OPERATIONS MANAGEMENT
AN INTERNATIONAL PERSPECTIVE

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Learning outcomes

• Participants should understand:
  - The significance of operating systems in manufacturing and service organizations
  - The link between general business strategy and strategic operation management
  - The key issues faced by operations managers and be aware of the different approaches available for the design of operating systems
  - The role of operations consultancy
Literature used in this seminar:

The seminar consists of 5 parts:

- 1. Introduction to Operations Management (Ch. 1-4)
- 2. The Operating System (Ch. 5-8)
- 3. Supply Chain Management (Ch. 9-11)
- 4. Lean Systems Methods (Ch. 12-13)
- 5. Operations Experience (Operations Simulation)
PART 1
INTRODUCTION TO OPERATIONS MANAGEMENT
INTRODUCTION TO OPERATIONS MANAGEMENT

Sub blocks:

1. Operations Management (introduction)

2. Operations Strategy

3. International Operations Strategies

4. Operations and the Internet
1

OPERATIONS AND SUPPLY CHAIN MANAGEMENT

INTRODUCTION
What is Operations Management, and what is the goal?

How does Operations Management relate to Marketing, Finance and HRM?

How does the internet and e-Business affects Operations Management?
Operations can be defined as a transformation process where e.g. materials, labour is transformed into e.g. goods, services.

**INPUT**
- Material
- Machines
- Labour
- Energy
- Management
- Capital

**OPERATIONS**

1. Input
2. Operations
3. Processes
4. Output
5. Feedback

**OUTPUT**
- Goods
- Services

Feedback

Requirements

Source: Russell & Taylor, 2009
Transformation processes

Transformation can be:

- Physical
- Locational
- Exchange
- Physiological
- Psychological
- Informational

Example:

- Manufacturing operations
- Transportation/warehousing
- Retail
- Health care
- Entertainment
- Communication
OPERATIONS MANAGEMENT

Organisation perspective

Source: Andrew Greasly, 2006
OPERATIONS MANAGEMENT
Systems perspective

**Inputs**
- Capital
- Material
- Equipment
- Facilities
- Suppliers
- Labour
- Knowledge
- Time

**Environment**
- Customers
- Government
- Competitors
- Technology
- Suppliers
- Economy

**Transformation System**
- Alteration
- Transportation
- Storage
- Inspection

**Output**
- Facilitating goods
- Services

Source: J.R. Meredith & S. M. Shafer, 2007
OPERATIONS MANAGEMENT
Supply Chain perspective

Tier 3 suppliers
Tier 2 suppliers
Tier 1 suppliers
Warehouses/Wholesale
Retail
Customers

Transformation process

Supply side

Demand side

Source: David Barnes, 2008
OPERATIONS MANAGEMENT

Range manufacturing to services

Degree of Tangibility

Low

High

DVD rental

Auto repair

Hand-made suit

Travel

Theatrical performance

Medical consultation

Degree of Customer contact

Low

High

Flour purchase

Source: Meredith & Shafer, 2007

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Operations Management Two day seminar
OPERATIONS MANAGEMENT
Operations within organisation

- Marketing
  - Availability
  - Lead time
  - Sales forecast
  - Customer orders

- Operations
  - Budgets
  - Cost analysis
  - Production- and inventory data

- Finance
  - Job design
  - Employee evaluation
  - Hiring/firing
  - Training

Source: Own compilation
• **Craft production** is the process of handcrafting products or services for individual customers.

• **Mass production** is the high-volume production of a standard product for a mass market.

• **Lean production** is an adaptation of mass production that prizes quality and flexibility.
• **Competitiveness** = degree to which an countries can produce goods and services that meet the test of international markets.

• **Productivity** = ratio of output to input

\[
\text{Productivity} = \frac{\text{Output}}{\text{input}} = \frac{\text{Output}}{\text{Labour}}
\]
Globalisation

Trade in Goods (% of GDP)

Source: Russell & Taylor, 2009
OPERATIONS STRATEGY
Introduction

- What is the relation between business strategy and operations strategy?
- What methods/tools do you know to relate both strategies?
- What approaches do you know of international operating businesses?
... in the majority of cases – about 70% - the real problem isn’t bad strategy but ... bad execution.
Strategy is a common vision that unites an organisation, provides consistency in decisions, and keeps the organisation moving in the right direction.

Strategy formulation consist of four basic steps:
- Defining the primary task
- Assessing internal- and external forces
- Determining order winners and order qualifiers
- Positioning the company
• Strategy planning hierarchy:

- **Corporate**
  - What business shall we be in? What resources are needed?

- **Business**
  - How do we compete in the business? What is the mission?

- **Function**
  - How does the function contribute to the business? What are the objectives?

Source: own compilation
OPERATIONS STRATEGY
Strategy formulation

**Vision/Mission Statement**

**Internal forces**
- Resources
- Core competencies/capacities
- Culture
- Weaknesses

**External forces**
- Environment
- Competitors
- Technology
- Customers

**Business strategy**

**Business model**

**Business Unit Strategies**

Source: Meredith & Shafer, 2007
Business and product strategies

- Business strategy based on introduction (Maidique and Patch):
  - First-to-market: Product available before competition. Price: high = skimming, low = volume
  - Second-to-market: Quickly imitating first, learn from mistakes, provide improved version.
  - Cost-minimalisation or late-to-market: Wait till demand is high and compete on price.
  - Market segmentation: Focussing on serving niche markets with specific needs. Flexible manufacturing.
OPERATIONS STRATEGY

Strategic decisions

• Strategic decisions affect:
  - Capacity: lead-times, responsiveness, operating costs
  - Facilities: where put production facilities
  - Human resources: skill levels, training requirements
  - Quality: target quality, what type of systems
  - Sourcing: suppliers selection, relationship/cooperation
  - Operating systems: technologies, processes, supporting systems
OPERATIONS STRATEGY
Strategy implementation

Operations strategy at Wal-Mart

Mission
Provide value for our customers

Competitive priority
Low prices every day

Operations strategy
Low inventories
Short flow times

Operations structure
Linked systems
Fast transport systems

Enabling processes and technologies
EDI/satellites
Cross-docking
Focussed locations

After a strategy is defined the work only begins:
- Strategy can be hard to understand;
- Strategy can be to general, or unrealistic;
- Areas and persons may interpret the same strategy differently.

How to implement a strategy:
- The strategic planning hierarchy;
- The aggregate project plan;
- Policy deployment;
- Balanced scorecard.
OPERATIONS STRATEGY
Strategic planning hierarchy

**Vision**: Which future developments are important for my organisation?

**Mission**: Given the Vision, which role can this organisation play in future developments?

**Strategy**: Given the Vision and Mission how can the organisation organise the activities in the most successful way?

**Culture**: Given the Vision and the Mission, what is the desired culture?

**Slogan**: How can we tell in 3 to 8 words where we, as an organisation, stand for?

**Operational target setting**: define the quantitative targets, critical success factors, performance indicators, norms and contingency.

Source: Own compilation
Reduce business cycle time by 50 percent

- Reduce production cycle time by 30 percent
- Reduce queue time by 50 percent
- Reduce set-up time by 50 percent
- Cut lot sizes in half
- Increase electronic transactions by 30 percent
- Redesign supplier quality reporting process
- Reduce supplier base by 50 percent
- Reduce purchasing cycle time by 30 percent

## OPERATIONS STRATEGY

### Policy deployment

<table>
<thead>
<tr>
<th>What</th>
<th>Who</th>
<th>When</th>
<th>Measure</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve workflow</td>
<td>Bill Wray</td>
<td>9-1-2003</td>
<td>Average queue time per job</td>
<td>€ 5,000</td>
</tr>
<tr>
<td>....</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Balanced scorecard developed by Robert Kaplan and David Norton examines an organisation in four critical areas:

- **Finance:** How should we look to our shareholders?
- **Customer:** How should we look to our customers?
- **Processes:** At which process must we excel?
- **Learning and growing:** How will we sustain our ability to change and improve?
Mobil’s Strategy Map

Revenue growth strategy

Finances
- Volume growth
  - Non-gasoline products & services
  - Net margin
  - More premium brands

Customers
- Delight the customer
  - Clean, fast, safe
  - Win-win dealer relations
  - Develop, business skills

Processes
- Create new products & services
  - Convenience store
- Build best-in-class franchise
  - Teamwork, quality
- Deliver products
  - On spec, on time
  - Inventory management

Learning and Growth
- Personal growth
  - Align goals
- Functional excellence
  - Strategic & job skills
- Process improvement
  - New technology

INTERNATIONAL STRATEGIES

Introduction

• How does internationalisation influences Operations Management?
Generic international strategies:

- **Market Access strategy:** In order to access and serve markets outside the home country.

- **Resource Seeking strategy:** In order to access and utilize specific resources outside the home country.

  - Flaharty & Ferdows
INTERNATIONAL STRATEGIES
Entering foreign markets

- An organisation might enter the foreign market by:
  - **Direct exports** to the country: special attention to communication, delivery, service, tailoring products
  - **Joint venture** involving local partner: using sales channels and distribution, special attention to choice of partner (and ownership)
  - Establishing a **sales subsidiary**: first real stage of direct foreign investment, direct control, special attention to communication local-home
  - Establishing a **production facility**: Major step involving significant direct investment, involving, product, process and in- and outbound logistics.
INTERNATIONAL STRATEGIES
Configurations for Operations

- Home country with exports
- Multi domestic operations
- Regional operations
- Global co-ordinated operations

Source: Barnes, 2008
Sources of competitive advantage can be developed by strategic actions in international operations:

- **Global sourcing**: Basic input resources from lowest cost location or sourcing sophisticated products from the best suppliers
- **Location**: Near customer facilities or concentrated locations
- **Network effects**: Configuring supplier network or managing the supply network
- **Competition**: A trigger to improve operations and/or focusing how and where to compete
OPERATIONS AND THE INTERNET
OPERATIONS AND THE INTERNET

Introduction

• How does the internet influences Operations Management?
• **E-Business** is changing the value chain, instead of expected elimination, new steps are created.

Traditional Value Chain:

- Manufacturer
- Wholesaler/Distributor
- Retailer
- Consumer

Value Chain with Intermediaries Eliminated:

- Manufacturer
- Consumer

Value Chain introducing New Intermediaries:

- Manufacturer
- Infomediary
- eRetailer
- Aggregator
- Portal
- Consumer

OPERATIONS AND THE INTERNET

E-Business transactions

Impact of e-Business

- Better customer relationship
- More efficient processes
- Lower costs of materials
- Information technology synergy
- Better and faster decision making
- New forms of organisations
- Expanded supply chain
- Higher customer expectations
- New ways of doing business
- Globalisation
PART 2

THE OPERATING SYSTEM
Sub blocks:

5. The Operating System


7. Enterprise Resource Planning (ERP)

8. Business Process Redesign (BPR)
THE OPERATING SYSTEM
THE OPERATING SYSTEM
Introduction

• What decisions must be made for organising the operations process?

• What is the importance of the layout of the process?

• What is the importance of innovation?
Decision steps in designing the operating system:

- Decouple Point
- Process
- Technologies
- Layout

- How do we want to serve the customer?
- How can we balance between batch size and set-up time?
- What technologies are available or can be developed?
- What is the smartest routing?

Source: own compilation
THE OPERATING SYSTEM
Process strategy

- **Process strategy** is an organisation’s overall approach for physical producing goods and services.

- **Process strategy** includes:
  - **Vertical integration**: The degree to which a firm produces parts that go into its products
  - **Capital intensity**: mix of capital and labour resources used in the production process
  - **Process flexibility**: the easy at which can be responded to changes in demand,
  - **Customer involvement**: The role of the customer.
THE OPERATING SYSTEM
Customer-decoupling-point

The logistic chain

Supplier

Customer

make-to-stock
assemble-to-order
make-to-order
design-to-order

Source: Own compilation
Examples from manufacturing industry

Make-to-order
Ship building industry

Assemble-to-order
Car building industry

Make-to-stock
Many industries

Source: Own compilation
Examples from food/service industry

Make-to-order
Catering industry

Assemble-to-order
Fast food industry

Make-to-stock
Pre-prepared Food industry

Source: Own compilation
Production process can be classified into:

- **Project**: is a one-at-a-time production of a product to customer order;
- **Batch production**: processes many different jobs at the same time in groups (or batches);
- **Mass production**: produces large volumes of a standard product for a mass market;
- **Continuous production**: is used for very high-volume commodity products.
THE OPERATING SYSTEM
Production process selection

Examples

Continuous production
Production of oil, electricity, paper, steel, foodstuffs.

Mass production
Production of automobiles, televisions, personal computers, fast food.

Batch production
Machine shops, bakeries, education, furniture making.

Projects
Building ship, rock concert, development new product.

Source: Russell & Taylor, 2009

Standardisation

Volume

High

Low

Low

High

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Operations Management Two day seminar
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THE OPERATING SYSTEM
Service process selection

Examples
- Electricity distribution
- Retail store
- Education
- Medical consult

Source: Russell & Taylor, 2009
• **Computer numerical controlled** (CNC) machines are controlled by software instructions in the memory of a computer.

• **Conveyors** are intelligent, fast and flexible transport systems to route the product through the process.
Automatic guided vehicles (AGV) is a driverless truck that follows a path of tape, rail or wires embedded in the floor or wireless radio commands.

Automated storage and retrieval systems (ASRS) can automatic store and retrieve goods (automated warehouses).
Flexible manufacturing systems (FMS) consists of numerous programmable machine tools connected by an automated material handling system.

Robots are manipulators that can be programmed to move work pieces or tools along a specified path.
THE OPERATING SYSTEM

Process plans

- Process plans may include:
  - **Blueprint** is a detailed drawing of product design;
  - **Bill of material** (BOM) is a list of the materials and parts that go into the products;
  - **Assembly charts** shows how a product is to be assembled;
  - **Operating process charts** shows how a product is to be fabricated;
  - **Routing sheet** is list of machines of work stations that shows the routing of a product.
THE OPERATING SYSTEM
Assembly chart of Big Mac

Bottom bun
Beef patty
Salt
Cheese
Lettuce
Sauce
Onions
Middle bun
Beef patty
Salt
Cheese
Lettuce
Onions
Pickles
Sesam seed top bun
Wrapper

First layer assembly
Complete Big Mac
Second layer assembly

Source: Russell & Taylor, 2009, p. 228
**Process flow chart of apple processing**

<table>
<thead>
<tr>
<th>Step</th>
<th>Process step</th>
<th>Description of process</th>
<th>Time (min)</th>
<th>Distance (Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Unload apples from truck</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Move to inspection</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Weight, inspect, sort</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Move to storage</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Wait until needed</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>...</td>
<td></td>
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<td>..</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>410</td>
<td>150</td>
</tr>
</tbody>
</table>

Date: 9-30-02  
Location: Graves Mountain  
Process: Applesauce

Source: Russell & Taylor, 2009, p. 230
THE OPERATING SYSTEM
Process diagram

Material Flow at Lands’ End

Receiving → Active Bins → Picking → Packing → Shipping

Reserve Storage

Quality Control → Back to Vendor

Mono-gramming → Embroid-ering → Hemming → Gift Boxing

Source: Russell & Taylor, 2003, p. 134
Effective facility layouts:
- Minimize material handling costs
- Utilize space and labour efficiently
- Eliminate bottlenecks
- Facilitate communication and interaction
- Reduce manufacturing/service cycle time
- Eliminate waste
- Incorporate safety
- Promote product and service quality
- Provide visual control and flexibility
- Increase capacity
Basic types of **production layouts**:
- **Process layouts** (*functional layouts*) are flexible and groups similar activities together according to the process or function they perform.
- **Product layouts** (*assembly lines*) are efficient and arrange activities in a line according to the sequence of operations for a particular product or service.
- **Fixed position layouts** are used for projects in which the product can not removed (too heavy, too fragile, too bulky).
THE OPERATING SYSTEM
Different layout types

- Process layout
- Product layout
- Fixed position layout
- Hybrid layout

Adopted from: Russell & Taylor, 2009
THE OPERATING SYSTEM
Different layout types services

Process layout

Product layout

Fixed position layout

Cellular layout

Adopted from: Russell & Taylor, 2009
THE OPERATING SYSTEM
Service layout

• Service layouts are mostly similar to process layouts.

• Differences could be:
  – Minimise the flow of customer (banking);
  – Minimise the flow of paperwork (government);
  – Maximise profit per unit of display space (retail);
  – Maximise customer flow (grocery).

• Service layouts are often visible to customer, so they must be aesthetically pleasing as well as functional.
THE OPERATING SYSTEM
Line balancing

- **Line balancing** tries to equalize the amount of work at each work station.

- **Cycle time** refers to the maximum amount of time the product is allowed to spend at each workstation if the targeted production rate is to be reached.

- **Idle time** is the time a workstation is performing no operation.

- **Balance delay** is the total idle time of the line.
THE OPERATING SYSTEM

Line balancing

- Flow time = 4 + 4 + 4 = 12
- Cycle time = max{4, 4, 4} = 4
- Idle time = 0
- Balance delay = 0

- Flow time = 3 + 4 + 3 = 10
- Cycle time = max{3, 4, 3} = 4
- Idle time = 1
- Balance delay = 2
THE OPERATING SYSTEM
Line balancing

- Flow time = 3 + 2 + 3 = 8
- Cycle time = max{3, 2, 3} = 3
- Idle time = 1
- Balance delay = 1
6 OPERATIONS PLANNING
Introduction

- What levels of planning do you know?
- How can an organisation control their stock levels?
- How can an organisation determine the re-order point?
OPERATIONS PLANNING
Planning hierarchy

- Operations planning hierarchy:

  - Forecasting
    - Input from sales/marketing in combination with historic data
  - Planning
    - Input from forecasting in combination with rough capacity calculations
  - Scheduling
    - Input from planning in combination with machine capacity calculations

Source: own compilation
OPERATIONS PLANNING
Strategic role of forecasting

- **Forecasting** is making a prediction of how much product will be sold in the future.

- A forecast is the basis for most important planning decisions like:
  - Scheduling
  - Inventory
  - Production
  - Workforce
  - Purchasing
  - Distribution
**Forecast methods** management can use:
- **Qualitative forecast methods** are subjective, like: judgement, opinion or experience from past.
- **Quantitative forecast methods** are based on mathematics, like: time series and regression.

- **A long-range forecast** is usually for a period longer than 2 years.
- **A short to mid range forecast** is typically for daily, weekly, or monthly sales, up to 2 years.
OPERATIONS PLANNING
Components of forecasting

Forms of forecast movements

- Trend with random movements
- Cycle
- Seasonal pattern
- Trend with seasonal pattern

OPERATIONS PLANNING
Components of forecasting

• Basic types of forecasting methods are:
  – Time series;
  – Regression methods;
  – Qualitative methods.

• **Time series** methods are statistical techniques that use historical demand data to predict future demand.

• **Regression (or qualitative) methods** attempt to develop a mathematical relationship between demand and factors that cause it to behave the way it does.
Capacity planning is a long term strategic decision that establishes the overall level of productive resources for an organisation.

*Capacity expansion strategies*, as demand grows the following strategies can be used:
- Capacity lead strategy
- Capacity lag strategy
- Average capacity strategy
OPERATIONS PLANNING
Capacity planning

Capacity lead strategy

Capacity lag strategy

Average capacity strategy

Incremental vs one-step
• The best operating level is the percent of capacity utilisation that minimises the unit costs.

Source: own compilation
Inputs and outputs from aggregate production planning

- Capacity constraints
- Strategic Objectives
- Company policies
- Demand forecasts
- Financial constraints
- Aggregate Production Planning
- Sales Plan
- Operations Plan

Periodic updating

Source: Russell & Taylor, 2003
When demand fluctuates (e.g. seasonal demand), demand patterns can be met:

- Producing at a constant rate, using inventory to absorb demand;
- Hiring and firing workers to match demand;
- Maintaining resources for high level demand;
- Increasing or decreasing working hours (overtime and undertime);
- Subcontracting work to other firms;
- Using part-time workers;
- Providing the service or product at a later period.
**OPERATIONS PLANNING**

Adjusting capacity to demand

---

**Level production**

- **Production units**
- **Stock units**

**Chase demand**

- **Production units**
- **Stock units**

Source: Russell & Taylor, 2003
OPERATIONS PLANNING
Hierarchical planning

OPERATIONS PLANNING
Sequencing

• Guidelines for selecting sequencing rules:
  - **SPT** (shortest processing time) is most useful when the shop is highly congested
  - Use **SLACK** (slack) for periods of normal activity
  - Use **DDATE** (due date) when only small tardiness values can be tolerated
  - Use **LPT** (longest processing time) if subcontracting is anticipated
  - Use **FCFS** (first come first served) when operating at low-capacity levels
  - Do not use **SPT** to sequence jobs that have to be assembled with other jobs at a later date
OPERATIONS PLANNING
Monitoring

Gantt Chart

Today's date

Behind schedule

Ahead of schedule

On schedule

Planned activity

Completed activity

Source: Russell & Taylor, 2009, p. 735
ENTERPRISE RESOURCE PLANNING (ERP)
What is Enterprise Resource Planning (ERP)?

What advantages and disadvantages of ERP do you know?

If you have many orders on the shop floor which orders would you give priority?
**Material requirement planning** (MRP) is a computerized inventory control and production planning.

<table>
<thead>
<tr>
<th>Year</th>
<th>MRP</th>
<th>MRP II</th>
<th>ERP</th>
<th>ERP II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>Production control</td>
<td>+ Capacity planning</td>
<td>+ Linking all internal business transactions</td>
<td>+ Linking all external business transactions</td>
</tr>
<tr>
<td></td>
<td>Inventory control</td>
<td>Shop floor control</td>
<td></td>
<td></td>
</tr>
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</table>

Source: Own compilation
**ENTERPRICE RESOURCE PLANNING**

Material requirements planning

- **Master Requirements planning** (MRP) translates a master schedule for end items into time-phased requirements for subassemblies, components and raw materials.

- MRP is useful for *dependant* and *discrete* demand items, complex products, job shop production, and assemble-to-order environments.
Material Requirements Planning

- Master production schedule
- Material requirement planning
- Product structure file
- Item master file
- Planned order releases
  - Work orders
  - Purchase orders
  - Rescheduling notices

Source: Russell & Taylor, 2009, p. 650
Levels of scheduling

- **Make-to-stock**: Master schedule finished products
- **Assemble-to-order**: Master schedule major subassemblies or modules
- **Make-to-order**: Master schedule components or materials

Source: Russell & Taylor, 2009, p. 652
ENTERPRISE RESOURCE PLANNING
Relaxing MRP assumptions

Adjusted load profile

Source: Russell & Taylor, 2009, p. 667
ENTERPRISE RESOURCE PLANNING
ERP modules

Customers

Supplier

Sales & marketing

Production & Material Management

Finance & Accounting

Human Resources

Customer order

Order status

Sales data

Sales analysis

Cost analysis

Cost data

Forecast & Sales orders

Purchase order

Delivery Confirmation

Production data & Inventory

Cost & Estimates

Hiring & Training

Job description

Payroll data

Hiring info

Source: Russell & Taylor, 2009, p. 670
ERP implementations have a history of mammoth projects over budget, out-of-control and bringing companies to bankruptcy.

ERP implementation involves:
- Analyse business process
- Choose modules to implement
- Align level of sophistication
- Finalise delivery and access
- Link with external partners
<table>
<thead>
<tr>
<th>Strategic Planning</th>
<th>Strategic Supply Chain Design</th>
<th>Strategic Sourcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Planning</td>
<td>Forecasting &amp; Lifecycle Planning</td>
<td>Promotion Planning</td>
</tr>
<tr>
<td>Procurement</td>
<td>Purchase Order Processing</td>
<td>Receipt Confirmation</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Production Planning &amp; Detailed Scheduling</td>
<td>Manufacturing execution</td>
</tr>
<tr>
<td>Warehousing</td>
<td>Inbound Processing</td>
<td>Outbound Processing</td>
</tr>
<tr>
<td>Order fulfilment</td>
<td>Sales Order Processing</td>
<td>Logistics Coordination</td>
</tr>
<tr>
<td>Transportation</td>
<td>Transportation Planning</td>
<td>Transportation Execution</td>
</tr>
<tr>
<td>Visibility</td>
<td>Procurement Visibility</td>
<td>Manufacturing Visibility</td>
</tr>
</tbody>
</table>

Source: SAP website
ENTERPRISE RESOURCE PLANNING
ERP implementation

• Industry solutions are best-practice templates designed to maximize efficiency and minimize customisation.

• Fast track implementation by standardised approach, for example AcceleratedSAP solution:
  - Phase 1: Project preparation
  - Phase 2: Business Blueprint
  - Phase 3: Realisation
  - Phase 4: Final preparation
  - Phase 5: Go Live & support
## ENTERPRICE RESOURCE PLANNING

### ERP project set-up

#### Project steps ERP implementation

<table>
<thead>
<tr>
<th>First decision</th>
<th>Selection ERP package</th>
<th>Set-up project team</th>
<th>Configuration phase 1</th>
<th>Configuration phase 2</th>
<th>Configuration phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>redesign</td>
<td>base</td>
<td>middle</td>
<td>fine</td>
<td></td>
</tr>
</tbody>
</table>

Go live preparation

Source: Own compilation
• **Customer relationship management** (CRM) supports processes that involve customer interaction.

• **Supply chain management** (SCM) supports processes related to supply chains.

• **Product life cycle management** (PLM) supports the product development and the product life cycle.

• Difficulty is connection between systems across multiple companies: XML can be good solution.
8 BUSINESS PROCESS REDESIGN
BUSINESS PROCESS REDESIGN

Introduction

- Why is the importance of redesigning processes
- How would you approach a redesign
Process innovation is important to:
- Increase productivity
- Increase competitiveness

Methods of process innovation:
- Continuous improvements: small improvements
- Breakthrough improvement: 50-100% improvement
BUSINESS PROCESS REDESIGN
Breakthrough/Process Redesign

Source: Russell & Taylor, 2003, p. 138
BUSINESS PROCESS REDESIGN
The reengineering process

- Customer requirements
- Strategic directives
- Goals and specifications
- Baseline analysis
- Benchmark data
- High-level process map
- Innovative ideas
- Design principles
- Detailed process map
- Model validation
- Performance measures
- Pilot study
- Source: Russell & Taylor, 2003, p. 138
BUSINESS PROCESS REDESIGN

Business Process Redesign (BPR)

- Remove waste, simplify, and consolidate activities;
- Link processes to create value;
- Let swiftest/most capable enterprise execute process;
- Flex the process for any time, any place, any way;
- Capture information digitally at the source;
- Provide visibility through fresher/richer information;
- Fit the process with sensors and feedback loops;
- Add analytic capabilities to the process;
- Connect, collect, create knowledge around process;
- Personalize the process with preferences of participants.
The **theory of constraints** (Eliyahu Goldratt) describes how complex organisations simply can achieve big breakthrough’s. The five main rules are:

- Identify the bottleneck in the system;
- Determine how the bottleneck can be exploited maximum;
- Make all other process steps subordinated to the bottleneck;
- Increase the throughput of the bottleneck;
- If this works successful a new bottleneck will show up. Without hesitation go back to step 1.
BUSINESS PROCESS REDESIGN
Theory of constraints

<table>
<thead>
<tr>
<th>Situation</th>
<th>50</th>
<th>40</th>
<th>30</th>
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<tbody>
<tr>
<td>Identify bottleneck</td>
<td>50</td>
<td>40</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Bottleneck exploited maximum</td>
<td>50</td>
<td>40</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Subordinated to bottleneck</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Increase output bottleneck</td>
<td>50</td>
<td>40</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>New bottleneck will show up</td>
<td>40</td>
<td>40</td>
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</tbody>
</table>

Source: Own compilation
PART 3

SUPPLY CHAIN MANAGEMENT
Sub blocks:

9. Supply Chain Management

10. Supply Chain Globalisation

11. Inventory Management
9 SUPPLY CHAIN MANAGEMENT
What is supply chain? What are all elements of the supply chain?

What are drivers for supply chain management?

How does the internet and e-Business affects Supply Chain Management?
Functions of the supply chain are:
SUPPLY CHAIN MANAGEMENT
The supply chain

Supplier → Manufacturer → Wholesale → Retail → Customer

- Purchasing
- Production
- Physical distribution
- Retailing
- Supply chain
- Reverse logistics

Source: Own compilation
SUPPLY CHAIN MANAGEMENT
Source, make and deliver

Source: Own compilation
### Players in the supply chain

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customers</strong></td>
<td>Become more critical, less bounded to products, services and shops and are open for testing from increasing alternatives.</td>
</tr>
<tr>
<td><strong>Retail</strong></td>
<td>Confronted with increasing competition, forces to improving retail forms and more professionalism with an increasing buying power to producers.</td>
</tr>
<tr>
<td><strong>Producers</strong></td>
<td>Confronted with increasing competition because of globalisation, and increasing pressure on margins and looking for optimising production and logistics.</td>
</tr>
<tr>
<td><strong>Logistic service providers</strong></td>
<td>Transportation, warehousing, assembling activities are more and more outsourced, increasing pressure on speed of delivery, large logistic service providers take the total-package and subcontract the transportation.</td>
</tr>
</tbody>
</table>
SUPPLY CHAIN MANAGEMENT
Strategic need

• Costs: total supply chain costs can be 50% or more of total operating costs.
  - Costs of storage, movement, personal, goods
  - Costs of responsive distribution and procuring
  - Costs of discontinuities between supply chain elements

• Others:
  - Increased global competition
  - Outsourcing
  - E-commerce
  - Increasing supply chain complexity.
SUPPLY CHAIN MANAGEMENT
Uncertainty and bullwhip

- Lack of global visibility for the entire supply chain
- Local optimal, not global optimal

- Difficult to Promise the Delivery Date
- Low On-Time-Delivery Ratio

Source: Own compilation
In the supply chain following information technologies are used:
- Bar coding
- Electronic Data Interchange (EDI)
- XML
- Handheld devices
- RF technology
- Computers, satellite tracking
- Imaging
- Artificial intelligence
- Point-of-sale
SUPPLY CHAIN MANAGEMENT
Information in the supply chain

Source: Own compilation
• General benefits of information exchange provides:
  - Improved customer service
  - Decreased cost-of-sales
  - Improved vendor/supplier relationships
  - Increased ROA
  - Improved cash-to-cash
  - Ability to proactively respond
  - Improved performance metrics
### Performance metrics

<table>
<thead>
<tr>
<th>Performance attribute</th>
<th>Metric performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer oriented</td>
<td></td>
</tr>
<tr>
<td>Supply chain deliver</td>
<td>Delivery performance</td>
</tr>
<tr>
<td></td>
<td>Fill rate</td>
</tr>
<tr>
<td></td>
<td>Perfect order fulfilment</td>
</tr>
<tr>
<td>Supply chain response</td>
<td>Order fulfilment lead-time</td>
</tr>
<tr>
<td></td>
<td>Supply chain response time</td>
</tr>
<tr>
<td></td>
<td>Production flexibility</td>
</tr>
<tr>
<td>Supply chain flexibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply chain management costs</td>
</tr>
<tr>
<td></td>
<td>Cost of goods sold</td>
</tr>
<tr>
<td></td>
<td>Value added productivity</td>
</tr>
<tr>
<td></td>
<td>Warranty/return costs</td>
</tr>
<tr>
<td>Internal facing</td>
<td></td>
</tr>
<tr>
<td>Supply chain costs</td>
<td>Cash-to-cash cycle time</td>
</tr>
<tr>
<td></td>
<td>Inventory days of supply</td>
</tr>
<tr>
<td></td>
<td>Asset turns</td>
</tr>
</tbody>
</table>
10 SUPPLY CHAIN GLOBALISATION
SUPPLY CHAIN GLOBALISATION
Introduction

- What is the effect of globalisation on the supply chain?
SUPPLY CHAIN GLOBALISATION

E-procurement

Supply chain management at Honda

1. P.O.
2. Supplier
3. Honda trading
4. P.O.
5. Supplier
6. Assembly plant
7. New car

SUPPLY CHAIN GLOBALISATION
Order fulfilment

Build-to-order cars over the Internet

Customer
CD player
Navigation
Aluminium wheels

Automobile company

Internet

Internet

CD player supplier

Navigation system supplier

Wheel supplier

Assembly plant

Dealer

Car

Internet

Internet

Parts delivery

Delivery
Warehouse Management systems (WMS) runs the DC’s daily operations and keeps track of inventories.

- WMS may include: transportation management, labour management, and warehouse optimisation.

- Typical WMS steps:
  - Put-away: receive and storage at specific location;
  - Picking: take an item from a location;
  - Packing: preparing item(s) for transportation;
  - Shipping: ship the goods via a carrier.
SUPPLY CHAIN GLOBALISATION

Warehouse management

- Order management
- Put-away and Picking
- Warehouse optimisation
- Yard management
- Order tracking
- Labour management
- Cross docking
- WMS management
- Packaging and labelling

Source: Russell & Taylor, 2009, p. 440
SUPPLY CHAIN GLOBALISATION
Cross-docking

Before cross docking

After cross docking

Source: Own compilation
Manufacturers organise own distribution

Manufacturer outsource transportation

Manufacturer outsource all logistic functions
## Basic modes of transportation

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railroad</td>
<td>Offer low-cost, large volume, great distance transport with accessibility limitations and long transit time.</td>
</tr>
<tr>
<td>Motor carriers</td>
<td>Accessible, flexible point-to-point service of small loads over short and long distances with consistent transit times, but more costly</td>
</tr>
<tr>
<td>Water carriers</td>
<td>Low cost, large volume great distance transportation with long transit times and service disruptions because of weather</td>
</tr>
<tr>
<td>Air carriers</td>
<td>Short transit time, high rate transportation, (service above price). Transportation option for high value-to-weight commodities.</td>
</tr>
<tr>
<td>Pipelines</td>
<td>Can only be used for liquids, low rate, but no option for manufactured goods.</td>
</tr>
</tbody>
</table>
Globalisation creates new obstacles:

- Increased documentation for invoices, insurance, letter of credit, ocean bills, airway bills
- Changing regulations varying per country
- Trade groups, tariffs, duties, landing costs
- Limited shipping modes
- Differences in communication
- Difference in business practices
- Government codes and reporting requirements
- Numerous players, agents, custom house brokers, financial institutions, insurance providers, carriers
SUPPLY CHAIN GLOBALISATION
International trade expertise

Duty specialist advising companies how to optimise for duties

Export trading companies combining all services of international trade

International freight forwarders handling all the details and obtain documents for crossing borders.

Purchasing agents in foreign countries identify reliable suppliers

Supplier(s)

Custom house broker manage the movements of imported goods through a country’s custom procedure

Export packers perform customized labelling and packaging

Export management companies handle overseas sales for companies and identify foreign companies licensed to manufacture their products

Source: Own compilation
11 INVENTORY MANAGEMENT
INVENTORY MANAGEMENT

Introduction

- What types of inventory do you know?
- Why do organisations keep inventory?
INVENTORY MANAGEMENT
Inventory management elements

- **Raw material buffers**: to cover for variations in suppliers deliveries;
- **Buffer inventories**: so that production can run smoothly in case of temporary machine breakdowns, or other work stoppages.
- **Finished goods inventories**: to cover for fluctuations in demand and work stoppage.
Inventory management is to determine the amount of inventory to keep in stock.

Inventory costs is the total of carrying, ordering, and shortage costs:

- **Carrying costs** are the costs of holding an item in inventory.
- **Ordering costs** are the costs of replenishing inventory.
- **Shortage costs** are temporary or permanent loss of sales when demand cannot be met.
ABC classification system:
- A parts: 70% of sales revenue, 20% of inventory items
- B parts: 20% of sales revenue, 30% of inventory items
- C parts: 10% of sales revenue, 50% of inventory items

Source: Russell & Taylor, 2009, p. 534
Inventory control using ABC classification:
- A parts: control each item with high frequency
- B parts: control each item with lower frequency
- C parts: control on minimum-maximum rules
INVENTORY MANAGEMENT
Inventory control approach

**Phase 0**
- Development
  - Define ABC
  - Produce zero-run

**Phase 1**
- Introduction
  - Monitor sales
  - Refine ABC

**Phase 2**
- In market
  - Production planning using SAP re-order functionality

**Phase 3**
- Outphasing
  - Monitor stocks and sales only plan if necessary

Source: Own compilation
INVENTORY MANAGEMENT
Economic order quantity models

The Inventory Order Cycle

Source: Russell & Taylor, 2009, p. 537
INVENTORY MANAGEMENT

Economic order quantity models

• **EOQ** is the optimal order quantity that will minimize total inventory costs.

\[
Q_{opt} = \sqrt{\frac{2 \times C_o \times D}{C_c}}
\]

- \(Q_{opt}\) = Optimal order quantity
- \(D\) = Demand
- \(C_o\) = Order costs / set-up costs
- \(C_c\) = Unit carrying costs / stock costs

• Assumptions to EOQ model:
  - Demand is known with certainty, is constant in time;
  - No shortages are allowed;
  - Lead-time for receipt of orders is constant
  - The order quantity is received all at once
INVENTORY MANAGEMENT

Reorder point

Source: Russell & Taylor, 2009, p. 547
INVENTORY MANAGEMENT

Stock controll

---

**Stock (in number of products)**

<table>
<thead>
<tr>
<th></th>
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<td>60</td>
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<tr>
<td>Sales</td>
<td>40</td>
<td>30</td>
<td>20</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>1</td>
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</table>

**Stock (in weeks sales)**

<table>
<thead>
<tr>
<th></th>
<th>101</th>
<th>102</th>
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<th>104</th>
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<tr>
<td>Stock</td>
<td>100</td>
<td>80</td>
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<td>10</td>
</tr>
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<td>20</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>1</td>
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Source: own compilation
PART 4
LEAN SYSTEMS
METHOD
Sub blocks:

12. Lean Manufacturing

13. Quality Management
12 LEAN MANUFACTURING
LEAN MANUFACTURING

Introduction

- What is Lean Manufacturing?
- Who invented Lean Manufacturing?
- Name some elements of Lean Manufacturing?
LEARN MANUFACTURING

Introduction

• Colloseum (Rome) – Standardisation
  - Capacity: 50,000 people
  - Build in 8 years

• Henry Ford – Assembly line
  - Price from $825 (1908) to $360 (1916)
  - Build in 81 hours

• Taiichi Ohno – Just-In-Time
  - Small lots mixed model assembly
  - Producing only what is needed
LEAN MANUFACTURING
Toyota Production System

• Toyota Production System (TPS):
  – Mass production not suitable for Japan
  – Scarcity of resources

• TPS basic principle: Sell one, make one
  – Efficient process: eliminating waste
  – Effective process: no intermediate storage
  – Flexibility: one piece flow mixed model

• Lean Manufacturing is the American version of TPS
LEAN MANUFACTURING
Basic elements of Lean

- Basic elements of Lean
  - Flexible resources;
  - Cellular layouts;
  - Pull production system;
  - Kanban production control;
  - Small-lot production;
  - Quick set-ups;
  - Uniform production levels;
  - Quality at the source;
  - Total productive maintenance;
  - Supplier networks.
LEARN MANUFACTURING
Flexible resources

- **Flexible resources** means multifunctional workers as general purpose machines

- **Multifunctional workers** perform more than one job.

- **General-purpose** machines perform several basic functions
  - Adopt machines to improve so that less operator presence is required.
Worker routes operating one or more cells

Cell 1

Worker 1

Cell 2

Worker 2

Cell 3

Worker 3

Cell 4

Cell 5
LEAN MANUFACTURING
Pull versus push

- **Push systems** rely on a predetermined schedule.

- **Pull systems** rely on customer requests.
**LEAN MANUFACTURING**

Kanban production control

- A **kanban** is a signal card that corresponds to a standard quantity of production.

![Diagram showing the kanban system](image)

- Materials ready for use by operator
- Materials in use, kanban issued for replenishment
- New materials arrive about quantity R is used
- Storage
- Operator
LEAN MANUFACTURING
Small lot productions

- Small lot productions requires less space, less capital investment, more flexibility, closer together, more simple transportation and ...
  ... quality problems are more easy to detect.

- Lower inventory levels expose problems as: lengthy set-ups, machine breakdowns, poor quality, bad design, unreliable suppliers.
• Lead time is typically made up of four components:
  - *Waiting time*, reduce or eliminate
  - *Moving time*, reduce by shorter distances
  - *Set-up time*, reduce by smart set-up
  - *Processing time*, reduce by increasing speed
LEAN MANUFACTURING
SMED

- **Single-Minute Exchange of Dies**
  - Separate internal set-up from external set-up;
  - Convert internal set-up to external set-up;
  - Streamline all aspects of set-up;
  - Perform set-up activities parallel or eliminate then entirely.

- Common techniques: preset settings, quick fasteners, locator pins, eliminate tools and make movements easier.
LEAn MANUFACTURING
Uniform production levels

- Uniform production levels result from smoothing production requirements by:
  - More accurate forecasts.
  - Smoothing demand.
  - Mixed model assembly steadies component production.

Daily sequence-batched:
S  S  A  A  A  C  C  C  C

Daily sequence-mixed:
S  A  C  A  C  S  C  A  C
LEAN MANUFACTURING
Quality at the source

- No buffers leave no room for errors and so focus on high quality.

- **Visual control**: kanban, standard operation sheets, process control charts and tool boards.

- **Jidoka**: Never pass on a defect by authorising workers to stop production to solve problem.
Total productive maintenance (TPM) combines preventive maintenance with total quality with the objective of zero breakdowns.

- Breakdown maintenance = repair to make a machine operational.
- Preventive maintenance = maintenance to keep the machine operational.
LEAN MANUFACTURING

5S

5S: Seiri, Seiton, Seison, Seiketsu, Shitsuke

1. Sort
2. Stabilize
3. Shine
4. Standardize
5. Sustain

BAJJ onker  Operations Management Two day seminar  164
**Supplier networks** includes:
- Located near to customer;
- Use small, side-loaded trucks and ship mixed loads;
- Consider establishing small warehouses near to customer or consolidating warehouses with other suppliers;
- Use standard containers and make deliveries according to a precise delivery schedule;
- Become a certified supplier and accept payment at regular intervals rather than on delivery.
LEAN MANUFACTURING
Benefits of Lean manufacturing

• JIT provides a wide range of benefits, including:
  - Reduced inventory, and space requirements
  - Improved quality
  - Lower costs
  - Shorter lead time
  - Increased productivity
  - Greater flexibility
  - Better relationship with suppliers
  - Simplified scheduling and control systems
  - Increased capacity
  - Better use of human resources and more product variety.
LEARN MANUFACTURING

Drawbacks of Lean manufacturing

• Lean is difficult to apply in organisations:
  - With a variability in demand
  - Low volume products
  - High volume mass production
  - Big changes in supply
    • strikes
    • fire
    • natural disasters
    • terrorism
    • epidemics like SARS
The Lean concept can also be applied to services:

- MacDonald’s, Domino’s and FedEx, who compete on speed and still provide their products at low cost and increasing variety;
- Construction firms that coordinate the arrival of materials “just as needed” instead of stockpiling them at site;
- Multifunctional workers in department stores that work the cash register, stock goods, arrange displays, and make sales;
- Level selling with “everyday low prices” at Wal-Mart and Food Lion;
LEAN MANUFACTURING
More lean

• Lean retailing:
  – Smaller orders, frequent replenishment
  – Shorter time-to-market

• Lean banking:
  – Standardisation of processes
  – Simplifying services

• Lean healthcare:
  – Reducing hospital visits
  – Simplifying forms and procedures
13 QUALITY MANAGEMENT
QUALITY MANAGEMENT

Introduction

• How would you define quality?
• What has more quality a Ferrari or a Pick up truck?
• How can an organisation ensure quality?
• What quality systems do you know?
QUALITY MANAGEMENT
The meaning of quality

- **Quality** or **fitness for use** is how well the product or service does what it is supposed to do.

A sports car and a pickup are equally “fit for use”. But with different design dimensions for different customer markets that result in different purchase prices.

- **Quality of design** involves designing quality characteristics into a product or service.
QUALITY MANAGEMENT
The meaning of quality

• **Dimensions of quality** for which a consumer looks:
  - **Performance**: basic operating characteristic;
  - **Features**: extra items added to the basic features;
  - **Reliability**: probability that a product will operate;
  - **Conformance**: degree to which standards are met;
  - **Durability**: how long the product lasts;
  - **Serviceability**: the ease, speed, of getting repairs;
  - **Aesthetics**: how a product looks, feels, smells, tastes;
  - **Safety**: assurance that the user will not be injured;
  - **Other perceptions**: subjective perceptions based on brand name, advertising, and the like.
QUALITY MANAGEMENT
The meaning of quality

- **Dimensions of service quality** for which a consumer looks:
  - *Time and timelines*: how long a customer must wait;
  - *Completeness*: is everything expected also provided;
  - *Courtesy*: how customers are treated by employees;
  - *Consistency*: is the same level provided each time;
  - *Accessibility and convenience*: how easy to obtain;
  - *Accuracy*: service performance right every time;
  - *Responsiveness*: how well the company reacts to unusual situations.
QUALITY MANAGEMENT
The meaning of quality

The meaning of quality

Producer’s perspective
- Quality of conformance
  - Conformance to specifications
  - Costs

Consumer’s perspective
- Quality of design
  - Quality characteristics
  - Price

Fitness for consumer use

Production

Marketing

Source: Russell & Taylor, 2009, p. 56
QUALITY MANAGEMENT
The cost of quality

• **Prevention costs** are costs incurred during product design, but also include training cost etc.

• **Appraisal costs** are costs of measuring, testing and analysing.

• **Internal failure costs** include scrap, rework, process failure, downtime, and price reductions.

• **External failure costs** include complaints, returns, warranty claims, liability, and lost sales.
QUALITY MANAGEMENT
Evolution of quality management

Quality inspection
Quality Control
Quality Assurance
Total Quality Management

Source: Own compilation
QUALITY MANAGEMENT
A basic quality model

Deming wheel

1 Plan
Identify the problem and develop the plan for improvement

2 Do
Implement the plan on a test basis.

3 Check
Assess the plan; is it working?

4 Act
Institutionalise improvement; continue the cycle

Source: Russell & Taylor, 2009, p. 59
Quality circle is a group of workers who address (production) problems.

Quality circles were developed by Kaoru Ishikawa in Japan in the 1960’s.

Source: Russell & Taylor, 2009, p. 68
QUALITY MANAGEMENT
Total quality management

- **Total quality management** (TQM) assures that products and services have the quality they have been designed for.

- **Quality assurance** is a commitment to quality throughout the organisation.

- **Total quality control** is a company-wide, systems approach to quality.
QUALITY MANAGEMENT
Total quality management

- **Total quality management** principles:
  - The *customer* defines quality;
  - Top management must provide the *leadership* for quality;
  - Quality is a *strategic* issue, requires a strategic plan;
  - Quality is the responsibility of *all employees*;
  - Focus on *continuous quality improvement*;
  - Quality problems are solved through *cooperation*;
  - Make use of *statistical quality control* methods;
  - *Training* and *education* of all employees are the basis for continuous quality improvement.
QUALITY MANAGEMENT

Total quality management

TQM throughout the organisation

- Marketing and R&D define what the customer wants
- Engineering creates a design to meet customers' expectations
- Purchasing acquires high quality parts and materials
- Engineering creates a design to meet customers' expectations
- Manufacturing ensures controlled production with zero defects
- Purchasing acquires high quality parts and materials
- Management maintains a smooth flow through production or service process
- Logistics ensures on-time delivery without damage
- After sales support provides customer with good instructions and assistance
- Human resources hires employees with required skills and provides training
- Manufacturing ensures controlled production with zero defects
- Logistics ensures on-time delivery without damage
- Management maintains a smooth flow through production or service process
- Human resources hires employees with required skills and provides training

Source: Own compilation
QUALITY MANAGEMENT

ISO 9000

- **ISO 9001 (9002)** is a world wide procedure for the international quality certification of suppliers.

- The **International Organisation for Standardisation** (ISO), headquartered in Geneva, Switzerland, has as its members the national standards organisation for more than 130 countries.

- Many (overseas) companies will not do business with a supplier unless it has ISO 9000 certification.
• **ISO 14001** is a world wide procedure for the certification of environment management systems.

• Seven steps to implement ISO 14001:
  - Step 1: Where are we now? Zero measurement
  - Step 2: What are the important environment topics?
  - Step 3: How can we control it day-by-day?
  - Step 4: What goals do we have?
  - Step 5: How can we set up the system?
  - Step 6: Get the system live
  - Step 7: Do what we promise
Six Sigma means 3.4 defects per million!

The goal is to improve process by reducing variations, waste of time & materials, costs of repair.

The four basic steps of six sigma:
- **Align:** Define metrics and high impact projects
- **Mobilize:** Develop empowered teams using *DMAIC*
- **Accelerate:** Execute project with aggressive time line
- **Govern:** Review status and share knowledge
• Break through problem solving: DMAIC
  - Define: What is the problem, who is the customer and what are needs
  - Measure: Process is measured, data collected and compare to desired
  - Analyze: Analyse to find the root cause of the problem
  - Improve: Develop solutions and implement them, measure to check, change if necessary
  - Control: Monitor the process to ensure right level of performance
PART 5

CURRENT TRENDS IN OPERATIONS MANAGEMENT
• **Moving beyond the factory**: Operations is strongly affected by what goes on outside.

• **The growing importance of services**: The service sector continues to grow.

• **The increased importance of the supply network**: The next step is working/sharing together.

• The increased importance of ICT: Internationalisation of services, mass customization, supporting product differentiation.

• **Low cost labour**: Off-shoring production/services to reduce costs, organising transferring operations.
OPERATIONS MANAGEMENT

Current Trends

- **Population changes**: In Europe, Japan and Russia aging populations, internationalisation of work force.

- **Discontinuities**: Increased risk of operations, bankruptcy of supplier/customer to death of key employee, more focus on business continuity planning.

- **Environmentalism**: Wide range of concerns that centre of environmental degradation.

- **Social responsibility**: Renewal of interest in concept that organizations should behave ethical.

- **Learning to change**: Organizations should be able to respond and adapt to changes in environment.
OPERATIONS MANAGEMENT

- Topics not included today:
  - Work Organisation
  - New Product Development
  - Project Management
  - Performance Measurement
  - Company visit
  - Company analysis
That’s it all

Thank you