into Systems Requirements
Object-Oriented Systems Analysis

- Identify problems or potential opportunities
- Identify key participants and collect data
- With the OO approach, a class is used to describe different types of objects
Figure 8.16
Generalization/Specialization Hierarchy Diagram for Single and Tandem Kayak Classes
The Systems Analysis Report

• Elements:
  – Strengths and weaknesses of existing system from a stakeholder’s perspective
  – User/stakeholder requirements for new system
  – Organizational requirements for new system
  – Description of what new information system should do to solve the problem
CONTENTS

BACKGROUND INFORMATION
PROBLEM or NEED STATEMENT
DATA COLLECTION
DATA and REQUIREMENTS ANALYSIS
RECOMMENDATIONS
APPENDIXES of DOCUMENTS, TABLES, and CHARTS
GLOSSARY of TERMS

Figure 8.17
A Typical Table of Contents for a Report on an Existing System
Systems Design

• Answers the question:
  – How will the information system solve a problem?

• Results in a technical design that:
  – Details system outputs, inputs, and user interfaces
  – Specifies hardware, software, databases, telecommunications, personnel, and procedures
  – Shows how these components are related
Logical and Physical Design

• Logical design:
  – Describes functional requirements of a system

• Physical design:
  – Specifies the characteristics of the system components necessary to put the logical design into action
Object-Oriented Design

• Using the OO approach:
  – You can design key objects and classes of objects in the new or updated system
  – Process includes considering the problem domain, the operating environment, and the user interface

• During design phase, consider the sequence of events that must happen for the system to function correctly
A Sequence Diagram to Add a New KayakItem Scenario
Environmental Design Considerations

• Environmental design:
  – Also called green design
  – Involves systems development efforts that slash power consumption, require less physical space, and result in systems that can be disposed of in a way that doesn’t negatively affect the environment
Generating Systems Design Alternatives

• Request for proposal (RFP):
  – Document that specifies required resources such as hardware and software in detail

• Evaluating and selecting a systems design:
  – Preliminary evaluation
  – Final evaluation
Johnson & Florin, Inc.
Systems Investigation Report

Contents

COVER PAGE (with company name and contact person)
BRIEF DESCRIPTION of the COMPANY
OVERVIEW of the EXISTING COMPUTER SYSTEM
SUMMARY of COMPUTER-RELATED NEEDS and/or PROBLEMS
OBJECTIVES of the PROJECT
DESCRIPTION of WHAT IS NEEDED
HARDWARE REQUIREMENTS
PERSONNEL REQUIREMENTS
COMMUNICATIONS REQUIREMENTS
PROCEDURES to BE DEVELOPED
TRAINING REQUIREMENTS
MAINTENANCE REQUIREMENTS
EVALUATION PROCEDURES (how vendors will be judged)
PROPOSAL FORMAT (how vendors should respond)
IMPORTANT DATES (when tasks are to be completed)
SUMMARY

Figure 8.19
A Typical Table of Contents for a Request for Proposal
The Design Report

- Primary result of systems design
- Reflects decisions made and prepares the way for systems implementation
Contents

PREFACE
EXECUTIVE SUMMARY of SYSTEMS DESIGN
REVIEW of SYSTEMS ANALYSIS
MAJOR DESIGN RECOMMENDATIONS
  Hardware design
  Software design
  Personnel design
  Communications design
  Database design
  Procedures design
  Training design
  Maintenance design
SUMMARY of DESIGN DECISIONS
APPENDICES
GLOSSARY of TERMS
INDEX
Systems Implementation

• Includes:
  – Hardware acquisition
  – Programming and software acquisition or development
  – User preparation
  – Hiring and training of personnel
  – Site and data preparation
  – Installation, testing, start-up, and user acceptance
Acquiring Hardware from an IS Vendor

• IS vendor:
  – Company that offers hardware, software, telecommunications systems, databases, IS personnel, or other computer-related resources

• Types of IS vendors include:
  – General computer manufacturers
  – Small computer manufacturers
  – Peripheral equipment manufacturers
Acquiring Software: Make or Buy?

- Make-or-buy decision:
  - Whether to obtain software from external or internal sources
- Externally acquired software and Software as a Service (SaaS):
  - Software as a Service (SaaS) allows businesses to subscribe to Web-delivered application software by paying a monthly service charge
Acquiring Database and Telecommunications Systems

• Databases:
  – A blend of hardware and software

• Virtual databases and database as a service (DaaS):
  – Popular ways to acquire database capabilities
User Preparation

• Readying managers, decision makers, employees, other users, and stakeholders for new systems
• Important but often ignored area of systems implementation
IS Personnel: Hiring and Training

• An organization might have to hire and, in some cases, train new IS personnel
• Personnel that might be needed for the new or modified system:
  – An IS manager
  – Systems analysts
  – Computer programmers
  – Data entry operators
Site Preparation

• Preparing the location of a new system
• Developing IS sites that are energy efficient is important
• Security is also important for site preparation
Data Preparation

• Also called data conversion
• Ensuring all files and databases are ready to be used with new computer software and systems
Installation

• Process of physically placing computer equipment on the site and making it operational
• Normally, manufacturer is responsible for installing computer equipment
• Someone from the organization (usually IS manager) should oversee the process
Testing

• Forms of testing:
  – Unit testing
  – System testing
  – Volume testing
  – Integration testing
  – Acceptance testing
Start-Up

• Begins with the final tested information system
• Approaches:
  – Direct conversion (plunge, direct cutover)
  – Phase-in approach (piecemeal)
  – Pilot start-up
  – Parallel start-up
Figure 8.22
Start-Up Approaches

1. Direct conversion
   - Old system
   - New system

2. Phase-in approach
   - Old system
   - New system
   - Pilot 1
   - Pilot 2
   - Pilot 3

3. Pilot start-up

4. Parallel start-up
   - Old system
   - New system
User Acceptance

- Formal agreement signed by user that states that a phase of installation or the complete system is approved
- Legal document that removes or reduces IS vendor’s liability
Systems Operation and Maintenance

• Systems operation:
  – Use of a new or modified system

• Systems maintenance:
  – Checking, changing, and enhancing the system to make it more useful in achieving user and organizational goals
Systems Review

• Final step of systems development
• Analyzes systems to make sure that they are operating as intended
• Can be performed during systems development
System Performance Measurement

• Monitoring the system:
  – Number of errors encountered
  – Amount of memory required
  – Amount of processing or CPU time needed
  – Other problems

• System performance products:
  – Software that measures all components of the information system
Summary

• Systems development team:
  – Stakeholders, users, managers, systems development specialists, and various support personnel

• Five phases of the traditional SDLC:
  – Investigation, analysis, design, implementation, and maintenance and review

• Prototyping:
  – An iterative development approach
Summary (continued)

• Investigation process:
  – Initiated by a systems request form

• Systems analysis:
  – The examination of existing systems

• Purpose of systems design:
  – To prepare the detailed design needs for a new system or modifications to an existing system

• Environmental design:
  – Involves systems development efforts that slash power consumption and take less physical space
Summary (continued)

• Purpose of systems implementation:
  – To install a system and make everything, including users, ready for its operation

• Software:
  – Can be purchased from external vendors or developed in house

• Systems operation:
  – The use of a new or modified system