

Taxonomy of Information Systems



Challenges

- Businesses need **different types** of information systems to support decision making and work activities for various organizational levels, functions
- Although it is necessary to design **different systems** serving different levels, functions, and business processes in the firm, more and more firms are finding advantages in **integrating systems**



2

Approach to taxonomy

- Organizational classification
- Functional classification
- Process-oriented classification



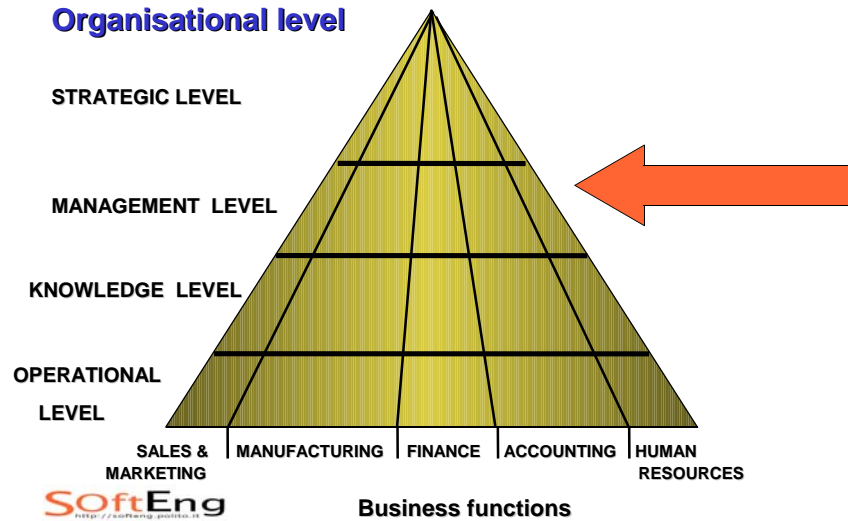
3

Organizational



4

Organizational taxonomy



5

Operational-level systems

- Support operational managers by keeping track of the elementary activities and transactions of the organization
 - ♦ Sales, payroll, flow of materials in a factory
- Answer routine questions
 - ♦ How many parts are in inventory?

SoftEng

6

Knowledge-level systems

- Help the firm integrate new knowledge into the business
- Help the organization control the flow of paperwork
- Most widely used applications in business today

SoftEng

7

Management-level systems

- Serve the monitoring, controlling, decision-making, and administrative activities of middle managers
- Provide periodic reports rather than instant information on operations
- Principal questions
 - ♦ Are things working well? (Routine monitoring)
 - ♦ What if? (Nonroutine decision making)

SoftEng

8

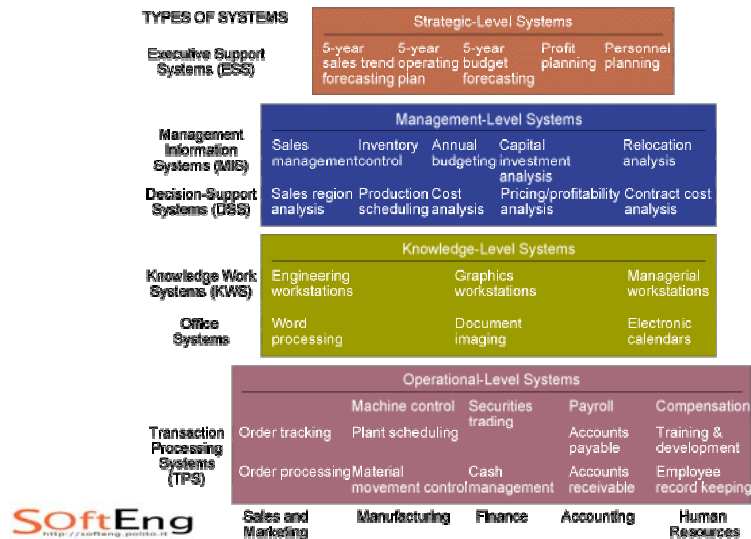
Strategic-level systems

- Help senior management tackle and address strategic issues and **long-term planning activities**
- Sample questions
 - ♦ What will employment levels be in five years?
 - ♦ What products should we be making in five years?

Major types of systems

- Executive support systems (ESS)
- Management information systems (MIS)
- Decision support systems (DSS)
- Knowledge work systems (KWS)
- Office automation systems (OAS)
- Transaction processing systems (TPS)

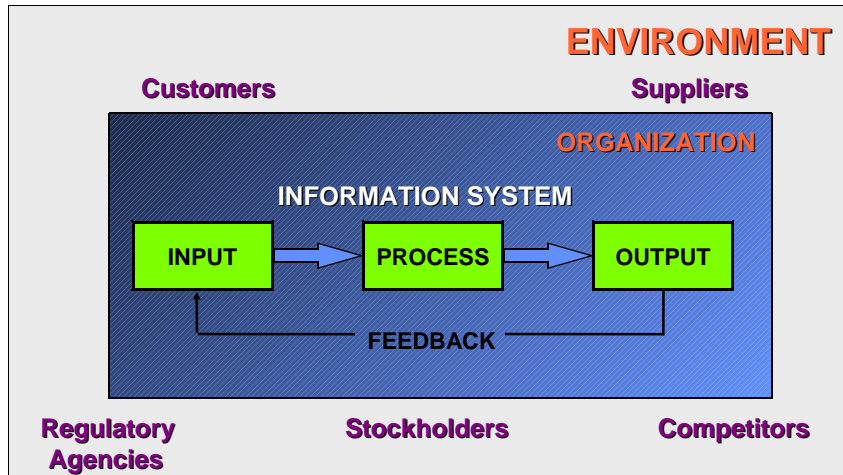
Major types of systems



TPS

- Operational level (key system!!!)
- Inputs: transactions, events
- Processing: sorting, merging, updating
- Outputs: detailed reports
- Users: operations personnel
- Example: package tracking system

Memo – Functions of an IS



Typical TPS applications

- MAJOR FUNCTIONS OF SYSTEMS:
 - ♦ Sales Management; Market Research; Promotion; Pricing; New Products
- MAJOR APPLICATION SYSTEMS:
 - ♦ Sales Order Info System; Market Research System; Pricing System

Sales & Marketing Systems

Typical TPS applications

- MAJOR FUNCTIONS OF SYSTEMS:
 - ♦ Scheduling; Purchasing; Shipping / Receiving; Engineering; Operations
- MAJOR APPLICATION SYSTEMS:
 - ♦ Materials Resource Planning Systems; Purchase Order Control Systems; Engineering Systems; Quality Control Systems

Manufacturing & Production Systems

Typical TPS applications

- MAJOR FUNCTIONS OF SYSTEMS:
 - ♦ Budgeting; General Ledger; Billing; Cost Accounting
- MAJOR APPLICATION SYSTEMS:
 - ♦ General Ledger; Accounts Receivable / Payable; Budgeting; Funds Management Systems

Finance & Accounting Systems

Typical TPS applications

- MAJOR FUNCTIONS OF SYSTEMS:
 - ♦ Personnel Records; Benefits; Compensation; Labor Relations; Training
- MAJOR APPLICATION SYSTEMS:
 - ♦ Payroll; Employee Records; Benefit Systems; Career Path Systems; Personnel Training Systems

Human Resources Systems

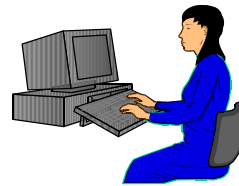
Typical TPS applications

- MAJOR FUNCTIONS OF SYSTEMS:
 - ♦ Admissions; Grade Records; Course Records; Alumni
- MAJOR APPLICATION SYSTEMS:
 - ♦ Registration System; Student Transcript System; Curriculum Class Control System; Alumni Benefactor System

Other Types (e.g., University)

Knowledge work systems

- Knowledge level
- Inputs: design specs
- Processing: modelling
- Outputs: designs, graphics
- Users: technical staff
- Example: engineering work station (CAD)



Office automation systems

- Data workers
- Toward a “paperless” office
 - ♦ Word processing, digital imaging, digital filing
- Scheduling
 - ♦ Electronic calendaring
- Communication
 - ♦ Email, videoconferencing
- Example: presentation graphics

MIS

- Report control oriented (summary and exceptions)
- Provide access to current performance and historical data
 - ♦ Past & present data
- Internal orientation
- Lengthy design process

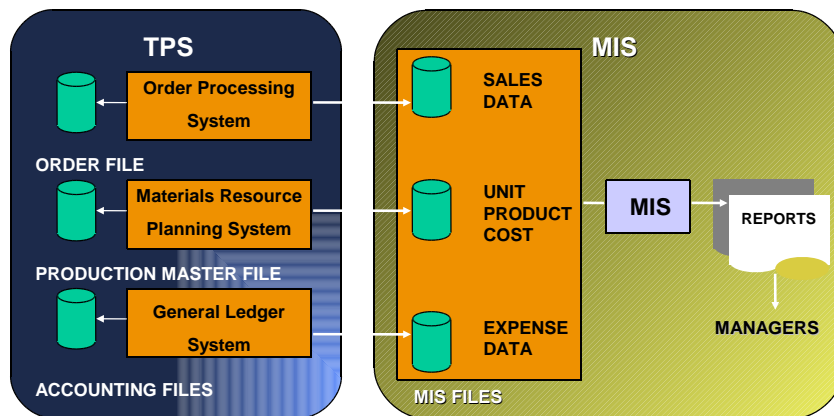
- Example: product unit performance, annual budgeting

MIS

- Management Information System
 - ♦ IS Serving the (middle) management level

- Inputs: high volume data (from TPS)
- Processing: simple models
- Outputs: summary reports
- Users: middle managers

TPS data for MIS applications



DSS Decision support systems

- Supports decision process (business intelligence)
- Use info from TPS, MIS, and extern
- Use many models to analyze and condense data
 - ♦ Sophisticated modeling tools
 - ♦ Great analytical power
- Interactive
 - ♦ Ask new question
 - ♦ Add new data
 - ♦ Change hypotheses



DSS Decision support systems

- Management level
- Inputs: low volume data
- Processing: interactive
- Outputs: decision analysis
- Users: professionals, staff

- Example: contract cost analysis, production scheduling

EIS Executive info systems

- Support decision making at the management top level
 - ♦ Non routine decisions
- EIS are not designed primarily to solve specific problems
- EIS provide a generalized computing and communications capacity that can be applied to a changing array of problems
 - ♦ They filter, compress, and track critical data, reducing time and effort required to obtain information useful to executives



EIS Executive info systems

- Workstations with menus, interactive graphics, and communications capabilities
- Can access historical and competitive data from **internal** corporate systems and **external** databases (e.G. Dow jones news)
- Designed to the **individual**
- Very **expensive** to keep up

EIS Executive support systems

- Strategic level
- Inputs: aggregate data
- Processing: interactive
- Outputs: projections
- Users: senior managers

- Example: 5 year operating plan

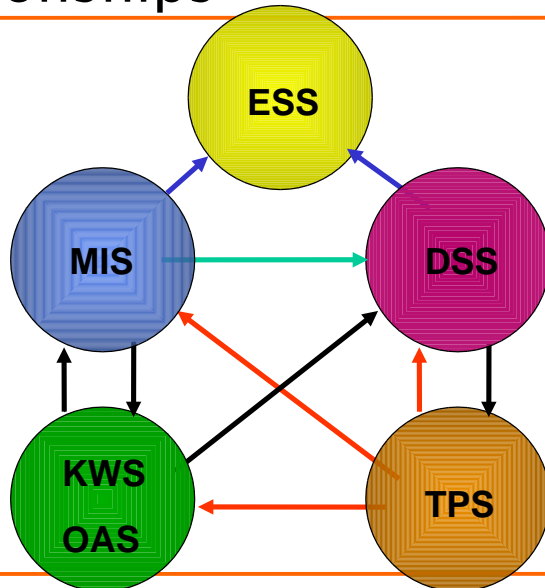
Decision support systems

- Management Information Systems (MIS)
 - ♦ assessment of structured decision at management level
- Decision Support Systems (DSS)
 - ♦ assessment of hypotheses and alternatives for loosely structured decisions
- Executive Information Systems (EIS/ESS)
 - ♦ high interactivity and flexibility in the production of synthesis data

Characteristics of IS

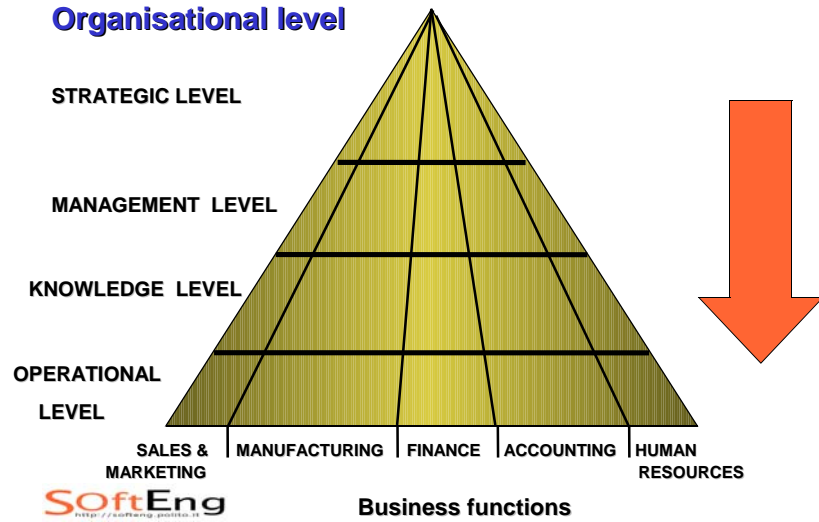
System	Input	Processing	Output	User
ESS	Aggregate data (external, internal)	simulation	Projections	Senior managers
DSS	Low-volume data (from optimized DBs), analytic models	Simulation, analysis	Special reports, decision analysis	Professionals, staff managers
MIS	Transactions summaries, high-volume data	Routine reports, low-level analysis	Summary and exception reports	Middle managers
KWS	Design spec, knowledge base	Modeling, simulation	Models, graphics	Professionals, technical staff
OAS	Documents, schedules	Document management, scheduling, communication	Documents, schedules, mail	Data workers
TPS	Transactions, events	Sorting, listing, merging	Detailed reports, lists, summaries	Operational managers, supervisors

Interrelationships



Functional

Functional taxonomy



33

Functional taxonomy

- Sales and Marketing Systems
- Manufacturing and Production Systems
- Finance and Accounting Systems
- Human Resources Systems

SoftEng
http://softeng.unibo.it

34

Sales and Marketing

- Marketing is concerned with
 - ♦ identifying the customers
 - ♦ determining what they need or want
 - ♦ planning and developing products and services to meet their needs
 - ♦ advertising and promoting these products and services
- Sales is concerned with
 - ♦ contacting customers
 - ♦ selling the products and services
 - ♦ taking orders
 - ♦ following up on sales

SoftEng
http://softeng.unibo.it

35

S&M examples

System	Description	Level
Order processing	Enter, process and track orders	Operational
Market analysis	Identify customers using demographics, markets, trends	Knowledge
Pricing analysis	Determine price for product or service	Management
Sales trend forecasting	Prepare 5-year sales forecast	Strategic

SoftEng
http://softeng.unibo.it

36

Manufacturing and Production

- Activities deal with
 - ♦ Planning, development, and maintenance of production facilities
 - ♦ The establishment of production goals
 - ♦ The acquisition, storage, and availability of production materials
 - ♦ Scheduling of equipment, facilities, materials, and labor required for finished products
- Integrate and control the production flow

M&P examples

System	Description	Level
Machine control	Control action of machines	Operational
Computer-aided design	Design new product	Knowledge
Production planning	Decide when and how many	Management
Facilities location	Decide where to locate new facilities	Strategic

Finance and Accounting

- Finance function
 - ♦ Managing the financial assets, such as cash, stocks, bonds, and other investments, in order to maximize the return
- Accounting function
 - ♦ Maintaining and managing the firm's financial records/receipts, disbursements, payroll, to account for the flow of funds in a firm

Finance and Accounting

System	Description	Level
Account receivable	Track money	Operational
Portfolio analysis	Design portfolio of investments	Knowledge
Budgeting	Prepare short-term budgets	Management
Profit planning	Plan long-term profits	Strategic

Human Resources

- HR function is responsible for
 - ♦ Attracting workforce
 - ♦ Developing workforce
 - ♦ Maintaining workforce
- Human resources information systems support activities such as
 - ♦ Identifying potential employees
 - ♦ Maintaining complete records on employees
 - ♦ Creating programs to develop employees skills

Human Resources

System	Description	Level
Training and development	Track employees training, skills and estimate performance	Operational
Career pathing	Design career paths for employees	Knowledge
Compensation analysis	Monitor fairness in employees wages and benefits	Management
HR planning	Plan long-term labor needs	Strategic

Process

Process-oriented taxonomy

- Business Process
 - ♦ Set of activities, for each: input, output, role
 - Input / output: material, information, knowledge
 - ♦ With objective of producing valuable product or service
- Can be inter or intra function

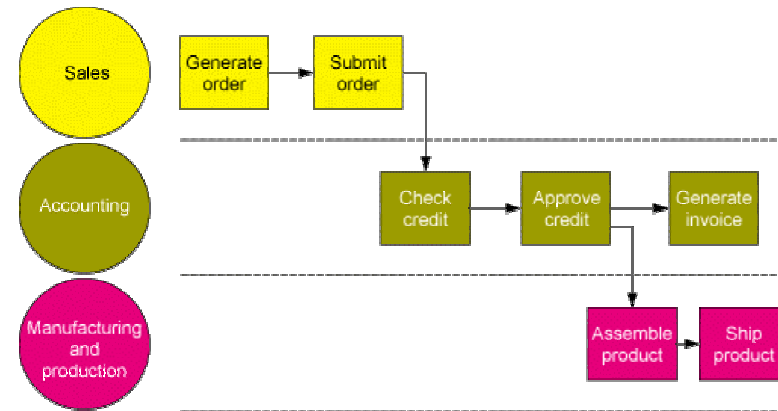
Processes – intra function

TABLE 2-6 EXAMPLES OF BUSINESS PROCESSES

Functional Area	Business Process
Manufacturing and production	Assembling the product
	Checking for quality
	Producing bills of materials
Sales and marketing	Identifying customers
	Making customers aware of the product
	Selling the product
Finance and accounting	Paying creditors
	Creating financial statements
	Managing cash accounts
Human resources	Hiring employees
	Evaluating employees' job performance
	Enrolling employees in benefits plans

Processes – inter function

Order fulfillment



Processes

- It is possible to automate processes and increase efficiency, but not necessarily the efficacy
- Focus:
 - Better understand which processes need to be improved
 - Not to automate processes just for the sake of automating

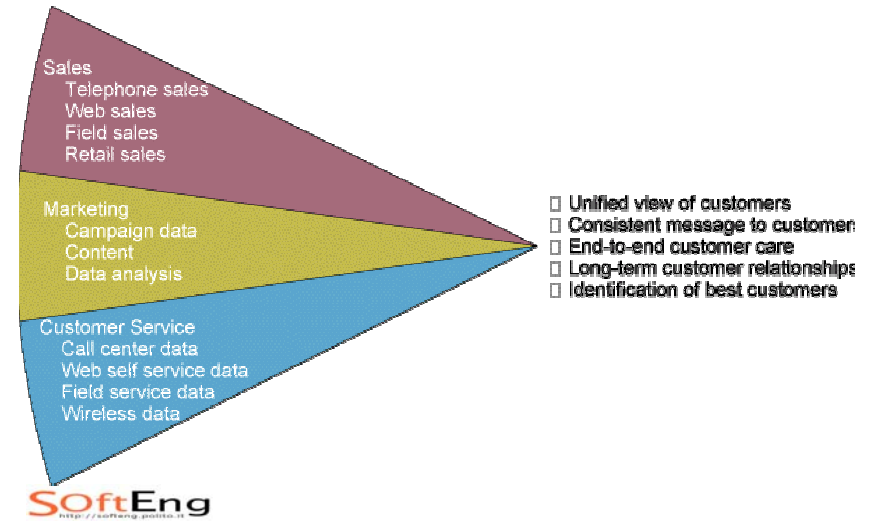
IS for process support

- CRM
 - Customer relationship management
- SCM
 - Supply chain management
- Enterprise systems

CRM

- Business and technology discipline to coordinate all of the business processes for dealing with customers
 - ♦ from receipt of an order acquisition through product delivery
 - ♦ From existing customer to new ones
- Old approach: customer information spread among different functions
- More recently: spread among different channels
 - ♦ Web site, call centers, counters

CRM



CRM should answer to

- What is the value of a particular customer to the firm over his or her lifetime?
- Who are our most loyal customers?
 - ♦ (It costs six times more to sell to a new customer than to an existing customer.) (Kalakota and Robinson, 2001).
- Who are our most profitable customers?
 - ♦ (Typically 80–90% of a firm's profits are generated by 10–20% of its customers.)
- What do these profitable customers want to buy?

SCM

- Coordination of all the activities and information flows involved in buying, making, and moving a product
- Old approach: no (little) integration of IS of different companies, functions

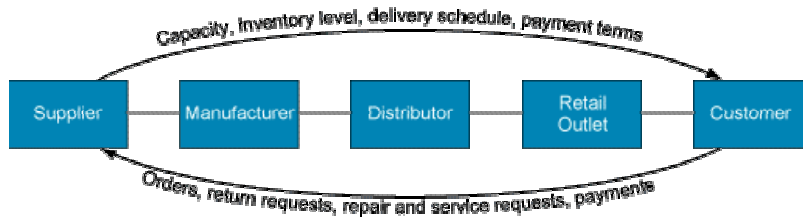


TABLE 2-7

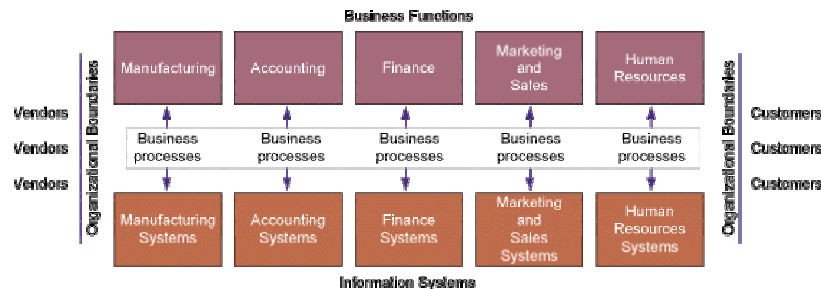
HOW INFORMATION SYSTEMS CAN FACILITATE SUPPLY CHAIN MANAGEMENT

Information systems can help participants in the supply chain

- Decide when and what to produce, store, and move
- Rapidly communicate orders
- Track the status of orders
- Check inventory availability and monitor inventory levels
- Track shipments
- Plan production based on actual customer demand
- Rapidly communicate changes in product design
- Provide product specifications
- Share information about defect rates and returns

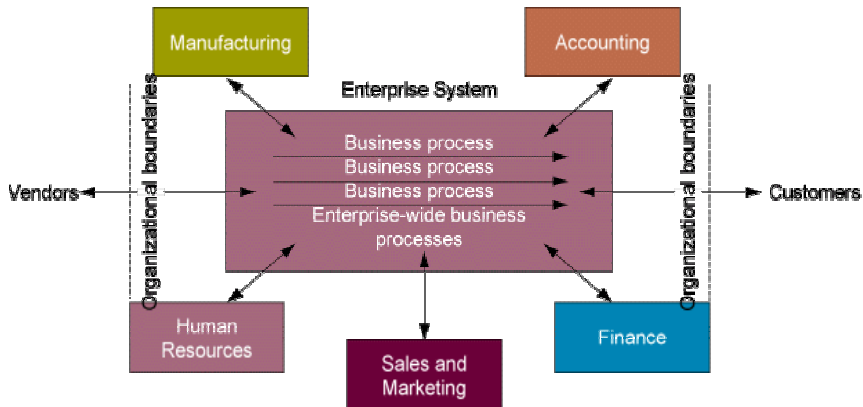
- Enterprise Information System, Enterprise Resource Planning

- Organizations often have several IS that do not talk to each other



- sales personnel might not be able to tell at the time they placed an order whether the items that were ordered were in inventory;
- customers could not track their orders;
- manufacturing could not communicate easily with finance to plan for new production

ERP



57

Example

- A sales representative in Brussels enters a customer order
- The factory in Hong Kong receives the order and begins production.
- The warehouse checks its progress on-line and schedules the shipment date.
- customer service representatives can track the progress of the order through every step of the manufacturing process.
- Updated sales and production data automatically flow to the accounting department.
- The system transmits information for calculating the salesperson's commission to the payroll department.
- The system also automatically recalculates the company's balance sheets, accounts receivable and payable ledgers, cost center accounts, and available cash

SoftEng
<http://softeng.unl.edu.it>

58

Exercise

- Management at your agricultural chemicals corporation has been dissatisfied with production planning. Production plans are created using best guesses of demand for each product which are based on how much of each product has been ordered in the past. If a customer places an unexpected order or requests a change to an existing order after it has been placed, there is no way to adjust the production plans. The company may have to tell customers it can't fill their orders or may run up extra costs maintaining additional inventory to prevent stock-outs. At the end of each month, orders are totaled and manually keyed into the company's production planning system. Data from the past month's production and inventory systems are manually entered into the firm's order management system. Analysts from the sales department and from the production department analyze the data from their respective systems to determine what the sales targets and what the production targets should be for the next month. These estimates are usually different. The analysts then get together at a high-level planning meeting to revise the production and sales targets to take into account senior management's goals for market share, revenues, and profits. The outcome of the meeting is a finalized production master schedule. The entire production planning process takes 17 business days to complete. Nine of these days are required to enter and validate the data. The remaining days are spent developing and reconciling the production and sales targets and finalizing the production master schedule.

SoftEng
<http://softeng.unl.edu.it>

59

Exercise – 2

- Draw a diagram of the production planning process.
- Analyze the problems this process creates for the company.
- Define new process

SoftEng
<http://softeng.unl.edu.it>

60

Case Study

- Politecnico IS for student management
 - ♦ Enrollment, exams, statini, study plan, schedul ..
- Functions?
- Processes?

- Levels of IS? (strategic, etc)

Processes of functions

- New student enrollment
- Teaching load and study plan
- Exam registration
- Exam booking
- Tax payment
- Schedules
- Classrooms allocation

Divisions

- Sales and marketing
- Accounting
 - ♦ Tax payment
 - ♦ New student enrollment
 - ♦ Teaching load and study plan
- Manufacturing (logistics)
 - ♦ Exam booking, exam registration
 - ♦ Classroom allocation
- Human resources
- Finance

Divisions

- Central administration
- Student office
 - ♦ Tax payment
 - ♦ New student enrollment
 - ♦ Teaching load and study plan
 - ♦ Exam registration, statini
- Faculty
 - ♦ Classroom allocation, schedule
 - ♦ Professor teaching hours
- Departments

Levels

- TPS central administration
 - ♦ Student enrollment, exam registration
 - ♦ IBM360+Oracle
- MIS student office
 - ♦ student enrolled per exam
 - ♦ student enrolled per degree course
 - ♦ exam pass statistics
- ESS (strategy)
 - ♦ Activate a new laurea degree in XY?
 - ♦ How many students in the last 3 academica years had an exam profile suggesting they would have enrolled in the new degree? (minimum threshold = 50 new enrollment per year)