Chapter 13

Building Information Systems

VIDEO CASES
- Video Case 1: IBM: Business Process Management in a SaaS Environment
- Video Case 2: IBM Helps the City of Madrid With Real-Time BPM Software
- Instructional Video 1: BPM Business Process Management Customer Story: BestHome Stores
- Instructional Video 2: Workflow Management: Visualized

Learning Objectives
- Explain how building new systems produces organizational change.
- Describe the core activities in the systems development process.
- Describe the principal methodologies for modeling and designing systems.
- Describe the alternative methods for building information systems.
- Describe new approaches for system building in the digital firm era.

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New Systems and Business Processes Put MoneyGram "On the Money"

- Problem: Inefficient manual processes, legacy systems
- Solutions: Enterprise suite to centralize data and replace legacy software, changes to corporate culture and organization
- Demonstrates the use of information systems to streamline and redesign business processes
- Illustrates need to address and make changes in culture and organization to support new systems
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Systems as Planned Organizational Change

• Structural organizational changes enabled by IT
  1. Automation
     • Increases efficiency
     • Replaces manual tasks
  2. Rationalization of procedures
     • Streamlines standard operating procedures
     • Often found in programs for making continuous
       quality improvements
       – Total quality management (TQM)
       – Six sigma

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Systems as Planned Organizational Change

• Structural organizational changes enabled by IT
  3. Business process redesign
     • Analyze, simplify, and redesign business processes
     • Reorganize workflow, combine steps, eliminate repetition
  4. Paradigm shifts
     • Rethink nature of business
     • Define new business model
     • Change nature of organization

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The most common forms of
organizational change are
automation and rationalization.
These relatively slow-moving
and slow-changing strategies
present modest returns but little
risk. Faster and more
comprehensive change—such
as redesign and paradigm
shifts—carries high rewards
but offers substantial chances
of failure.

FIGURE 13-1
• **Business process management (BPM)**
  - Variety of tools, methodologies to analyze, design, optimize processes
  - Used by firms to manage business process redesign

• **Steps in BPM**
  1. Identify processes for change.
  2. Analyze existing processes.
  3. Design the new process.
  4. Implement the new process.
  5. Continuous measurement.

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**AS-IS BUSINESS PROCESS FOR PURCHASING A BOOK FROM A PHYSICAL BOOKSTORE**

2. If in stock, get permission to sell.
4. Charge to credit card.
6. Crank up cash register.
7. Get receipt.
8. Give change.
9. Charge to credit card.

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**REDESIGNED PROCESS FOR PURCHASING A BOOK ONLINE**

1. Access website
2. Search for book
3. Request book
4. Order book
5. Charge to credit card
6. Receive book
7. Confirm receipt
8. Process transaction
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Systems as Planned Organizational Change

• Various BPM tools used to:
  – Identify and document existing processes.
    • Identify inefficiencies.
  – Create models of improved processes.
  – Capture and enforce business rules for performing, automating processes.
  – Integrate existing systems to support process improvements.
  – Verify that new processes have improved.
  – Measure impact of process changes on key business performance indicators.

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Overview of Systems Development

• Systems development:
  – Activities that go into producing an information system solution to an organizational problem or opportunity
    1. Systems analysis
    2. Systems design
    3. Programming
    4. Testing
    5. Conversion
    6. Production and maintenance

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Interactive Session: Organizations

Burton Snowboards Speeds Ahead with Nimble Business Processes
Abide the interactive session and discuss the following questions:

• Analyze Burton using the value chain and competitive forces models.
• Why are the business processes described in this case such an important source of competitive advantage for Burton?
• Explain exactly how these process improvements enhance Burton’s operational performance and decision making.
Building a system can be broken down into six core activities.

**Systems analysis**
- Analysis of problem to be solved by new system
  - Defining the problem and identifying causes
  - Specifying solutions
    - Systems proposal report identifies and examines alternative solutions
  - Identifying information requirements
- Includes feasibility study
  - Is solution feasible and good investment?
  - Is required technology, skill available?

System analysis (cont.)
- Establishing information requirements
  - Who needs what information, where, when, and how
  - Define objectives of new/modified system
  - Detail the functions new system must perform
- Faulty requirements analysis is leading cause of systems failure and high systems development cost
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Overview of Systems Development

- **Systems design**
  - Describes system specifications that will deliver functions identified during systems analysis
  - Should address all managerial, organizational, and technological components of system solution
  - **Role of end users**
    - User information requirements drive system building
    - Users must have sufficient control over design process to ensure system reflects their business priorities and information needs
    - Insufficient user involvement in design effort is major cause of system failure

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Table 13.1 Design Specifications

<table>
<thead>
<tr>
<th>INPUT</th>
<th>PROCESSING</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA</td>
<td>OPERATIONS</td>
<td>DOCUMENTATION</td>
</tr>
<tr>
<td>Origins</td>
<td>Transformations</td>
<td>System documentation</td>
</tr>
<tr>
<td>Flow</td>
<td>Processed inputs</td>
<td>User documentation</td>
</tr>
<tr>
<td>USER INTERFACE</td>
<td>Program code</td>
<td>Procedure documentation</td>
</tr>
<tr>
<td>Simplicity</td>
<td>Input/Output</td>
<td>Conversion documentation</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Error checking</td>
<td>Error correction</td>
</tr>
<tr>
<td>Menu</td>
<td>Error handling</td>
<td>System maintenance</td>
</tr>
<tr>
<td>RADIO COMMUNICATION</td>
<td>Error recovery</td>
<td>Change control</td>
</tr>
</tbody>
</table>

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Overview of Systems Development

- **Programming**
  - System specifications from design stage are translated into software program code

- **Testing**
  - Ensures system produces right results
  - Unit testing: Tests each program in system separately
  - System testing: Test functioning of system as a whole
  - Acceptance testing: Makes sure system is ready to be used in production setting
  - Test plan: All preparations for series of tests

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When developing a test plan, it is imperative to include the various conditions to be tested, the requirements for each condition tested, and the expected results. Test plans require input from both end users and information systems specialists.

**Conversion**

- Process of changing from old system to new system

- Four main strategies
  1. Parallel strategy
  2. Direct cutover
  3. Pilot study
  4. Phased approach

- Requires end-user training
- Finalization of detailed documentation showing how system works from technical and end-user standpoint

**Production and maintenance**

- System reviewed to determine if revisions needed
- May include post-implementation audit document
- Maintenance
  - Changes in hardware, software, documentation, or procedures to a production system to correct errors, meet new requirements, or improve processing efficiency
    - 20% debugging, emergency work
    - 20% changes to hardware, software, data, reporting
    - 60% of work: User enhancements, improving documentation, recoding for greater processing efficiency

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**A SAMPLE TEST PLAN TO TEST A RECORD CHANGE**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Conversion</th>
<th>Special Requirements</th>
<th>Expected Results</th>
<th>Expected Output</th>
<th>Expected Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>Prep</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test</td>
<td>Prep</td>
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<td>Test</td>
<td>Prep</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FIGURE 13-5

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Overview of Systems Development

- Conversion
- Production and maintenance

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2/23/2014
Table 13.2 Systems Development

<table>
<thead>
<tr>
<th>Core Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems analysis</td>
<td>Identify problem(s), clarify objectives, establish information requirements</td>
</tr>
<tr>
<td>Systems design</td>
<td>Create design specifications</td>
</tr>
<tr>
<td>Programming</td>
<td>Translate design specifications into code</td>
</tr>
<tr>
<td>Testing</td>
<td>Unit test, system test, acceptance test</td>
</tr>
<tr>
<td>Conversion</td>
<td>Plan conversion, prepare data documentation, train users and technical staff</td>
</tr>
<tr>
<td>Installation and maintenance</td>
<td>Operate the system, evaluate the system, modify the system</td>
</tr>
</tbody>
</table>

Most prominent methodologies for modeling and designing systems:
1. Structured methodologies
2. Object-oriented development

Structured methodologies
- Structured: Techniques are step-by-step, progressive
- Process-oriented: Focusing on modeling processes or actions that manipulate data
- Separate data from processes

Data flow diagram (DFD):
- Primary tool for representing system’s component processes and flow of data between them
- Offers logical graphic model of information flow
- High-level and lower-level diagrams can be used to break processes down into successive layers of detail

Data dictionary: Defines contents of data flows and data stores
Process specifications: Describe transformation occurring within lowest level of data flow diagrams
Structure chart: Top-down chart, showing each level of design, relationship to other levels, and place in overall design structure
The system has three processes: Verify availability (1.0), Enroll student (2.0), and Confirm registration (3.0). The name and content of each of the data flows appear adjacent to each arrow. There is one external entity in this system: the student. There are two data stores: the student master file and the course file.

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HIGH-LEVEL STRUCTURE CHART FOR A PAYROLL SYSTEM

This structure chart shows the highest or most abstract level of design for a payroll system, providing an overview of the entire system.

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Overview of Systems Development

• Object-oriented development
  – Object is basic unit of systems analysis and design
    • Object:
      – Combines data and the processes that operate on those data
      – Data encapsulated in object can be accessed and modified only by operations, or methods, associated with that object
    – Object-oriented modeling based on concepts of class and inheritance
      • Objects belong to a certain class and have features of that class
      • May inherit structures and behaviors of a more general, ancestor class
• Object-oriented development
  – More iterative and incremental than traditional structured development
  • Systems analysis: Interactions between system and users analyzed to identify objects
  • Design phase: Describes how objects will behave and interact; grouped into classes, subclasses and hierarchies
  • Implementation: Some classes may be reused from existing library of classes, others created or inherited
  – Because objects reusable, object-oriented development can potentially reduce time and cost of development

• Computer-aided software engineering (CASE)
  – Software tools to automate development and reduce repetitive work, including
    • Graphics facilities for producing charts and diagrams
    • Screen and report generators, reporting facilities
    • Analysis and checking tools
    • Data dictionaries
    • Code and documentation generators
  – Support iterative design by automating revisions and changes and providing prototyping facilities
  – Require organizational discipline to be used effectively
• Alternative systems-building methods
  – Traditional systems life-cycle
  – Prototyping
  – End-user development
  – Application software packages
  – Outsourcing

• Traditional systems life-cycle:
  – Oldest method for building information systems
  – Phased approach:
    • Development divided into formal stages
    • “Waterfall” approach: One stage finishes before next stage begins
  – Formal division of labor between end users and information systems specialists
  – Emphasizes formal specifications and paperwork
  – Still used for building large complex systems
  – Can be costly, time-consuming, and inflexible

• Prototyping
  – Building experimental system rapidly and inexpensively for end users to evaluate
  – Prototype: Working but preliminary version of information system
  – Approved prototype serves as template for final system
  – Steps in prototyping
    1. Identify user requirements.
    2. Develop initial prototype.
    3. Use prototype.
    4. Revise and enhance prototype.
The process of developing a prototype can be broken down into four steps. Because a prototype can be developed quickly and inexpensively, systems builders can go through several iterations, repeating steps 3 and 4, to refine and enhance the prototype before arriving at the final operational one.

**Advantages of prototyping**
- Useful if some uncertainty in requirements or design solutions
- Often used for end-user interface design
- More likely to fulfill end-user requirements

**Disadvantages**
- May gloss over essential steps
- May not accommodate large quantities of data or large number of users
- May not undergo full testing or documentation

**End-user development:**
- Uses fourth-generation languages to allow end-users to develop systems with little or no help from technical specialists
- Fourth generation languages: Less procedural than conventional programming languages
  - PC software tools
  - Query languages
  - Report generators
  - Graphics languages
  - Application generators
  - Application software packages
  - Very high-level programming languages
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Alternative Systems Building Approaches

• End-user development (cont.):
  – Advantages:
    • More rapid completion of projects
    • High-level of user involvement and satisfaction
  – Disadvantages:
    • Not designed for processing-intensive applications
    • Inadequate management and control, testing, documentation
    • Loss of control over data
  – Managing end-user development
    • Require cost-justification of end-user system projects
    • Establish hardware, software, and quality standards

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Alternative Systems Building Approaches

• Application software packages
  – Save time and money
  – Many offer customization features:
    • Software can be modified to meet unique requirements without destroying integrity of package software
  – Evaluation criteria for systems analysis include:
    • Functions provided by the package, flexibility, user friendliness, hardware and software resources, database requirements, installation and maintenance efforts, documentation, vendor quality, and cost
  – Request for Proposal (RFP)
    • Detailed list of questions submitted to packaged-software vendors
    • Used to evaluate alternative software packages

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Alternative Systems Building Approaches

• Outsourcing
  – Several types
    • Cloud and SaaS providers
      – Subscribing companies use software and computer hardware provided by vendors
    • External vendors
      – Hired to design, create software
      – Domestic outsourcing
        • Driven by firms need for additional skills, resources, assets
      – Offshore outsourcing
        • Driven by cost-savings
• **Outsourcing (cont.)**
  
  **Advantages**
  
  • Allows organization flexibility in IT needs

  **Disadvantages**
  
  • Hidden costs, for example:
    
    – Identifying and selecting vendor
    
    – Transitioning to vendor
  
  • Opening up proprietary business processes to third party

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**TOTAL COST OF OFFSHORE OUTSOURCING**

<table>
<thead>
<tr>
<th>Cost of Outsourcing Contracts</th>
<th>Base Case</th>
<th>Worst Case</th>
<th>Best Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Costs</td>
<td>$100,000</td>
<td>$120,000</td>
<td>$80,000</td>
</tr>
<tr>
<td>Hidden Costs</td>
<td>$20,000</td>
<td>$24,000</td>
<td>$16,000</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$120,000</td>
<td>$144,000</td>
<td>$96,000</td>
</tr>
</tbody>
</table>

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**Rapid Application Development (RAD)**

• **Process of creating workable systems in a very short period of time**

• **Utilizes techniques such as:**
  
  – Visual programming and other tools for building graphical user interfaces
  
  – Iterative prototyping of key system elements
  
  – Automation of program code generation
  
  – Close teamwork among end users and information systems specialists
• Joint application design (JAD)
  – Used to accelerate generation of information requirements and to develop initial systems design
  – Brings end users and information systems specialists together in interactive session to discuss system’s design
  – Can significantly speed up design phase and involve users at intense level

• Agile development
  – Focuses on rapid delivery of working software by breaking large project into several small subprojects
  – Subprojects
    • Treated as separate, complete projects
    • Completed in short periods of time using iteration and continuous feedback
  – Emphasizes face-to-face communication over written documents, allowing collaboration and faster decision making

• Component-based development
  – Groups of objects that provide software for common functions (e.g., online ordering) and can be combined to create large-scale business applications
  – Web services
    • Reusable software components that use XML and open Internet standards (platform independent)
    • Enable applications to communicate with no custom programming required to share data and services
    • Can engage other Web services for more complex transactions
    • Using platform and device-independent standards can result in significant cost-savings and opportunities for collaboration with other companies
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Application Development for the Digital Firm

- Mobile application development
  - Special requirements for
    - Smaller screens, keyboards
    - Multitouch gestures
    - Saving resources (memory, processing)
  - Responsive Web design
    - Web sites programmed so that layouts change automatically according to user’s computing device
  - Three main platforms
    - iPhone/iPad, Android, Windows Phone

Interactive Session: Technology

What Does It Take to Go Mobile?
- What management, organization, and technology issues need to be addressed when building mobile applications?
- How does user requirement definition for mobile applications differ from that in traditional systems analysis?
- Describe the business processes changed by USAA’s mobile applications before and after the applications were deployed.

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