High level models

Licensing Note

Goal

- High level models of organizations and business processes
  - To classify processes
  - To support analysis and search of IT applications to support processes

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"Most businesses have just three core processes:

1. Sell stuff
2. Deliver stuff
3. Making sure you have stuff to sell and deliver"

Geary Rummler

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High level models

- Anthony's pyramid
  - Business functions
  - Organizational levels
- T Model + Business domains
  - Support
  - Primary
  - Managerial

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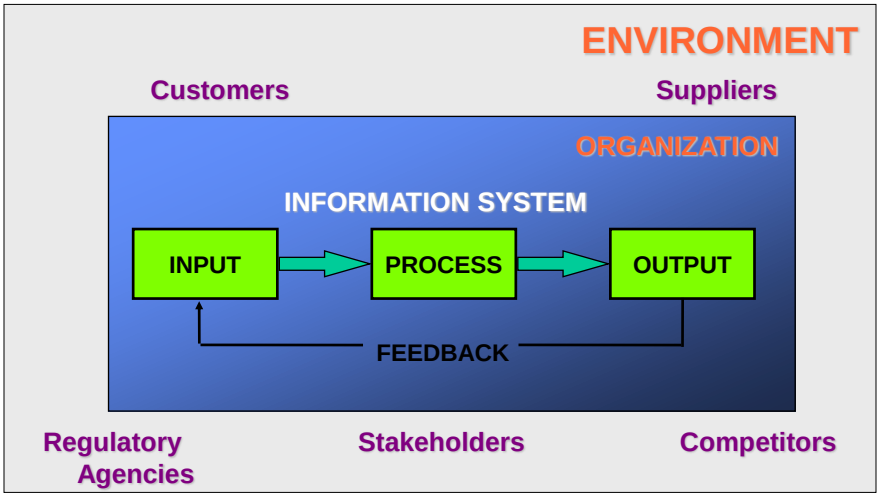
Control loop model



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- Very simplistic view on IS
  - Processes information from input to output (cfr CRASO)
- Important view on context and environment
  - Organizations (and the related IS) are influenced / interfaced with 5 types of actors

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Anthony's model

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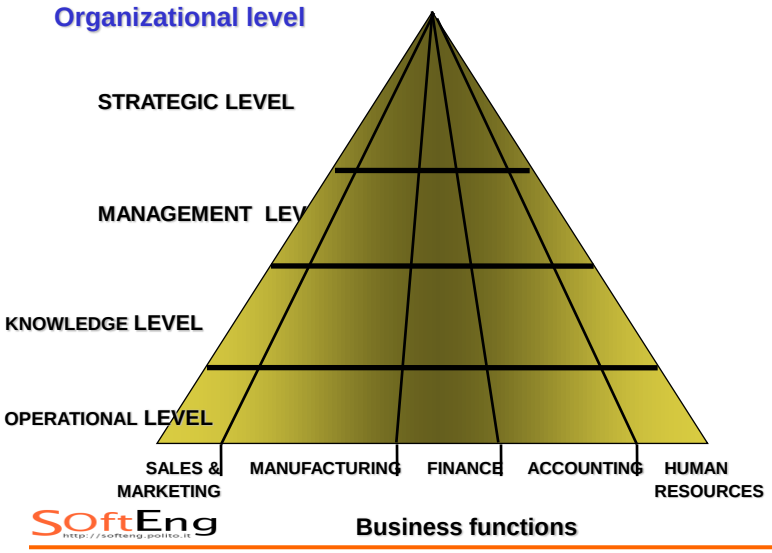
Anthony's model (pyramid)



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- Mixes
  - Functional view in terms of business functions
  - Organizational view in terms of hierarchical levels
  - At each intersection different IS functions are needed

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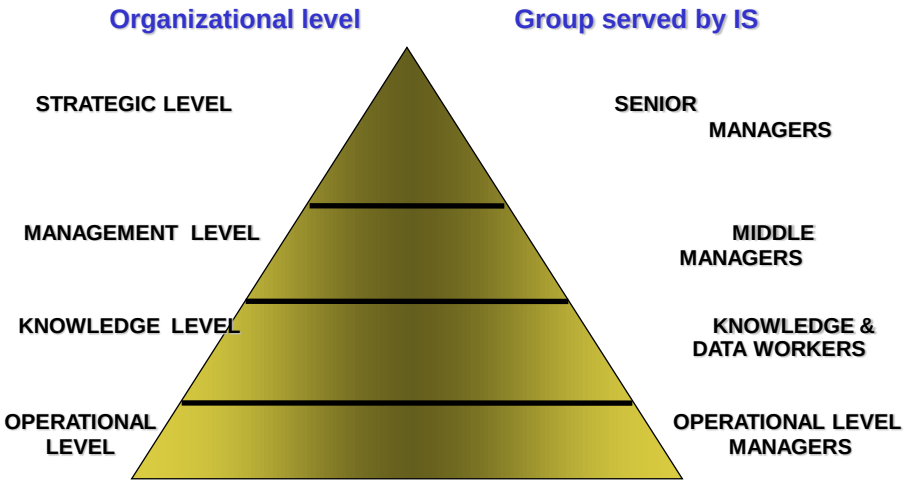
Organizational view



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Horizontal levels

- Operational level
  - Activity: support to day by day, repetitive activities
  - Time frame: fine grained, present
  - Size: majority of employees
- Management level
  - Activity: control and planning of operational level
  - Time frame: weeks / months, past and near future
  - Size: limited number of employees

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Horizontal levels

- Strategic level
  - Activity: key decisions on future
  - Time frame: long term future (months, years)
  - Size: very limited (1-10 people)

Horizontal levels

- Knowledge level
  - (only for organizations that design their products / services)
  - (not really a horizontal level, more an organizational unit)
  - Activity: design new products / services
  - Time frame: present, future
  - Size: depends on complexity of product / service

Example of process/levels

- City:
  - **Strategic** – check costs and incomes of social services, definition of new prices, building plans
  - **Management** – payment control, reminders, monthly comparison of budget vs. actual income
  - **Operational**– citizen payment accounting, road maintenance, pollution measurement

Example of process/levels

- Bank:
  - **Strategic** – assess performance of a service, decision to activate a new service
  - **Management** – review of negative balances, monitor employees and level of services
  - **Operational** – implement operations on accounts (withdrawals, bank transfers, ..)

Example of process/levels

- Water bottling company:
  - **Strategic** – select most promising market areas
  - **Management** – check weekly budget vs. actual
  - **Operational** – recording of orders

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Operational level

- Importance of IS = f (IO, IP)
  - IO – Information intensity of product
  - IP – Information intensity of process

[Porter Millar 1985]

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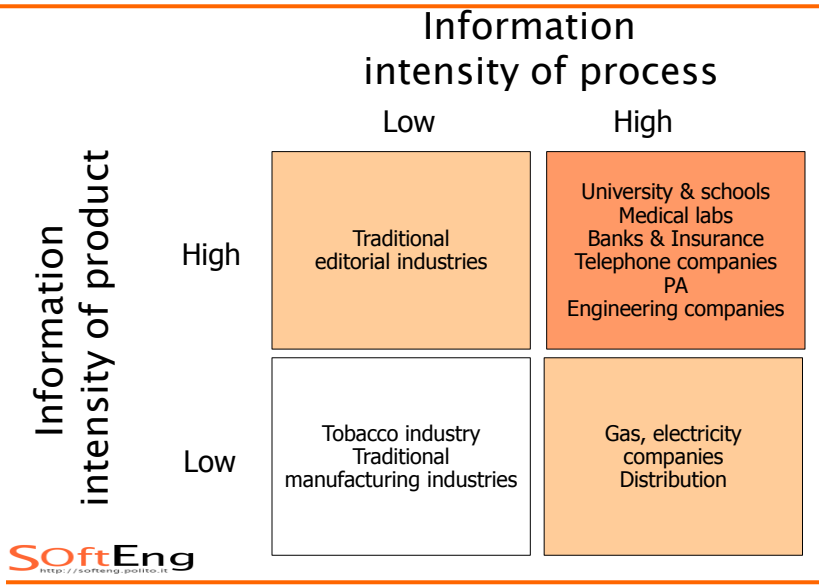
Operational level



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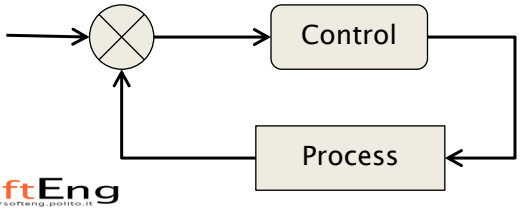
Management level

- Supports the management control loop
  - Goal definition
    - typically economical / budget
  - Analisys of results
  - Corrective actions



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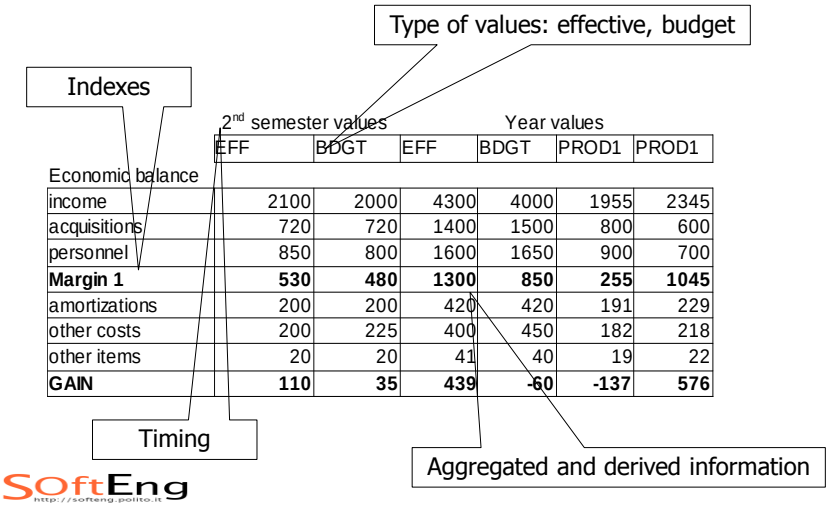
Management level

Management IS: Information for control



Economic balance	EFF	BDGT	EFF	BDGT	PROD1	PROD1
income	2100	2000	4300	4000	1955	2345
acquisitions	720	720	1400	1500	800	600
personnel	850	800	1600	1650	900	700
Margin 1	**530**	**480**	**1300**	**850**	**255**	**1045**
amortizations	200	200	420	420	191	229
other costs	200	225	400	450	182	218
other items	20	20	41	40	19	22
GAIN	**110**	**35**	**439**	**-60**	**-137**	**576**

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Operational vs. Management

	Operational	Management
Usage	Continuous	Periodic (eg. weekly)
Information	Simple, Current	Aggregate, Historical

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Strategic

- Analysis of very large data sets
  - Customer analysis (profiling)
  - Product analysis (dependability)
  - Performance analysis (dashboard)
    - Response time, quality level

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Strategic level

- Volumes of data available for analysis via business intelligence, data warehouse

Sector	Number of usual customers (order of magnitude)	Example of analysis (indexes)
Telephony (eg. EU monopolists)	More than 10 Million	- Profitability - Behavior / preferences
Bank (large banks)	More than 1 Million	- Profitability - Behavior / preferences
Electricity and gas (European monopoly)	Between 100.000 and 1 Million	- Profitability - Behavior / preferences
PA / Finance (Europe)	More than 10 Million	- Sectorial study - Segmentation of customer - Identify potential
Distribution	Between 100.000 and 1 Million	- Behavior / preferences

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)

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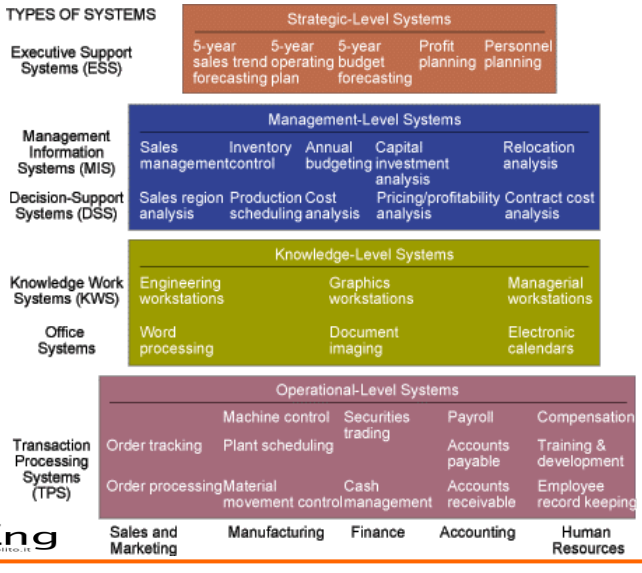
Major types of systems



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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

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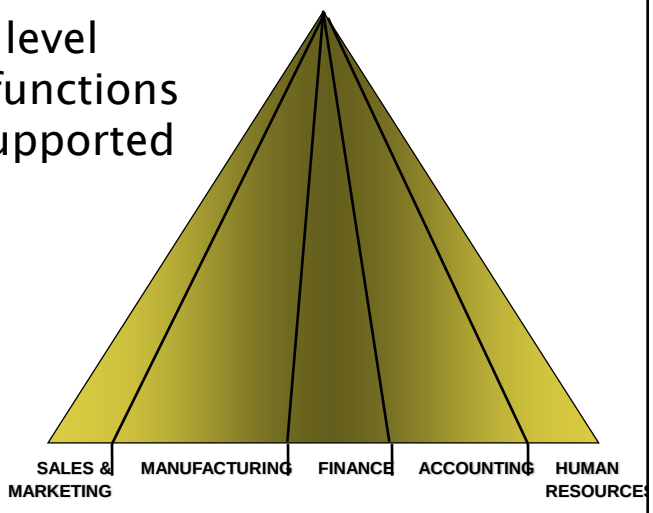
Business function view

- IS as high level business functions offered/supported



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Business functions

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Services to business functions

- E.g. Manifacturing function
  - Fulfill an order
  - Look at status of order
- E.g. Sale function
  - Accept an order
  - Make a bid

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Functional taxonomy

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

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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

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Sales & Marketing 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 forcasting	Prepare 5-year sales forcast	Strategic

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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

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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

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Finance and Accounting

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

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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

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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

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Human Resources

System	Description	Level
Training and development	Track employees training, skills and extimate 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

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T Model

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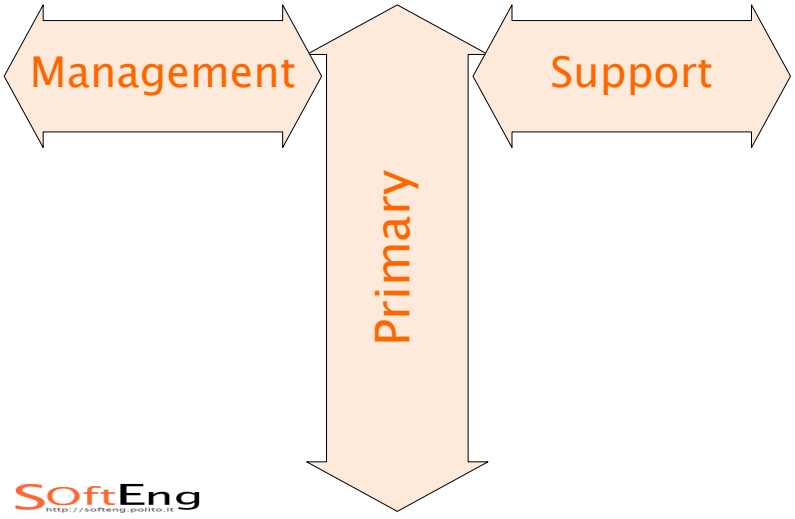
T Model



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Process families

Managerial processes	Primary Processes	Support Processes
Strategic planning Control Business Intelligence …	Production and provisioning of products and services	Accounting Resources management (human, investments, estate) Business support: (IT, general services) …
GOAL: Lead the organization	GOAL: Serve the customers	GOAL: Provide services to the organization and comply with law obligations

Process families

- Support
  - IT, Human resources, Accounting, Firm infrastructure
- Management
  - Business intelligence, strategy, management control
- Primary/Operational
  - Produce service or product

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Business domains

- Manufacturing
- Process industry
- Telecom
- Bank and insurance / Finance
- Retail
- Utilities
- Public administration
- Health
- …

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Vertical vs. Horizontal

- Vertical = specific to business domain
- Horizontal= not specific

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Process families and v – h

- Support
  - IT, Human resources, Accounting, Firm infrastructure
  - (horizontal)
- Managerial
  - Business intelligence, strategy, management control
  - (horizontal)
- Primary
  - Produce service or product
  - (vertical)

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SUPPORT PROCESSES

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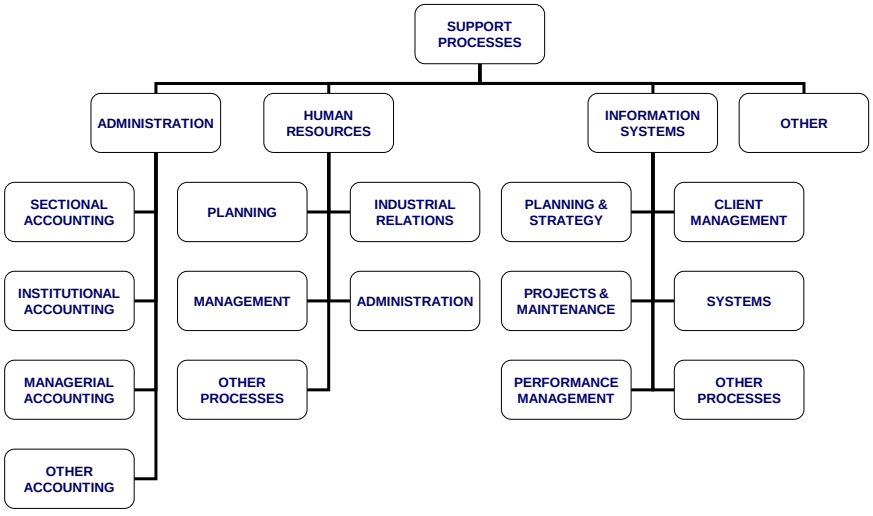
Support processes



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Support processes – Accounting

- Very old
  - Luca Pacioli, 1494, double entry bookkeeping
- Standards and norms available
  - Standards: IAS/IFRS

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Support processes – Accounting

- Sectional
  - Towards customers and suppliers
  - Accounts payable, accounts receivable
- Institutional
  - Towards stakeholders and law
  - Balance sheet, public communications, consolidated balance (groups), certifications
- Management accounting
  - Towards internal structure

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Support processes – HR

- Planning
  - Understand what skills are needed
    - Training, hiring
- Relationships
  - With trade unions
- Administration
  - Record working (leave) days
  - Payroll
  - Pension, health, insurance, taxes

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Support processes – HR

- Management
  - Search skills
  - Relationship management
  - Record skills and history
  - Training
  - Evaluation and compensation systems
  - Outplacement

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Support processes – IT

- Planning
- Production
- Operation

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MANAGERIAL PROCESSES

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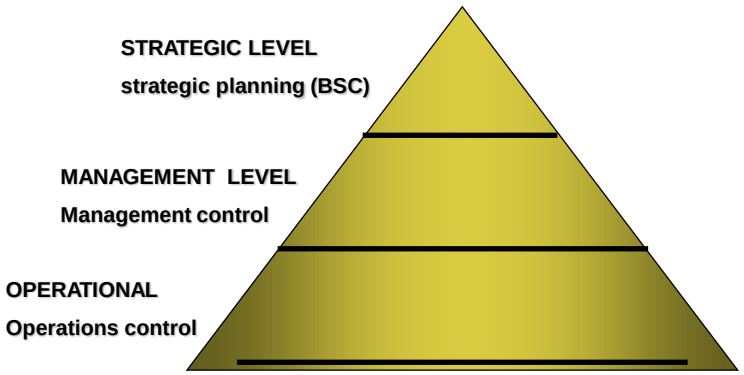
Managerial processes



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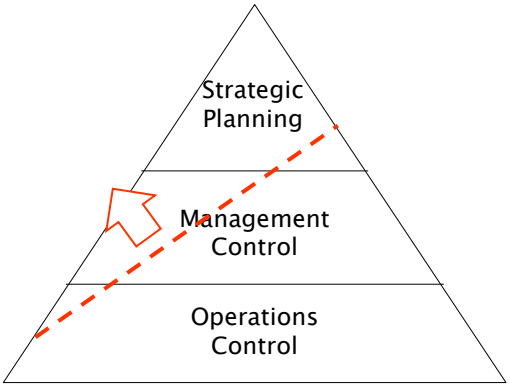
Managerial processes



IT has progessively automated managerial processes making large multinational organizations controllable

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Strategic planning

- What: strategy (markets, products, ..)
- When: as needed
- Output: strategic plan (projects that implement the strategy)
- Means: BSC
  - See later: Strategy chapter
  - See later: KPI BSC CSF

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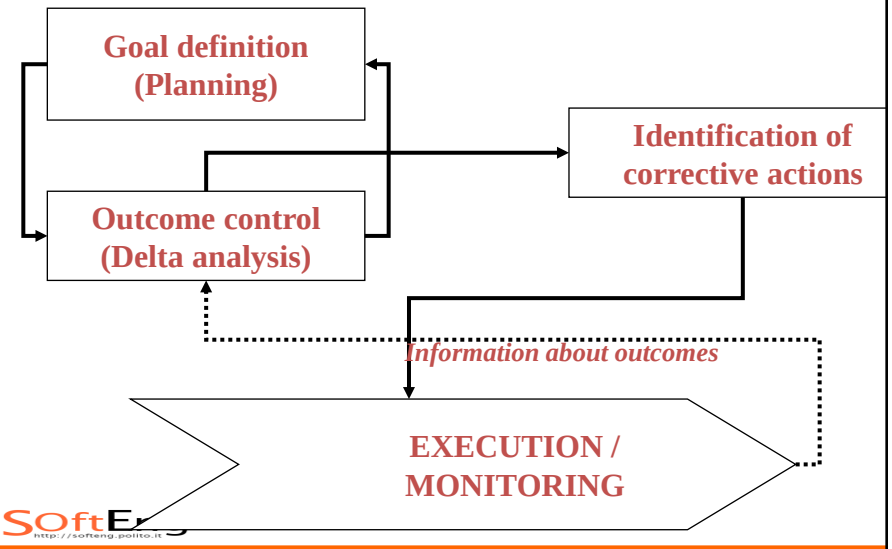
Management Control



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Management Control

- What
  - Budget (overall, per organizational unit)
- When
  - Planning (definition of planned budget), annual
  - Control (actual vs. planned), monthly
- Similar for most domains

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Operational control

- What
  - Specific operational indicators
  - (Depends strongly on domain)
- When
  - Frequent (continuous)
- Very structured for domains with complex products (automotive, aerospace), loosely structured in other domains (engineering)

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Decisions

- Simon (1958),
- Gorry and Scott Morton (1971)
  - Structured: follows an algorithm and is repeatable
  - Semistructured: output is defined, inputs and decisions partially defined
  - Unstructured: no algorithm, subjective

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Decisions

Decision Process	Level		
	Operational	Managerial	Strategic
Structured	Stock resupply	Maintenance Budget	Plant placement
Semi-structured	Bonds buy-sell	**Sale Budget**	Fund raising
Unstructured	Select cover for magazine	Manager hiring	R&D strategy

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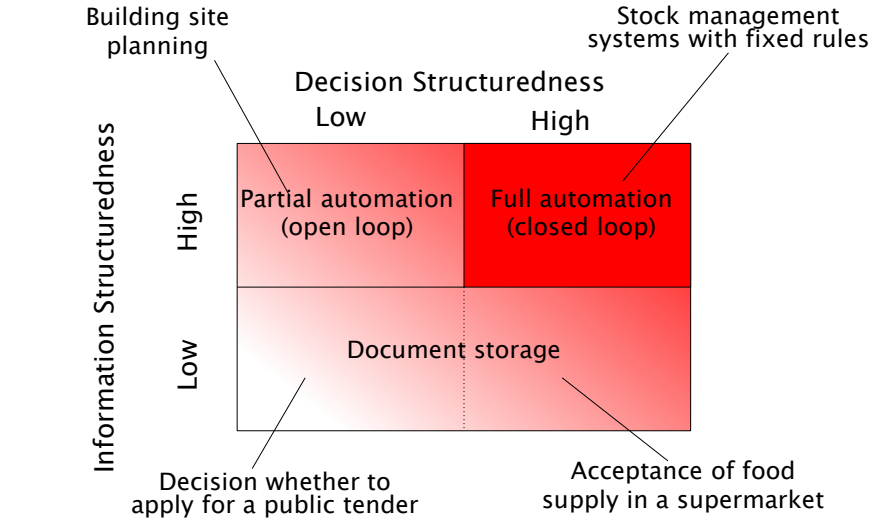
Control and Decisions



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PRIMARY PROCESSES

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Primary by business domain

- Manufacturing companies
- Process industries (chemistry, metallurgy)
- Telecom operators
- Utilities
- Banks/insurances
- Retail
- Public Administration (PA)
- Health

Manufacturing

- Value chain
- Planning Execution in manufacturing
- SCOR
- Segmentation by vendors
- Segmentation by integrators
- Open segmentations

Value chain

- [Porter 80, Porter Miller 1985]
- Process view of a company
  - Cfr. functional + org view in Antony
- Company implements sequence of processes/activities to deliver product/service
  - Primary/support activities
- Value of product is how much the customer is willing to pay for it
  - Cost != price

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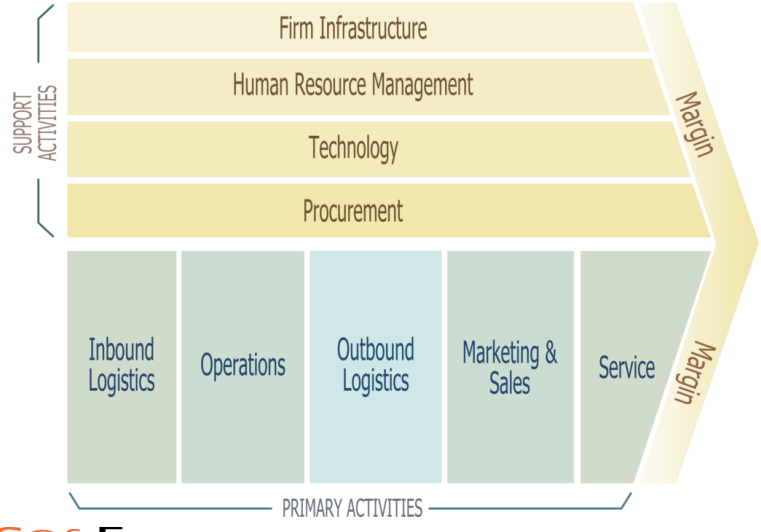
Value Chain



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Drawing by Dinesh Pratap Singh

Value chain

- Value chain defined for manufacturing companies
- Value chain concept still high level to identify ESs

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Planning / execution model

- Focus on vertical phases (inbound logistics, product design, operations, outbound logistics)
- Detail them (for manufacturing companies) and describe lower level processes

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Process types

- Processes and subprocess types
  - Planning
    - Strategic analysis
    - Planning
      - Year, month, week
  - Execution
    - Process and product data
    - Order management
    - Material management
    - Physical operations

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Planning

	Goal	Issues	Horizon
Strategic analysis	Understand Market and technology trends	Complex and heterogenous data	Months years
Plan 1 year	Define requests and needs	Scope: plants	
Plan 1 month		Scope: plants and cells	2 months
Plan 1 week	Define request and needs	Scope: cells	2 weeks

Execution

	Goal	Issues	Scope
Product and process data	Capture know how on product and how to produce it	Complex and heterogenous data	company
Order flow	Define store and process orders from customers. Input to planning.	Large data volumes Order tracing	Intercompany and interfunction
Material flow	Define, store, and process orders to suppliers. Monitor available materials.	Large data volumes Material tracing	Intercompany and interfunction
Physical flow	Monitor all events (materials, assemblies)	Large data volumes Real time	Intercompany and interfunction

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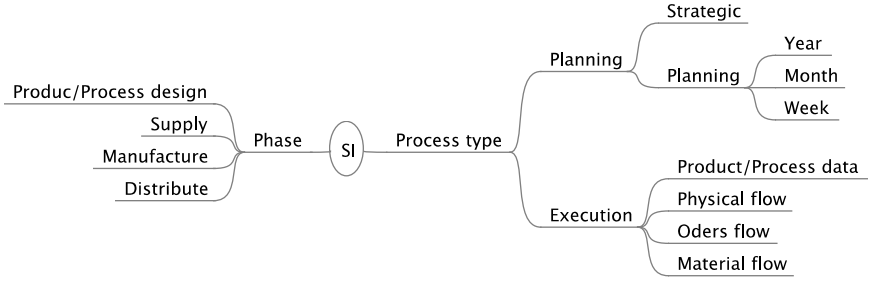
Process type vs. Phase



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Process type vs phase

Phase/ Process type	Product/process design	Procure	Manufacture	Distribute
Plan				
Execute				

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Process type vs phase: AP

	Product/process design	Supply	Manufacture	Distribute
Strategic plan	Technology and market overview	Survey suppliers	--	Market studies. Customer studies
Plan – 1 year	Plan new products/plants	Plan purchases	Plan production	Sales forecast and sales plan
Plan – 1 month	Plan/assign design tasks	Plan and assign purchases	Plan production – plant	Plan distribution
Plan – 1 week	Plan/assign design tasks	Plan purchases. Expedite late supplies	Plan production – cells	Plan / assign distribution tasks
Process product data	List of parts: specifications, designs	List of suppliers. Bill of materials	List of plants, machines, working cycles	List of customers. Catalogue of products
Physical flow	Store and distribute designs, specs		Move parts and assemblies. Monitor state of production.	Manage and ship products. Manage inventories
Orders flow		Send orders to suppliers	Send orders to production	Receive orders
Material flow		Test and store received parts		

Product and process data

- PLM tools: product lifecycle management
  - Storage, retrieval, processing
  - Change management
- Bill of Materials (BOM)
  - For each end product, list of parts
    - What supplies are needed for product Y?
    - What is cost of supplies?
    - What categories of supplies are needed for product Y?
    - What parts are common between X and Y?
- Production cycle
  - For each end or intermediate product, list of manufacturing / assembly operations

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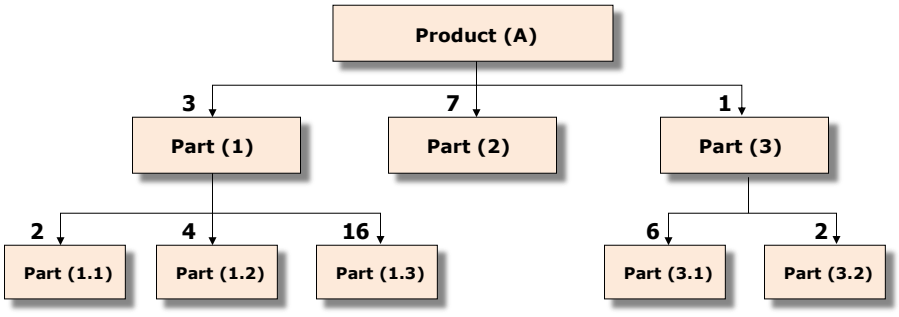
Ex. BoM



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缩略字

Common acronyms and functions

- CAD CAM systems
  - Product design
- PLM (Product Lifecycle Management)
  - Store and process designs
- Planning (Manufacturing Resource Planning)
  - From product data (BOM) and customer orders, define orders for suppliers
- Execution (CIM)
  - From product data (production cycle) control manufacturing

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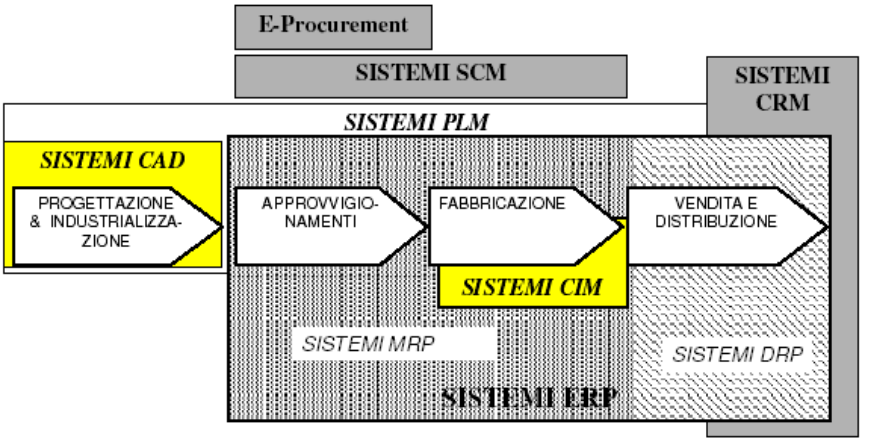
CIM

- Computer Integrated Manufacturing
- Planning and execution specific to manufacturing phase

Level	Function	Technologies
Machine	Execute physical process	PLC (Prog. Logic Controller) base on microprocessors
Cell	Coordination of flows among machines/resources (sequencing, integration, resource sharing)	Microprocessor supervised by PCs or ad-hoc computers
Area	Executive planning of area Physical movement of materials	Local networks with medium sized servers
Plant	Production planning	Local networks with plant servers
Company	Raw material procurement Inter-plant systems	Company-wide network and servers

Manufacturing company



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SCOR

- Supply Chain Operation Reference
- www.supply-chain.org
  - 750 members
- Extension/variation of AP for manufacturing industries

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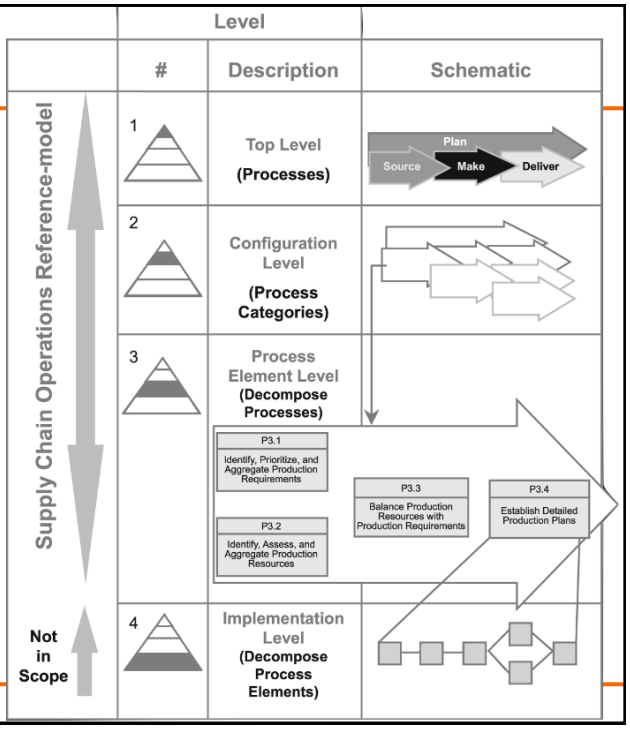
SCOR – processes

- Plan
- Execute
  - Source: supplies
  - Make: production
  - Deliver: shipping and distribution
  - Return: defective products or supplies
- Enable
  - Preparation storage and processing of information for Plan and Execute

SCOR – levels

- Three levels
  - Top level (plan, source etc)
  - Configuration level
    - High level processes are configured to company. Ex: Make -> make to order vs make to inventory vs make to design
  - Process element
    - Low level processes

SCOR



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分类

Segmentations by vendors

- Categories of processes and related supporting IT modules

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Segmentation (Sap, automotive)

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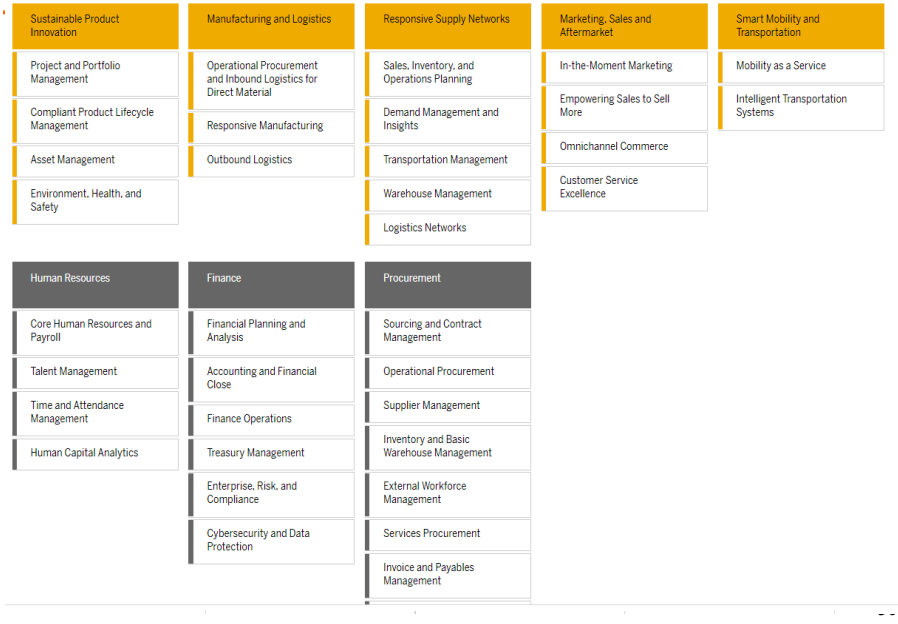

Segmentations by vendors

Automotive-Supplier - (Edition 2004)

Enterprise Management	Strategic Enterprise Management	Management Accounting	Financial Accounting	Corporate Governance	Financial Supply Chain Management	Business Analytics
Marketing, Sales & Services	Marketing	Sales	Transportation Planning & Delivery	Service	Warranty	Analytics
Product Lifecycle Management	Define Strategy & Concept	Verification of Concept	Prototyping Phase	Preproduction Phase	Product Data Management	Lifecycle Support
Supply Chain Management and Procurement	Operational Procurement	Supplier Relationship Management	Inbound Logistic	Billing	Vendor Performance	Event Management
Manufacturing (Make to Order to Stock)	Supply Planning	Manufacturing Execution	Supply to Line	Inventory Management	Quality Management	Event Management
Order Management	OEM Relationship Management (ORM)	Sales Planning	Sales Execution	Billing and Receipt Settlement		
Service	Demand Planning & Forecasting	Supply Network Planning	Sales & Delivery	Manufacturing	Procurement	Lifecycle Logistics
Business Support	Employee Life-Cycle & Transaction Management	Procurement	Financial Supply Chain Management	Fixed Asset Management	Environment, Health & Safety	

Segmentation, car rental

	Marketing and Customer Management	Products	Rentals Management	Rental Fleet Logistics	Business Administration
Plan	Customer Segmentation	Rental Product Strategy	Location and Channel Strategy	Fleet Strategy	Corporate / LOB Strategy
	Customer Relationship Strategy	Product Development/ Design	Location Design and Layout	Fleet Planning	Financial Management and Planning
	Marketing Strategy and Planning		Channel Design and Layout	OEM Relationship Planning	Real Estate Planning
Manage	Customer Behavior Modeling	Promotions Management	Channel and Location Profitability	OEM Performance Management	Alliance Management
	Market and Competitor Research	Pricing Management	Location Operations Management	Inbound Logistics	Business Performance Reporting
	Segmentation Management		Reservations Management		Legal and Regulatory Compliance
	Call Center		Workforce Management		Real Estate and Construction Management
					Risk Management
					Stock Ledger
	Campaign Management				HR Management (Career Development, Training, Recruiting)
Execute	Customer Service	Purchasing/ Sourcing	Rentals and Reservations	Location Operations	HR Administration / Payroll
	Preferred Member Management	Demand Forecasting	Time and Attendance	Fleet Servicing	Corporate Audit
	Customer Communications				Corporate Accounting (GL, AP, A/R, Treasury, etc.)
	Mass Marketing and Advertising			Fleet Management	Indirect Procurement
	Target Marketing				PR and Investor Relations
					IT Systems and Operations

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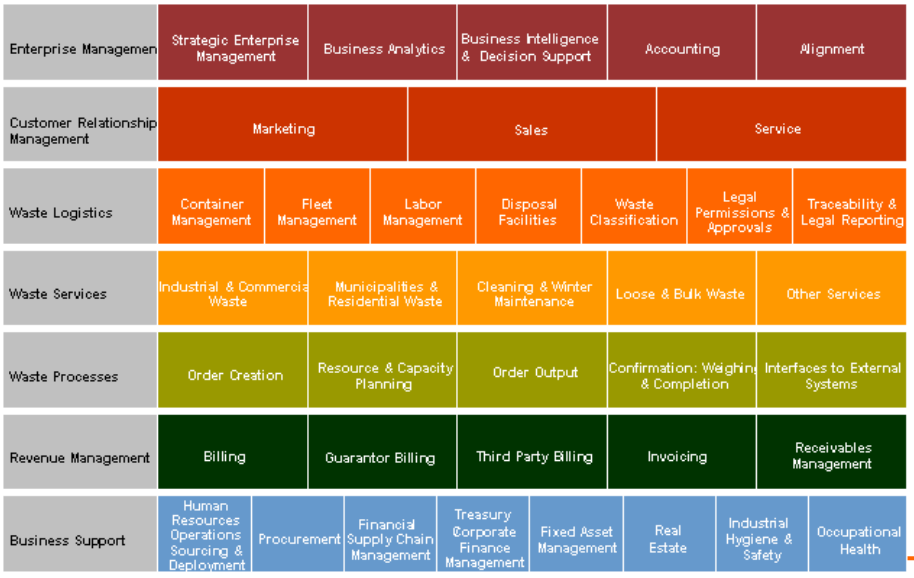
Segmentation, waste management



Segmentation by vendor

- Previous examples by SAP
- Similar available by Oracle, ..
- Of course
  - Non neutral
  - Non standard
  - Non interoperable

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Segmentation by integrators

- Accenture, HP, IBM, PriceWaterhouse..
- Private non disclosed know how of the companies
- Often matching the ones of vendors

Open segmentations

- Efforts to define open, public segmentations
  - Business process management initiative – EU
    - www.bpmi.org
  - Open process handbook initiative – US
    - www.mit.edu

Process industries

- Two high level primary processes
  - Production
  - Maintenance of plant

成果

工厂

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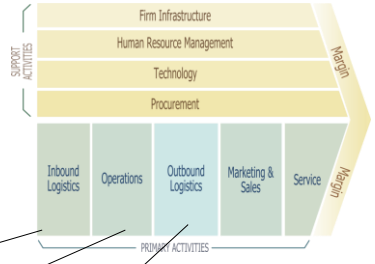
Process industries



- Inbound logistics:
  - Raw material supply
  - Spare parts and maintenance material procurement, supply
- Operations
  - Plant supervision + process control
  - Machinery maintenance
- Outbound logistics
  - Product distribution and sale

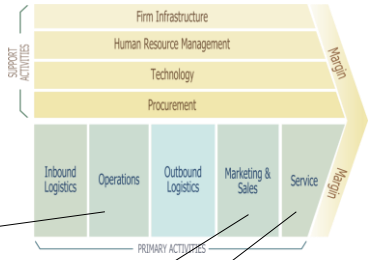
Issues

- Simple supply processes
  - Few raw substances (oil, coke) vs. thousands parts (manufacturing)
- Simple (absent) product design processes
  - recipes
- Importance of maintenance of facilities
- Importance of process control
  - Safety, strategic products, environment
  - Iso iec 61508, 61511
- Importance of coordination of multi-plant productions

Telecom operators

- Three high level primary processes
  - Network management
  - Service management
  - Workforce management

Telco operators



- Operations
  - Network: Plan network, design network, maintain network
  - Service: Service design, activation and delivery
  - Workforce: plan execute jobs, procure, store spare parts, manage technical documentation
- Marketing and sales
  - Marketing and sales, per customer type (business, retail)
  - Billing
- After sale service
  - Complaints, technical support

Issues

- Two customer/product categories
  - Retail (individual, SME), business
    - Business customers: VPN, dedicated lines, ..
- Strict link between process (network management) and product
  - Call data records for billing
  - See prepaid cards, real time billing
- Blurred distinction sales / after sales
  - Continuous interaction with customer
- Key role of IT
  - All is digital and digitally enabled: ICT
- Innovation in product and process
  - Billing modes and new products (prepaid cards)

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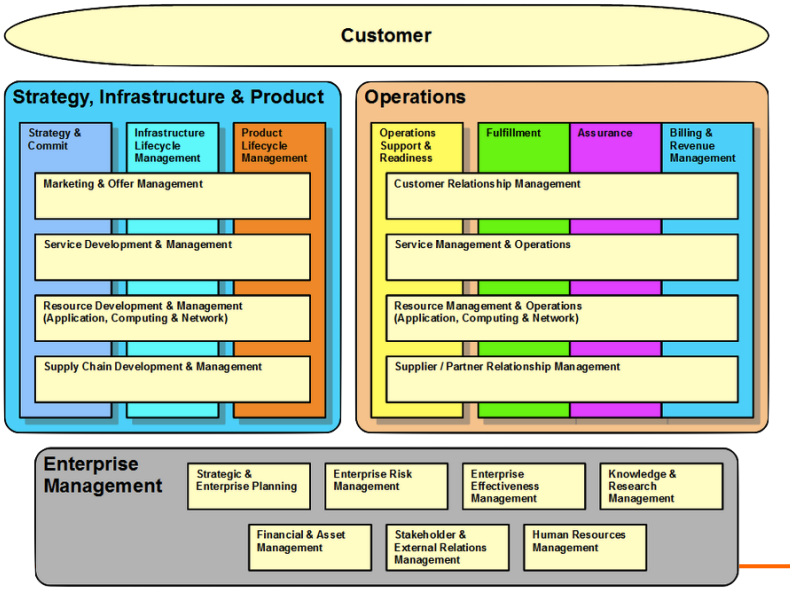
eTom framework



Utilities

- Supply of natural resources / energy
  - electrical energy, natural gas, water
- Three roles
  - Production of resource (a process industry)
    - Ex: Enel Power
  - Trading of resource
    - Ex: Sorgenia, Enel distribuzione
  - Network (usually state owned)
    - Ex: TERNA

Utilities

- Three processes
  - service management
    - Buy /sell resource, design and market service offers, bill
  - Network management
    - Only last mile and meters
  - Workforce management

- Similar to telco, but core network is NOT managed by resellers

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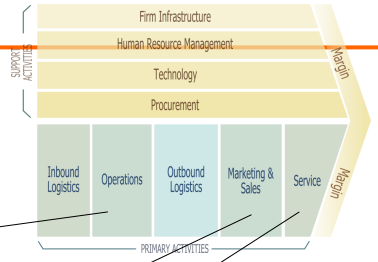
Utilities



- Operations
  - Service: Service activation and delivery
  - Network/workforce: meter and lines management
- Marketing and sales
  - Marketing and sales, per customer type (business, retail)
  - Billing
- After sale service
  - Complaints, technical support

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Issues

- Little innovation of product
- Some innovation of process
  - ENEL: Digital meter connected via electric lines
  - Solar production, smart grids, many producers model
- Process control (network monitoring and control)
- Little customer turnover
- Two customer classes
  - Retail, business

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Banks – insurances

- One main process
  - Service management
- Service can be
  - Banks: account management, investment management, lending (mortgages, loans)
  - Insurance: vehicles, life, pension plan, health plans

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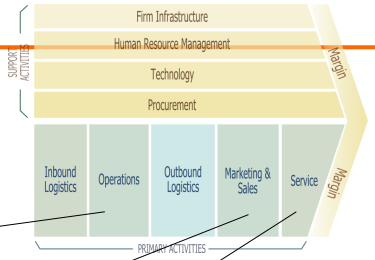
Banks insurances



- Operations
  - Service: Service activation and delivery
- Marketing and sales
  - Marketing and sales, per customer type (business, retail)
- After sale service
  - Complaints, support

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Issues – banks

- Customer segmentation
  - Business, individuals and SMEs, private banking
- Products
  - Accounts
  - Financial services (loan, mortgages)
  - Financial services (investments)
- Data replication
  - Often customer data replicated among units (ex accounts and financial)

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Issues – insurances

- Products
  - Life, vehicles, buildings
    - Replication of customer data
- IS
  - IS for local agency vs. IS in main site

Retail

- Two main process
  - Procurement and inbound logistics
  - Store(s) management

Retail

- Management
  - Offers strategies, acquisitions, supplier selection, contracts
- Logistics (regional centers)
  - Receive from suppliers, sort
- Point of sale (large number)
  - Shelf resupply, goods preparation, sale

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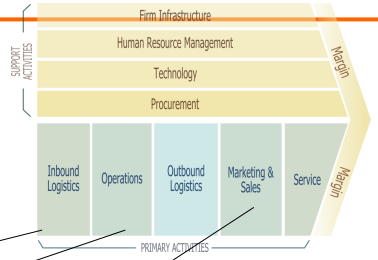
Retail



- Inbound logistics:
  - Products supply, procurement
- Operations
  - Stores management, supervision, control
- Marketing and sales
  - Billing
  - Campaign management, advertising

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Issues

- Large number of stores (point of sales), suppliers, customers
- Regional warehouses (logistics)
- Perishable goods (food)
- Simple processes, big volumes, small margins

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Issues for all service domains

- Banks, Insurances
- Telco operators, utilities
- Retail

- Large number of customers, frequent interactions
- Multichannel interaction
  - Web, mobile, desk, call center
- Strong competition, need to understand the customer
  - CRM, BI

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Public administration

- Management processes often absent
- Support processes more automated
- Primary processes
  - Services to citizens and companies
  - Political processes at different levels
    - Design, discuss, approve, promulgate laws
  - Lack of reference frameworks

Acronyms

- ES
- ERP
- CAD CAM
- PLM
- CIM
- SCM
- MRP
- ..
- CRM

Summary

- High level models classify business processes using different criteria
  - Business functions and organization levels
  - Support, management, primary
  - Business domain
  - Segmentations by domain
- Business process are not described in detail
- However these models are important to provide a holistic view, to drive analysis and design of ISs

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