Developing and Acquiring Information Systems

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Managing Information Technology
L9-FIST3UIT

Quick Review

- Managing in the **digital world**
- Gaining **competitive advantage**
- Information systems **infrastructures** and **services**
- Enabling **E-Commerce**
- **Communication** and **Collaboration**, **Social Media**
- **Business intelligence,** Big data and Analytics
- Enhancing **Business Processes**
- **Supply Chain** and **Customer Relationship** Management

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Topics

- Making the business case
- The systems development process
- Acquiring information systems

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Maker movement

- **Maker** movement?
  - **Arduino** platform
  - **Raspberry Pi** systems
  - **3D printers**
  - IoT **sensors**
  - Communications
- Do it yourself (**DIY**)
- Do it with others (**DIWO**)

FIGURE 9.1

3D printing is an enabler of the maker movement.
Source: Alexei Sysoev/Fotolia.

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Making the business case

- How do you **specify** and **defend** the **case**?
- Do you **improve or replace** existing systems?
- How do you get a **go** vs **no go** decision?

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Making the business case

- **Productivity paradox**?
- How to assess gains?

FIGURE 9.2

Unintended consequences can limit the productivity gains from IS investments.

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Making the business case

- **Productivity paradox**?
- How to assess gains?

FIGURE 9.3
Factors leading to the IS productivity paradox.

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Making the business case

TABLE 9.1 **Three Types of Arguments Commonly Made in the Business Case for an Information System**

Type of Argument	Description	Example
Faith	Arguments based on beliefs about organizational strategy, competitive advantage, industry forces, customer perceptions, market share, and so on	"I know I don't have good data to back this up, but I'm convinced that having this customer relationship management system will enable us to serve our customers significantly better than our competitors do and, as a result, we'll beat the competition… You just have to take it on faith."
Fear	Arguments based on the notion that if the system is not implemented, the firm will lose out to the competition or, worse, go out of business	"If we don't implement this enterprise resource planning system, we'll get killed by our competitors because they're all implementing these kinds of systems … We either do this or we die."
Facts	Arguments based on data, quantitative analysis, and/or indisputable factors	"This analysis shows that implementing the inventory control system will help us reduce errors by 50 percent, reduce operating costs by 15 percent a year, and increase production by 5 percent a year and will pay for itself within 18 months."

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Making the business case

- Based on faith, fear, facts, based

FIGURE 9.4

A successful business case will be based on faith, fear, and facts.

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Making the business case

- Facts based:
  - Identifying **costs**
  - Identifying **benefits**

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Making the business case

- Identifying **costs**:
  - Non-recurring costs
    - **Capital expenditure** (equipment, buildings, physical assets, long-term)
  - Recurring costs
    - Non-capital (**operational**) expenditure
- Determining total cost of ownership (**TSO**)
- Another characterisation:
  - Tangible
  - Non-tangible

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Making the business case

- Identifying **benefits**:
  - Tangible vs intangible benefits
  - Quantifying can be a challenge sometimes

Benefit:

New system saves at least one hour per day for 12 mid-level managers.

Quantified as:

Manager's salary (per hour)	$30.00
Number of managers affected	12
Daily savings (one hour saved × 12 managers)	$360.00
Weekly savings (daily savings × 5)	$1,800.00
Annual savings (weekly savings × 50)	$90,000.00

FIGURE 9.8

Converting time savings into dollar figures.

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Making the business case

- **Cost-benefit** analysis

		2018	2019	2020	2021	2022
Costs						
Non-recurring						
Hardware		$ 20,000				
Software		$ 7,500				
Networking		$ 4,500				
Infrastructure		$ 7,500				
Personnel		$100,000				
Recurring						
Hardware			$ 500	$ 1,000	$ 2,500	$ 15,000
Software			$ 500	$ 500	$ 1,000	$ 2,500
Networking			$ 250	$ 250	$ 500	$ 1,000
Service fees			$ 250	$ 250	$ 250	$ 500
Infrastructure				$ 250	$ 500	$ 1,500
Personnel			$ 60,000	$ 62,500	$ 70,000	$ 90,000
Total costs		$139,500	$ 61,500	$ 64,750	$ 74,750	$110,500
Benefits						
Increased sales		$ 20,000	$ 50,000	$ 80,000	$115,000	$175,000
Error reduction		$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Cost reduction		$100,000	$100,000	$100,000	$100,000	$100,000
Total benefits		$135,000	$165,000	$195,000	$230,000	$290,000
Net costs/benefits		$ (4,500)	$103,500	$130,250	$155,250	$179,500

FIGURE 9.5

Worksheet showing a simplified cost–benefit analysis for a web-based order fulfillment system.

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Making the business case

- **Comparing** competing alternatives

Criteria	Weight	Alternative A		Alternative B		Alternative C	
		Rating	Score	Rating	Score	Rating	Score
Requirements							
Web-based Interface	18	5	90	5	90	5	90
Security capabilities	18	1	18	5	90	5	90
BI capabilities	14	1	14	5	70	5	70
	50		122		250		250
Constraints							
Software Costs	15	4	60	5	75	3	45
Hardware Costs	15	4	60	4	60	3	45
Operating Costs	15	5	75	1	15	5	75
Ease of Training	5	5	25	3	15	3	15
	50		220		165		180
Total	100		342		415		430

FIGURE 9.6

Decisions about alternative projects or system design approaches can be assisted using a weighted multicriteria analysis.

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Making the business case

- Knowing the **audience** (stakeholders)

TABLE 9.2 Characteristics of Different Stakeholders Involved in Making IS Investment Decisions

Stakeholder	Perspective	Focus/Project Characteristics
Management	Representatives or managers from each of the functional areas within the firm	Greater strategic focus; largest project sizes; longest project durations
Steering committee	Representatives from various interest groups within the organization (they may have their own agendas at stake when making investment decisions)	Cross-functional focus; greater organizational change; formal cost–benefit analysis; larger and riskier projects
User department	Representatives of the intended users of the system	Narrow, nonstrategic focus; faster development
IS executive	Has overall responsibility for managing IS development, implementation, and maintenance of selected systems	Focus on integration with existing systems; fewer development delays; less concern with cost–benefit analysis

Source: Based on Valacich and George (2017) and McKeen, Guimaraes, and Wetherbe (1994).

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Making the business case

- Multi-factor, **multi-criteria decision** making

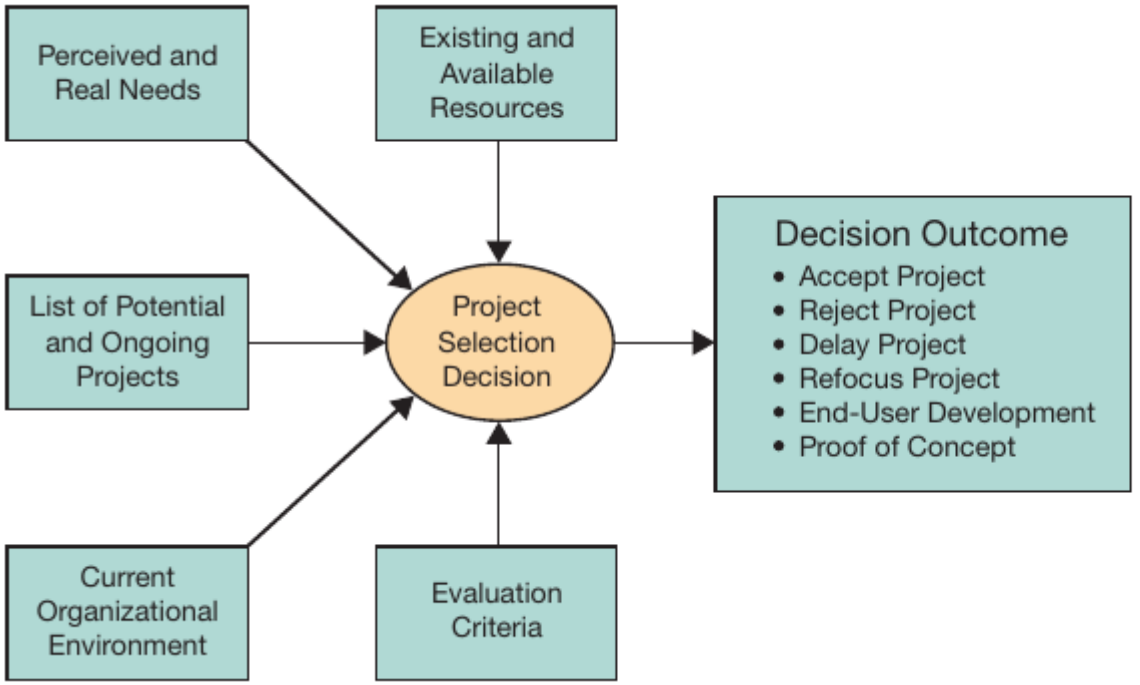

FIGURE 9.7

Investment selection decisions must consider numerous factors and can have numerous outcomes.

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The systems development process

- Custom software
- Off-the-shelf software

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The systems development process

- Custom software
  - Customizability
  - Problem specificity

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The systems development process

- Off-the-shelf software

TABLE 9.3 Examples of Off-the-Shelf Application Software

Category	Application	Description	Examples
Business information systems	Payroll	Automation of payroll services, from the optical reading of time sheets to generating paychecks	ZPAY Intuit Payroll
	Inventory	Automation of inventory tracking, order processing, billing, and shipping	Intuit QuickBooks NetSuite
Office automation	Personal productivity	Support for a wide range of tasks from word processing to graphics to e-mail	OpenOffice Corel Office Microsoft Office

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The systems development process

- **Open source software** (OSS)
  - Free and open source
  - Various licensing models
  - Wide variety of useful software
- How to benefit from OSS?
  - **Know how** needed
  - **Maturity** assessment needed
  - Understanding **licensing**
  - **Integration**

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The systems development process

- **Systems integration**, combining
  - Customizable
  - Off-the-shelf
  - Open source

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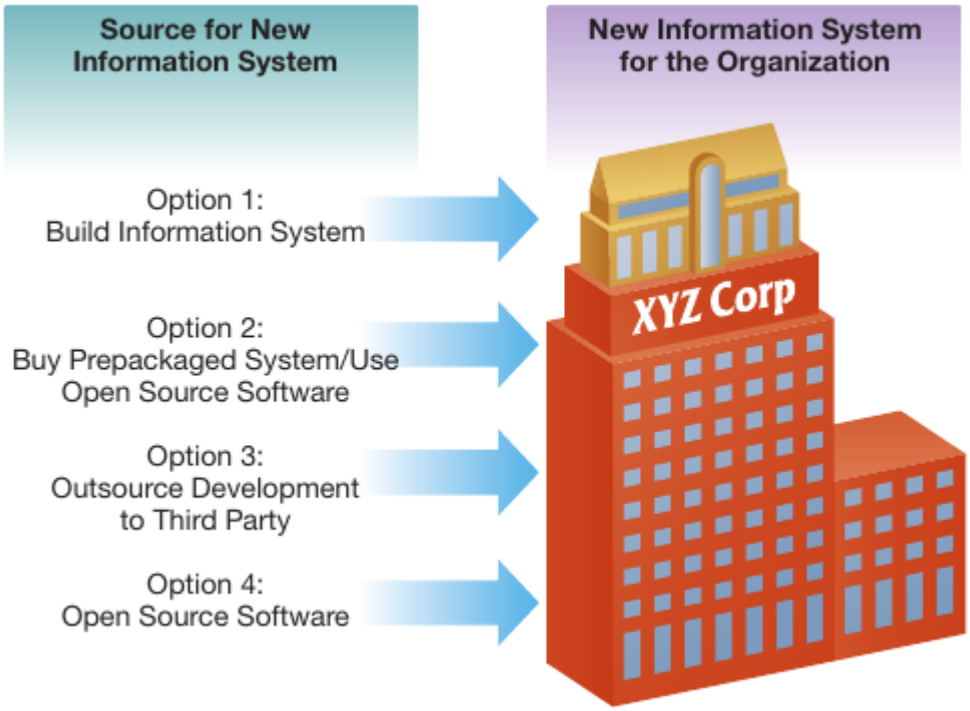
The systems development process

- **Sourcing** IS systems

FIGURE 9.9

There are a variety of sources for information systems.



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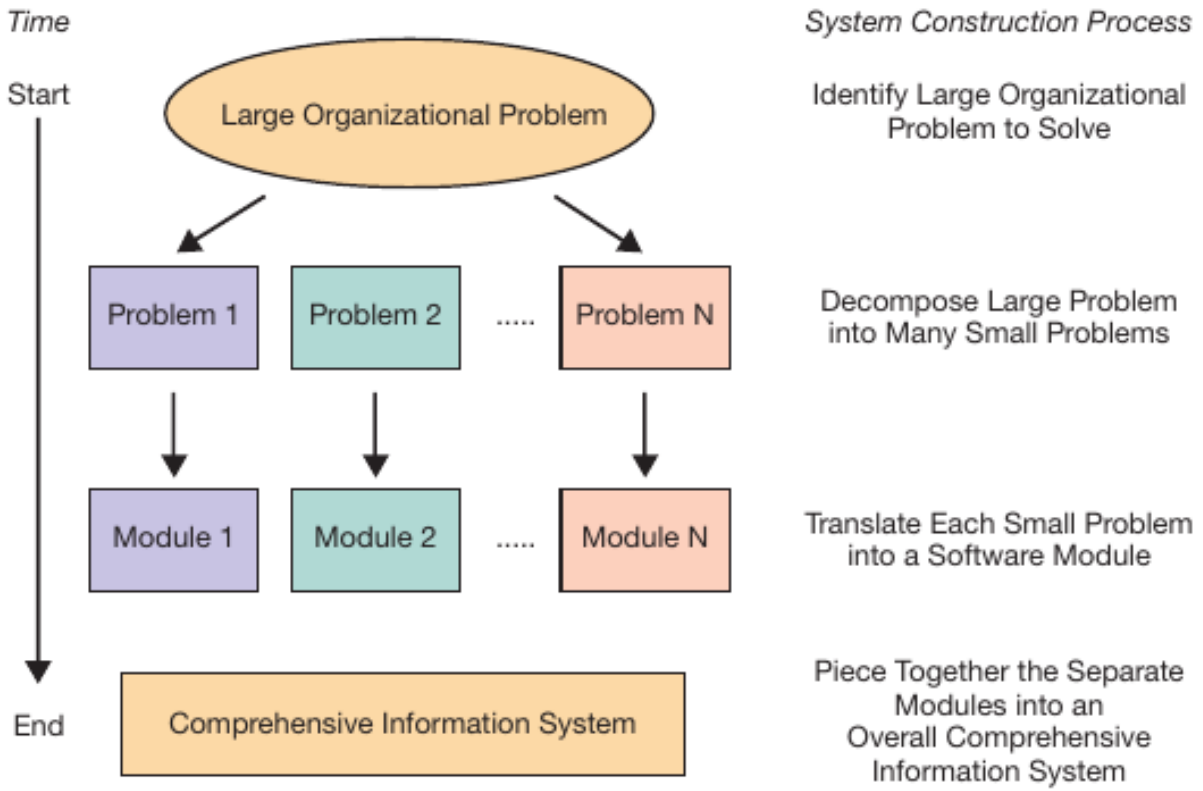
The systems development process

- Problem **decomposition**

FIGURE 9.10

Problem decomposition makes solving large, complex problems easier.



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The systems development process

- Important role of users
- System development controls
  - Software bug tracing
  - Version control
  - Change management

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The systems development process

- Systems Development Life Cycle
  - Systems planning and selection
  - Systems analysis
  - Systems design
  - Systems implementation and operation

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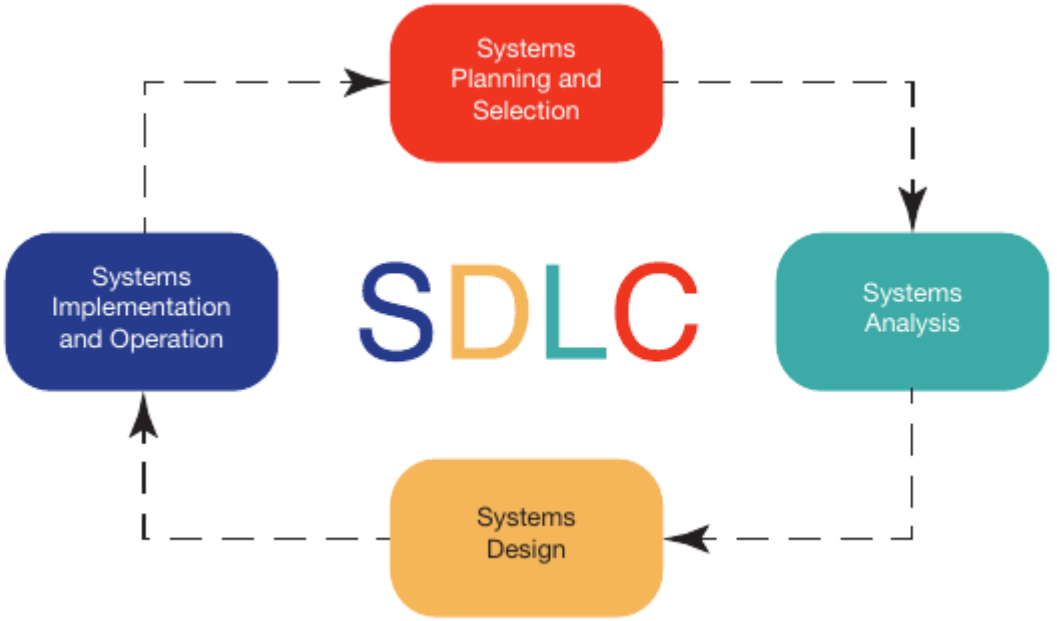
The systems development process

- Systems Development Life Cycle

FIGURE 9.11

The SDLC defines the typical process for building systems.



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The systems development process

- Systems Planning and Selection

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The systems development process

- Systems Analysis
  - Collecting requirements
  - Modeling data
  - Modeling processes and logic

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The systems development process

- Systems Requirements

  - ***Interviews.*** Analysts interview people informed about the operation and issues of the current or proposed system.
  - ***Questionnaires.*** Analysts design and administer surveys to gather opinions from people informed about the operation and issues of the current or proposed system.
  - ***Observations.*** Analysts observe system users at selected times to see how data are handled and what information people need to do their jobs.
  - ***Document Analysis.*** Analysts study business documents to discover issues, policies, and rules as well as concrete examples of the use of data and information in the organization.
  - ***Joint Application Design.*** **Joint application design (JAD)** is a group meeting–based process for requirements collection (Figure 9.12). During this meeting, the users *jointly* define and agree on system requirements or designs. This process can result in dramatic reductions in the length of time needed to collect requirements or specify designs.

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The systems development process

- Key elements to the development
  - Requirements
  - Data
  - Data flow
  - Processing (business) logic

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The systems development process

- Systems design
  - Processing and logic
  - Database and files
  - Human-computer and machine-machine interfaces

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The systems development process

- Systems implementation and operation
  - Software development and testing
  - System conversion, documentation, training and support

The systems development process

- Systems testing

TABLE 9.4 General Testing Types, Their Focus, and Who Performs Them

Testing Type	Focus	Performed by
Developmental	Testing the correctness of individual modules and the integration of multiple modules	Programmer
Alpha	Testing of overall system to see whether it meets design requirements	Software tester
Beta	Testing of the capabilities of the system in the user environment with actual data	Actual system users

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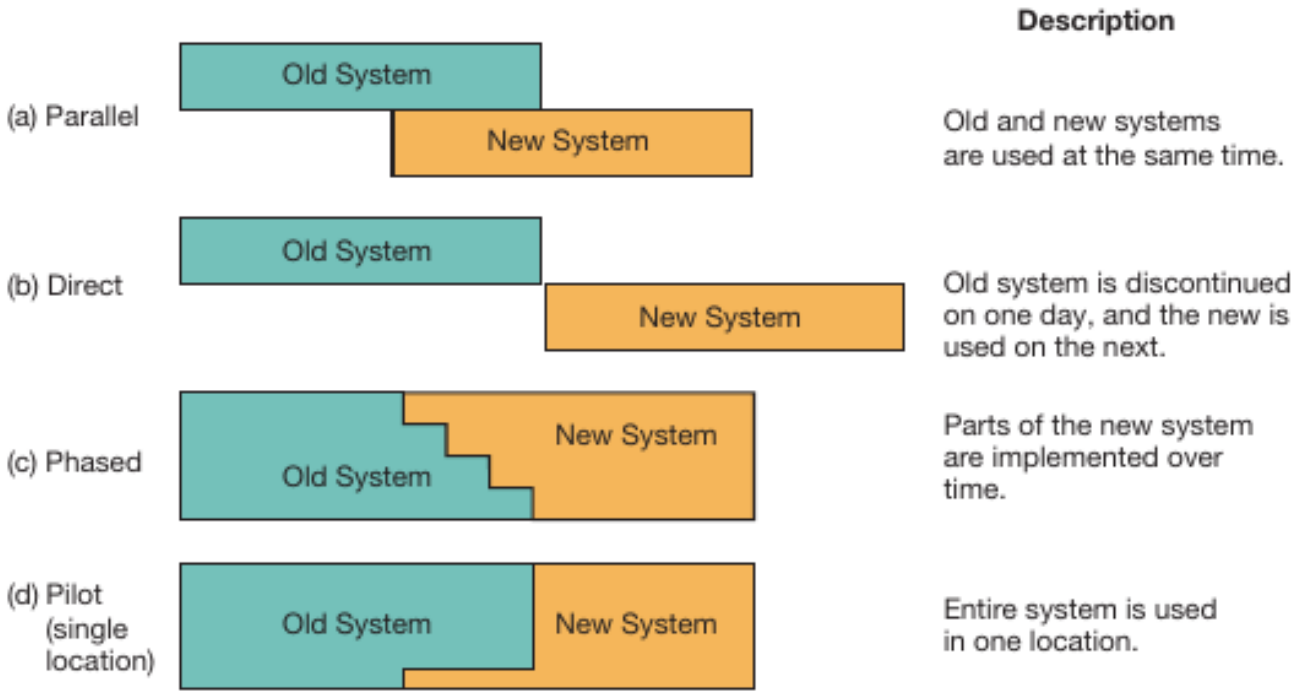
The systems development process

- Systems conversion

FIGURE 9.18

Software conversion strategies.



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The systems development process

- User training

TABLE 9.5 User Training Options

Training Option	Description
Tutorial	One person taught at a time
Course	Several people taught at a time
Computer-aided instruction	One person taught at a time by the computer system
Interactive training manuals	Combination of tutorials and computer-aided instruction
Resident expert	Expert on call to assist users as needed
Software help components	Built-in system components designed to train users and troubleshoot problems
External sources	Vendors and training providers offering tutorials, courses, and other training activities

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The systems development process

- Systems maintenance

TABLE 9.6 Types of Systems Maintenance

Maintenance Type	Description
Corrective maintenance	Making changes to an information system to repair flaws in the design, coding, or implementation
Adaptive maintenance	Making changes to an information system to evolve its functionality, to accommodate changing business needs, or to migrate it to a different operating environment
Preventive maintenance	Making changes to a system to reduce the chance of future system failure
Perfective maintenance	Making enhancements to improve processing performance or interface usability or adding desired but not necessarily required system features (in other words, "bells and whistles")

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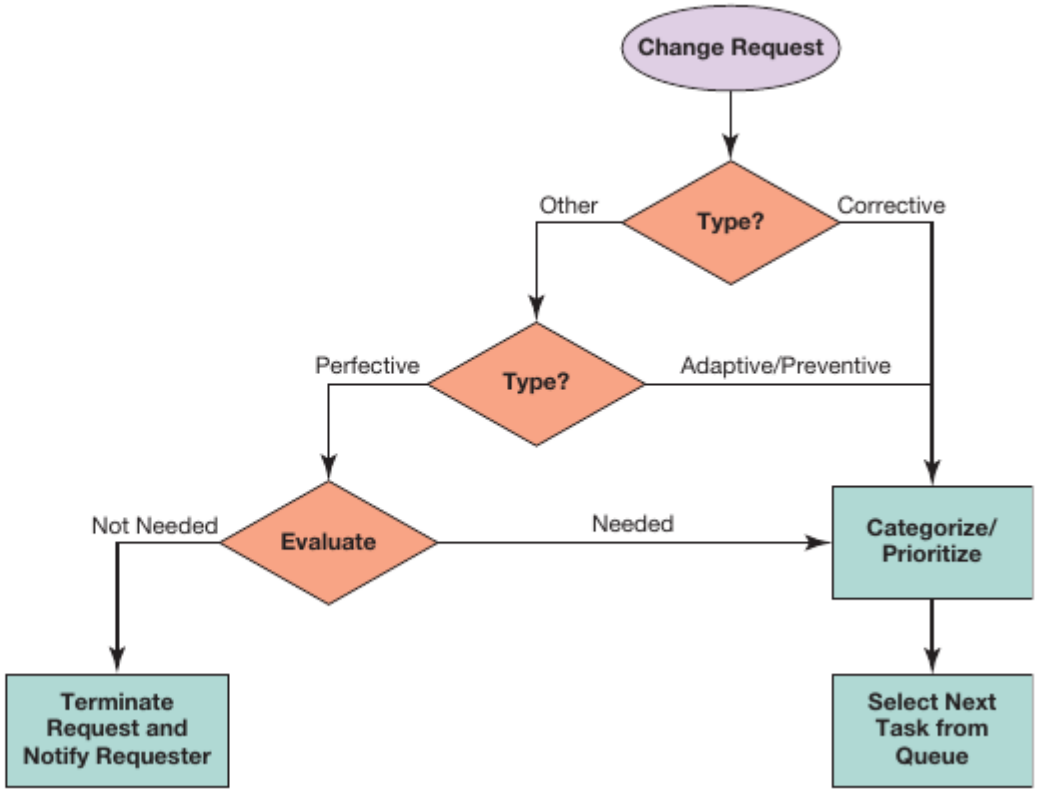
The systems development process

- Systems changes implementation

FIGURE 9.19

Change requests are prioritized based on business benefits.



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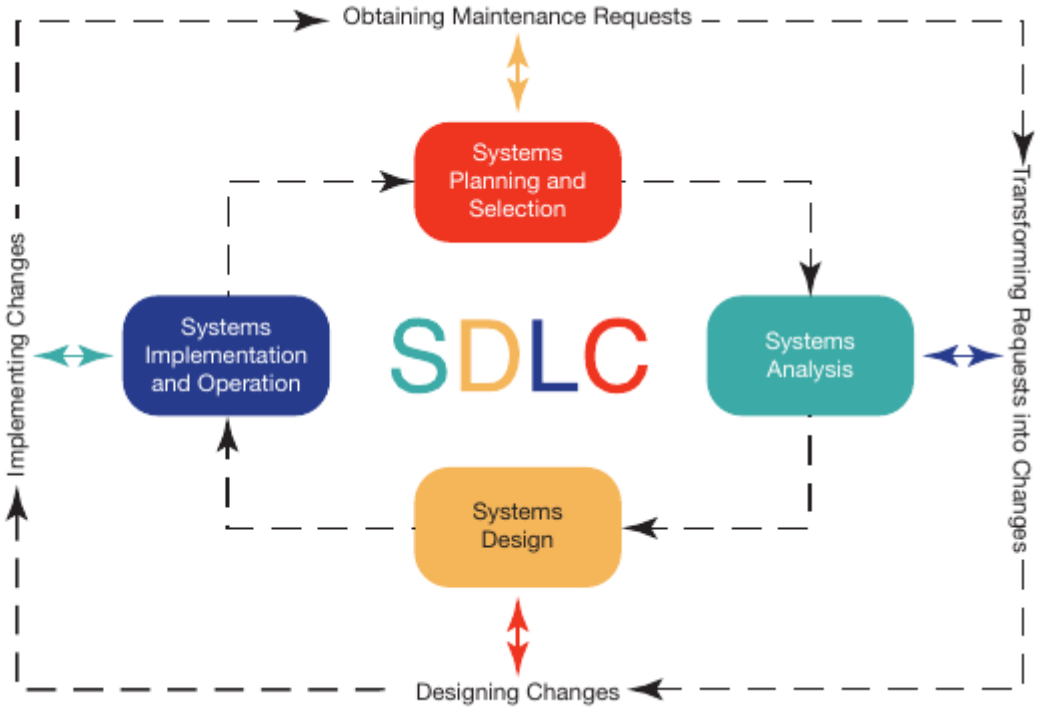
The systems development process

- Systems changes implementation, SDLC

FIGURE 9.20

Mapping of system maintenance activities to the SDLC.



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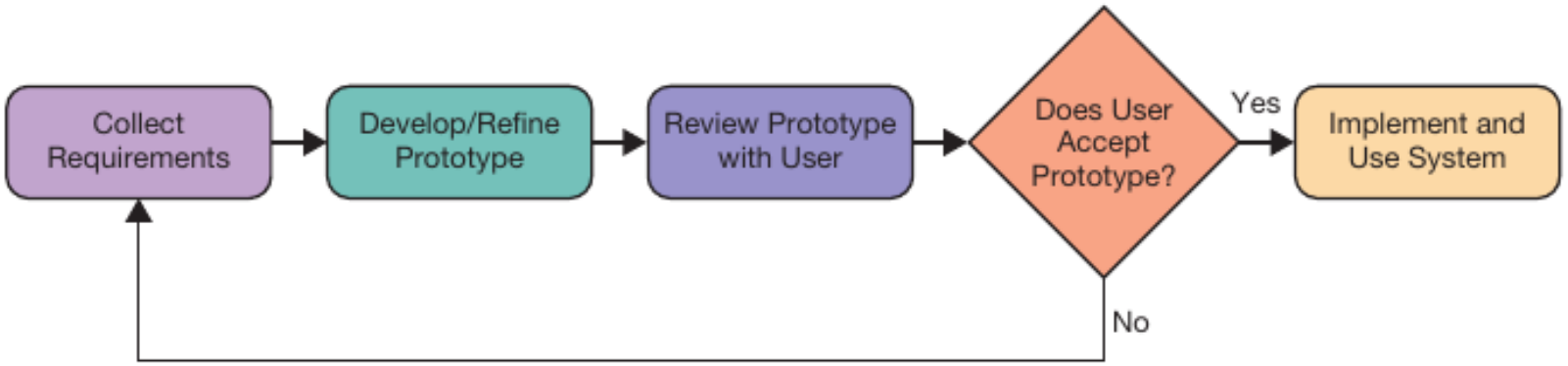
The systems development process

- Alternative approach, Prototyping, Trial and error

FIGURE 9.21

The prototyping process uses a trial-and-error approach to discovering how a system should operate.



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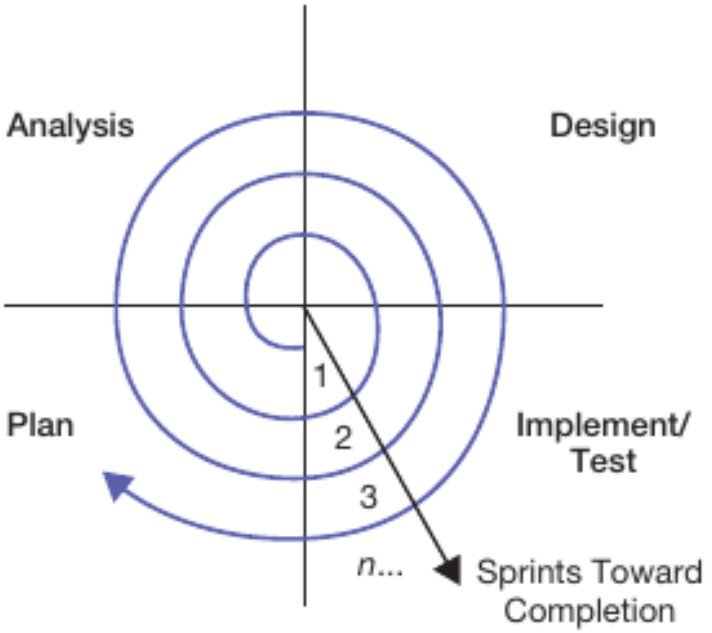
The systems development process

- Alternative approach, Agile methodology
  - Scrum

FIGURE 9.22

Agile methodologies evolve using an iterative development approach.



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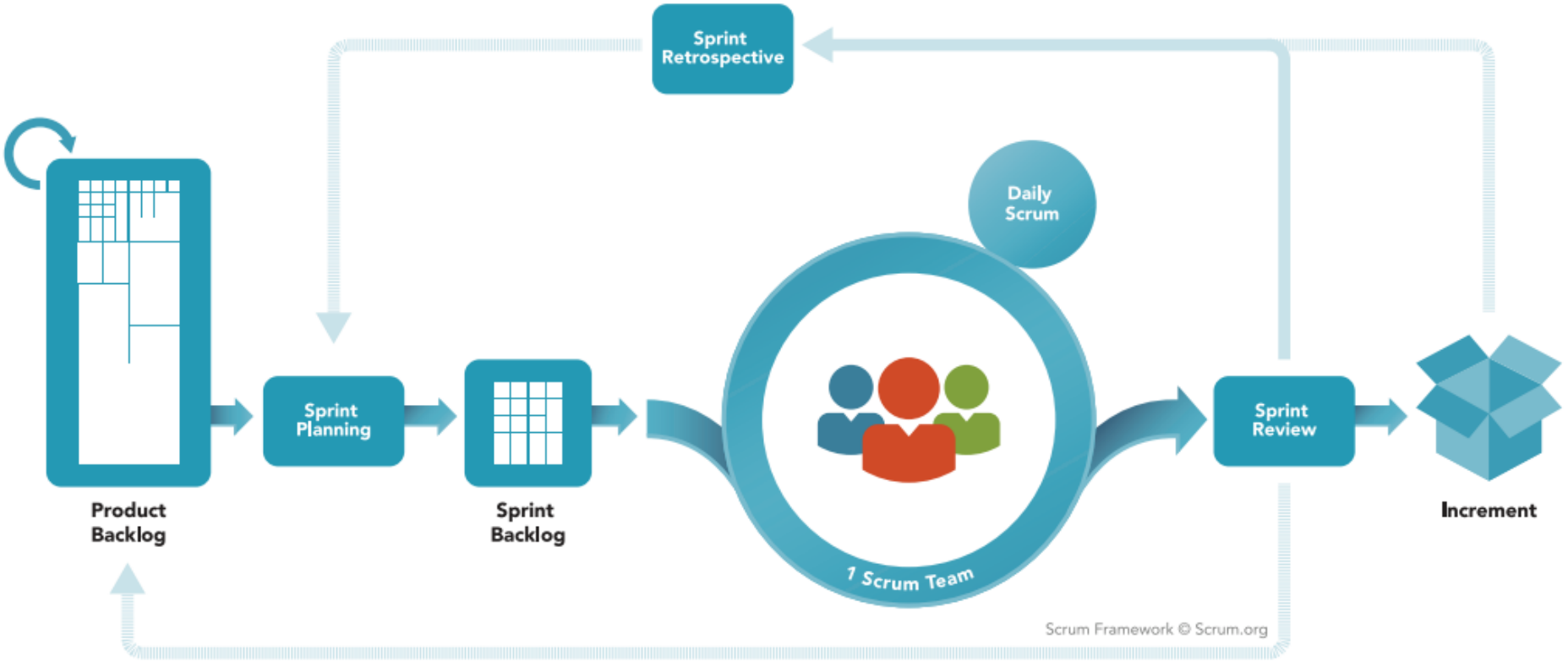
The systems development process

- Scrum process



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The systems development process

- Security issues

TABLE 9.7 Existing and Emerging Security Threats

Issue	Description
Hardware/IoT	Hardware-based cyber attacks are on the rise as criminals are finding ways to infiltrate various devices and gadgets (e.g., industrial control systems and IoT devices) that cannot be protected with normal antivirus software.
Ransomware	A type of malware that restricts access to the infected computer system in some way, and demands that the user pay a ransom to the malware operators to remove the restriction.
Unknown vulnerabilities	These reflect unintended flaws in hardware and software that leave it open to various forms of exploitation including unauthorized access or malicious behavior.
Cloud services	Utilizing cloud services has allowed many companies to better manage IT costs and also provide individuals with incredible convenience; at the same time, this efficient model may come at a higher security price as malicious hackers increasingly focus on the cloud.
Wearables	Wearable technologies such as watches, fitness trackers, and smart clothing are typically connected to mobile device apps; poorly written apps can open backdoors to a cache of sensitive data.
Connected cars	Connected cars with onboard computers and applications are becoming mainstream; many of these technologies have inadequate security, potentially resulting in staggering safety concerns.
Warehouses of stolen data	The influx of widespread data breaches of patient, employee, and customer data has made available a treasure trove of data on the "dark web," putting individuals and organizations at tremendous risk.
Hacktivism	The act of hacking, or breaking into a computer system, for a politically or socially motivated purpose continues to concern businesses and governments.

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Acquiring Information Systems

- Scenarios, when alternative approach is needed:
  - ***Situation 1: Limited IS Staff.*** Often, an organization does not have the capability to build a system itself. Perhaps its development staff is small or deployed on other activities and does not have the capability to take on an in-house development project.
  - ***Situation 2: IS Staff Has Limited Skill Set.*** In other situations, the IS staff may not have the skills needed to develop a particular kind of system. This has been especially true with the explosive growth of the web and mobile devices; many organizations are having outside groups develop and manage their websites and mobile apps.
  - ***Situation 3: IS Staff Is Overworked.*** In some organizations, the IS staff may simply not have the time to work on all the systems that the organization requires or wants.
  - ***Situation 4: Problems with Performance of IS Staff.*** Earlier in this book, we discussed how and why systems development projects could sometimes be risky. Often, the efforts of IS departments are derailed because of staff turnover, changing requirements, shifts in technology, or budget constraints. Regardless of the reason, the result is the same: another failed (or flawed) system.

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Acquiring Information Systems

- External acquisition of a prepackaged system
- Outsourcing systems development

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Acquiring Information Systems

- External acquisition steps
  - Systems planning and selection
  - System analysis
  - Development of a Request for proposal **RFP**
  - Proposal evaluation
  - Vendor selection

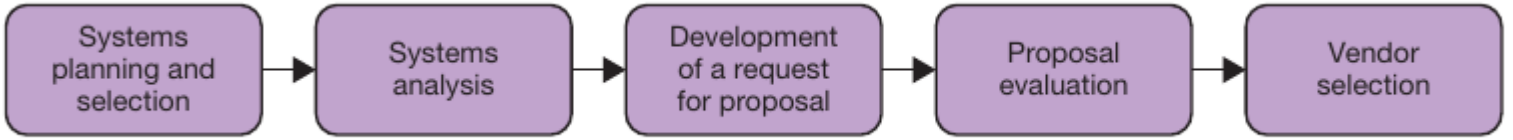

FIGURE 9.23
Steps in external acquisition.

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Acquiring Information Systems

- Evaluation criteria

TABLE 9.8 Commonly Used Evaluation Criteria

Hardware Criteria	Software Criteria	Other Criteria
Brand/manufacturer	Business alignment	Installation/training
Speed/storage	Required/desired features	Vendor characteristics (years in business, flexibility, reputation, etc.)
Reliability	Reliability	
Scalability for growth	Operations integration	Price
Ease of installation	Scalability for growth	
Ease of integration	Support model	
Warranty	Usability	

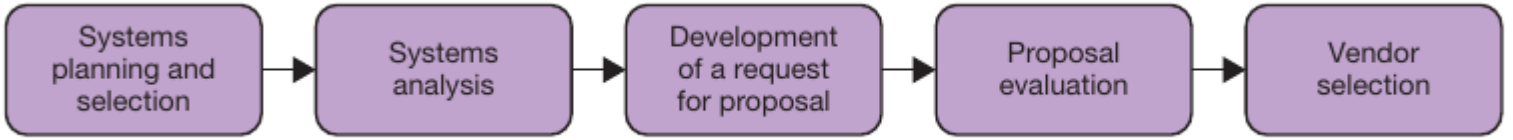

FIGURE 9.23
Steps in external acquisition.

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Acquiring Information Systems

- Managing software licenses

TABLE 9.9 Different Types of Software Licenses

Restrictiveness	Software Types	Rights	Restrictions	Examples
Full rights	Public domain software	Full rights	No restrictions; owner forsakes copyright	Different programs for outdated IBM mainframes
	Non-protective open source (e.g., Berkeley software development [BSD] license)	Freedom to copy, modify, and redistribute the software; can be incorporated into a commercial product	Creator retains copyright	Free BSD operating system; BSD components in (proprietary) Mac OS X operating system
	Protective open source (e.g., general public license [GPL])	Freedom to copy, modify, and redistribute the software	Modified or redistributed software must be made available under the same license; cannot be incorporated into commercial product	Linux operating system
	Proprietary software	Right to run the software (for licensed users)	Access to source code severely restricted; no rights to copy or modify software	Windows operating system
No rights	Trade secret	Software typically only used internally	Access to source code severely restricted; software is not distributed outside the organization	Google PageRank™ algorithm

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Acquiring Information Systems

- Managing software licenses
  - Off-the shelf (shrink wrap, click wrap licenses)
  - Enterprise licenses (volume)
  - Open source license
- **Cost** of mismanaging licenses
  - Can be surprising

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Acquiring Information Systems

- Outsourcing systems development, why?

  - ***Cost and Quality Concerns.*** In many cases it is possible to achieve higher-quality systems at a lower price through economies of scale, better management of hardware, lower labor costs, and better software licenses on the part of a service provider.
  - ***Problems in IS Performance.*** IS departments may have problems meeting acceptable service standards because of cost overruns, delayed systems, underutilized systems, or poorly performing systems. In such cases, organizational management may attempt to increase reliability through outsourcing.
  - ***Supplier Pressures.*** Perhaps not surprisingly, some of the largest service providers are also the largest suppliers of software or computer equipment (e.g., IBM or HP). In some cases, the aggressive sales forces of these suppliers are able to convince senior managers at other organizations to outsource their IS functions.
  - ***Simplifying, Downsizing, and Reengineering.*** Organizations under competitive pressure often attempt to focus on only their "core competencies." In many cases, organizations simply decide that running information systems is not one of their core competencies and decide to outsource this function to companies such as Infosys, Accenture, or IBM whose primary competency is developing and maintaining information systems.
  - ***Financial Factors.*** When firms turn over their information systems to a service provider, they can sometimes strengthen their balance sheets by liquidating their IT assets. Also, if users perceive that they are actually paying for their IT services rather than simply having them provided by an in-house staff, they may use those services more wisely and perceive them to be of greater value.
  - ***Organizational Culture.*** Political or organizational problems are often difficult for an IS group to overcome. However, an external service provider often brings enough clout, devoid of any organizational or functional ties, to streamline IS operations as needed.
  - ***Internal Irritants.*** Tensions between end users and the IS staff are sometimes difficult to eliminate. At times this tension can intrude on the daily operations of the organization, and the idea of a remote, external, relatively neutral IS group can be appealing. Whether the tensions between users and the IS staff (or service provider) are really eliminated is open to question; however, simply having the IS group external to the organization can remove a lingering thorn in management's side.

Acquiring Information Systems

- Managing outsourcing relationship

1. A strong, active chief information officer (CIO) and staff should continually manage the legal and professional relationship with the outsourcing firm.
2. Clear, realistic performance measurements of the systems and of the outsourcing arrangement, such as tangible and intangible costs and benefits, should be developed.
3. The interface between the customer and the outsourcer should have multiple levels (e.g., links to deal with policy and relationship issues and links to deal with operational and tactical issues).

- Using outsourcing strategically

1. What to outsource?
2. When to outsource?

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Key Points

- Making the business case
- The systems development process
- Acquiring information systems

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