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Business Information Systems  
Unit 4  
**Business Processes and  
Business Process Management**  
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### Key Processes in a Production Firm

- Offer Process (customer-to-order)
- Order Process (order-to-invoice)
- Product Development (idea-to-market)
- Customer Service (failure-to-invoice)

cf. Wigand et al. (2003), p. 80

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### What is a Business Process?

- Any combination of activities that contribute to an individual, identifiable, desired output that adds value to the business operations.
  - Printing pay checks
  - Processing e-mail orders
  - Exchanging defective parts
  - Credit approval

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### Process Models, Process Instances, Ad-hoc Processes

- Some processes are executed in a standardized manner, often based on a formal definition of the process. The latter is called a **Process Model**.
- Process models can be informal or formal and thus machine-readable.
  - **Informal**: McDonald's instructions for assembling a burger
  - **Formal**: UML activity diagram of a process
- An actual execution of a process is called a **Process Instance**.
- Some process instances do not follow a predefined pattern; these are called **Ad-hoc Processes**.

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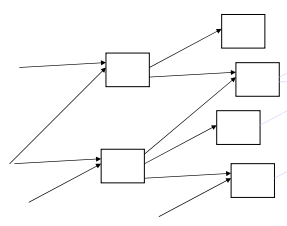
### Characteristics of Business Processes

- They have a **duration**, i.e. their execution can span a significant amount of time (not simple request-response)
- They can involve **machine and human actors**.
- They often require **data from other processes** inside the enterprise.
- They may require interaction with and contributions from the customer.

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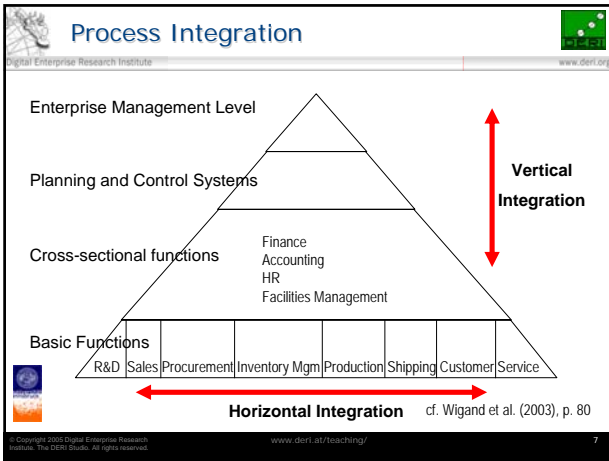
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### The Process Space of an Enterprise

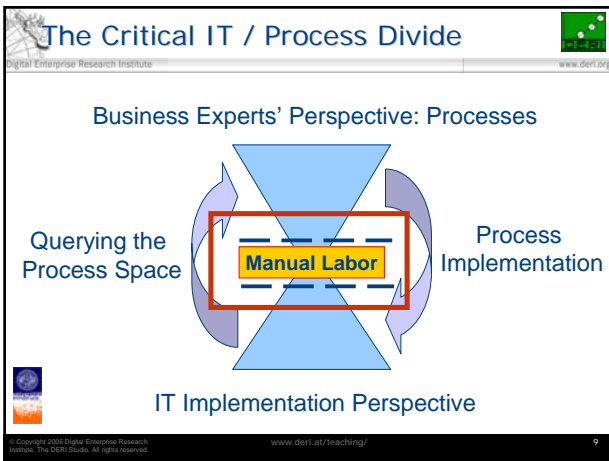
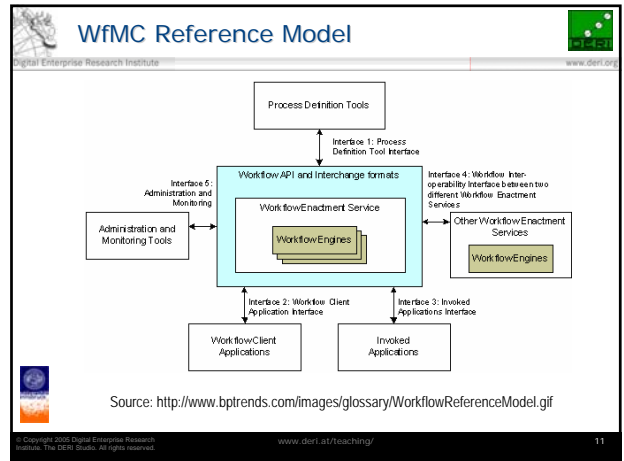
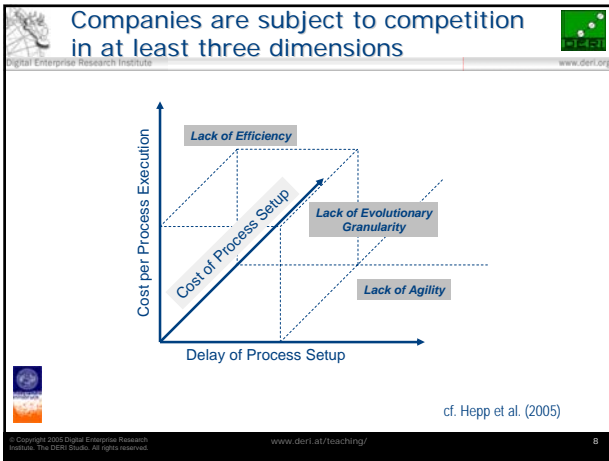


- Complex
- Dependencies
- Concurrent
- Access to scarce resources
- Evolutionary character

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- ### P2A: Workflow Management Systems
- First era of process automation
  - WfMS – a system that „supports a specific set of business processes through the execution of a **process specification**“
  - Perspectives:
    - Resources and Resource Management
    - Organizational Units
    - Tasks and Task Management
    - Data and Data Flow
    - Temporal Aspects (e.g. deadlines and durations)
    - Applications
    - Business Rules
    - Exception Handling
- cf. A. Oberweis: Person-to-Application Processes: Workflow Management, in Dumas/van der Aalst/ ter Hofstede: Process-Aware Information Systems
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- ### Challenges of Workflow Mgm Systems
- Lag in modeling or modifying workflow types (= models)
  - Alternative approach: Workflow Mining
  - Multiple workflow definition languages
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## P2P: Computer-Supported Collaborative Work

- Focus: Collaboration between human actors
- Difference to WfMS: P2P instead of P2A
  - interaction instead of sequential contributions
- Core challenges: Complexity of social interaction
  - supporting without restricting
  - e.g. voting mechanisms
- A form of a CSCW: Wiki infrastructure

cf. Ellis/Barthelmeß/Chen/Wainer: Person-to-Person Processes: Computer-supported Collaborative Work, in Dumas/van der Aalst/ter Hofstede: Process-Aware Information Systems

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## The Sense and Nonsense of Business Process Modeling and Business Process Reengineering

- Modeling existing processes is costly and takes time
- Many processes are „home-grown“ and do not follow best practices.
- As a consequence, modeling existing, sub-optimal processes for later implementation can be nonsense, because
  - the process itself could be improved
  - the process might change in the meantime
- Trend: Comprehensive packages of business software as libraries of best practices
  - also simplifies supply chain integration, reporting, ...

cf. R. Thome, A. Hufgard.: Continuous System Engineering., Würzburg 1996.

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## M2M: Enterprise Application Integration and Supply-Chain Integration

- **EAI**: Integrating processes, data flows, and systems inside an enterprise
- Business environments are usually heterogeneous, autonomous, and distributed („HAD“).
- Reasons: Historically grown systems landscape, decentralized decision making
- Lack of a „Chief Integration Officer“
- Due to inherent change, systems evolve in an uncoordinated manner
  - non-synchronized software updates / release changes
  - modifications in data representation and services choreographies
- Web services (SOAP-based) offer at least a technological base for exposing legacy functionality

cf. C. Bussler: Enterprise Application Integration and Business-to-Business Integration Processes, in Dumas/van der Aalst/ter Hofstede: Process-Aware Information Systems

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## Process Modeling

- **UML**
  - General idea of UML: common framework for software engineering notations that cover varying aspects
  - General challenge of UML: Ground all models in a common formal semantics
  - Most important model for Process Modeling: **Activity Diagrams**
  - Also: Class Diagrams for organizational structure etc.
- **Event-Driven Process Chains (EPCs)**
  - key component of SAP ERP software for business engineering
- **Petri Nets**
  - Models of distributed and concurrent discrete dynamic systems with a focus on local consequences of operations
  - Various subtypes of Petri Nets
  - strong formal grounding

[1] Engels/Forster/Heckel/Thone: Process Modeling Using UML  
 [2] Scheer/Thomas/AdamA. Oberweis: Process Modeling Using Event-Driven Process Chains,  
 [3] J. Desel: Process Modeling Using Petri Nets

All in: Dumas/van der Aalst/ter Hofstede: Process-Aware Information Systems

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## M2M: Supply-Chain Integration

SCOR is Based on Five Distinct Management Processes

Source: <http://www.supply-chain.org>

Integration of processes that have independent paths of evolution!  
 The same process can be part of multiple supply chains!

cf. C. Bussler: Enterprise Application Integration and Business-to-Business Integration Processes, in Dumas/van der Aalst/ter Hofstede: Process-Aware Information Systems

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## Process Mining

- Idea: WfMS and other Information Systems leave a lot of data about how processes are actually executed and how systems are used
  - Log files
  - execution times
  - Menu paths followed etc.
- This can be used to
  - identify mismatches between software usage and predefined processes
  - identify the need for new processes

cf. van der Aalst/Weijters: Process Mining, in Dumas/van der Aalst/ter Hofstede: Process-Aware Information Systems

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### The Six Sigma Principle of Process Quality

- Idea:** Make defective parts or insufficient service delivery an extremely unlikely event.
- Background:** The more complex business interactions are, the more costly is the occurrence of any component failure
- Example:**
  - one defective seat prevents the completion of a whole car and can interrupt the overall production run
  - a defective power supply or CD-ROM in a cell phone package can lead to extremely costly product exchange and service operations
- Definition:** Less than 3.4 parts per million parts (or service transactions) are allowed to exceed the lower or upper limit of product specification.

### The Six Sigma Principle of Process Quality

**Six Sigma Principle:**  
The distance between the mean and the upper limit and between the mean and the lower limit **is equal or greater than 6 times the variance.**

$$\sigma = \sqrt{\sum_{i=1}^N \frac{(\alpha_i - \mu)^2}{N^*}}$$

### The Six Sigma Principle of Process Quality (2)

- It is **impossible** to produce
  - sausages that weigh **exactly** 100 grams,
  - foils that are **exactly** 100 mm wide,
  - corn flakes packages that contain **exactly** 250 grams,
  - match boxes that **always** contain 100 matches.
- The likelihood for a continuous variable in a stochastic process to have exactly a discrete value is zero. **Only intervals** for values **may have a non-zero likelihood.**
- There is always variance**, due to
  - human error,
  - limitations of measuring,
  - unavoidable tolerances in machines and operations.

### Example: SLA for a Call Center Process

- Service Level Agreement**
  - every call should be answered in less than 20 seconds
- Log file**
- Is this a Six Sigma Process?**

| Incoming | Answered | Delay    |
|----------|----------|----------|
| 11:03:50 | 11:03:51 | 00:00:01 |
| 11:03:52 | 11:03:59 | 00:00:07 |
| 11:03:57 | 11:04:30 | 00:00:33 |
| 11:04:13 | 11:04:15 | 00:00:02 |
| 11:03:50 | 11:03:59 | 00:00:09 |
| 11:03:52 | 11:04:30 | 00:00:38 |
| 11:03:57 | 11:03:59 | 00:00:02 |
| 11:04:13 | 11:04:15 | 00:00:02 |
| 11:03:50 | 11:04:30 | 00:00:40 |
| 11:03:52 | 11:03:59 | 00:00:07 |

### Process Quality: Distribution and Variance

$$\sigma = \sqrt{\sum_{i=1}^N \frac{(\alpha_i - \mu)^2}{N^*}}$$

### Example: SLA for a Call Center Process

| Incoming | Answered | Delay    |
|----------|----------|----------|
| 11:03:50 | 11:03:51 | 00:00:01 |
| 11:03:52 | 11:03:59 | 00:00:07 |
| 11:03:57 | 11:04:30 | 00:00:33 |
| 11:04:13 | 11:04:15 | 00:00:02 |
| 11:03:50 | 11:03:59 | 00:00:09 |
| 11:03:52 | 11:04:30 | 00:00:38 |
| 11:03:57 | 11:03:59 | 00:00:02 |
| 11:04:13 | 11:04:15 | 00:00:02 |
| 11:03:50 | 11:04:30 | 00:00:40 |
| 11:03:52 | 11:03:59 | 00:00:07 |

Mean:  
 $\mu = (1+7+33+2+9+38+2+2+40+7)/10 = 14.1$

$$\sigma^2 = \sum_{i=1}^N \frac{(\alpha_i - \mu)^2}{N^*}$$

$\sigma^2 = 233.69$   
 $\sigma = 15.29$

Upper limit: 20 secs  
 Upper limit - mean: 5.9  
 $6 * \sigma = 91.72$

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Thank you!

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