Enterprise Resource Planning (ERP)

University/Faculty Regulations

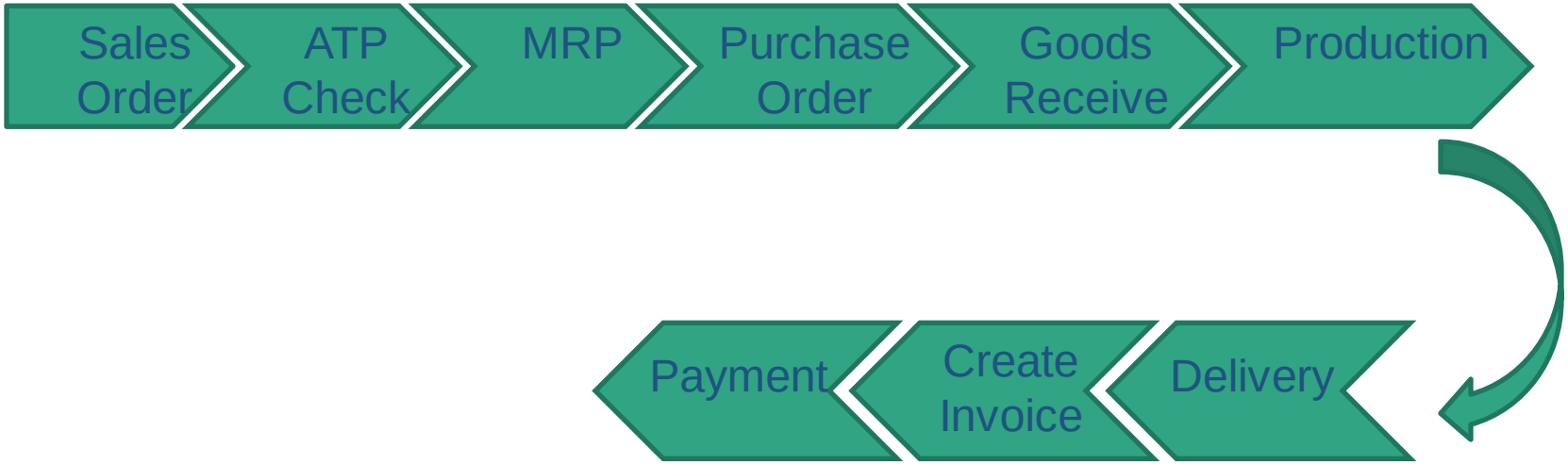
- **Minimum attendance in class : 75%**
- **No plagiarism in report/academic work and writing (Merriam-Webster's Collegiate Dictionary, Eleventh Edition, USA, 2003)**
  - to steal and pass off (the ideas or words of another) as one's own
  - to use (another's production) without crediting the source
  - to commit literary theft
  - to present as new and original an idea or product derived from an existing source
- **No cheating in examination**

Chapter 1
Introduction to ERP

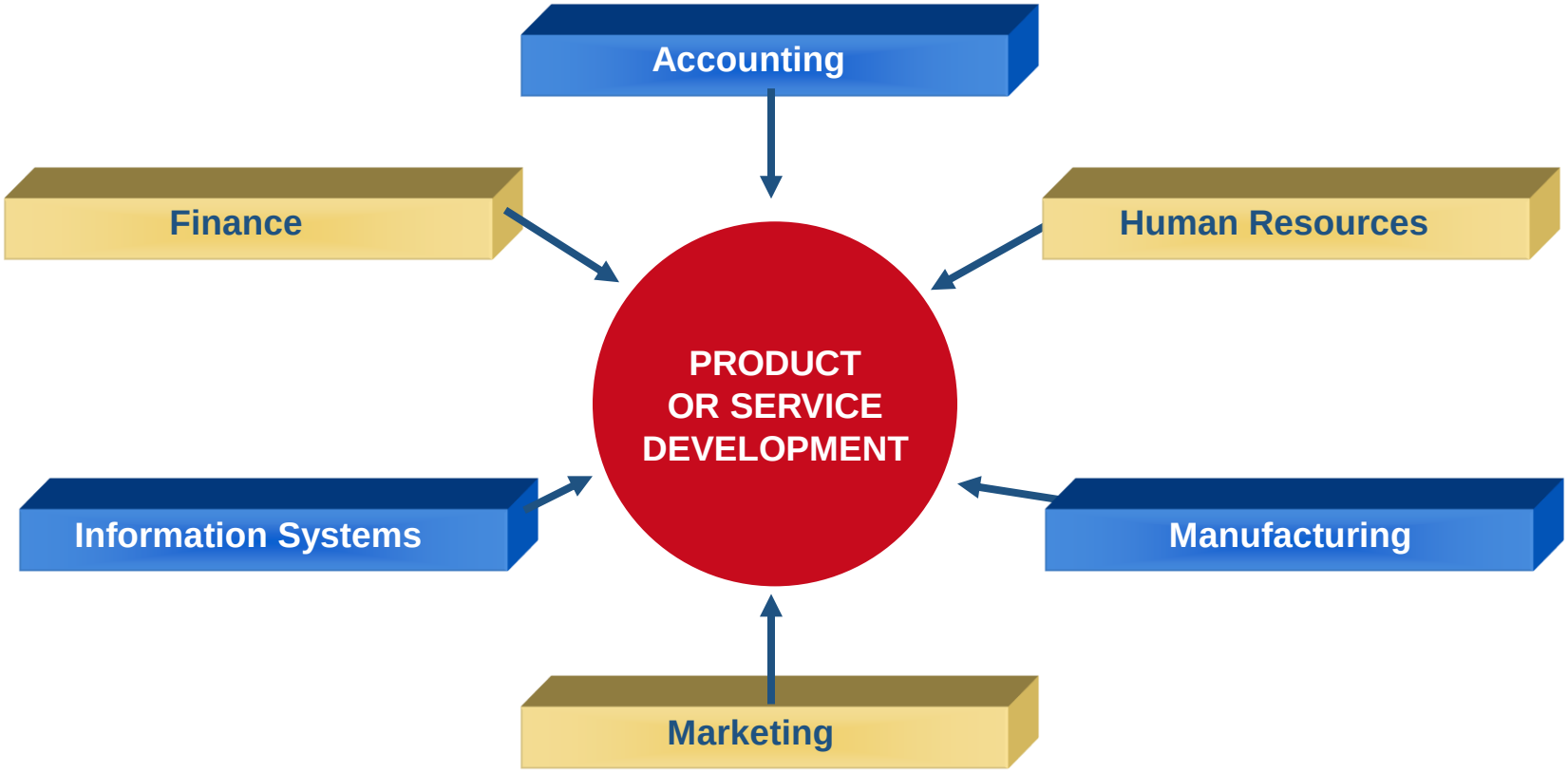
Learning Objectives

- Name the main functional areas of operation used in business
- Differentiate a business process from a business function
- Identify the kinds of data that each main functional area produces and needs
- Define integrated information systems and explain why they are important
- Identify the factors that led to the development of Enterprise Resource Planning (ERP) systems
- Describe the distinguishing modular characteristics of ERP software
- Discuss the pros and cons of implementing an ERP system
- Summarize ongoing developments in ERP

Business is Complex Activities!



Organization's Business Structure



History of Information Systems Within Organizations

Name	Era	Scope	Perspective	Example	Technology Symbols
Calculation systems	1950–1980 (Your grandfather)	Single purpose	Eliminate tedious human calculations. "Just make it work!"	Payroll General ledger Inventory	Mainframe Punch card
Functional systems	1975–20?? (Your mother)	Business function	Use computer to improve operation and management of individual departments.	Human resources Financial reporting Order entry Manufacturing (MRP and MRP II)	Mainframe Stand-alone PCs Networks and LANs
Integrated systems (also cross-functional or process-based systems)	2000 ... (You)	Business process	Develop IS to integrate separate departments into organization-wide business processes.	Customer relationship management (CRM) Enterprise resource planning (ERP)	Networked PCs Client-servers The Internet Intranets

Functional Systems

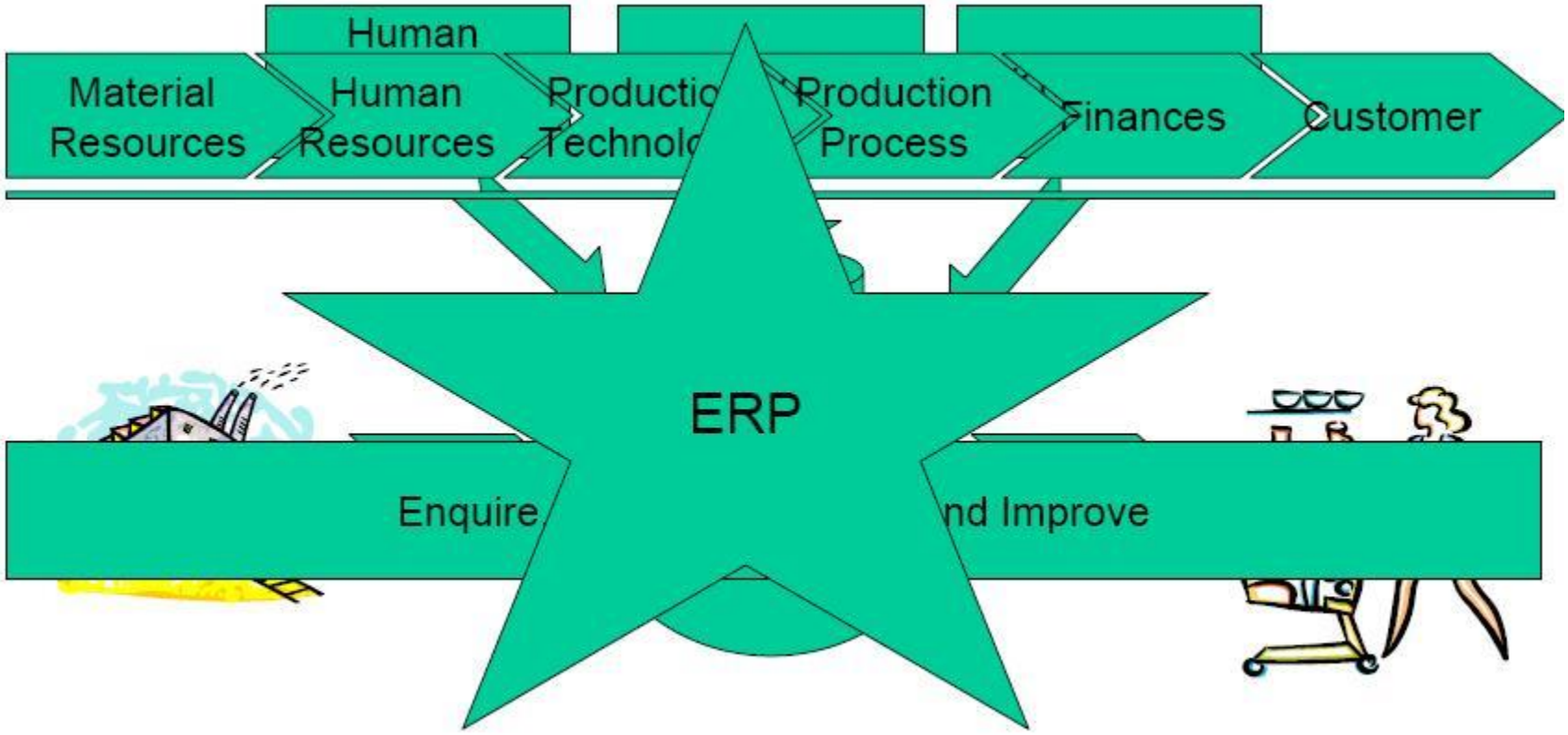
- **Functional systems facilitated the work of a single department/function**
- **These systems grew as a natural expansion of the capabilities of systems of the first era**
  - Payroll expanded to become human resources
  - General ledger became financial reporting
  - Inventory was merged into operations or manufacturing
- **These new functional areas added features and functions to encompass more activities and to provide more value and assistance**
- **The problem with functional applications is their isolation**
- **Functional applications are sometimes called islands of automation**

What is ERP Systems?

- **The software tools used to manage enterprise data**
- **A packaged business software system to**
  - automate and integrate the majority of business processes
  - share common data and practices
  - produce and access information in a real-time environment

An ERP system introduces "best practices" which are defined as "simply the best way to perform a process"

ERP as Integrated System



- **The goal is to provide quick and effective access to information**
- **From stand alone systems to integrated system to support business processes**
- **Common information model**
- **Standardized interfaces**

ERP is Used in …

- Aerospace & Defense
- Automotive
- Banking
- Chemicals
- Consumer Products
- Defense & Security
- Engineering, Const.
- Healthcare
- High Tech
- Higher Education
- Industrial Machinery
- Insurance
- Life Sciences
- Logistics Service Prod
- Media
- Mill Products
- Mining
- Oil & Gas
- Pharmaceuticals
- Postal Services
- Professional Services
- Public Sector
- Railways
- Retail
- Telecommunications
- Utilities
- Wholesale Distribution

The Evolution of ERP

- In the 1960s: most software packages included inventory capability
- In the 1970s: MRP (Materials Requirements Planning) system used a master production schedule and a bill of materials file with the list of materials needed to produce each item
- In the 1980s: MRPII systems incorporated the financial accounting systems along with manufacturing and materials management systems
- By the 1990s: ERP systems provided seamless integration of all information flows in the company – financial accounting, human resource, supply chain management and customer information

Before and After ERP: Business Standpoint

	Before ERP	With ERP
Cycle time	Costly bottlenecks	Time and cost reduction of business processes
Transactions processing	Multiple transactions use multiple data files	Faster transactions, using common data. Reduces the time and cost of multiple updates
Financial management	Increased cost of excess inventory, cost of overdue accounts receivable	Improves operational performance (e.g. Less excess inventory, reduction in accounts receivable)
Business processes	Proliferation of fragmented processes with duplication of effort	Re-engineering around a business model that conforms with "best practices"
Productivity	Lack of responsiveness to customers and suppliers	Improvements in financial management and customer service
Supply chain management	Lack of integration	Linkages with suppliers and customers
E-business	Web-based interfaces support isolated systems and their components	Web-based interfaces are front-end to integrated systems
Information	Lack of tactical information for effective monitoring and control of organizational resources	Allows cross-functional access to the same data for planning and control. Provides widely available information
Communications	Lack of effective communications with customers and suppliers	Facilitates organizational communications with customers and suppliers

Before and After ERP: Systems Standpoint

	Before ERP	With ERP
Information systems	Stand-alone systems	Integrated systems
Coordination	Lack of coordination among business functions (e.g. manufacturing and sales)	Supports coordination across business functions
Databases	Non-integrated data; data have different meanings (e.g. Customer); inconsistent data definition	Integrated data; data have the same meaning across multiple functions
Maintenance	Systems are maintained on a piecemeal basis; inconsistencies result; it's costly to maintain separate legacy systems	Uniform maintenance; changes affect multiple systems
Interfaces	Difficult to manage interfaces between systems	Common interfaces across systems
Information	Redundant; inconsistent information	Consistent real-time information (e.g. about customers, vendors)
System architecture	May not be state of the art	Relies on a client-server model
Processes	Incompatible processes	Consistent business processes which are based upon an information model
Applications	Disparate applications (e.g. many different purchasing systems)	Singgle applications (e.g. common purchasing system)

Business Benefits of ERP

ERP Performance Outcomes	Sweden Average*	U.S. Average*
Quickened information response time	3.81	3.51
Increased interaction across the enterprise	3.55	3.49
Improved order management/order cycle	3.37	3.25
Decreased financial close cycle	3.36	3.17
Improved interaction with customers	2.87	2.92
Improved on-time delivery	2.82	2.83
Improved interaction with suppliers	2.78	2.81
Reduced direct operating costs	2.74	2.32
Lowered inventory levels	2.60	2.70

*scale: 1 (not at all) to 5 (a great extent)
Sources: Mabert, Soni and Venkataramanan, 2000; Olhager and Selldin, 2003.

Tangible Benefits with ERP

Tangible Benefits	% of Companies
Inventory reduction	32
Personnel reduction	27
Productivity improvement	26
Order management improvement	20
Financial close cycle reduction	19
IT cost reduction	14
Procurement cost reduction	12
Cash management improvement	11
Revenue/profit increase	11
Transportation/logistics cost reduction	9
Maintenance reduction	7
Online delivery improvement	6

Source: Fryer, Bronwyn, “The ROI Challange”, CFO, September 1999, p.90

Intangible Benefits with ERP

Intangible Benefits	% of Companies
Information/visibility	55
New/improved processes	24
Customer responsiveness	22
Integration	13
Standardization	12
Flexibility	9
Business performance	7
Supply/demand chain	5

Source: Fryer, Bronwyn, “The ROI Challange”, CFO, September 1999, p.90

Company's Motivation to Implement ERP

Company's Motivation to Implement ERP	Swedish Average*	U.S. Average*
Replace legacy systems	4.11	4.00
Simplify and standardize systems	3.67	3.85
Gain strategic advantage	3.18	3.46
Improve interactions with suppliers, customers	3.16	3.55
Ease of upgrading systems	2.96	2.91
Link to global activities	2.85	3.17
Restructure company organization	2.70	2.58
Pressure to keep up with competitors	2.48	2.90

*scale: 1 (not at all) to 5 (a great extent)

Functional Areas and Business Processes

- **To understand ERP, you must understand how a business works**
  - Functional areas of operation
  - Business processes

Business Functions

Functional Areas of Operation

- Business functions: Activities specific to a functional area of operation
  - Marketing and Sales (M/S)
  - Supply Chain Management (SCM)
  - Accounting and Finance (A/F)
  - Human Resources (HR)

Functional Areas of Operation [2]

❖ Examples of functional areas of operation and their business functions

Functional area of operation	Marketing and Sales	Supply Chain Management	Accounting and Finance	Human Resources
Business functions	Marketing of a product	Purchasing goods and raw materials	Financial accounting of payments from customers and to suppliers	Recruiting and hiring
	Taking sales orders	Receiving goods and raw materials	Cost allocation and control	Training
	Customer support	Transportation and logistics	Planning and budgeting	Payroll
	Customer relationship management	Scheduling production runs	Cash-flow management	Benefits
	Sales forecasting	Manufacturing goods		Government compliance
	Advertising	Plant maintenance		

Functional Areas of Operation [3]

- **Functional areas are interdependent**
  - Each requires data from the others
- **Better integration of functional areas leads to improvements in communication, workflow, and success of company**
- **Information system (IS): Computers, people, procedures, and software that store, organize, and deliver information**

Business Processes

Definition of Business Processes

- **Collection of activities that takes one or more kinds of input and creates an output that is of value to customer**
  - Customer can be traditional external customer or internal customer
- **Thinking in terms of business processes helps managers to look at their organization from the customer's perspective**

Business Processes [2]

- Sample business processes related to the sale of a personal computer

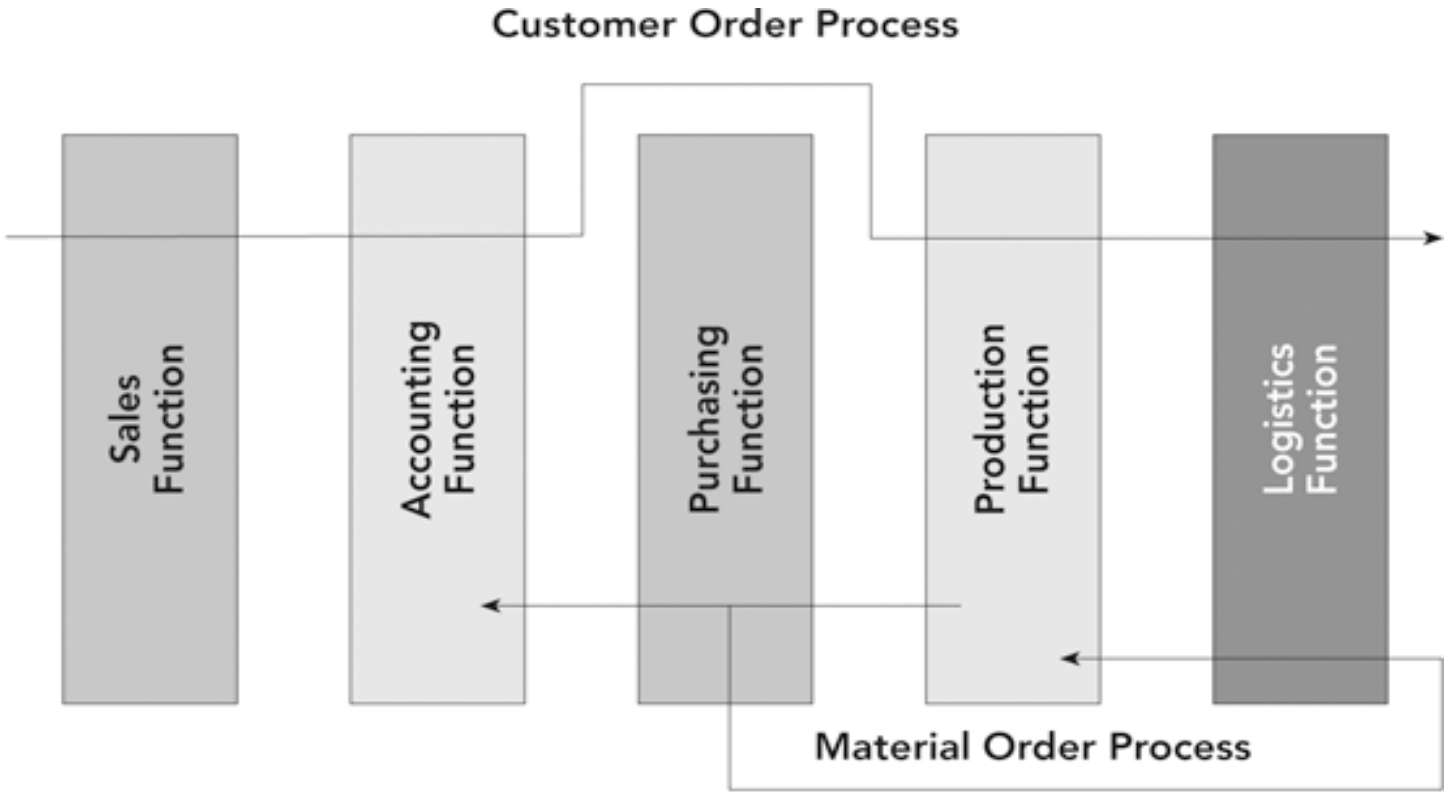
Input	Functional area responsible for input	Process	Output
Request to purchase computer	Marketing and Sales	Sales order	Order is generated
Financial help for purchase	Accounting and Finance	Arranging financing in-house	Customer finances through the computer company
Technical support	Marketing and Sales	24-hour help line available	Customer's technical query is resolved
Fulfillment of order	Supply Chain Management	Shipping and delivery	Customer receives computer

Business Processes [3]

- **Businesses must always consider customer's viewpoint in any transaction**
- **Successful customer interaction**
  - Customer (either internal or external) is not required to interact with each business function involved in the process
- **Successful business managers view business operations from the perspective of a satisfied customer**
- **Sharing data effectively and efficiently between and within functional areas leads to more efficient business processes**
- **Integrated information systems: Systems in which functional areas share data**

Business Processes [4]

- A process view of business



Business Processes [5]

- **Businesses take inputs (resources) and transform these inputs into goods and services for customers**
  - Inputs: Material, people, equipment
- **Managing inputs and business processes effectively requires accurate and up-to-date information**

Marketing and Sales

❖ Functions of Marketing and Sales

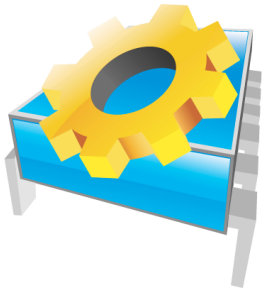
- Developing products
- Determining pricing
- Promoting products to customers
- Taking customers' orders
- Helping create a sales forecast

Marketing and Sales [2]

- **Marketing and Sales tasks for the lemonade stand**
  - Formal recordkeeping not required
  - Need to keep track of customers
  - Product development can be done informally
  - Good repeat customers allowed to charge purchases—up to a point
    - Records must show how much each customer owes and his or her available credit

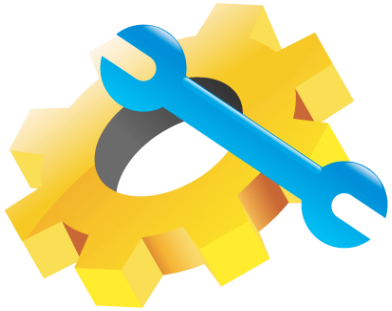
Supply Chain Management (SCM)

- **Functions within Supply Chain Management**
  - Making the lemonade (manufacturing/production)
  - Buying raw materials (purchasing)
- **Production planning requires sales forecasts from M/S functional area**
  - **Sales forecasts**: Analyses that attempt to predict the future sales of a product



Supply Chain Management [2]

- **Production plans used to develop requirements for raw materials and packaging**
  - Raw materials: Bottled spring water, fresh lemons, artificial sweetener, raw sugar
  - Packaging: Cups, straws, napkins
- **SCM and M/S must choose a recipe for each lemonade product sold**



Accounting and Finance

- **Functions within Accounting and Finance**
  - Recording raw data about transactions (including sales), raw material purchases, payroll, and receipt of cash from customers
- **Raw data: Numbers collected from those operations, without any manipulation, calculation, or arrangement for presentation**

Accounting and Finance [2]

- **Data from Accounting and Finance used by Marketing and Sales and Supply Chain Management**
  - Sales records are important component of sales forecast
  - Sales forecast is used in making staffing decisions and in production planning
  - Records from accounts receivable used to monitor the overall credit-granting policy of the lemonade stand

Human Resources

- **Functions of Human Resources**
  - Recruit, train, evaluate, and compensate employees
- **HR uses sales forecasts developed by the individual departments to plan personnel needs**
- **Systems integrated using ERP software provide the data sharing necessary between functional areas**

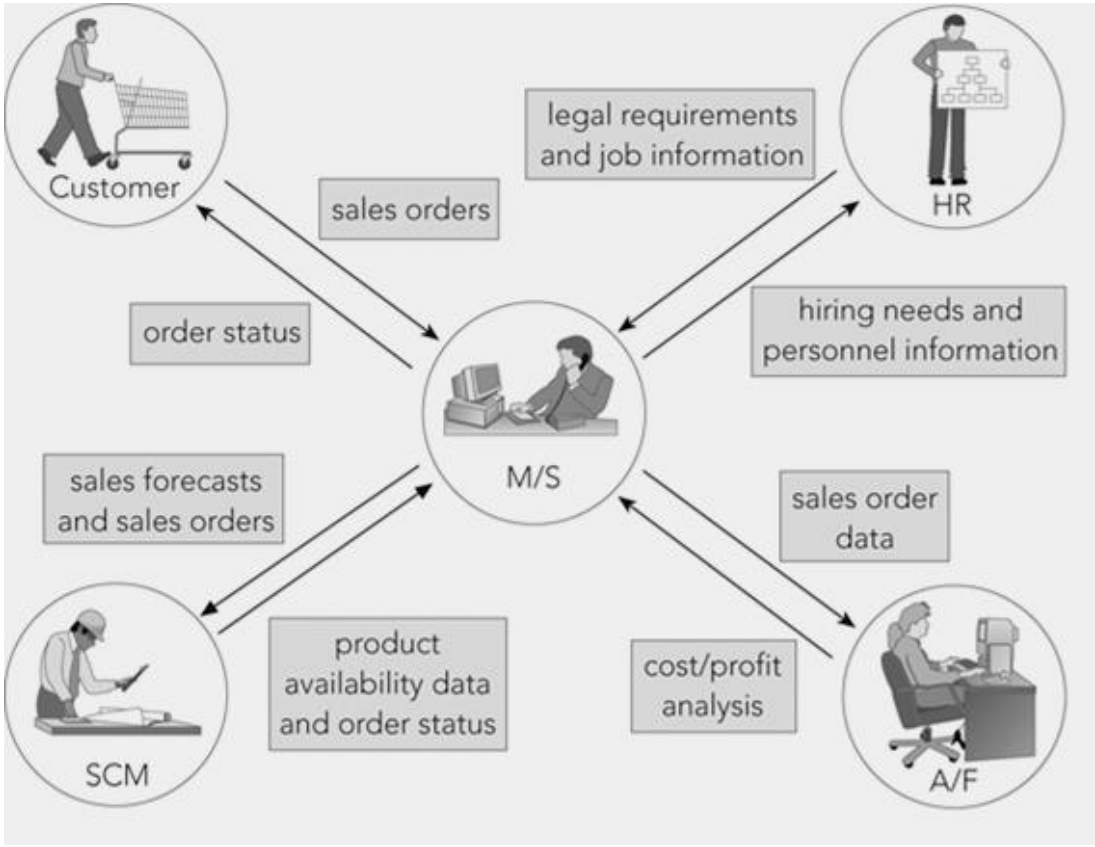
Functional Area Information Systems

Marketing and Sales

- **Needs information from all other functional areas**
- **Customers communicate orders to M/S in person or by telephone, e-mail, fax, the Web, etc.**
- **M/S has a role in determining product prices**
  - Pricing might be determined based on a product's unit cost, plus some percentage markup
  - Requires information from Accounting and Finance, and Supply Chain Management data

Marketing and Sales [2]

❖ The Marketing and Sales functional area exchanges data with customers and with the Human Resources, Accounting and Finance, and Supply Chain Management functional areas

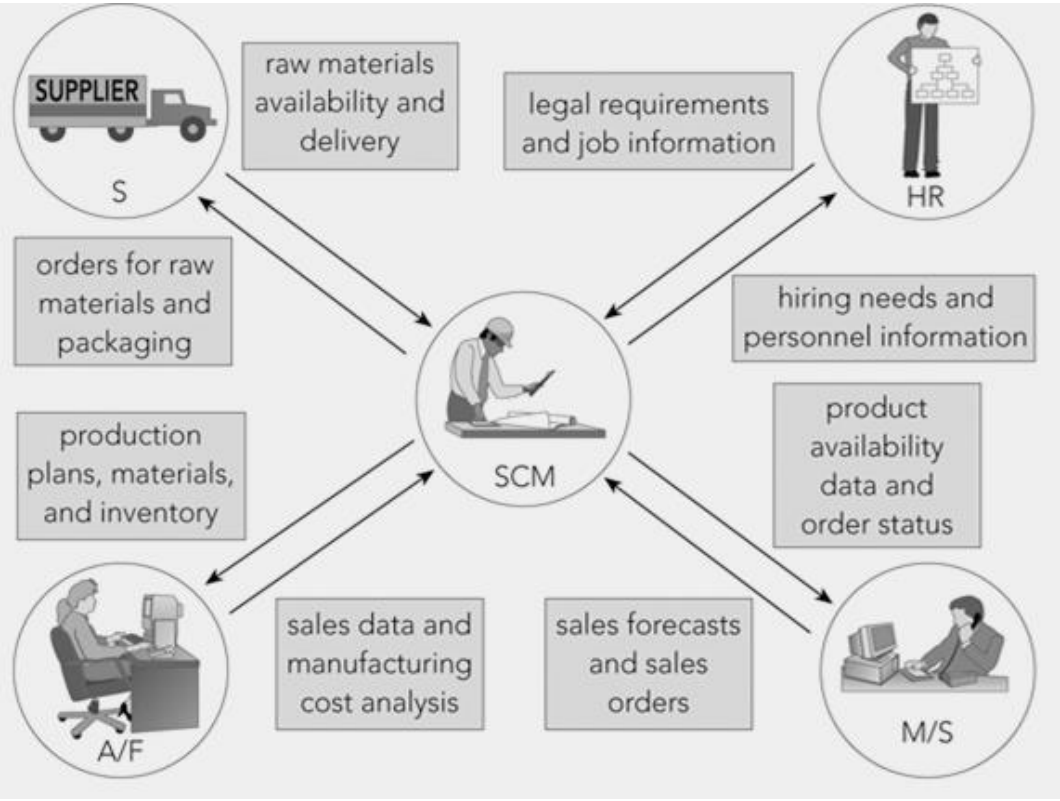


Supply Chain Management

- Needs information from various functional areas
- Production plans based on information about product sales (actual and projected) that comes from Marketing and Sales
- With accurate data about required production levels:
  - Raw material and packaging can be ordered as needed
  - Inventory levels can be kept low, saving money
- Supply Chain Management data and records can:
  - Provide data needed by Accounting and Finance to determine how much of each resource was used
  - Support the M/S function by providing information about what has been produced and shipped
- Supply Chain Management interacts in some ways with Human Resources

Supply Chain Management [2]

❖ The Supply Chain Management functional area exchanges data with suppliers and with the Human Resources, Marketing and Sales, and Accounting and Finance functional areas

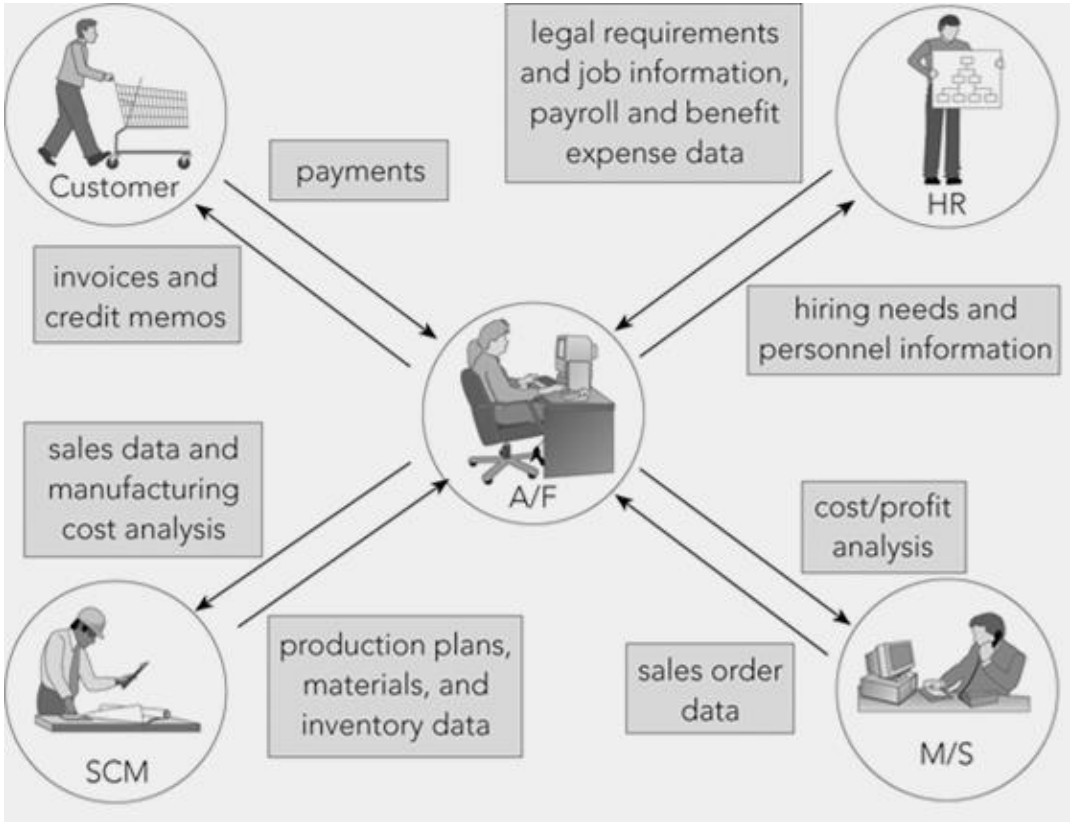


Accounting and Finance

- Needs information from all other functional areas
- A/F personnel:
  - Record company's transactions in the books of account
  - Record accounts payable when raw materials are purchased and cash outflows when they pay for materials
  - Summarize transaction data to prepare reports about company's financial position and profitability
- People in other functional areas provide data to A/F
  - M/S provides sales data
  - SCM provides production and inventory data
  - HR provides payroll and benefit expense data
- M/S personnel require data from A/F to evaluate customer credit

Accounting and Finance [2]

❖ The Accounting and Finance functional area exchanges data with customers and with the Human Resources, Marketing and Sales, and Supply Chain Management functional areas

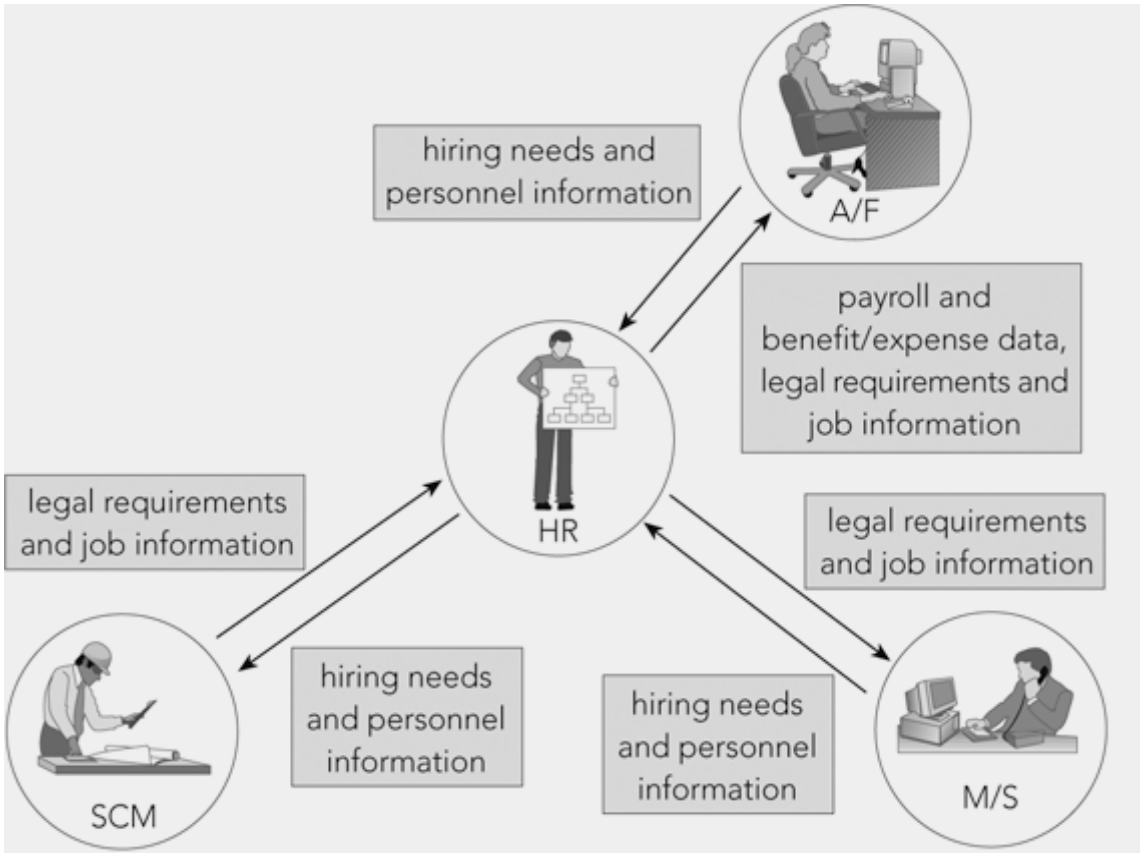


Human Resources

- HR needs information from the other departments
- Tasks related to employee hiring, benefits, training, and government compliance are all responsibilities of HR
- HR needs accurate forecasts of personnel needs from all functional units
- HR needs to know what skills are needed to perform a particular job and how much the company can afford to pay employees
- Observing governmental regulations in recruiting, training, compensating, promoting, and terminating employees

Human Resources [2]

❖ The Human Resources functional area exchanges data with the Accounting and Finance, Marketing and Sales, and Supply Chain Management functional areas



ERP Modules Supported by Vendors

Function	SAP	Oracle	PeopleSoft
Sales order processing	Sales and Distributions (SD)	Marketing Sales Supply Chain	Supply Chain Management
Purchasing	Materials Management (MM)	Procurement	Supplier Relationship Management
Production Planning	Production Planning (PP)	Manufacturing	
Financial Accounting	Financial Accounting (FA)	Financials	Financial Management Systems
Management Accounting	Controlling (CO)		
Human Resources	Human Resources (HR)	Human Resources	Human Capital Management

Source: Vendor Websites

ERP Design Alternatives

Option	Cost and Time	Advantages	Disadvantages
Vanilla ERP implementation	$150 million over 5 years	Complete standardization of business processes based upon vendor's "best practices"	Competitors have access to the same system Disruption of operations over 3-5 years
Partial ERP implementation (e.g. selected modules)	$108 million over 2-3 years	Partial changes in business processes	Disruption of operations over 2-3 years
In-house development	$240 million over 7-10 years	Custom-designed ERP system – unique from competitors	Long-term analysis and design process; high expenses
Status quo	No cost but no gain	No business process change; little disruption of operations	May provide a competitive disadvantage because competitors have an ERP system

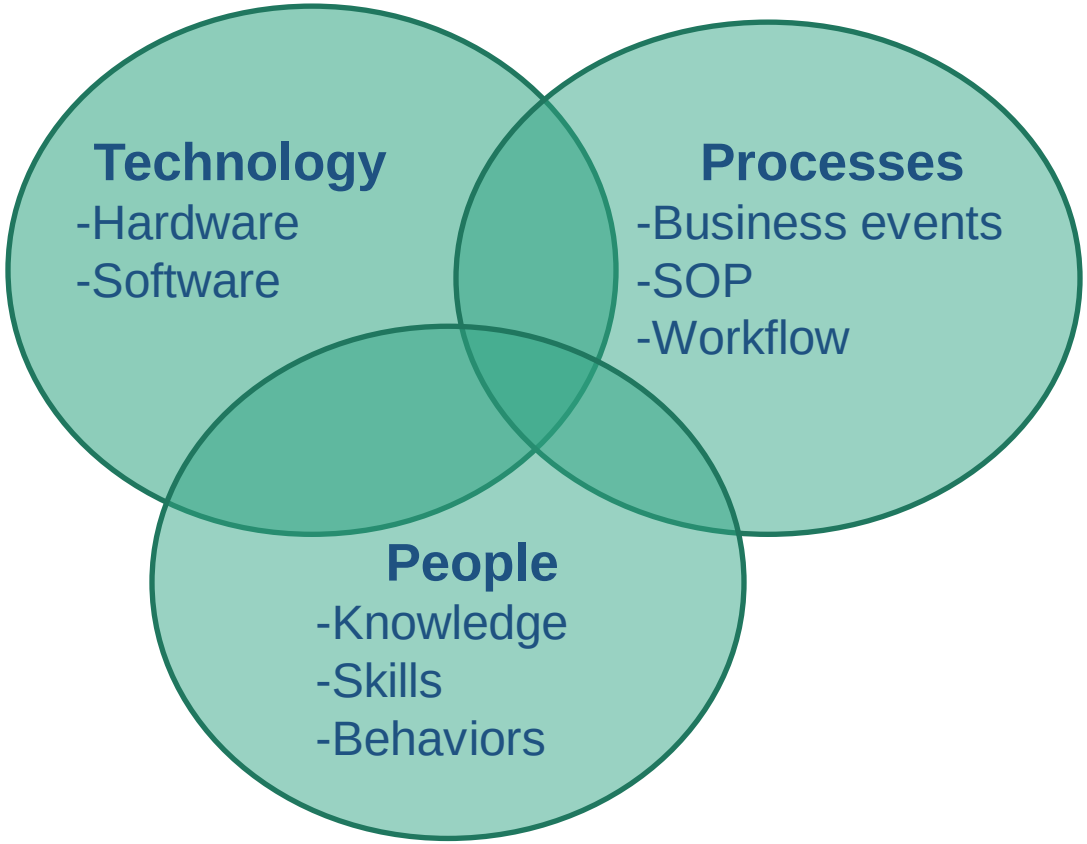
ERP Implementation Approach

Implementation Approach	Swedish (%)	U.S. (%)
Single ERP package	55.6	39.8
Single ERP package with other systems	30.1	50
Multiple ERP packages with other systems	6.5	4.0
Best-of-breed from several ERP packages	3.9	3.9
Totally in-house developed	2.0	0.5
In-house plus specialized packages	2.0	1.0

ERP Cost Components

ERP Cost Component	Swedish (%)	U.S. (%)
Software	24.2	30.2
Hardware	18.5	17.8
Consulting	30.1	24.1
Training	13.8	10.9
Implementation team	12.0	13.6

Main Elements in Implementing ERP



The Stages in Implementing ERP System

- **Markus et al. Proposes three stages:**
  - The project phase
    - Introducing ERP software
  - The shakedown phase
    - Implementing ERP software into the firm's operations
  - The onward and upward phase
    - ERP modules are sucessfully integrated with operations that the organization can achieve the actual business results such as inventory reduction

ERP Issues

- Use ERP system or develop from scratch?
- The biggest mistake made in implementing ERP, especially in a manufacturing environment, is to redesign the new system to work in the old environment (Honig, 1999)

The Development of ERP Systems

The Evolution of Information Systems

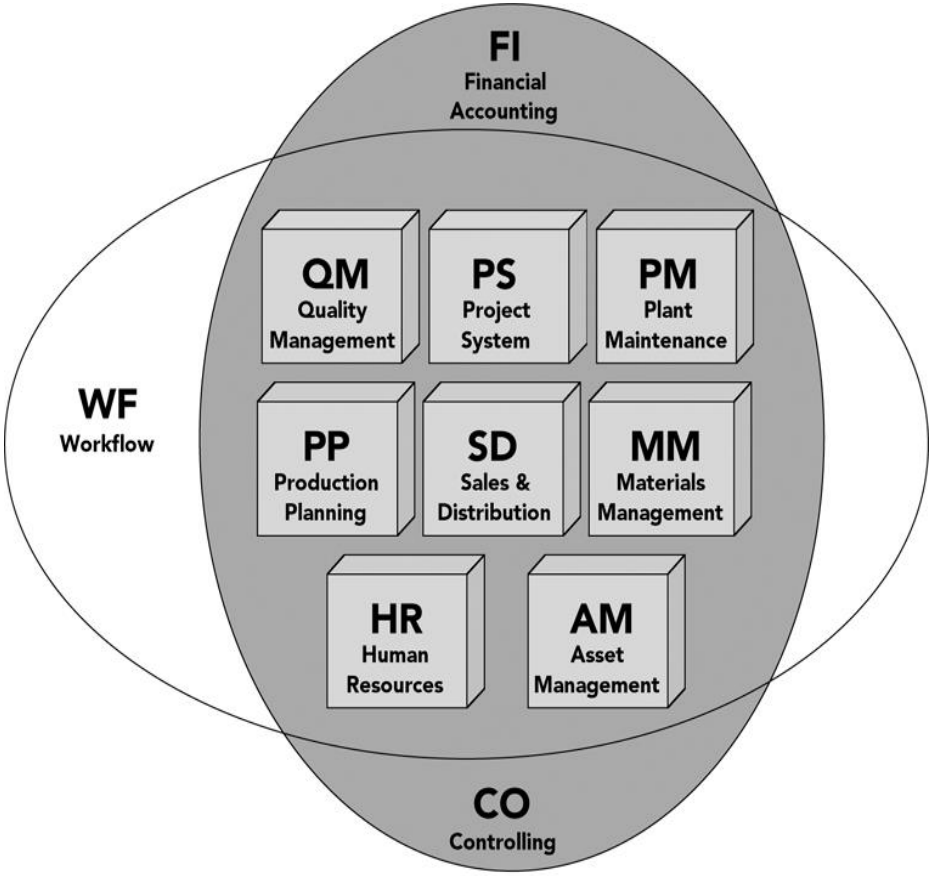
- **Silos**
  - Information systems configuration used until recently
  - Companies had unintegrated information systems that supported only the activities of individual business functional areas
- **Current ERP systems evolved as a result of:**
  - Advancement of hardware and software technology
  - Development of a vision of integrated information systems
  - Reengineering of companies to shift from a functional focus to a business process focus

ERP Software Emerges: SAP and R/3

- 1972: five former IBM systems analysts in Mannheim, Germany formed *Systemanalyse und Programmentwicklung* (Systems, Applications and Products in Data Processing, or SAP)
- SAP ERP: Latest versions of ERP systems by SAP and other companies allow:
  - All business areas to access the same database
  - Elimination of redundant data and communications lags
  - Data to be entered once and then used throughout the organization
- SAP's goals:
  - Develop a standard software product that could be configured to meet the needs of each company
  - Data available in real time
  - Users working on computer screens, rather than with voluminous printed output

SAP ERP

- **SAP ECC 6.0 (Enterprise Central Component 6.0)**
  - Sales and Distribution (SD)
  - Materials Management (MM)
  - Production Planning (PP)
  - Quality Management (QM)
  - Plant Maintenance (PM)
  - Asset Management (AM)
  - Human Resources (HR)
  - Project System (PS)
  - Financial Accounting (FI)
  - Controlling (CO)
  - Workflow (WF)



(Courtesy of SAP AG)

Summary

- **Employees working in one functional area need data from employees in other functional areas**
  - Functional area information systems should be integrated, so shared data are accurate and timely
- **Managers think in terms of business processes that integrate the functional areas**
  - Need to share information between functions and functional areas
  - ERP software provides this capability by means of a single common database
- **Accounting and Finance: Financial accounting to provide summaries of operational data in managerial reports, controlling accounts, planning and budgeting, and cash-flow management**

Summary [2]

- **Human Resources: Recruits, hires, trains, and compensates employees, ensures compliance with government regulations, and oversees the evaluation of employees**
- **Information systems capture, process, and store data to provide information needed for decision making**
- **Employees working in one functional area need data from employees in other functional areas**
  - Functional area information systems should be integrated, so shared data are accurate and timely
- **Managers think in terms of business processes that integrate the functional areas**
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References

- E.F.Monk and B.J. Wagner. *Concepts in Enterprise Resource Planning,* 4th edition. Course Technology, 2013
- Magal and Word. *Integrated Business Processes with ERP Systems*. Wiley, 2012
- Sumner, Mary. *Enterprise Resource Planning*. Prentice Hall, 2005.
- Teaching Materials from SAP University Alliances

Assignment 1

Purpose: Understand the existing open source ERP softwares

- Make a group (2-3 students) and write a paper in English (max. 5 pages) about existing open source ERP software package (min. 3 ERP software package)
  - Software description
  - Functionalities/modules
  - Advantages and disadvantages (comparison among software packages)
- Use IEEE format
- Deadline **18th September 2013**
  - Hardcopy (submited in the class)
  - Softcopy to SCELE