Introduction to Systems Analysis

Introduction to Systems Analysis and Design

- **Information technology (IT)** refers to the combination of hardware, software, and services that people use to manage, communicate, and share information
- **Systems Development -** Business information systems are developed by people who are technically qualified, business-oriented, and highly motivated. Successful developers also must be good communicators with strong analytical and critical thinking skills.
- **Systems Analysis & Design -** is a step-by-step process for developing high-quality information systems. **An information system** combines information technology, people, and data to support business requirements. For example, information systems handle daily business transactions, improve company productivity, and help managers make sound decisions. The IT department team includes systems analysts who plan, develop, and maintain information systems.

The Impact of Information Technology

❖ Who develops Information Systems?

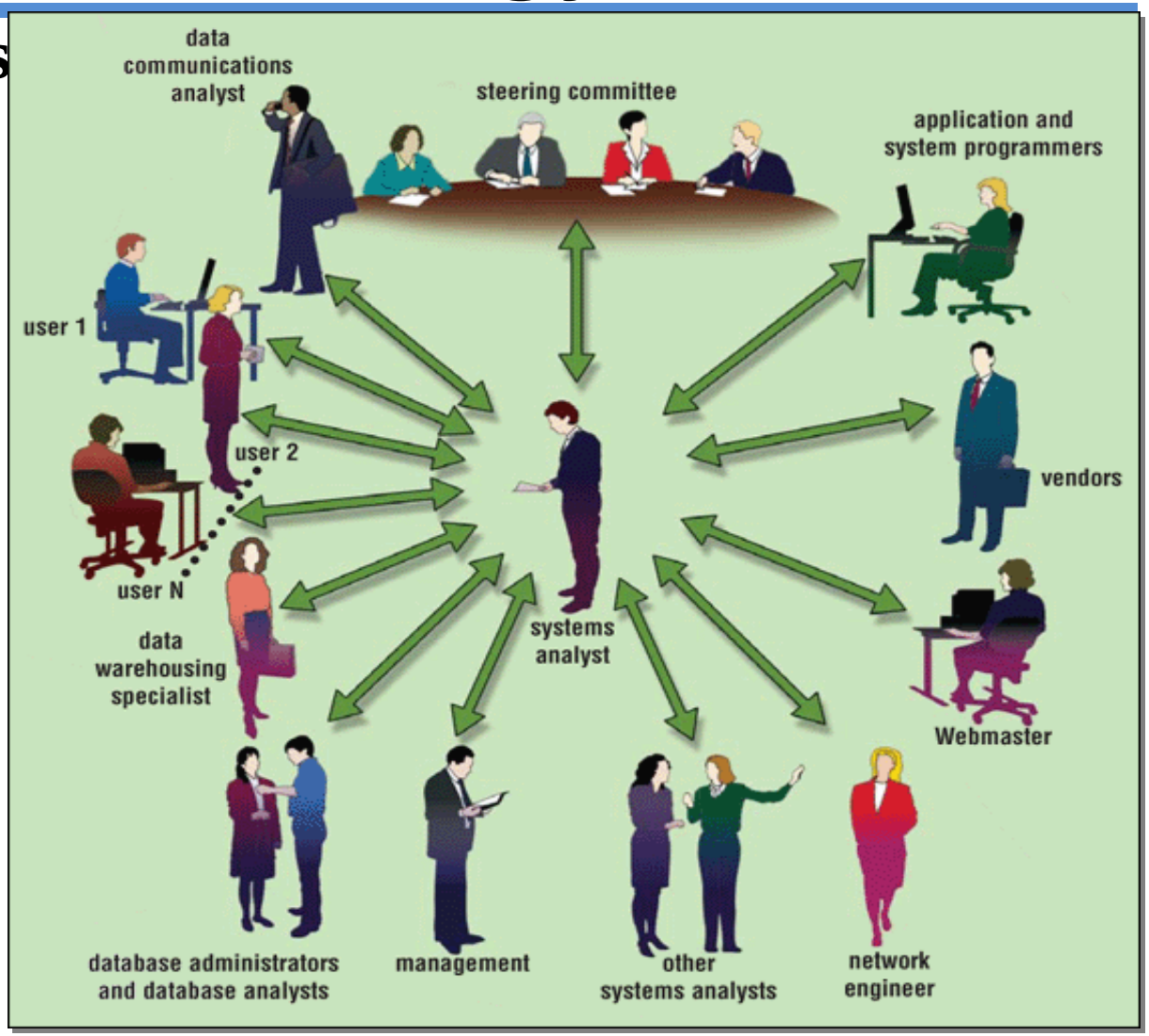
- Traditionally:
  - ❑ In-house applications
  - ❑ Software packages
- Today, the choice is much more complex,
  - ❑ Internet-based application services
  - ❑ Outsourcing
  - ❑ Custom solutions from IT consultants
  - ❑ Enterprise-wide software strategies
- It is always important for companies to plan the system carefully before considering implementation options.

System Components

- An information system has five key components, as shown in Figure 1-8: hardware, software, data, processes, and people.
  - **Hardware** consists of everything in the physical layer of the information system. For example, hardware can include servers, workstations, networks, telecommunications equipment, fiber-optic cables, mobile devices, scanners, digital capture devices, and other technology-based infrastructure.
  - **Software** refers to the programs that control the hardware and produce the desired information or results. Software consists of system software and application software.
  - **Data** is the raw material that an information system transforms into useful information.
  - **Processes** describe the tasks and business functions that users, managers, and IT staff members perform to achieve specific results.
  - **People** who have an interest in an information system are called stakeholders. Stakeholders include the management group responsible for the system, the users (sometimes called end users) inside and outside the company who will interact with the system, and IT staff members, such as systems analysts, programmers, and network administrators who develop and support the system.

The Impact of Information Technology

Who participates in the system development life cycle?



System Development Methods

- **Structured analysis** is a traditional systems development technique that is time-tested and easy to understand. Structured analysis uses a series of phases, called the **systems development life cycle (SDLC)**, to plan, analyze, design, implement, and support an information system. Structured analysis uses a set of process models to describe a system graphically.
- **Object-Oriented Analysis -** Whereas structured analysis treats processes and data as separate components, object oriented analysis combines data and the processes that act on the data into things called **objects**. Systems analysts use O-O to model real-world business processes and operations. The result is a set of software objects that represent actual people, things, transactions, and events. Using an O-O programming language, a programmer then writes the code that creates the objects.
- **Agile methods** attempts to develop a system incrementally, by building a series of prototypes and constantly adjusting them to user requirements. As the agile process continues, developers revise, extend, and merge earlier versions into the final product. An agile approach emphasizes continuous feedback, and each incremental step is affected by what was learned in the prior steps.

SDLC

- The systems development life cycle (SDLC) is the process of determining how an information system (IS) can support business needs, designing the system, building it, and delivering it to users.
- The key person in the SDLC is the systems analyst, who analyzes the business situation, identifies the opportunities for improvements, and designs an IS to implement the improvements.

THE SYSTEMS ANALYST

- The systems analyst plays a key role in IS development projects.
- The systems analyst works closely with all project team members so that the team develops the right system in an effective way.
- Systems analysts must understand how to apply technology in order to solve problems.
- Systems analysts may serve as **change agents** who identify organizational improvement needed, design systems to implement those changes, and train and motivate others to use the systems.

Systems Analyst Skills

- Technical – Must understand the technical environment, technical foundation, and technical solution.
- Business – Must understand how IT can be applied to business situations.
- Analytical – Must be problem solvers.

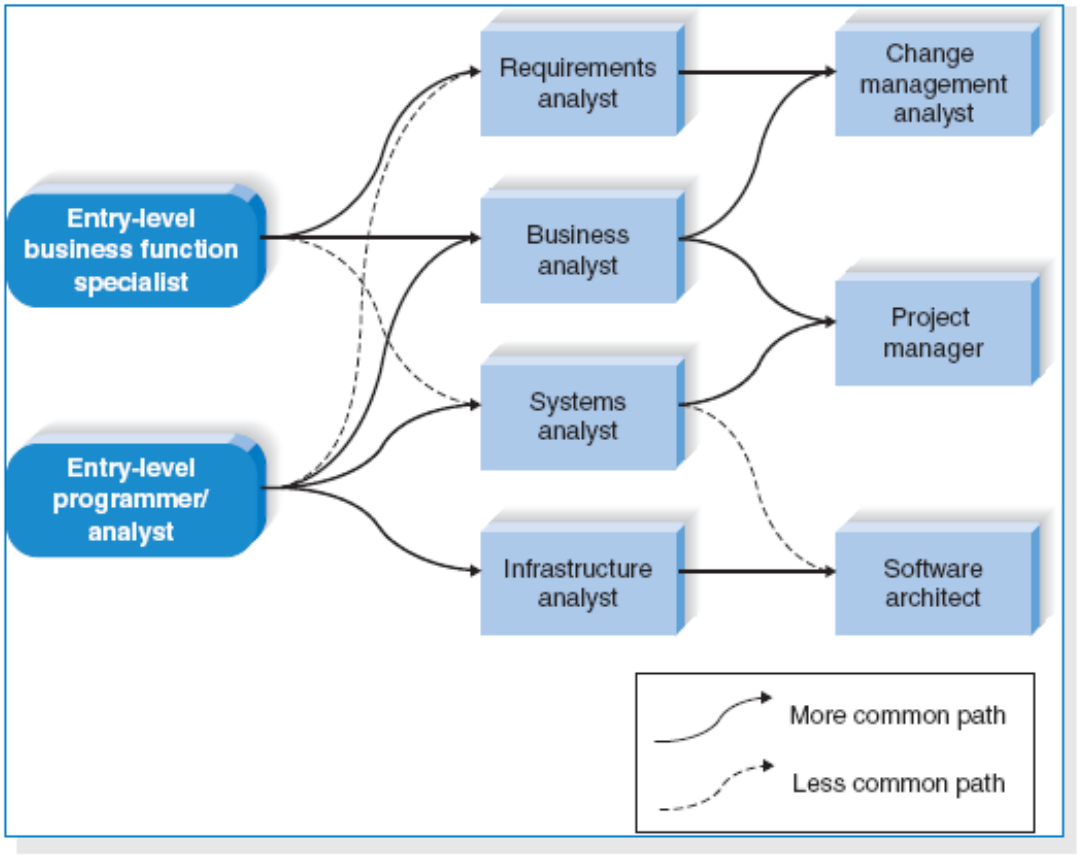
Systems Analyst Skills cont'd

- Interpersonal – Need to communicate effectively.
- Management – Need to manage people and to manage pressure and risks.
- Ethical - Must deal fairly, honestly, and ethically with other project members, managers, and systems users.

Systems Analyst Roles

- **Systems analyst** - Focuses on the IS issues surrounding the system.
- **Business analyst** - Focuses on the business issues surrounding the system.
- **Requirements analyst** - Focuses on eliciting the requirements from the
- stakeholders associated with the new system
- **Infrastructure analyst** - Focuses on technical issues surrounding the ways the system will interact with the organization's technical infrastructure (hardware, software, networks, and databases)
- **Change management analyst** - Focuses on the people and management issues surrounding the system installation; documentation, support, training
- **Project manager** - Ensures that the project is completed on time and within budget, and that the system delivers the expected vale to the organization.

Career Paths for Systems Analysts



THE SYSTEMS DEVELOPMENT LIFE CYCLE (SDLC)

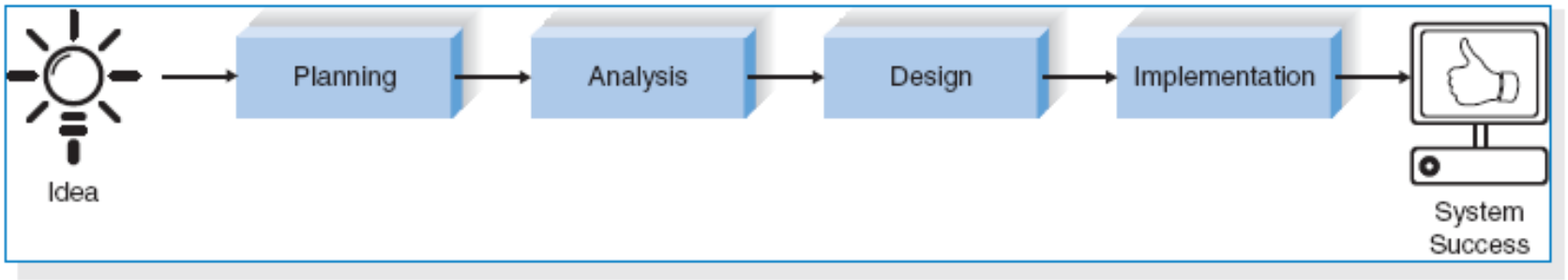


FIGURE 1-2
The Systems Development Life Cycle

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- The **SDLC** is composed of four fundamental phases:
  - Planning
  - Analysis
  - Design
  - Implementation
- Each of the phases is composed of steps, which rely on techniques that produce *deliverables* (specific documents that explain various elements of the system).

Planning

- This phase is the fundamental process of understanding *why* an information system should be built, and determining *how* the project team will go about building it.

The planning phase has two steps:

1. During **project initiation**, the system's business value to the organization is identified (How will it lower costs or increase revenues?).
2. During **project management (**Once the project is approved**)**, the project manager creates a work plan, staffs the project, and puts techniques in place to help the project team control and direct the project through the entire SDLC.

Analysis

- The analysis phase answers the questions of *who* will use the system, *what* the system will do, and *where* and *when* it will be used.
- During this phase the project team investigates any current system(s), identifies improvement opportunities, and develops a concept for the new system.

The analysis phase has three steps:

1. **Analysis strategy**: This is developed to guide the projects team's efforts. Such a strategy usually includes a study of the current system (called the as-is system) and its problems, and envisioning ways to design a new system (called the to-be system).
2. **Requirements gathering**: The analysis of this information leads to the development of a concept for a new system. This concept is used to build a set of analysis models.
3. **System proposal**: The proposal (often called system requirements document) is presented to the project sponsor and other key individuals who decide whether the project should continue to move forward.

Design

- The design phase decides ***how*** the system will operate, in terms of the hardware, software, and network infrastructure; the user interface, forms, and reports that will be used; and the specific programs, databases, and files that will be needed.

The design phase has four steps:

1. **Design Strategy**: This clarifies whether the system will be developed by the company or outside the company.
2. **Architecture Design**: This describes the hardware, software, and network infrastructure that will be used. The interface design specifies how the users will move through the system (e.g., by navigation methods such as menus and on-screen buttons) and the forms and reports that the system will use.
3. **Database and File Specifications**: These documents define what and where the data will be stored.
4. **Program Design**: Defines what programs need to be written and what they will do.

Implementation

- During the implementation phase, the system is either developed or purchased (in the case of packaged software) and installed.
- This phase is usually the longest and most expensive part of the process.

The implementation phase has three steps:

1. **System Construction**: The system is built and tested to make sure it performs as designed.
2. **Installation**: The old system is turned off and the new one is turned on.
3. **Support Plan**: Includes a post-implementation review as well as a systematic way for identifying changes needed for the system.

Systems Development Methods

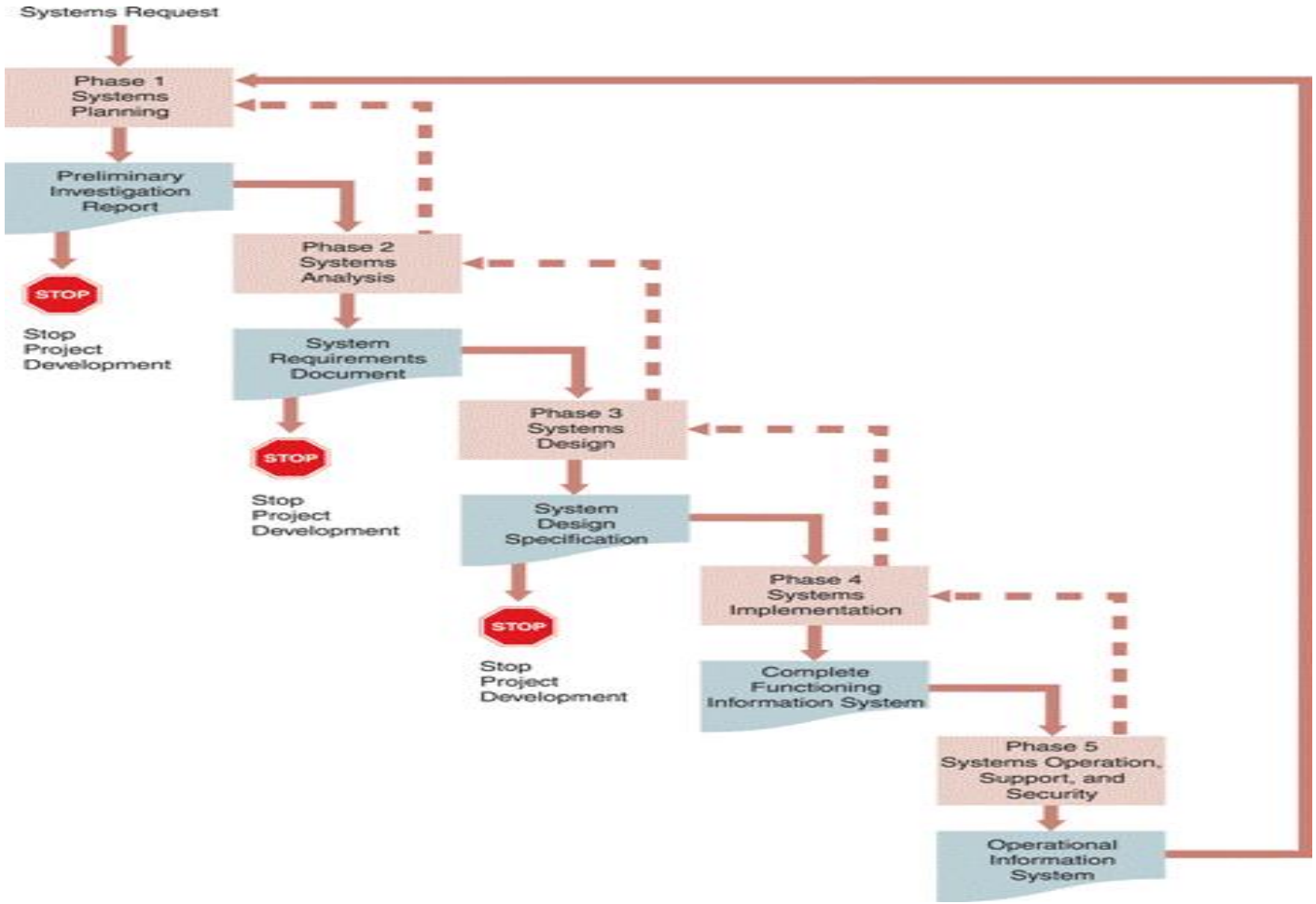

Figure 1-6 The phases and deliverables of the SDLC are shown in the waterfall model.

PROJECT IDENTIFICATION AND INITIATION

- A project is identified when someone in the organization identifies a ***business need*** to build a system.
- A need may surface when an organization identifies unique and competitive ways of using IT.
- To leverage the capabilities of ***emerging technologies*** such as cloud computing, RFID, Web 2.0

Business Process Management (BPM)

- Nowadays many new IS projects grow out of BPM.
- BPM is a methodology used by organizations to continuously improve end-to-end business processes.

BPM Process

- Defining and mapping the steps in a business process.
- Creating ways to improve on the steps in the process that add value
- Finding ways to eliminate or consolidate steps in the process that do not add value
- Creating and adjusting electronic workflows to match the improved process maps.

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- **Business process automation (BPA)** – technology components are used to complement or substitute manual process.
- **Business process improvement (BPI)** – creating new, re-designed processes to improve the workflows, and/or utilizing new technologies enabling new process structures.
- **Business process reengineering (BPR)** – changing the fundamental way in which the organization operate.

Project sponsor

- The project sponsor is a person (or group) who has an interest in the system's success
- The project sponsor will work throughout the SDLC to make sure that the project is moving in the right direction from the perspective of the business.
- The project sponsor serves as the primary point of contact for the project team.
- The size or scope of the project determines by the kind of sponsor that is involved.

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- The project sponsor has the insights needed to determine the business value that will be gained from the system.
- Tangible value can be quantified and measured easily (reduction in operating costs).
- An intangible value results from an intuitive belief that the system provides important, but hard-to-measure benefits to the organization.

System Request

- The document that describes the business reasons for building a system and the value that system is expected to provide.
- The project sponsor usually completes this form as part of a formal system selection process within the organization.

(cont'd)

- The business requirements of the project refer to the business capabilities that the system will need to have.
- The business value describes the benefits that the organization should expect from the system.
- Special issues are included on the document as a catchall category for other information that should be considered in assessing the project.

(cont'd)

- The completed system request is submitted to the approval committee for consideration.
- The committee reviews the system request and makes an initial determination of whether to investigate the proposed project or not.
- If so, the next step is to conduct a feasibility analysis.

FEASIBILITY ANALYSIS

- Feasibility analysis guides the organization in determining whether to proceed with a project.
- Feasibility analysis also identifies the important risks associated with the project that must be managed if the project is approved.

(cont'd)

- As with the system request, each organization has its own process and format for the feasibility analysis, but most include techniques to assess three areas:
  - Technical feasibility
  - Economic feasibility
  - Organizational feasibility
- The results of evaluating these three feasibility factors are combined into a feasibility study deliverable that is submitted to the approval committee at the end of project initiation.

Technical Feasibility

- Technical feasibility is the extent to which the system can be successfully designed, developed, and installed by the IT group.
- It is, in essence, a technical risk analysis that strives to answer the question: “Can we build it?”

(cont'd)

- Risks can endanger the successful completion of a project. The following aspects should be considered:
  - Users' and analysts' should be familiar with the application.
  - Familiarity with the technology
  - Project size
  - Compatibility of the new system with the technology that already exists

Economic Feasibility

- Economic feasibility analysis is also called a cost-benefit analysis, that identifies the costs and benefits associated with the system.
- This attempts to answer the question: “Should we build the system?”

Cash Flow Analysis and Measures

- IT projects involve an initial investment that produces a steam of benefits over time, along with some on-going support costs.
- Cash flows, both inflows and outflows, are estimated over some future period.

Simple cash flow projection

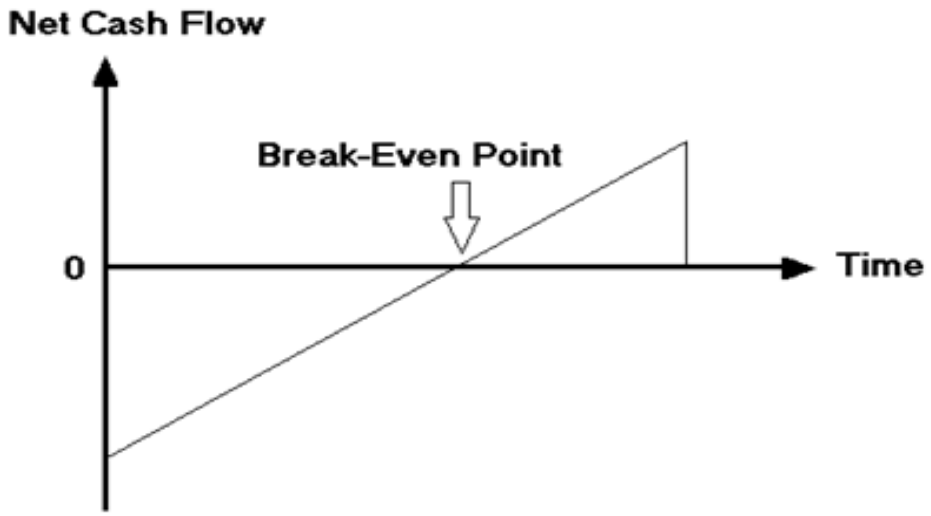
	Year 0	Year 1	Year 2	Year 3	Total
Total Benefits		45,000	50,000	57,000	152,000
Total Costs	100,000	10,000	12,000	16,000	138,000
③ Net Benefits (Total Benefits – Total Costs)	(100,000)	35,000	38,000	41,000	14,000
④ Cumulative Net Cash Flow	(100,000)	(65,000)	(27,000)	14,000	

Common methods for evaluating a project's worth

- Return on Investment (ROI)

  ROI=(Total Benefits – Total Costs)/Total Costs

- Break-Even Point (BEP)



Discounted cash flow technique

- Discounted case flows are used to compare the present value of all cash inflows and outflows for the project in the today's dollar te

$$PV = \frac{\text{Cash flow amount}}{(1 + \text{rate of return})^{n}}$$

- Net present value (NPV): the difference between the total PV of the benefits and the total PV of the costs.

Discounted cash flow projection

	Year 0	Year 1	Year 2	Year 3	Total
Total Benefits		45,000	50,000	55,000	
PV of Total Benefits		40,909	41,322	42,825	125,056
Total Costs	100,000	10,000	12,000	16,000	
PV of Total Costs	100,000	9,091	9,917	12,021	131,029

Steps to conduct an economic feasibility analysis

1. Identify Costs and Benefits
2. Assign Values to Costs and Benefits
3. Determine Cash Flow
4. Assess Project's Economic Value
   - ROI
   - BEP
   - NPV

Identify Costs and Benefits

- The costs and benefits and be broken down in to four categories:
  - Development costs
  - Operational costs
  - Tangible benefits
  - Intangibles

Development Costs	Operational Costs
Development team salaries	Software upgrades
Consultant fees	Software licensing fees
Development training	Hardware repairs
Hardware and software	Hardware upgrades
Vendor installation	Operational team salaries
Office space and equipment	Communications charges
Data conversion costs	User training

Tangible Benefits	Intangible Benefits
Increased sales	Increased market share
Reductions in staff	Increased brand recognition
Reductions in inventory	Higher quality products
Reductions in IT costs	Improved customer service
Better supplier prices	Better supplier relations

Assign Values to Costs and Benefits

- Once the types of costs and benefits have been identified, the systems analysts needs to assign specific dollar values to them.

	2012	2013	2014	2015	2016	Total
Benefits						
Increased sales		500,000	530,000	561,800	595,508	2,187,308
Reduction in customer complaint calls[a]		70,000	70,000	70,000	70,000	280,000
Reduced inventory costs		68,000	68,000	68,000	68,000	272,000
Total Benefits[b]		**638,000**	**668,000**	**699,800**	**733,508**	**2,739,308**
Development Costs						
2 servers @ $125,000	250,000	0	0	0	0	250,000
Printer	100,000	0	0	0	0	100,000
Software licenses	34,825	0	0	0	0	34,825
Server software	10,945	0	0	0	0	10,945
Development labor	1,236,525	0	0	0	0	1,236,525
Total Development Costs	**1,632,295**	**0**	**0**	**0**	**0**	**1,632,295**
Operational Costs						
Hardware		50,000	50,000	50,000	50,000	200,000
Software		20,000	20,000	20,000	20,000	80,000
Operational labor		115,000	119,600	124,384	129,359	488,343
Total Operational Costs		**185,000**	**189,600**	**194,384**	**199,359**	**768,343**
Total Costs	**1,632,295**	**185,000**	**189,600**	**194,384**	**199,359**	**2,400,638**
Total Benefits – Total Costs	**(1,632,295)**	**453,000**	**478,400**	**505,416**	**534,149**	**338,670**
Cumulative Net Cash Flow	**(1,632,295)**	**(1,179,295)**	**(700,895)**	**(195,479)**	**338,670**	
Return on Investment (ROI)	**14.1%**	**(338,670/2,400,638)**				
Break-even Point	**3.37 years**	**(3 years of negative cumulative cash flow + [534,149 – 338,670]/534,149 = .37)**				

[a] Customer service values are based on reduced costs of handling customer complaint phone calls.

[b] An important yet intangible benefit will be the ability to offer services that our competitors currently offer.

Determine Cash Flow

- A formal cost-benefit analysis usually contains costs and benefits over a selected number or years to show cash flow over time.
  - Determine ROI
  - Determine BEP
  - Determine NPV

(cont'd)

	2012	2013	2014	2015	2016	Total
Benefits						
Increased sales		500,000	530,000	561,800	595,508	
Reduction in customer complaint calls[a]		70,000	70,000	70,000	70,000	
Reduced inventory costs		68,000	68,000	68,000	68,000	
Total Benefits[b]		**638,000**	**668,000**	**699,800**	**733,508**	
Present Value Total Benefits		**601,887**	**594,518**	**587,566**	**581,007**	**2,364,978**
Development Costs						
2 Servers @ $125,000	250,000	0	0	0	0	
Printer	100,000	0	0	0	0	
Software licenses	34,825	0	0	0	0	
Server software	10,945	0	0	0	0	
Development labor	1,236,525	0	0	0	0	
Total Development Costs	**1,632,295**	**0**	**0**	**0**	**0**	
Operational Costs						
Hardware		50,000	50,000	50,000	50,000	
Software		20,000	20,000	20,000	20,000	
Operational labor		115,000	119,600	124,384	129,359	
Total Operational Costs		**185,000**	**189,600**	**194,384**	**199,359**	
Total Costs	**1,632,295**	**185,000**	**189,600**	**194,384**	**199,359**	
Present Value Total Costs	**1,632,295**	**174,528**	**168,743**	**163,209**	**157,911**	**2,296,686**
NPV (PV Total Benefits – PV Total Costs)						**68,292**

[a] Customer service values are based on reduced costs of handling customer complaint phone calls.

[b] An important yet intangible benefit will be the ability to offer services that our competitors currently offer.

Organizational Feasibility

- Organizational feasibility of the system is how well the system ultimately will be accepted by its users and incorporated into the ongoing operations of the organization.
- There are many organizational factors that can have an impact on the project, and seasoned developers know that organizational feasibility can be the most difficult feasibility dimension to assess.
- In essence, an organizational feasibility analysis is to answer the question “If we build it, will they come?”

Feasibility Analysis Assessment factors

Technical Feasibility: Can We Build It?

- Familiarity with application: Less familiarity generates more risk.
- Familiarity with technology: Less familiarity generates more risk.
- Project size: Large projects have more risk.
- Compatibility: The harder it is to integrate the system with the company's existing technology, the higher the risk will be.

Economic Feasibility: Should We Build It?

- Development costs
- Annual operating costs
- Annual benefits (cost savings and/or increased revenues)
- Intangible benefits and costs

Organizational Feasibility: If We Build It, Will They Come?

- Project champion(s)
- Senior management
- Users
- Other stakeholders
- Is the project strategically aligned with the business?

(cont'd)

- One way to assess the organizational feasibility is to understand how well the goals of the project align with the business objectives and organizational strategies.
- A second way to assess the organizational feasibility is to conduct **stakeholder analysis.**
- A stakeholder is a person, group, or organization that can affect a new system
  - Project champion
  - System users
  - Organizational management
  - Other stakeholders

SUMMARY

- The **Systems Analyst** is the key person in the development of information systems.
- **The Systems Development Lifecycle** consists of four stages: Planning, Analysis, Design, and Implementation.
- **Project Identification and Initiation** recognize a business need that can be satisfied through the use of information technology.
- **System Request** describes the business value for an information system.
- A **Feasibility Analysis** is used to provide more detail about the risks associated with the proposed system.

Test Yourself

1. In order to best support user's IT needs, IT professionals need to understand the company's business operations. What process might a system analyst use to accomplish this?
   - Business process modeling is used to represent a company's operations and information needs.

Test Yourself

2. What are the five key components of information systems?

Test Yourself

2. What are the five key components of information systems?

Hardware

Software

Data

Processes

People

Test Yourself

3. How are business information systems identified?

Test Yourself

3. How are business information systems identified?

   - Functions and features

Test Yourself

4. True/False: An enterprise computing system is highly specialized and targeted for a company's top executives.

Test Yourself

4. True/False: An enterprise computing system is highly specialized and targeted for a company's top executives.

False

Test Yourself

5. SDLC is an example of a _____ approach, while Extreme Programming is an example of an _____ approach.

Test Yourself

5. SDLC is an example of a predictive approach, while Extreme Programming is an example of an adaptive approach.

Test Yourself

6. CASE tools are:

a) an object oriented methodology

b) techniques or tools to help plan and design information systems

c) team-based fact finding techniques

Test Yourself

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Test Yourself

7. Objects, classes, and methods are all terms used in structured/object oriented methodologies

Test Yourself

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Test Yourself

8. What are the phases of the systems development life cycle?

Test Yourself

8. What are the phases of the systems development life cycle?

- Systems planning
- Systems analysis
- Systems design
- Systems implementation
- Systems operation and support

Test Yourself

9. List at least three of the six functions of a typical IT department

Test Yourself

9. List at least three of the six functions of a typical IT department
   1. Application development
   2. Systems support
   3. User support
   4. Database administration
   5. Network administration
   6. Web support

Test Yourself

10. True/False: Certification is a professional credential that is valued by little (if any) companies.

Test Yourself

10. True/False: Certification is a professional credential that is valued by little (if any) companies.

False