This Evening’s Program

- Project Management
  - Project based operations management
  - Features and benefits
  - Scheduling and controlling projects
  - Why projects fail
- Change Management
- Case Study – The Rise and Demise of an Excellent Team
- Exercises – Critical Path Method (refer to the Folder of Readings)
- Inventory Management
  - The strategic role of inventory
  - The types and positioning of inventory (ABC method)
  - Volume & timing decisions
  - Costing inventory
Project planning and control manages the delivery of projects on time, on specification and on budget.

What is a Project?

- Unique set of objectives
- Definite start point and end point
- Governed by scope, cost and time goals
- Aim to achieve results and disband
- Contract to on-going management
The Fundamentals of Project Management

Once again the original project was not a project at all. It was a dream. This dream, when stuffed into the big end of a structured functional decomposition system development methodology, not only got stuck, it turned into a nightmare.

Management then had to face the problem of how to divide the nightmare into some doable projects, each of which had the potential of becoming a nightmare itself.

The only algorithm known to successfully decompose very large project into doable projects was practised in secret by the Druids in the 1st century AD.

Complexity and Uncertainty as project dimensions

- Individual
- Group
- Organisation
- Multi-organisation
- Nation
- Multi-nation

- Low complexity
- High complexity

- Low uncertainty
- High uncertainty

- Basic research
- Oil, gas exploration
- Product development
- Advertising campaign
- Chemical plant
- Oil Tanker
- Airport
- Company audit
- Wedding
- Military campaign
- Antarctic expedition
- Thames Barrier
- Airbus
- Military campaign
- Channel Tunnel
- Euro project
- Car plants
- Chemical plant
- Motorway
- Thames Barrier
- Airbus
- Military campaign
- Channel Tunnel
- Euro project
- Car plants
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Stages in project management

Stage 1: Understanding the project environment
Stage 2: Project definition
Stage 3: Project planning
Stage 4: Technical execution
Stage 5: Project control

Changes
Corrective action

The environment in which projects take place

Project
- Geography
- Economy
- Government
- Resources
- Sub-contractors
- Suppliers
- National culture
- Company strategy
- Other projects
- Customers
- Users
- Competitors
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**The three project objectives of Quality, Cost and Time**

- **Quality**: New aircraft project
- **Cost**: Fixed grant research project
- **Time**: Music festival

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**Stages in the project planning process**

1. **Identify the activities in the project**
2. **Estimate the times and resources for activities**
3. **Identify the relationships and dependencies between the activities**
4. **Identify time and resource schedule constraints**
5. **Fix the schedule for time and resources**

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*Adjust as necessary*
“Making breakfast” –
Do activities at earliest time

0 1 2 3 4 5 6 7 8 9

Activities requiring operator time

Staff required

0 1 2 3 4 5 6 7 8 9

Time (mins)

“Making breakfast” –
Minimising staff requirements

0 1 2 3 4 5 6 7 8 9

Staff required

0 1 2 3 4 5 6 7 8 9

Time (mins)
“Making breakfast” – Maximising toast quality

Staff required

Project Planning Tools

Gantt Charts
Critical Path Method (CPM)
Program Evaluation and Review Technique (PERT)
Gantt Chart

- Also known as a bar chart
- Named after Henry Gantt (World War I shipbuilding)
- Very useful for showing:
  - Amount of time involved
  - Sequence of activities
  - Dependencies between activities
- Can also be used for:
  - Tracking progress of the project
  - Scheduling resources to activities
  - Identify milestones (major review points) for the project

Gantt Chart

<table>
<thead>
<tr>
<th>Activity</th>
<th>1</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design house and obtain financing</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Lay foundation</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order and receive materials</td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Build house</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select paint</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Select carpet</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Finish work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Month
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- **Activity**
  - Design house
  - Lay foundation
  - Order and receive materials
  - Build house
  - Select paint
  - Select carpet
  - Finish work

- **Resources required**

**CPM**

- Critical Path Method (CPM)
  - Du Pont & Remington-Rand (1956)
  - based on deterministic (i.e. predictable) task times
**Critical Path**

- A path is a sequence of connected activities running from start to end nodes in network
- The critical path is the path with the longest duration in the network
- A project cannot be completed in a shorter time than the time of the critical path

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**Activities Organised In a Project**

- **Activity on Arrow**
  - Activity 1
  - Activity 2
  - Node 1
  - Node 2
- **Activity on Node**
  - Activity 1
  - Activity 2
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**Project Planning**

**Activities in Series**

1. Construct forms
2. Pour concrete
3. Dummy activity

**Project Planning**

**Activities in Parallel**

1. Construct forms
2. Pour concrete
3. Dummy activity
4. Build walls
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**Project Plan For A House**

1. Design house and obtain financing
2. Order and receive materials
3. Lay foundation
4. Build house
5. Select paint
6. Select carpet
7. Finish work

**PERT**

(1,3,4) to (3,4,6)

(optimistic time, most likely time, pessimistic time)
### PERT

Mean time = \( t_{(opt)} + 4 t_{(likely)} + t_{(pess)} \)

\[
\frac{6}{6}
\]

Variance = \( \left( t_{(pess)} - t_{(opt)} \right)^2 \)

\[
\frac{36}{36}
\]

Project Mean = Sum of Activity Means

Project Variance = Sum of Activity Variances

( Measure of Riskiness)

### PERT Example

1. Recruiting
2. Equipment installation
3. Off-line Training
4. System development
5. On-job training
6. System Testing

Dummy
**Exercises**

From the Folder of Readings
- Problems 1 & 2 - Scheduling using CPM
- Problem 3 – CPM for a construction project

CPM Node format:

<table>
<thead>
<tr>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS</td>
</tr>
<tr>
<td>LF</td>
</tr>
<tr>
<td>ES</td>
</tr>
<tr>
<td>EF</td>
</tr>
</tbody>
</table>

**Case Study – The Rise and Demise of an Excellent Team**

- What motivated the team up to the Documentation stage?
- What happened then?
- What forces were acting on the group?
- What lessons can be learned here?
Project Management . . .

- Is more than just the numbers
- Is not the same as Managing the Project
- Don’t forget the human factor
- The success of a project is (usually) inversely proportional to its size and timeframe
- Need exit champions just as much as they need project champions

If you are interested . . . See www.pmoz.com.au for more information. Also, there’s a lot of information on the Operations Management web site.

Project Management – The Problems & Pitfalls

- Focus on quantitative aspects
- Project Reification – blind faith
- Failure to adequately carry out critical project reviews
- Throw more resources at the problem
- What was the objective again?

Characteristics of Project Organisations

- Organisational units formed on a temporary basis
- Definite objective and when this is achieved unit disbands.
- Size and composition of the project team may vary considerably during the project life cycle.
- Tasks, environment and resources to manage may vary considerably over the project life cycle.

Characteristics of Project Organisations (cont.)

- Team members may have a dual reporting requirement responsible to project manager and functional manager.
- Authorities and delegations may be divided and/or unclear.
- Often the project managers will have little direct authority over project resources and objectives, and
- Team members may come from more than one organisation.
Good Project Management must include & appreciate the importance of:

- Business Impact
- Risk Management
- Issue Management
- Documentation Management
- Resource Management
- Communications Management
- Scope Management
- Change Management


Change Management

- One of the most under-estimated areas of management, particularly with regards projects
- About 2/3 of change management programs fail
- Resistance to change is a natural phenomena – it means moving away from a state of equilibrium (or inertia)
- People are fearful of change – a survival instinct. (All your senses are focused on change)
- Yet, change is constant and necessary
Types of Change Management

- Technical
  - New equipment, technology, software systems (e.g. MRP, ERP), etc.
- Procedural
  - New procedures, BRP, as a result of new technology, etc.
- Organisational
  - Mergers, acquisitions, corporate reorganisations

The Concept of Change

As Is State

CHANGE

WORKERS

CHANGE TEAM

LEADERSHIP

PROCESS

INFORMATION FLOW

CULTURE

Transition State

To Be State
Why Change Fails

• Lack of top-management support
• Failure to focus on the primary objective
• Fuzzy, poorly-defined definition of the “to be” state
• Failure to integrate all major change initiatives into a master plan
• Lack of attention to the “human” issues
• Failure to address or even listen to opponents of the change

Why Change Fails (cont.)

• Failure to obtain customer support
• Lack of clear metrics, performance measures
• Lack of resources
• No, or insufficient contingency plans
• No effective change management system
The Elements of Successful Change

- A clear vision of where you want to be
  - there is a compelling need for the change
- Clearly defined “to-be” organisation
- Commitment to making change
  - management is part of the culture
- Form a Change Management Team with a clear charter

The Elements of Successful Change (cont.)

- Breed an atmosphere of open, even excessive, communication and discussion
  - Everyone should be allowed to have a say
  - Address all issues, don’t allow them to fester
- Remember the human factor in all aspects of the change program
- Identify and involve ALL stakeholders
The Elements of Successful Change (cont.)

- Build a systematic change management methodology to implement change (and have a contingency plan for when things go wrong)
- Integrate that methodology into the heart of the change
- Identify clear, concise performance measures, and constantly measure progress against them

Change Management – The Impact of IT

- IT is only a means to an end
- IT should never drive change without a clear business case for change… fix the process before automating it!
- IT systems should always be linked to satisfying explicit, high-priority customer needs… internal and external
- Ensure adequate return on investments in technology… account for all the costs!
Change Management – The Last Word

Change...

- is constant and inevitable
- is necessary for long term survival
- should only be made for sound business reasons, never technical ones
- must be managed
- doesn't have to be traumatic. Things will go wrong. Plan for it and accommodate it in the overall scheme of things

Inventory Planning & Control
Inventory Planning & Control

Supply
The operation
Operations resources

Delivery of products and services when required

Demand
The market
Customer requirements

INVENTORY PLANNING AND CONTROL

Compensating for the differences in timing between the supply and demand of material resources

A definition of inventory planning and control

Supply of products and services
The operation's resources

Demand for products and services
The operation's customers
### Types of Inventory

- Raw Materials
- Work in Process (WIP)
- Semi-finished Goods
- Finished Goods

### Why do Companies Hold Inventory?

In a perfect world:

- Raw materials available in any quantity, at any time, with 100% on time delivery
- Production plants would never breakdown
- 100% product quality
- Plants always have sufficient capacity
- Upstream and downstream production processes run together in perfect sync
- Perfect forecasts Just-In-Time deliveries
- Production quantities exactly equal to demand
- Delivery trucks never breakdown
- Stock would never be damaged
- Staff never sick or on strike
Why do Companies Hold Inventory?

In the real world:

- Companies are continually faced with variability and uncertainty throughout the entire supply chain
- Companies require inventory to provide:
  - Buffer to allow operations to run smoothly amidst the uncertainty
  - Lever to balance the customer service, cost and operational objectives of a company.
  - Purchasing in large volumes
  - Longer production runs
  - Quick response from locations close to the customer
- Inventory management needs to optimise operational and financial performance of the company, while satisfying customer expectations

The re-order point

Demand ($D$) = 100 items per week
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The order quantity decision

- Stock-holding costs
- Ordering costs

How much to order?

The economic order quantity

- Total costs
- Stock-holding costs
- Ordering costs

EOQ

Order quantity
The order timing decision

Ordering too early

When to order?

Ordering too late

Inventory classifications and measures

Class A items - the 20% or so of high-value items which account for around 80% of the total stock value

Class B items - the next 30% or so of medium-value items which account for around 10% of the total stock value

Class C items - the remaining 50% of so of low-value items which account for around the last 10% of the total stock value
### Inventory Items Listed in Descending Order of Dollar Volume

<table>
<thead>
<tr>
<th>Inventory Item</th>
<th>Unit cost ($)</th>
<th>Monthly Sales (units)</th>
<th>Monthly Dollar Volume ($)</th>
<th>Percent of Dollar Volume</th>
<th>Percent of SKUs</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers</td>
<td>3000</td>
<td>50</td>
<td>150,000</td>
<td>74</td>
<td>20</td>
<td>A</td>
</tr>
<tr>
<td>Entertainment center</td>
<td>2500</td>
<td>30</td>
<td>75,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigerators</td>
<td>400</td>
<td>60</td>
<td>24,000</td>
<td>16</td>
<td>30</td>
<td>B</td>
</tr>
<tr>
<td>Monitors</td>
<td>1000</td>
<td>15</td>
<td>15,000</td>
<td>16</td>
<td>30</td>
<td>B</td>
</tr>
<tr>
<td>Monitors</td>
<td>200</td>
<td>50</td>
<td>10,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stereos</td>
<td>150</td>
<td>60</td>
<td>9,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cameras</td>
<td>200</td>
<td>40</td>
<td>8,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td>50</td>
<td>100</td>
<td>5,000</td>
<td>10</td>
<td>50</td>
<td>C</td>
</tr>
<tr>
<td>Computer disks</td>
<td>5</td>
<td>1000</td>
<td>5,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDs</td>
<td>20</td>
<td>200</td>
<td>4,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td>305,000</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

### How do we Reduce Inventory?

- As a buffer (safety stock)
  - breakdowns
  - quality
  - raw materials
  - variation in demand
- Reduce set-up costs
- Cyclical smoothing
- Economic order quantity
Reducing Inventories – A 2 step approach

1. Eliminate Excess Inventory:
   - Reduce inventory to satisfy service levels based on current supply network variability and stock replenishment frequencies

2. Root Cause Analysis:
   - Identify and eliminate root cause problems contributing to excess inventory requirements such as high supply / demand variability or long replenishment cycles

Reducing Inventory – Supply Network Analysis

- Root causes of supply network variability include:
  - poor forecast accuracy
  - poor supplier delivery performance
  - low schedule adherence
  - long lead times
  - high lead time variability
  - poor delivery performance
  - low product quality
  - poorly maintained equipment
  - poorly trained staff

- Segmentation of products by ABC class may allow service levels to be reduced for less critical products
Reducing Inventory – Other Strategies

- Reduced batch sizes
  - Can only do this if you reduce set up times
- Increased production frequency
- JIT (Just in Time) (we'll discuss this in session 9)

An Internet Exercise

- You have just returned from a business trip examining some potential new sites for your organisation's operations. You have over around 100 photos in your digital camera and need to have them printed for your presentation in a week. Company policy is to get a minimum of three prices from suppliers.
- Using the Internet, get three prices for printing the 100 photos on 10 x 15 cm paper. The three prices should include the cheapest price you can find, along with a “middle of the road” price and one very expensive price to show your boss what a good deal you're getting with the cheapest price.
- We'll compare prices in session 7.

(How do your prices compare with taking the photos to a retail store for printing?)