	CONCEPT PHASE	DESIGN PHASE	TENDER PHASE	CONSTRUCTION PHASE	OPERATION PHASE
CLIENT	• Set competence and resource criteria for Designer and Planning Supervisor roles and then appoint. • Decide format for pre-tender H&S plan and structure so as to enable other duty holders to be effective. • Start Completing the pre-tender H&S plan (major hazards, access, plans, soil types, existing H&S files). • Decide format for H&S file.	• Assist Planning Supervisor in producing pre-tender H&S plan. • Set resource and competence requirements for Principal Contractor.	• Check the pre-tender H&S plan. • Add pre-tender H&S plan to tender documentation. • Evaluate potential Principal Contractors.	• Check construction H&S plan is in place and Principal Contractor is correctly organised before allowing work to commence. • Ensure Principal Contractor has systems to manage daily site safety issues. • Audit the Principal Contractor.	• Receive the H&S file. • Ensure H&S file available to Operational staff and Maintenance staff. • Make available H&S file to any future CDM projects on this site (to assist in preparing any future pre-tender H&S plan). • Keep the H&S file up to date with respect to any minor changes.
PLANNING SUPERVISOR	• If notifiable, complete the F10 and submit. • Discuss with Client content and timescales for pre-tender H&S plan and H&S file. • If requested, advise client on competence of potential designers.	• Collate information from Designer and Client into pre-tender H&S plan. • Audit Designer with respect to CDM designer duties. • If requested, advise Client on resources and competence required of Principal Contractor.	• Finalise the pre-tender H&S plan. • If requested, provide advice to the Client on the Principal Contractor's construction H&S plan. • If requested, provide advice to the Client on the selection of the Principal Contractor.	• Compile the H&S file. • Monitor the design. • Hand over file to Client. • If requested, advise Principal Contractor on resources and competencies of Sub-Contractors.	
DESIGNER	• Ensure client understands Designer duties in CDM. • Commence assessment of H&S issues in design work (Construction and Operation).	• Continue to assess H&S issues during design. • Treat hazards in line with hierarchy found in Management regs 1999. • Ensure Planning Supervisor aware of control measures being planned. • Liaise with any other designers on the project.	• Continue to assess H&S issues during design. • Treat hazards in line with hierarchy found in Management regs 1999. • Ensure Planning Supervisor is aware of control measures being planned. • Liaise with any other designers on the project.	• Ensure Planning Supervisor has any information necessary for the H&S file. • Liaise with any other designers on the project.	
PRINCIPAL CONTRACTOR			**Before appointment** • Respond to the pre-tender H&S plan by producing a construction H&S plan. **Once appointed** • Request further information if necessary to complete the construction H&S plan. • Set competence and resource standards for Sub-Contractors and recruit. • Ensure the correct competencies and resources are in place.	• Ensure construction H&S plan is developed and kept live as project progresses. • Manage H&S on site. To include site induction training and competency checks. • Display F10 if notifiable. • Control access. • Provide data to the Planning Supervisor for the H&S file. • Liaise with Planning Supervisor regarding design changes.	
SUB-CONTRACTOR			• Consider competencies and resources required of any Sub-Contractors and recruit. • Co-operate and provide information to the Principal Contractor as requested.	• Co-operate with Principal Contractor and requirements of the construction H&S Plan. • Manage H&S on their part of site. May include training and competency checks. • Provide data to the Principal Contractor for the H&S file. • Liaise with Planning Supervisor regarding design changes.	

PROJECT LIFE CYCLE

DEFINITION

The Project Life Cycle refers to a logical sequence of activities to accomplish the project's goals or objectives.

PHASES IN PROJECT LIFE CYCLE

- Initiation or Birth phase, in which the outputs and critical success factors are defined.
- Planning phase, characterized by breaking down the project into smaller parts/tasks.
- Execution phase, in which the project plan is executed.
- Closure or Exit phase, that marks the completion of the project.

1) Initiation

- **Creation of a Product / Project Description Document**. This is an informal, high-level statement describing the characteristics of the product / project / process to be created.
- **Development of Project Feasibility Document**. This identifies project constraints, alternatives and related assumptions applied to the end product to be developed. Project feasibility is characterized by four basic components:
  - Business Problem Description.
  - Approach Overview to be used to develop.
  - Potential Solutions of the problem.
  - Preliminary Recommendations.

- **Development of Project Concept Document**. It determines What is to be done? How will it be done? and Why is it to be done? Thus determining the business value achieved after project completion.

- **Creation of Project Charter**. Project Charter formally communicates the initiation of the project. It consists of Project Scope, Project Authority and Critical Success Factors.

- **Project Team is responsible for the following activities:**
- Conducting Interviews and yellow pad sessions with customers and stakeholders.
- Conduct research and brainstorming sessions for generating more necessary information.
- Preparation of Project Feasibility Document, Project Concept Statement and Project Charter.
- Preparation of other ancilliary documents as defined in the organization standards.

common barriers and problems during the Intiation Phase

Some common barriers and problems are faced by Project Managers during the Intiation Phase which hamper the project to get started:

- Project Team Frustration builds up as the project does not seem to get started.
- There is a Lack of Committment from the Management and Key Stakeholders.
- Customer Indecision may arise due to non-visibility of the end product by the customer.
- Locating the right people can be difficult while assembling the Project Initiation Team.
- Lack of consensus on Project Objectives can kill the project before it starts.

Planning Phase

- **The Project Planning Phase** follows the Project Initiation Phase and is the most important phase in project management. The effort spent in planning can save countless hours of confusion and rework in the subsequent phases.

The purpose of the Project Planning Phase

- Establish Business Requirements.
- Establish Cost, Schedule, List of Deliverables and Delivery Dates.
- Establish Resource Plan.
- Get Management Approval and proceed to next phases.

The basic processes of the Project Planning Phase

- **Scope Planning.** This specifies the in-scope requirements for the project.
- **Preparing the Work Breakdown Structure.** This specifies the breakdown of the project into tasks and sub-tasks.
- **Organizational Breakdown Structure.** This specifies who all in the organization need to be involved and referred for Project Completion.
- **Resource Planning.** This specifies who will do what work at which time of the project.
- **Project Schedule Development.** This specifies the entire schedule of the activities detailing their sequence of execution.
- **Budget Planning.** This specifies the budgeted cost to be incurred in the completion of the Project.

Project Initiation Phase defines a few **facilitating processes** as well that are required for successful Project Completion. These can be:

- **Procurement Planning.** Planning for procurement of all resources (staff and non-staff).
- **Communication Planning.** Planning on the communication strategy with all project stakeholders.
- **Quality Planning.** Planning for Quality Assurance to be applied to the Project.
- **Risk Management Planning.** Charting the risks, contingency plan and mitigation strategies.
- **Configuration Management Planning.** Defines how the various project artifacts will get stored.

Both the basic processes and facilitating processes produces a **Project Plan**.

During this phase, Project Team is responsible for the following activities:

- **Project Managers** are responsible for developing the Project Plan thus ensuring that all the project planning requirements are fulfilled.
- **Functional / Management** personnel are responsible ensures that adequate resources are available for the project.
- **Key Stakeholders** should approve the Project Plan before moving to the next phase.
- Project Planning is essential for a project's success. Project Planning helps team members to understand their responsibilities and expectations from them. Project Planning Phase identifies scope, tasks, schedules, risks, quality and staffing needs.

Project Execution and Control Phase

ideally starts once the Project Plan has been approved and baselined. Project Execution is characterized by the actual work on the tasks planned and project Control involves the comparison of the actual performance with the planned performance and taking appropriate corrective action to get the desired output.

Project Team is responsibilities:

- Team Members execute the tasks as planned by the Project Manager.
- Project Manager is responsible for performance measurement which includes finding variances between planned and actual work, cost and schedule.
- Project manager is responsible for providing Project Status. Report to all key stakeholders to provide visibility.
- All Project Key stakeholders are responsible for the review of the matrices and variances.
- All Project Key stakeholders are responsible for taking necessary action of the variances thus determined so as to complete the project within time and budget.

The **basic processes** of the Project Execution and Control

- Project Plan Execution.
- Review of Metrics and Status Reports.
- Change Control Process. This defines the procedures to handle the changes that are introduced during Project Execution and Control.

The **facilitating processes** during Project Execution and Control

- Quality Assurance and Quality Control.
- Performance Monitoring.
- Information Distribution or Status Reporting.
- Project Administration.
- Risk Monitoring and Control.
- Scope Control.
- Schedule and Cost Control.
- Contract Administration.

Project Closure Phase

The last phase of the Project Life Cycle. The commencement of the Project Closure Phase is determined by the completion of all Project Objectives and acceptance of the end product by the customer.

- Project Closure includes the following **tasks**:
- Release of the resources, both staff and non-staff, and their redistribution and reallocation to other projects, if needed.
- Closure of any financial issues like labour, contract etc.
- Collection and Completion of All Project Records.
- Archiving of All Project Records.
- Documenting the Issues faced in the Project and their resolution. This helps other projects to plan for such type of issues in the Project Initiation Phase itself.
- Recording Lessons Learned and conducting a session with the Project Team on the same. This helps in the productivity improvement of the team and helps identify the dos and donts of the Project.
- Celebrate the Project Completion. Its party time folks!!!

The **basic process** of the Project Closure Phase

- **Administrative Closure.** This is the process of preparation of closure documents and process deliverables. This includes the release and redistribution of the Project Resources.
- **Development of Project Post Implementation Evaluation Report.** It includes
  - Project Sign-Off
  - Staffing and Skills
  - Project Organizational Structure
  - Schedule Management
  - Cost Management
  - Quality Management
  - Configuration Management
  - Customer Expectations Management
  - Lessons Learned

Lessons Learned

- Did the delivered product / solution meet the project requirements and objectives?
- Was the customer satisfied?
- Was Project Schedule Met?
- Was the Project completed within Budgeted Cost?
- Were the risks identified and mitigated?
- What could be done to improve the process?

Quality Management

Operations Management

Lecture Outline

- Meaning of Quality
- Total Quality Management
- Quality Improvement and Role of Employees
- Strategic Implications of TQM
- Six Sigma

Lecture Outline (cont.)

- TQM in Service Companies
- Cost of Quality
- Quality Management and Productivity
- Identifying Quality Problems and Causes
- Quality Awards and Setting Quality Standards
- ISO 9000

Meaning of Quality

- Webster's Dictionary
  - degree of excellence of a thing
- American Society for Quality
  - totality of features and characteristics that satisfy needs
- Consumer's and Producer's Perspective

Meaning of Quality: Consumer's Perspective

- **Fitness for use**
  - how well product or service does what it is supposed to
- **Quality of design**
  - designing quality characteristics into a product or service
- A Mercedes and a Ford are equally "fit for use," but with different design dimensions

Dimensions of Quality: Manufactured Products

- Performance
  - basic operating characteristics of a product; how well a car is handled or its gas mileage
- Features
  - "extra" items added to basic features, such as a stereo CD or a leather interior in a car
- Reliability
  - probability that a product will operate properly within an expected time frame; that is, a TV will work without repair for about seven years

Dimensions of Quality: Manufactured Products (cont.)

- Conformance
  - degree to which a product meets pre–established standards
- Durability
  - how long product lasts before replacement
- Serviceability
  - ease of getting repairs, speed of repairs, courtesy and competence of repair person

Dimensions of Quality: Manufactured Products (cont.)

- Aesthetics
  - how a product looks, feels, sounds, smells, or tastes
- Safety
  - assurance that customer will not suffer injury or harm from a product; an especially important consideration for automobiles
- Perceptions
  - subjective perceptions based on brand name, advertising, and the like

Dimensions of Quality: Service

- Time and Timeliness
  - How long must a customer wait for service, and is it completed on time?
  - Is an overnight package delivered overnight?
- Completeness:
  - Is everything customer asked for provided?
  - Is a mail order from a catalogue company complete when delivered?

Dimensions of Quality: Service (cont.)

- Courtesy:
  - How are customers treated by employees?
  - Are catalogue phone operators nice and are their voices pleasant?
- Consistency
  - Is the same level of service provided to each customer each time?
  - Is your newspaper delivered on time every morning?

Dimensions of Quality: Service (cont.)

- Accessibility and convenience
  - How easy is it to obtain service?
  - Does a service representative answer you calls quickly?
- Accuracy
  - Is the service performed right every time?
  - Is your bank or credit card statement correct every month?
- Responsiveness
  - How well does the company react to unusual situations?
  - How well is a telephone operator able to respond to a customer’s questions?

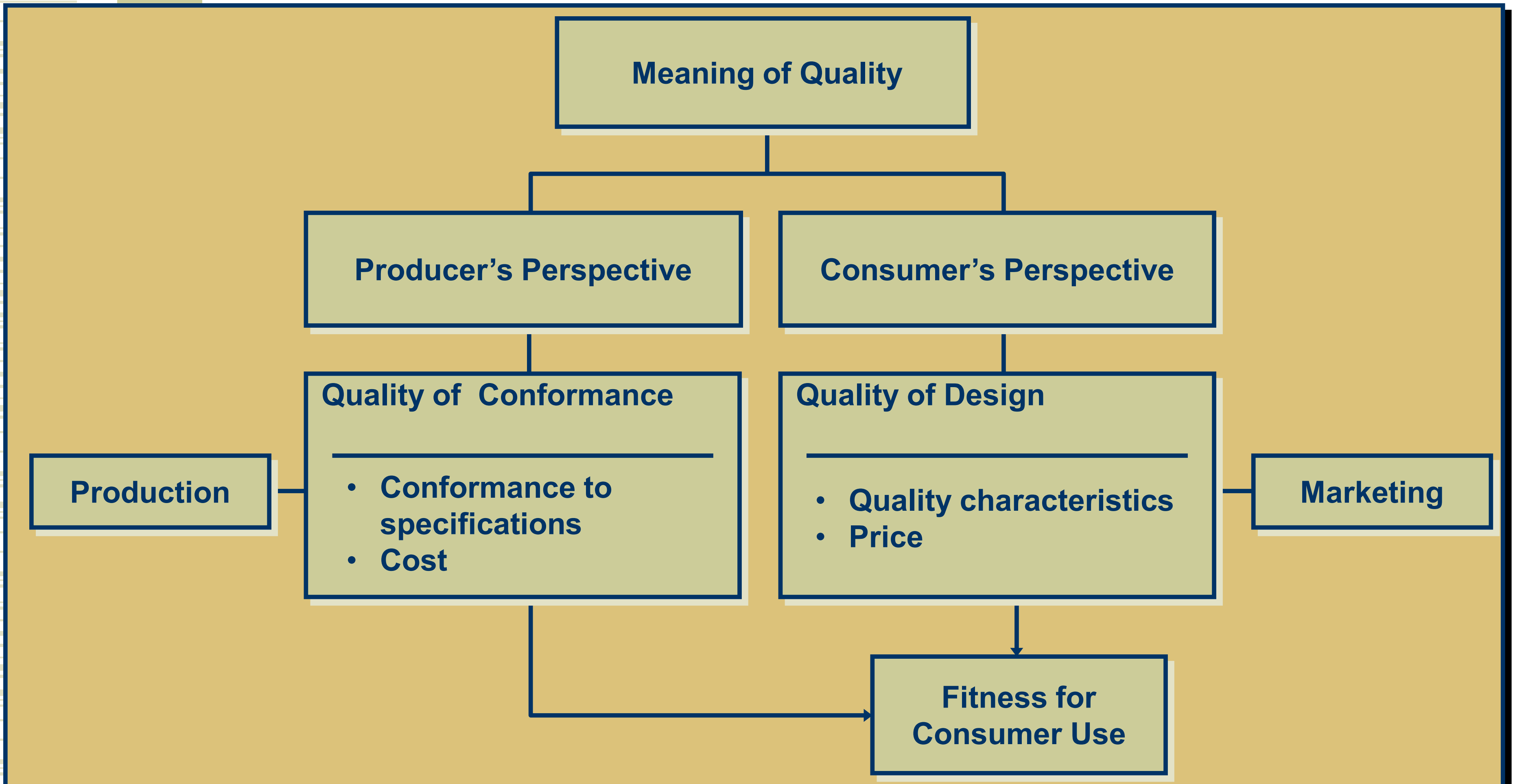
Meaning of Quality: Producer's Perspective

- Quality of Conformance
  - Making sure a product or service is produced according to design
    - if new tires do not conform to specifications, they wobble
    - if a hotel room is not clean when a guest checks in, the hotel is not functioning according to specifications of its design

Meaning of Quality: A Final Perspective

- Consumer's and producer's perspectives depend on each other
- Consumer's perspective: PRICE
- Producer's perspective: COST
- Consumer's view must dominate

Meaning of Quality



Total Quality Management

- Commitment to quality throughout organization

- Principles of TQM
  - Customer-oriented
  - Leadership
  - Strategic planning
  - Employee responsibility
  - Continuous improvement
  - Cooperation
  - Statistical methods
  - Training and education

Quality Gurus

- Walter Shewart
  - In 1920s, developed control charts
  - Introduced the term "*quality assurance*"
- W. Edwards Deming
  - Developed courses during World War II to teach statistical quality-control techniques to engineers and executives of companies that were military suppliers
  - After the war, began teaching statistical quality control to Japanese companies
- Joseph M. Juran
  - Followed Deming to Japan in 1954
  - Focused on strategic quality planning

Quality Gurus (cont.)

- Armand V. Feigenbaum
  - In 1951, introduced concepts of total quality control and continuous quality improvement
- Philip Crosby
  - In 1979, emphasized that costs of poor quality far outweigh the cost of preventing poor quality
  - In 1984, defined absolutes of quality management—conformance to requirements, prevention, and "zero defects"
- Kaoru Ishikawa
  - Promoted use of quality circles
  - Developed "fishbone" diagram
  - Emphasized importance of internal customer

Deming's 14 Points

1. ***Create constancy of purpose***
2. ***Adopt philosophy of prevention***
3. ***Cease mass inspection***
4. ***Select a few suppliers based on quality***
5. ***Constantly improve system and workers***

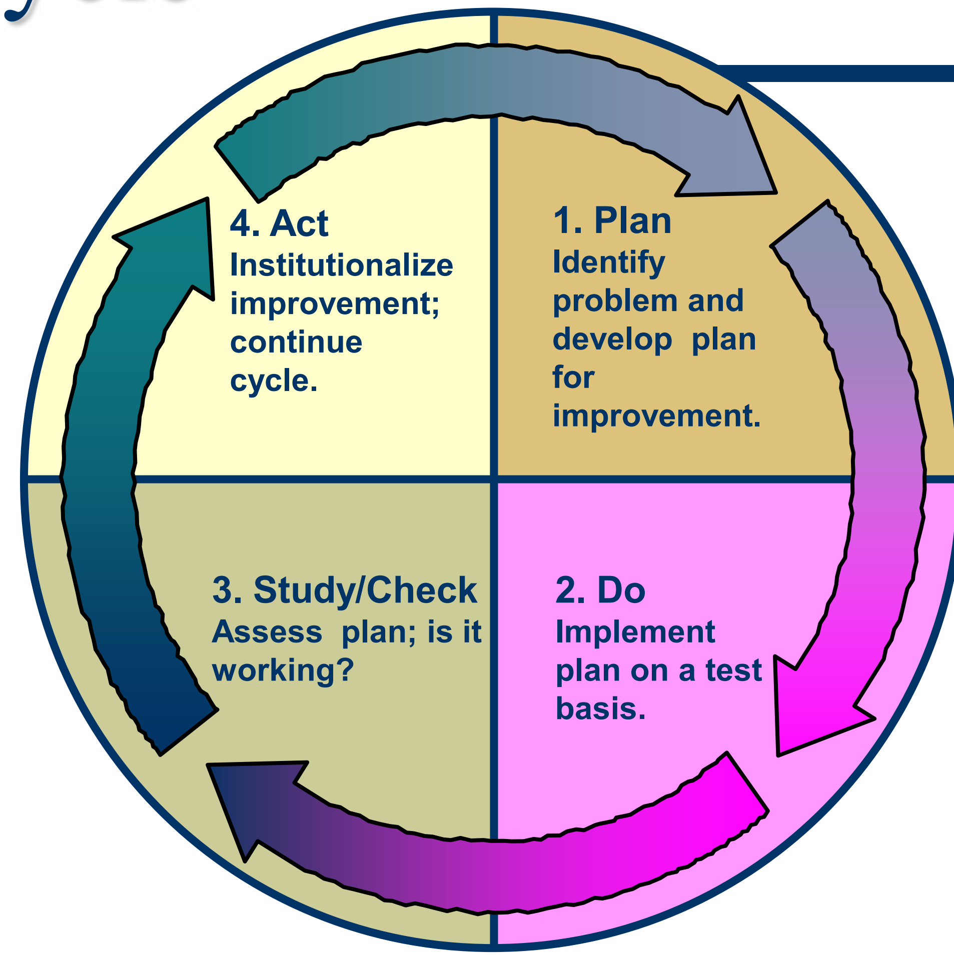
Deming’s 14 Points (cont.)

6. ***Institute worker training***
7. ***Instill leadership among supervisors***
8. ***Eliminate fear among employees***
9. ***Eliminate barriers between departments***
10. ***Eliminate slogans***

Deming's 14 Points (cont.)

11. ***Remove numerical quotas***
12. ***Enhance worker pride***
13. ***Institute vigorous training and education programs***
14. ***Develop a commitment from top management to implement above 13 points***

Deming Wheel: PDCA Cycle



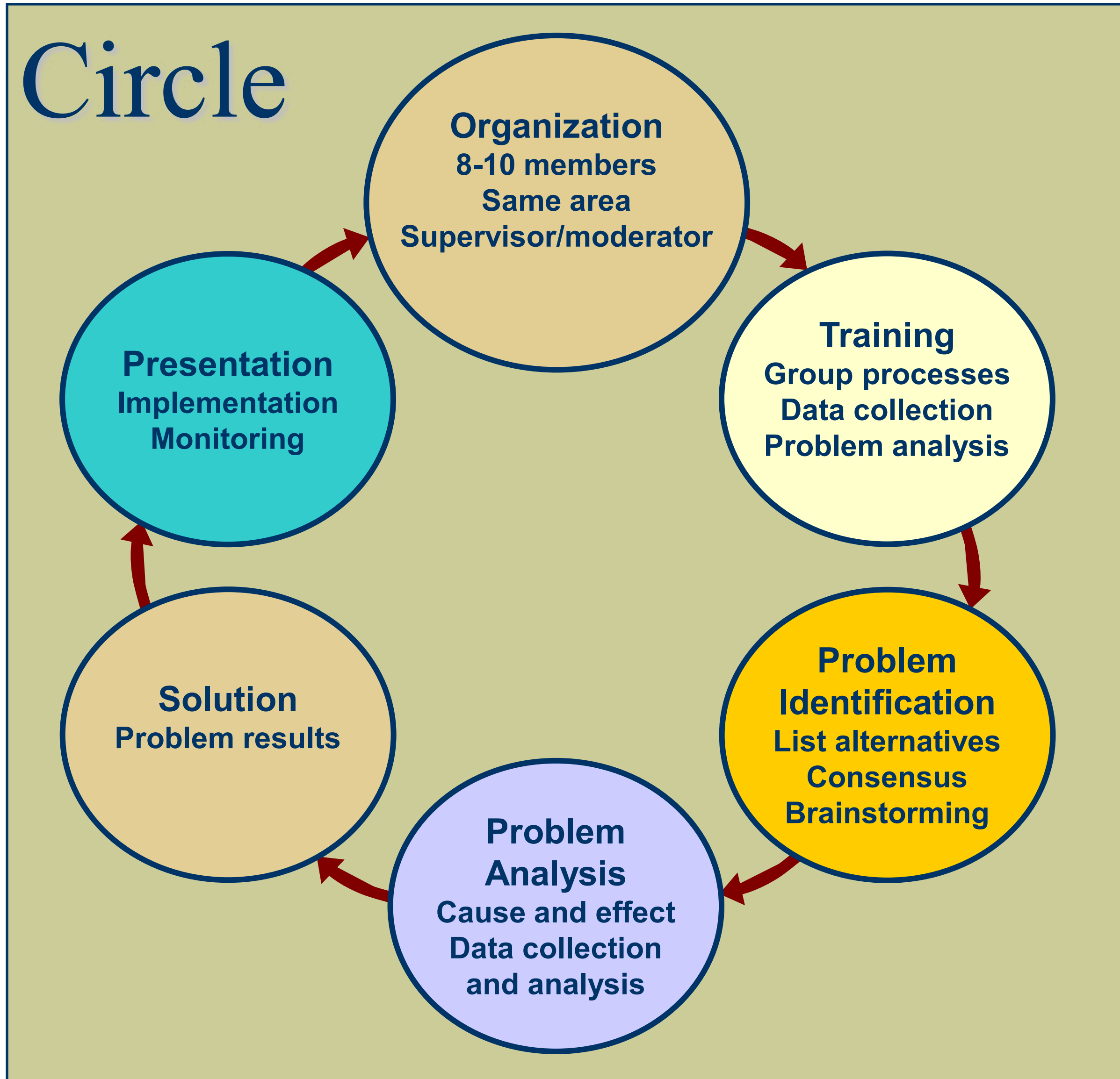
TQM and…

- … **Partnering**
  - a relationship between a company and its supplier based on mutual quality standards
- … **Customers**
  - system must measure customer satisfaction
- … **Information Technology**
  - infrastructure of hardware, networks, and software necessary to support a quality program

Quality Improvement and Role of Employees

- **Participative problem solving**
  - employees involved in quality management
  - every employee has undergone extensive training to provide quality service to Disney's guests

Quality Circle



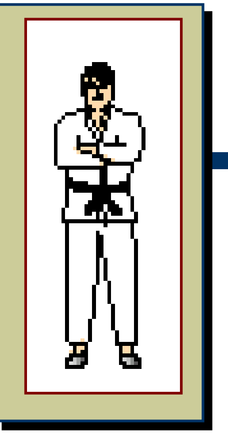
Strategic Implications of TQM

- *Strong leadership*
- *Goals*, *vision*, or *mission*
- *Operational plans and policies*
- *Mechanism for feedback*

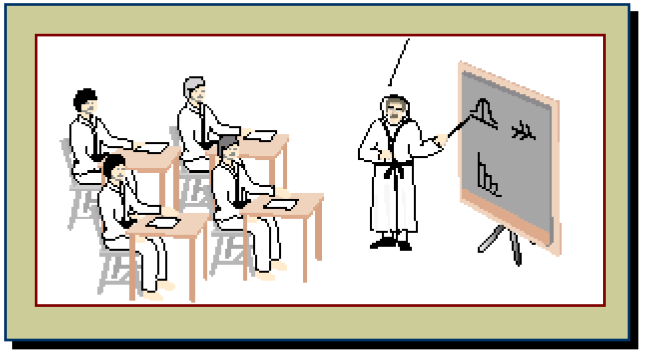
Six Sigma

- A process for developing and delivering near perfect products and services
- Measure of how much a process deviates from perfection
- 3.4 defects per million opportunities
- Champion
  - an executive responsible for project success

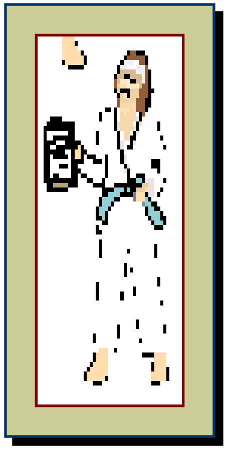
Black Belts and Green Belts



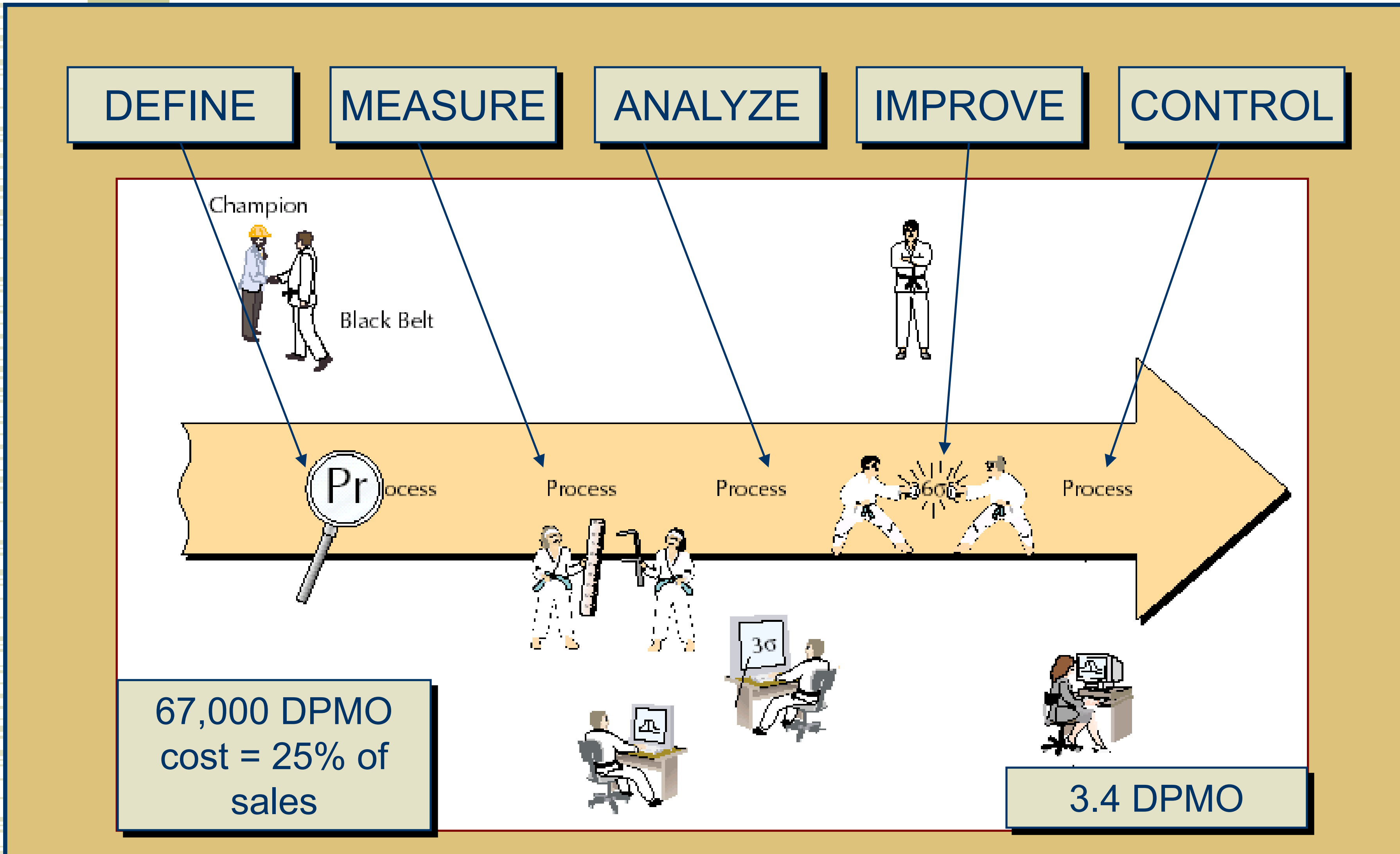
- **Black Belt**
  - project leader
- **Master Black Belt**
  - a teacher and mentor for Black Belts



- **Green Belts**
  - project team members



Six Sigma: DMAIC



TQM in Service Companies

- Principles of TQM apply equally well to services and manufacturing
- Services and manufacturing companies have similar inputs but different processes and outputs
- Services tend to be labor intensive
- Service defects are not always easy to measure because service output is not usually a tangible item

Quality Attributes in Service

- Benchmark
  - "best" level of quality achievement one company or companies seek to achieve
- Timeliness
  - how quickly a service is provided

"quickest, friendliest, most accurate service available."

Cost of Quality

- Cost of Achieving Good Quality
  - Prevention costs
    - costs incurred during product design
  - Appraisal costs
    - costs of measuring, testing, and analyzing
- Cost of Poor Quality
  - Internal failure costs
    - include scrap, rework, process failure, downtime, and price reductions
  - External failure costs
    - include complaints, returns, warranty claims, liability, and lost sales

Prevention Costs

- Quality planning costs
  - costs of developing and implementing quality management program
- Product-design costs
  - costs of designing products with quality characteristics
- Process costs
  - costs expended to make sure productive process conforms to quality specifications
- Training costs
  - costs of developing and putting on quality training programs for employees and management
- Information costs
  - costs of acquiring and maintaining data related to quality, and development of reports on quality performance

Appraisal Costs

- Inspection and testing
  - costs of testing and inspecting materials, parts, and product at various stages and at the end of a process
- Test equipment costs
  - costs of maintaining equipment used in testing quality characteristics of products
- Operator costs
  - costs of time spent by operators to gar data for testing product quality, to make equipment adjustments to maintain quality, and to stop work to assess quality

Internal Failure Costs

- *Scrap costs*
  - costs of poor-quality products that must be discarded, including labor, material, and indirect costs
- *Rework costs*
  - costs of fixing defective products to conform to quality specifications
- *Process failure costs*
  - costs of determining why production process is producing poor-quality products
- *Process downtime costs*
  - costs of shutting down productive process to fix problem
- *Price-downgrading costs*
  - costs of discounting poor-quality products—that is, selling products as "seconds"

External Failure Costs

- Customer complaint costs
  - costs of investigating and satisfactorily responding to a customer complaint resulting from a poor-quality product
- Product return costs
  - costs of handling and replacing poor-quality products returned by customer
- Warranty claims costs
  - costs of complying with product warranties
- Product liability costs
  - litigation costs resulting from product liability and customer injury
- Lost sales costs
  - costs incurred because customers are dissatisfied with poor quality products and do not make additional purchases

Measuring and Reporting Quality Costs

- **Index numbers**
  - ratios that measure quality costs against a base value
  - **labor index**
    - ratio of quality cost to labor hours
  - **cost index**
    - ratio of quality cost to manufacturing cost
  - **sales index**
    - ratio of quality cost to sales
  - **production index**
    - ratio of quality cost to units of final product

Quality–Cost Relationship

- **Cost of quality**
  - Difference between price of nonconformance and conformance
  - Cost of doing things wrong
    - 20 to 35% of revenues
  - Cost of doing things right
    - 3 to 4% of revenues
  - Profitability
    - In the long run, quality is free

Quality Management and Productivity

- **Productivity**
  - ratio of output to input
- **Yield:** a measure of productivity

Yield=(total input)(% good units) + (total input)(1-%good units)(% reworked)

or

$$Y=(I)(\%G)+(I)(1-\%G)(\%R)$$

Product Cost

$$\text{Product Cost} = \frac{(K_d)(I) + (K_r)(R)}{Y}$$

where:

K_d = direct manufacturing cost per unit

I = input

K_r = rework cost per unit

R = reworked units

Y = yield

Computing Product Yield for Multistage Processes

$$Y = (I)(\%g_1)(\%g_2) \ldots (\%g_n)$$

where:
I = input of items to the production process that will result in finished products
g_i = good-quality, work-in-process products at stage i

Quality–Productivity Ratio

QPR

- productivity index that includes productivity and quality costs

$$QPR = \frac{\text{(non-defective units)}}{\text{(input) (processing cost) + (defective units) (reworked cost)}}$$

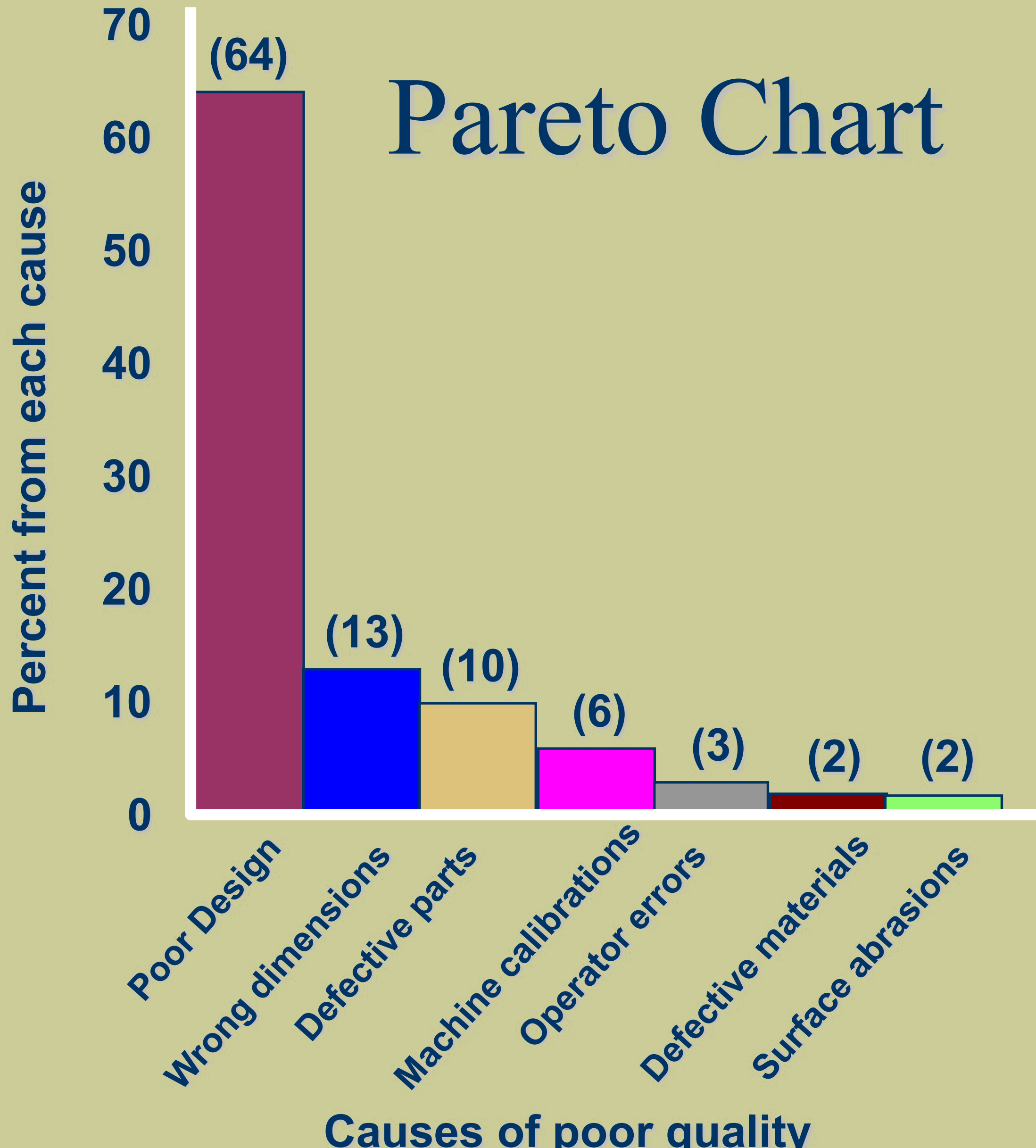
Seven Quality Control Tools

- Pareto Analysis
- Flow Chart
- Check Sheet
- Histogram
- Scatter Diagram
- SPC Chart
- Cause-and-Effect Diagram

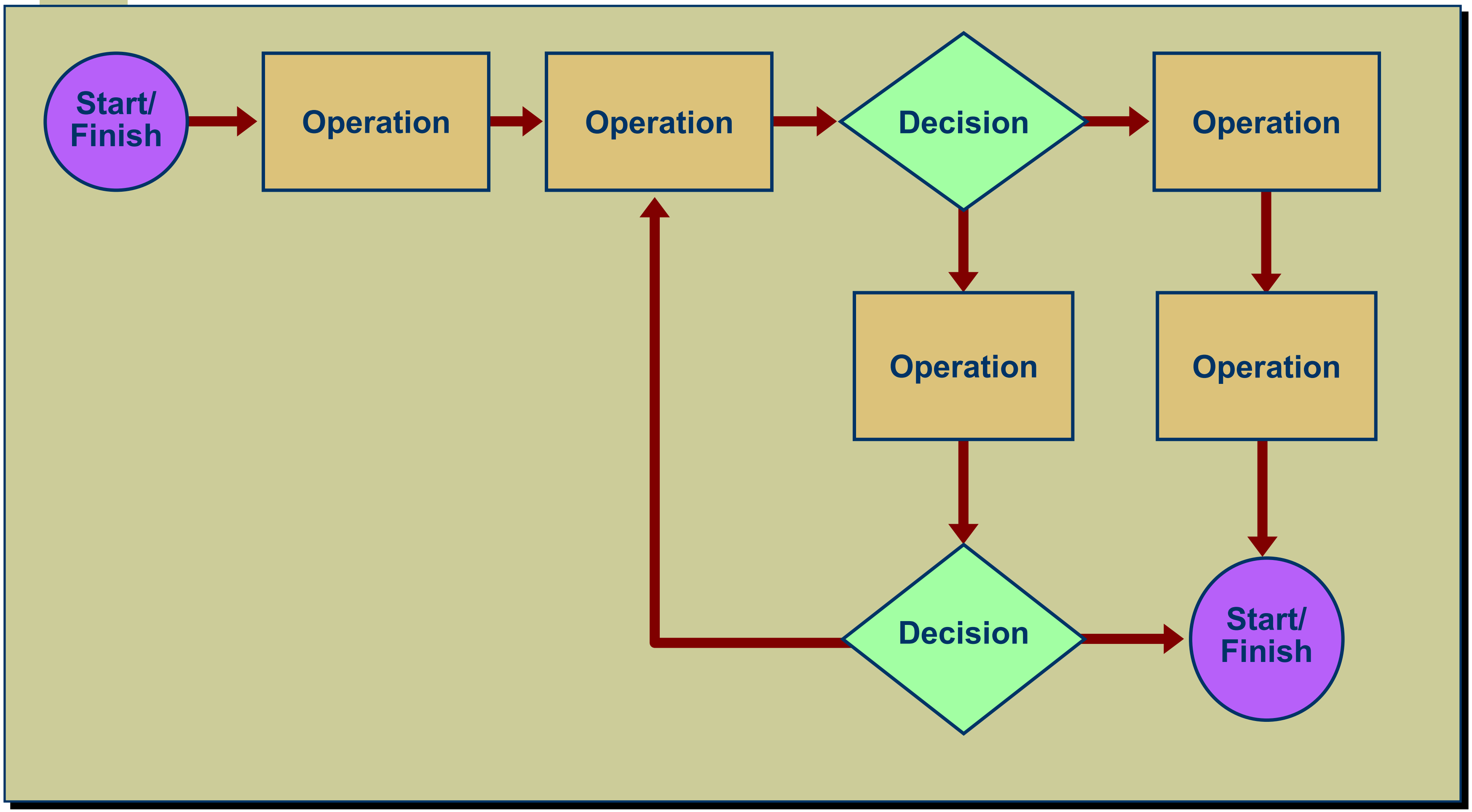
Pareto Analysis

CAUSE	NUMBER OF DEFECTS	PERCENTAGE
Poor design	80	64 %
Wrong part dimensions	16	13
Defective parts	12	10
Incorrect machine calibration	7	6
Operator errors	4	3
Defective material	3	2
Surface abrasions	3	2
	125	100 %

Pareto Chart



Flow Chart



Start/ Finish
Operation
Operation
Decision
Operation
Operation
Operation
Decision
Start/ Finish

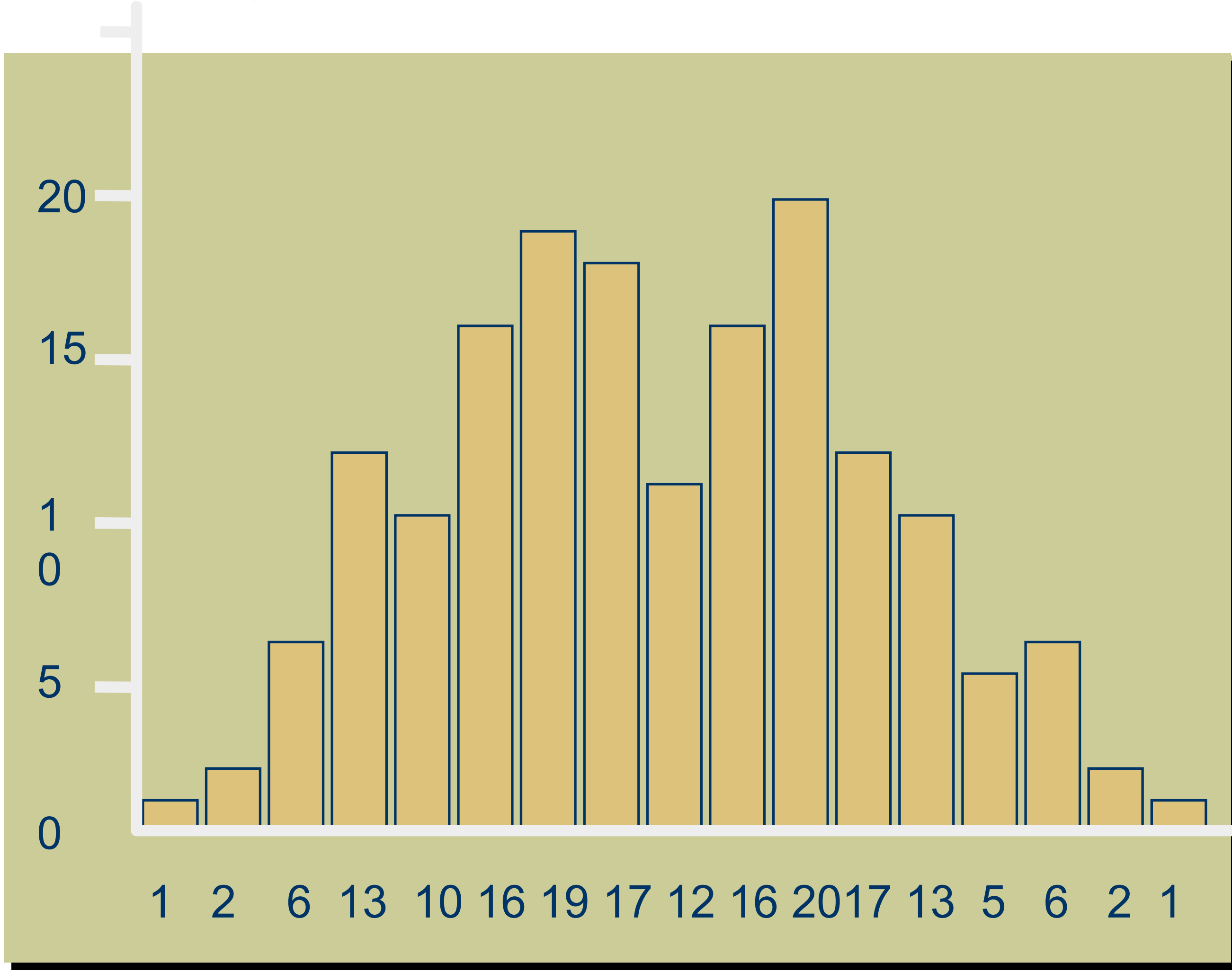
Check Sheet

COMPONENTS REPLACED BY LAB
TIME PERIOD: 22 Feb to 27 Feb 2002
REPAIR TECHNICIAN: Bob

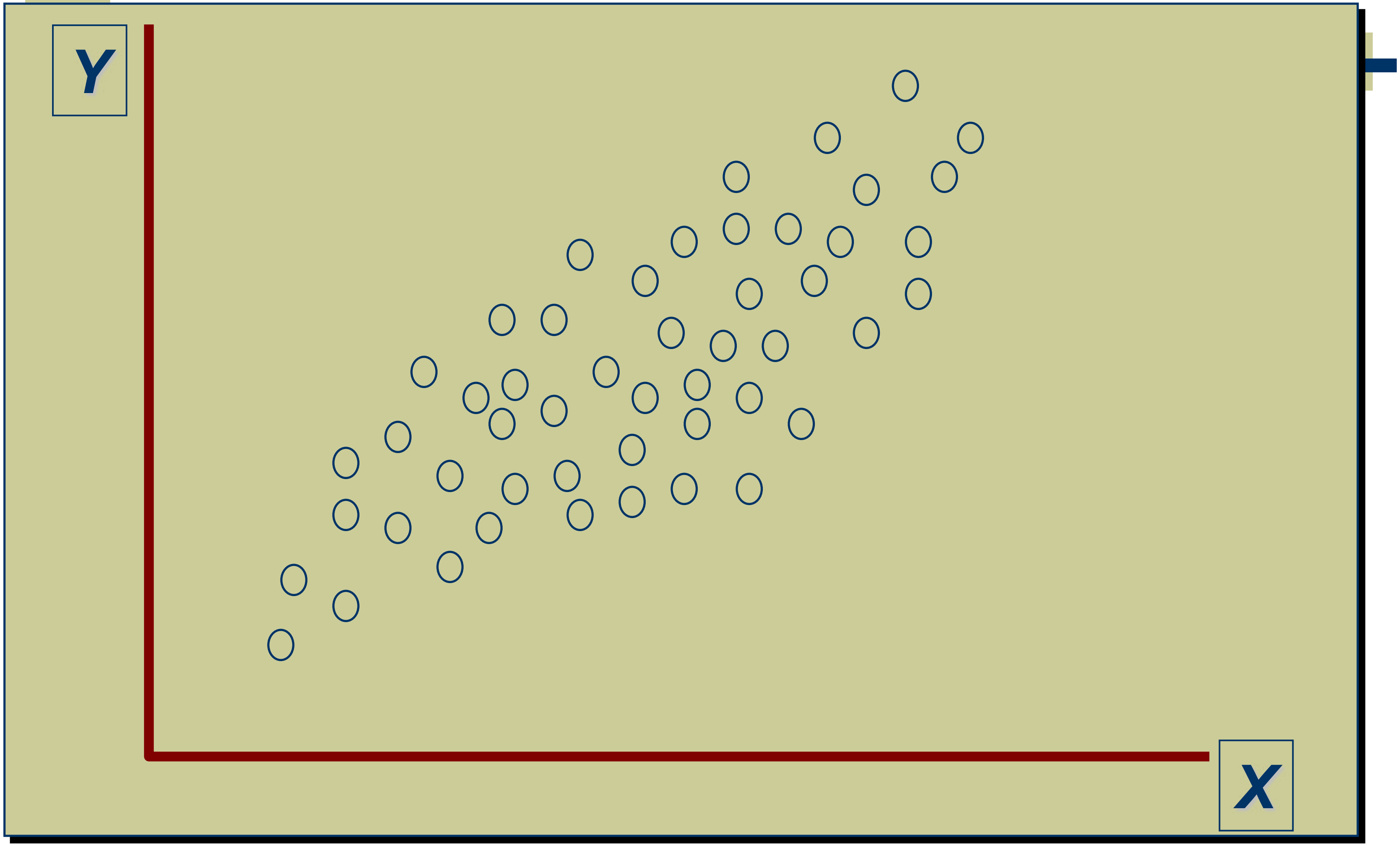
TV SET MODEL 1013

Integrated Circuits	𝍸
Capacitors	𝍸 𝍸 𝍸 𝍸 𝍸 ||
Resistors	||
Transformers	𝍸
Commands	
CRT	|

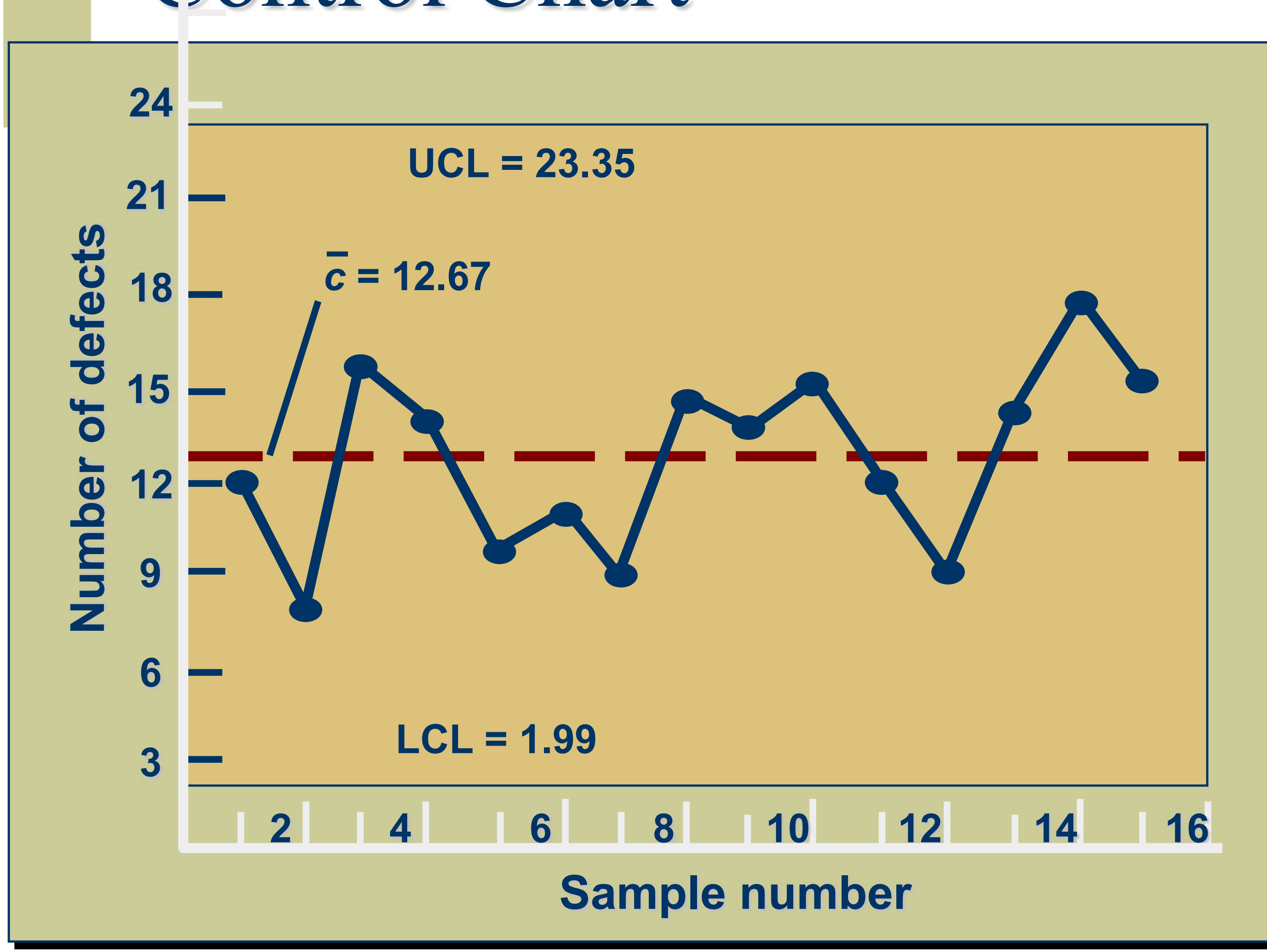
Histogram



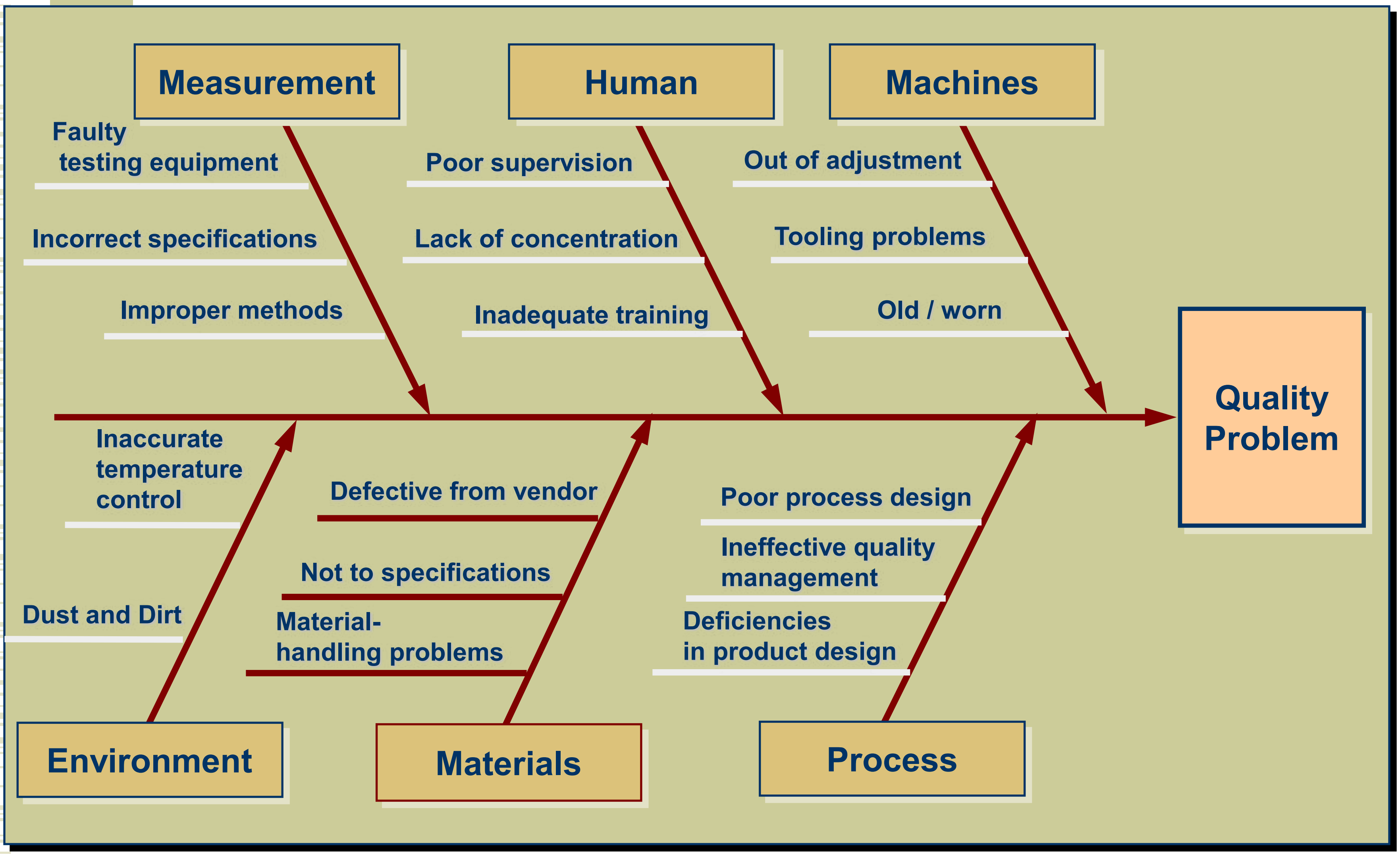
Scatter Diagram



Control Chart



Cause-and-Effect Diagram



Baldrige Award

- Created in 1987 to stimulate growth of quality management in the United States
- Categories
  - Leadership
  - Information and analysis
  - Strategic planning
  - Human resource
  - Focus
  - Process management
  - Business results
  - Customer and market focus

Other Awards for Quality

- National individual awards
  - Armand V. Feigenbaum Medal
  - Deming Medal
  - E. Jack Lancaster Medal
  - Edwards Medal
  - Shewart Medal
  - Ishikawa Medal
- International awards
  - European Quality Award
  - Canadian Quality Award
  - Australian Business Excellence Award
  - Deming Prize from Japan

American Customer Satisfaction Index (ACSI)

- Measures customer satisfaction
- Established in 1994
- Web site: www.acsi.org
  - Examples (in 2003)
    - Amazon.com scored 88 (highest in service)
    - Dell scored of 78 (highest in computer industry)
    - Cadillac scored 87 (highest in car industry)

ISO 9000

- A set of procedures and policies for international quality certification of suppliers
- Standards
  - ISO 9000:2000
    - *Quality Management Systems—Fundamentals and Vocabulary*
    - defines fundamental terms and definitions used in ISO 9000 family
- ISO 9001:2000
  - *Quality Management Systems—Requirements*
  - standard to assess ability to achieve customer satisfaction
- ISO 9004:2000
  - *Quality Management Systems—Guidelines for Performance Improvements*
  - guidance to a company for continual improvement of its quality-management system

Implications of ISO 9000 for U.S. Companies

- Many overseas companies will not do business with a supplier unless it has ISO 9000 certification
- ISO 9000 accreditation
- ISO registrars
- A total commitment to quality is required throughout an organization

Project development process

PROJECT LIFE CYCLE

PRELIMINARY STAGE

- INCEPTION
- BRIEFING
- PLANNING
- CONCEPTUAL
- FEASIBILITIES STUDY

DESIGN DEVELOPMENT

SKETCH DESIGN

DETAIL DESIGN

PROCUREMENT

CONSTRUCTION

COMMISIONING / HAND OVER/

COMPLETION

OCCUPATION/OPERATION

REFURBISHMENT

DEMOLITION

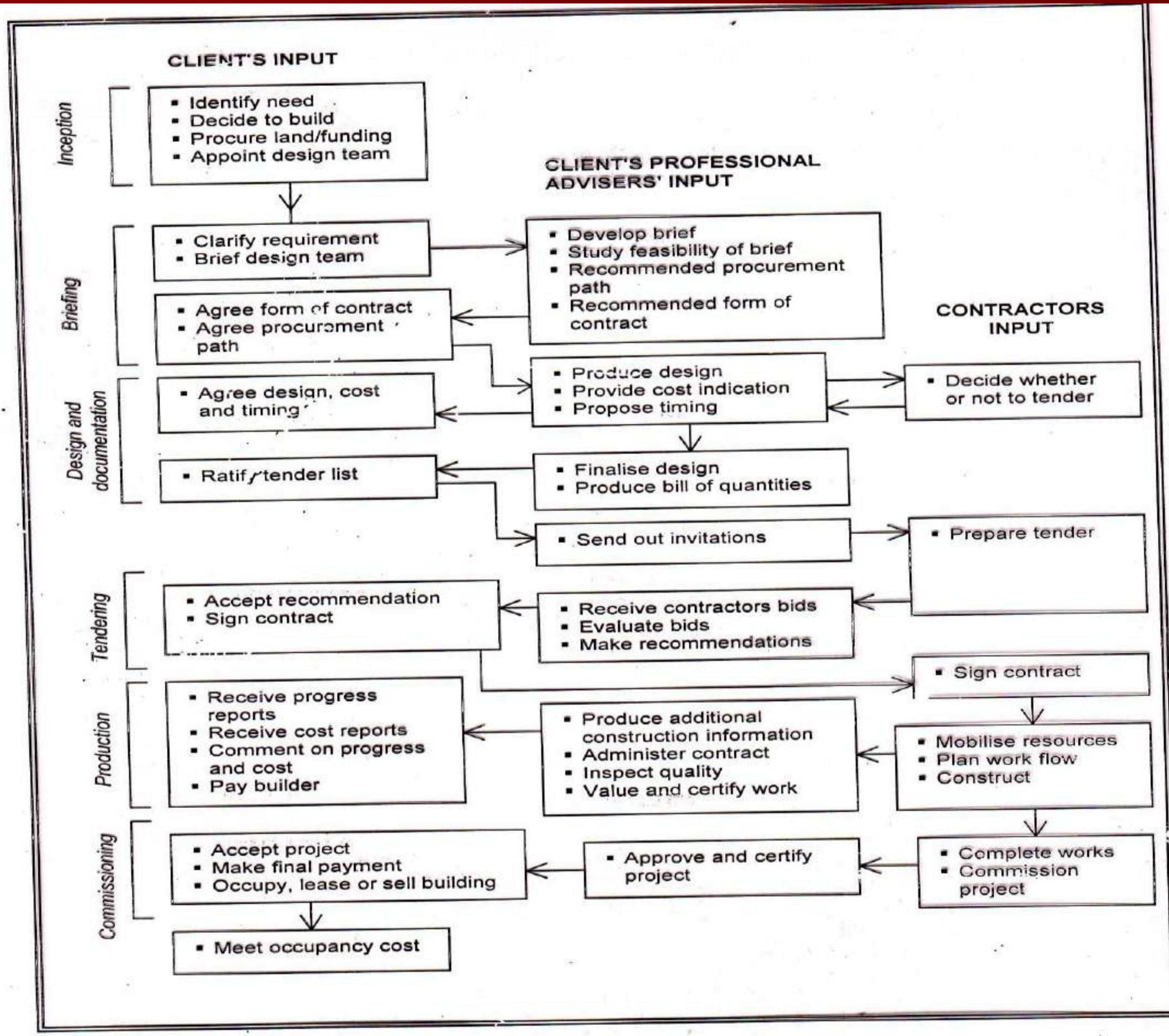
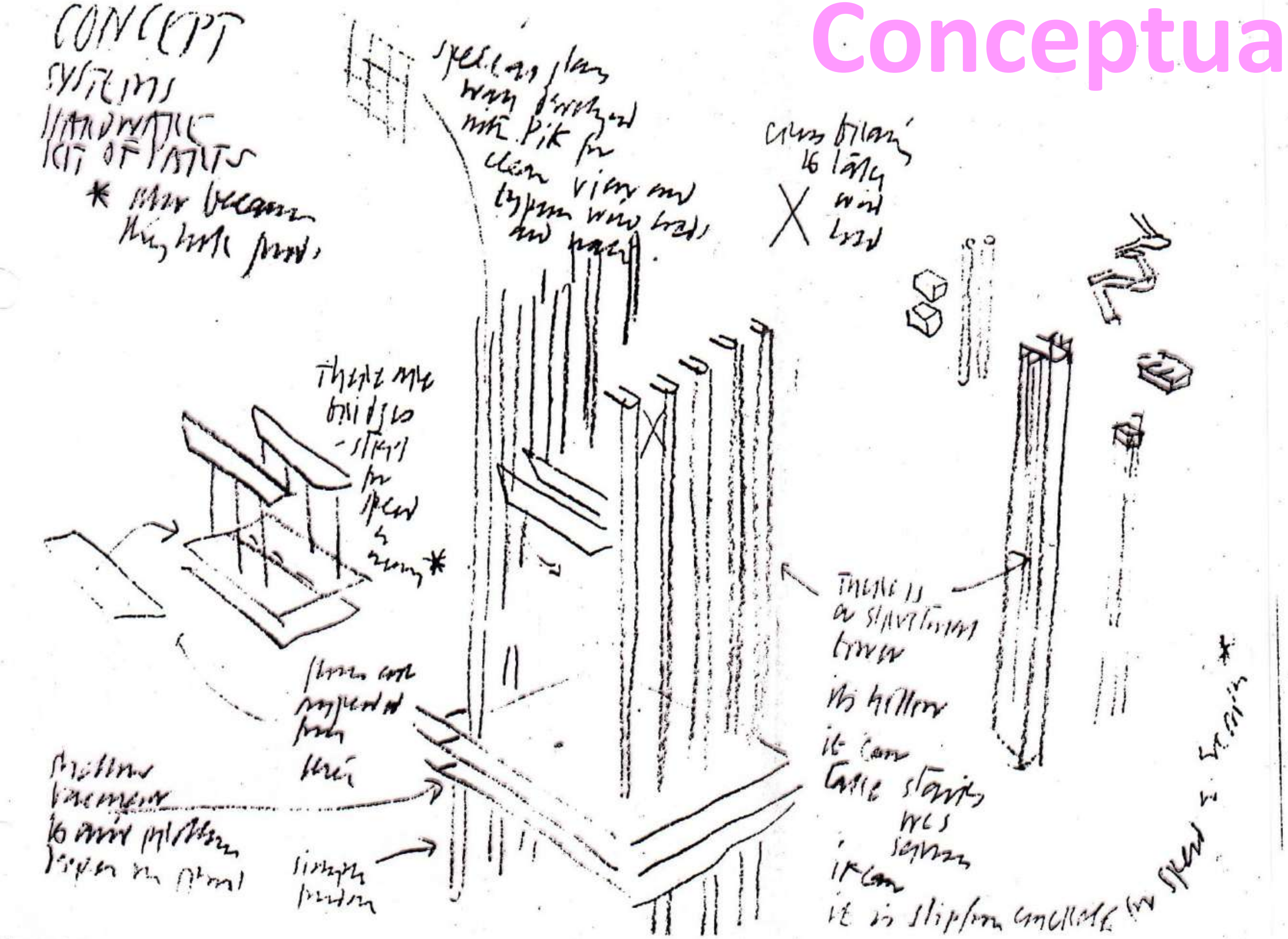


Figure 2.3 **Traditional sequence of activities in construction project (Kwakye 1997)**

Conceptual

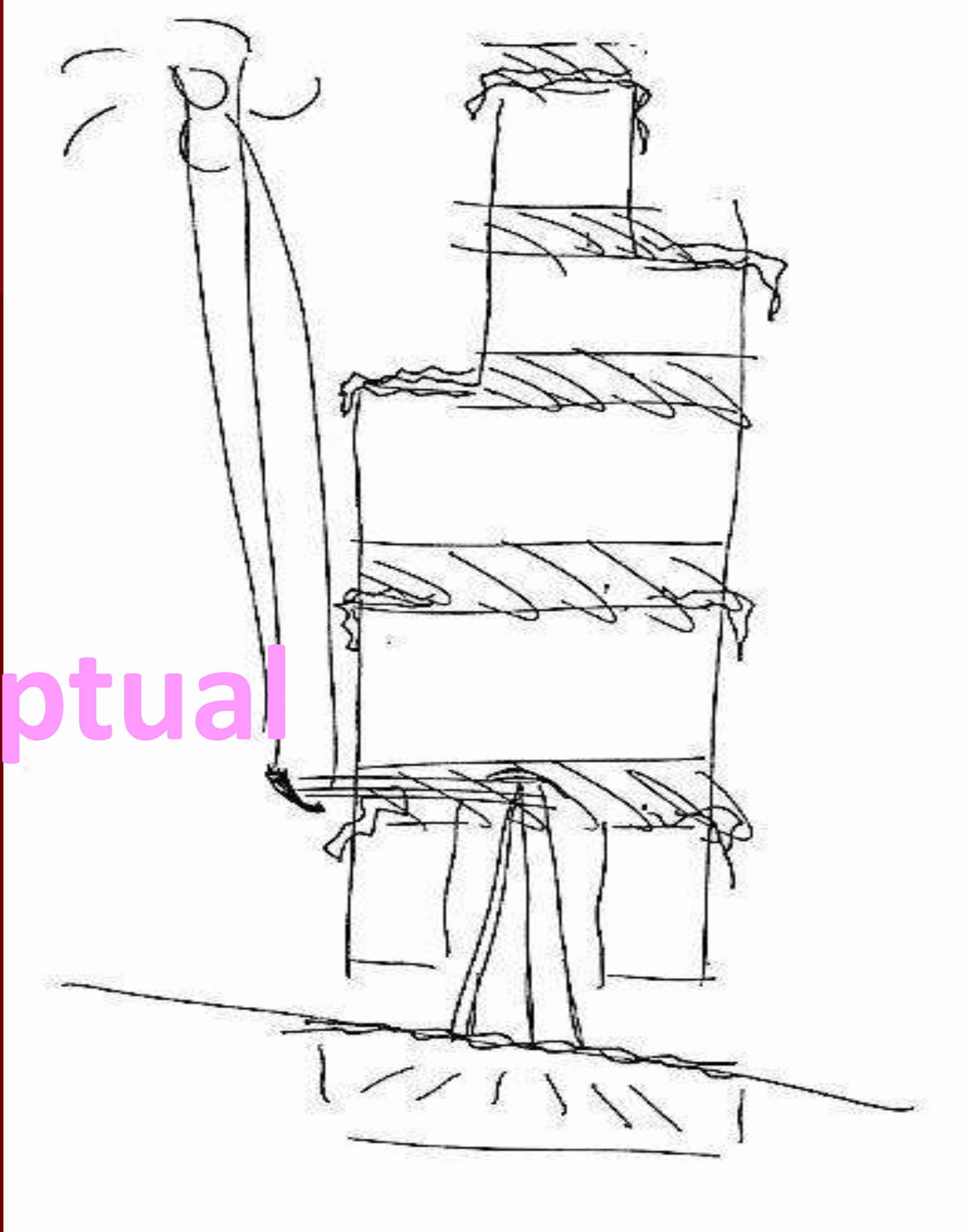


CONCEPT
SYSTEMS
HARDWARE
KIT OF PARTS
There are bridges
There is a service tower
its hollow
it is slipform concrete

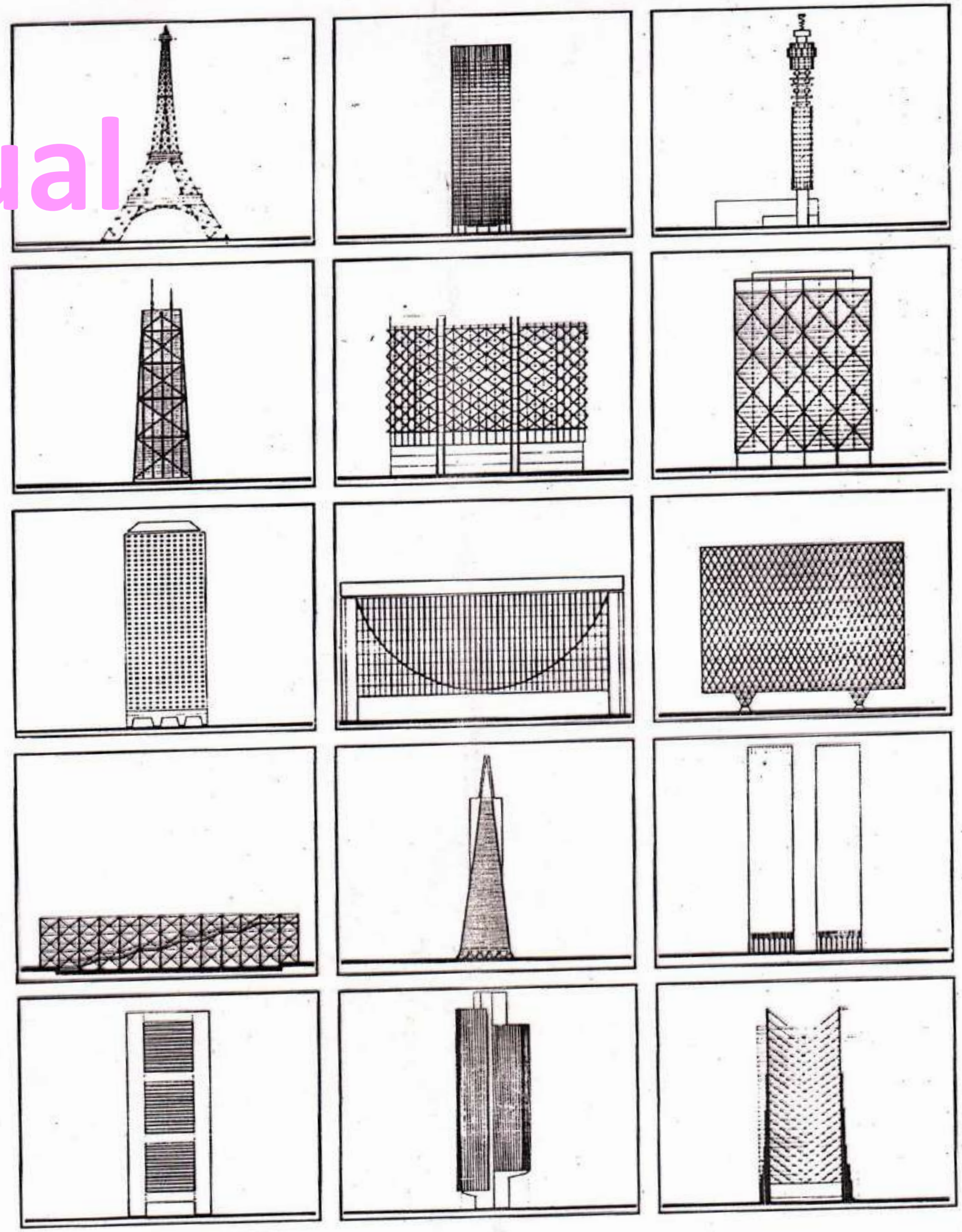

COMPANY ESTABLISHMENT
Project Financial source
LAND OFFICE
Land title / conversion of land status
Submit application for development to local authority
Local authority – Building Plan
Layout plan
Structural /M&E
Local authorithy will coordinate with other related agency: JPS / JBA / TEN / ETC
APPROVAL GRANTED
BEGIN CONSTRUCT
COMPLETION AND CFO

- (Land tittle acquisition) Permohonan Beri Milik Tanah
- (Land conversion for development) Permohonan Tukar Syarat Tanah Kepada Pembangunan
- (Plan approval – Layout / Boundary) Permohonan Kelulusan Pelan Susunatur/Pertapakan/Pecah SempadanTanah
- (Infrastructur – Earthwork and drainage plan approval) Permohonan Kelulusan Pelan Infrastruktur - Kerjatanah dan Sistem Saliran
- (Building plan approval and Infrastructure) Permohonan Kelulusan Pelan Bangunan/Prasarana
- (Certificate Fitness of Occupancy) Permohonan Kelulusan Sijil Kelayakan Menduduki Bangunan (CFO)

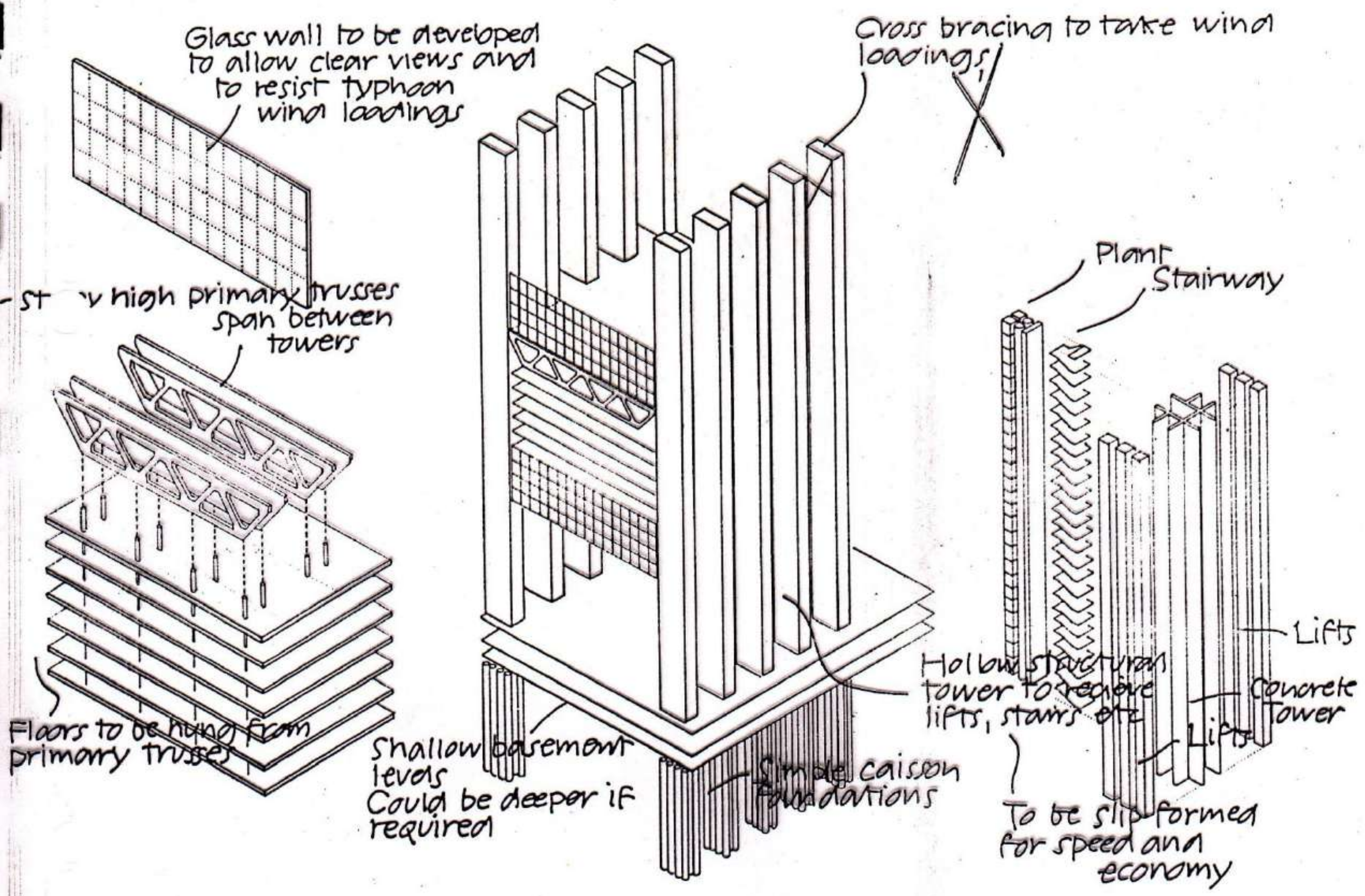
Conceptual



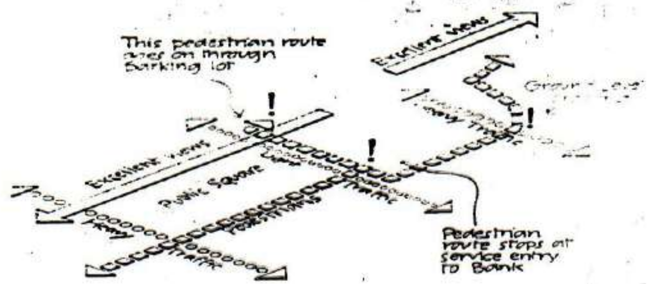
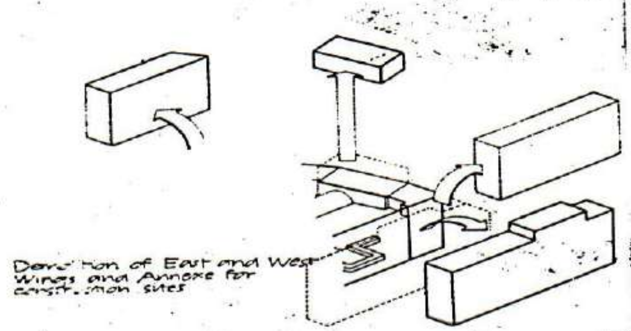
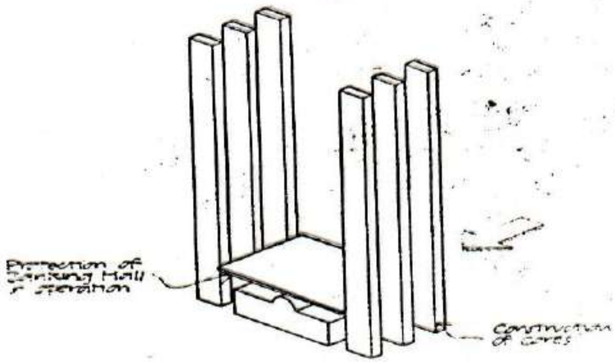
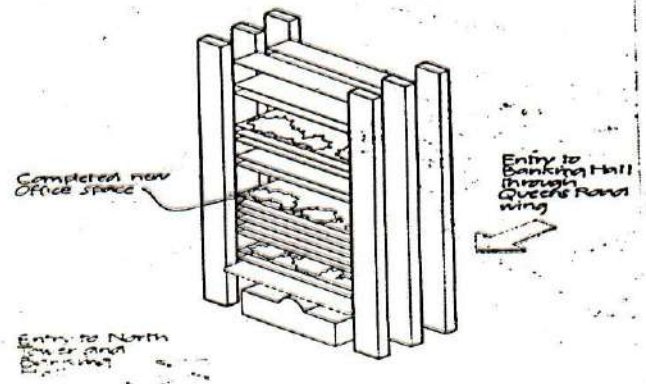
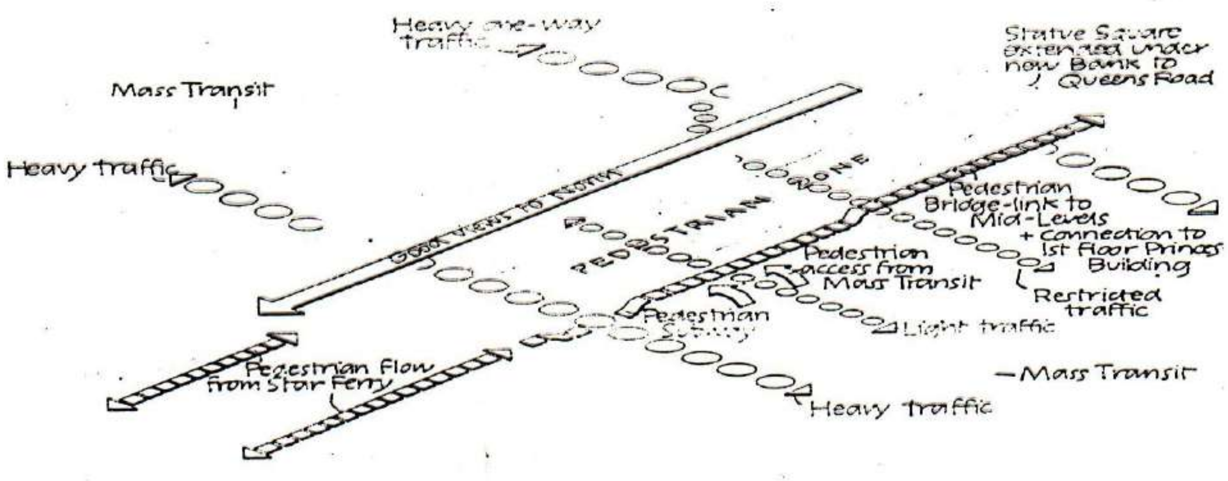
Conceptual



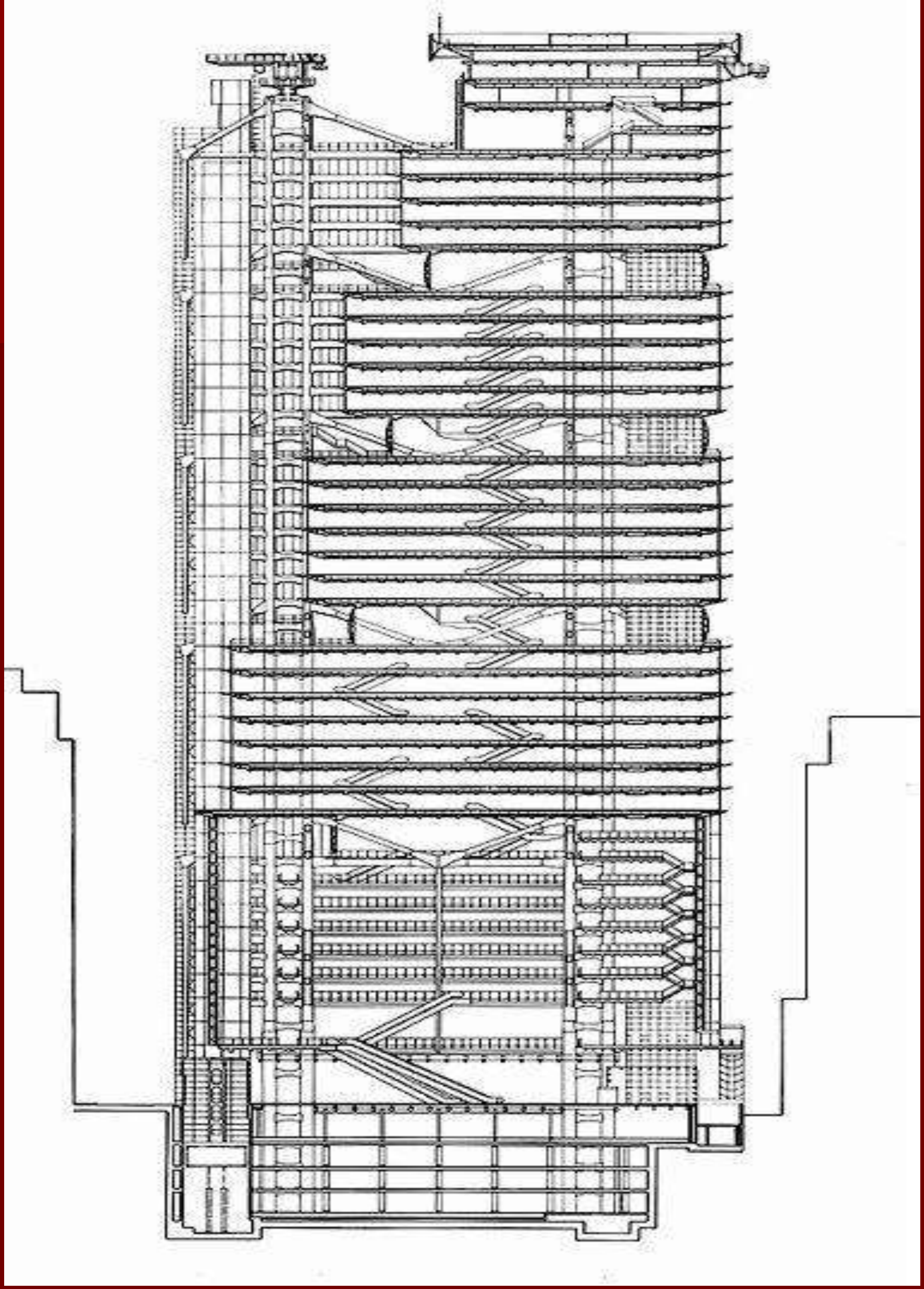
Extracts from the flip-books, January 1980: examples of buildings with externally expressed structural systems. Left to right from the top row: Eiffel Tower, Paris; Seagram Building, New York; Post Office Tower, London; John Hancock Building, Chicago; office building in Cannon Street, London; Aluminium Co. of America, San Francisco; Connaught Centre, Hong Kong; Federal Reserve Bank, Minneapolis; Group Practice Clinic, Salt Lake City; IBM Building, Pittsburgh, Centre Pompidou, Paris; William Pereira Building, San Francisco; World Trade Center, New York; OCBC, Singapore; National Westminster Tower, London; Hongkong and Shanghai Banking Corporation, May 1980 presentation.



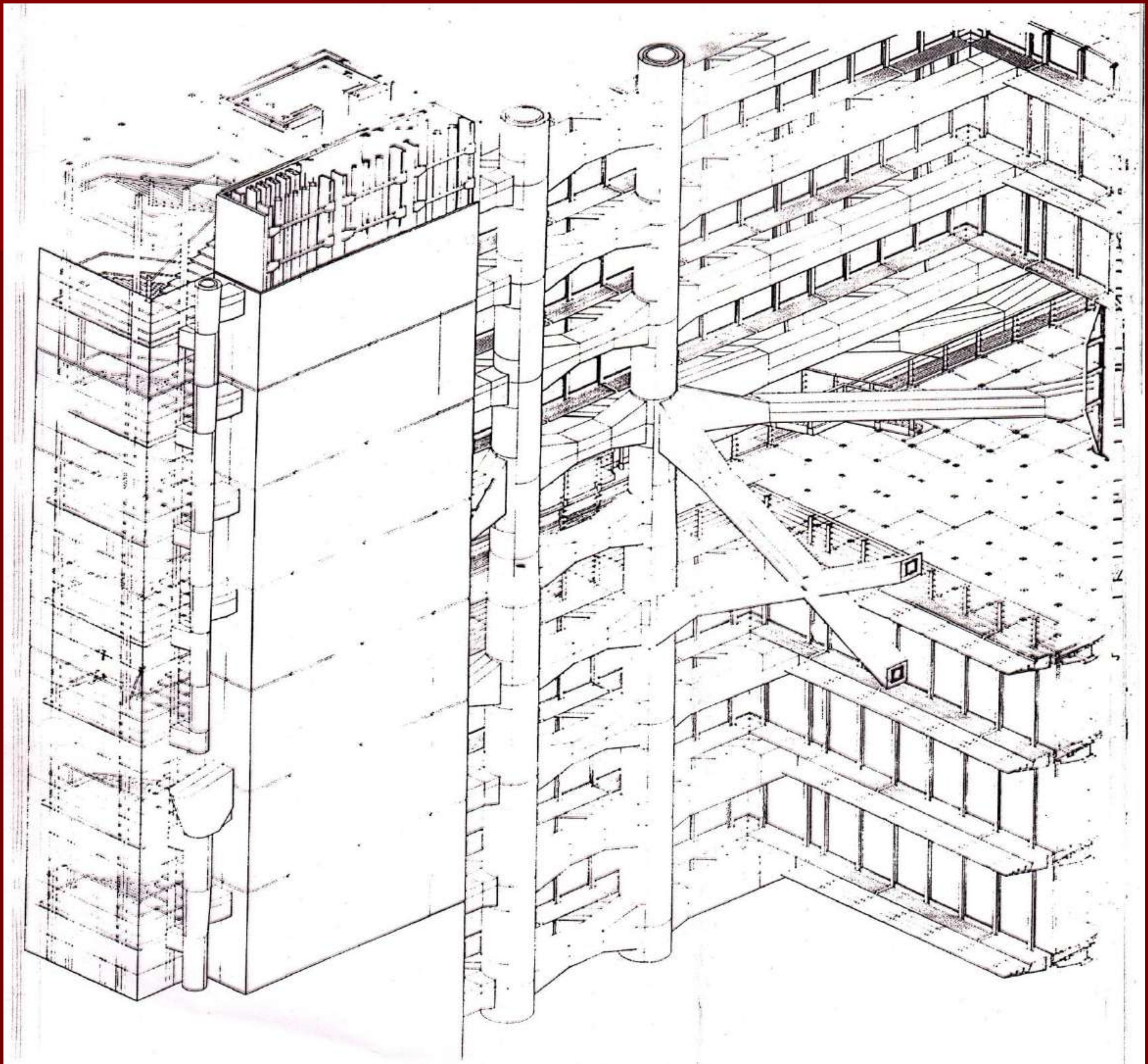
Page 57 of Foster Associates' 'Proposals for 1 Queen's Road Hong Kong'.


This pedestrian route
Excellent views
Excellent views
Public Square
Pedestrians
Pedestrian route stops at service entry to Bank

East and West
Wings and Annexe for

Construction of cores

Completed new Office space
Entry to Banking Hall through Queens Road wing
Entry to North

Heavy one-way traffic
Statue Square extended under new Bank to Queens Road
Mass Transit
Heavy traffic
GOOD VIEWS TO NORTH
PEDESTRIAN ZONE
Pedestrian Bridge-link to Mid-Levels + connection to 1st floor Princes Building
Pedestrian access from Mass Transit
Restricted traffic
Pedestrian
Light traffic
Pedestrian Flow from Star Ferry
Mass Transit
Heavy traffic

Sketch design



Sketch design



Completion and operation


www.GreatBuildings.com


www.GreatBuildings.com


www.GreatBuildings.com


www.GreatBuildings.com

Introduction to Benchmarking

What is Benchmarking

- Benchmarking is an improvement process that is used to identify best practice within a peer group and facilitate it’s incorporation into your organization

Why best practice

- Best practice refers to techniques, methods or processes that are more effective at delivering a desired outcome.
- Incorporating best practice into your organization can lead to greater efficiency and effectiveness and a happier customer.

Benefits of Benchmarking

- Benchmarking helps identify the gaps between the organization that is undertaking the benchmarking assessment and best practice.
- Undertaking benchmarking can lead to improvements being incorporated into processes and systems delivering gains in efficiency and effectiveness
- Benchmarking can help align improvement activity with strategic goals and objectives

The Benchmarking process

- Benchmarking has a defined process
  1. Identify the process that will be benchmarked – consider what metrics will be measured
  2. Measure results in own organization
  3. Identify a benchmarking partner (look for one with favourable results or to the metric being measured or known best practice)
  4. Measure the process
  5. Analyze the conditions that determine the favourable results
  6. Determine an action plan to take your organization to the favourable results
  7. Review Benchmarking results and conduct regular reviews with your peer(s).

Problems with Benchmarking

- Problems with benchmarking occur where
  - Data is not obtained for the process being measured – and analysis becomes subjective
  - No peer group/best practice identified (including data available)
  - The gap between current state and best practice is captured but nothing is done about it
  - Assumed best practice isn't best practice
  - Benchmarking happens as a one off event and not reviewed periodically

The importance of data

- In order to measure the gap between the measuring organization and best practice quantifiable measures need to be taken
- This requires data
- Unless this method is followed results can be subjective and inaccurate
- Follow on improvement activity can have negligible impact

Using your Peer-group

- Benchmarking relies on a partner organization or “peers” which will be measured against.
- Peers could be a different group in the same organization (e.g two purchasing departments in a multinational organization) or a completely separate company
- The importance is measuring your performance against another “peer” with a different standard

Benchmarking doesn't stop

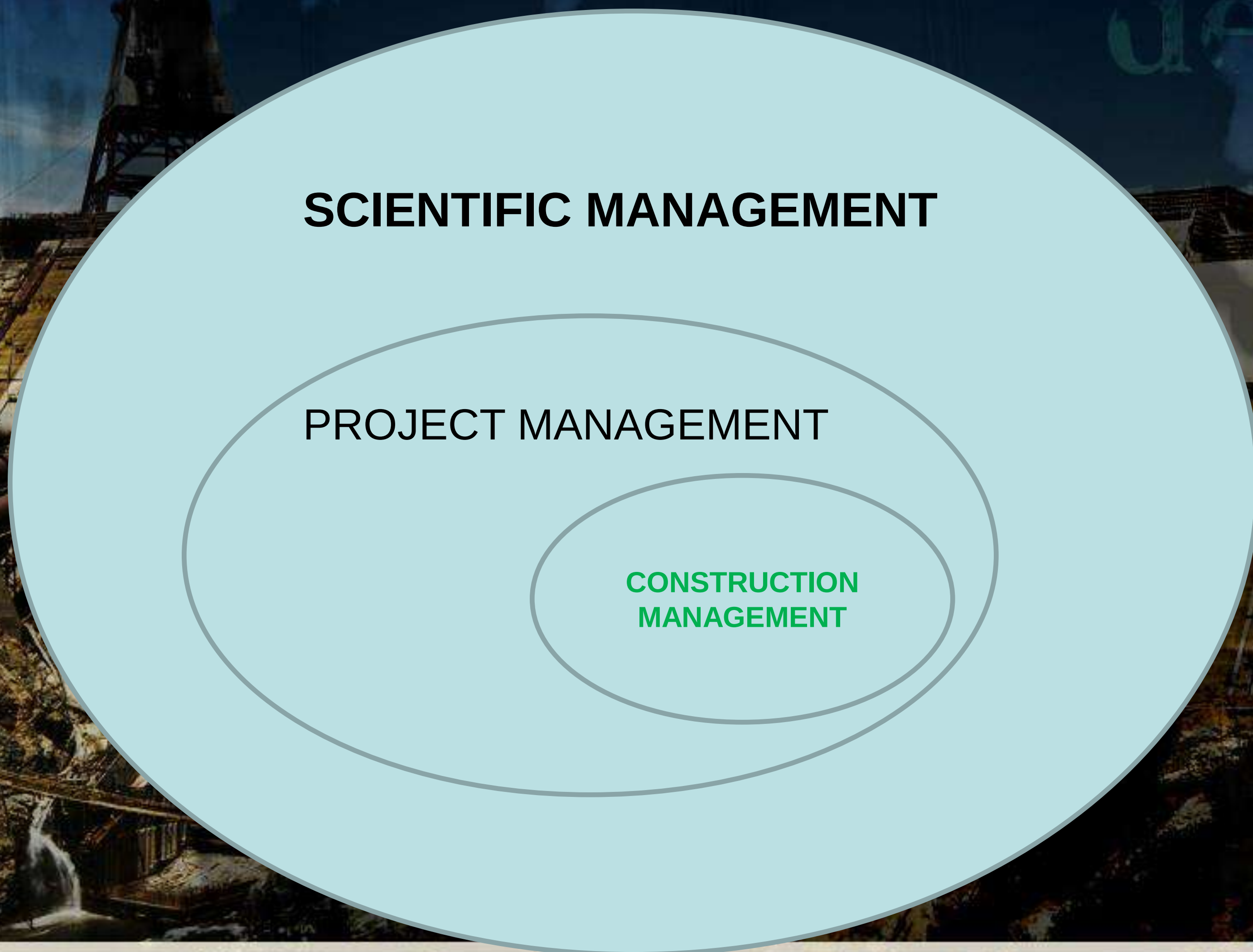
- Benchmarking should be viewed as a continuous improvement method
- Regular reviews of performance should be taken especially if improvement activity is underway to transition to "best practice"
- Regular reviews of the peer group should be taken to cater for any changes/improvement made

Further resources

- For more information try these web resources
  - http://www.ogc.gov.uk/documentation_and_templates_benchmarking.asp
  - http://www.ebenchmarking.com/
  - http://www.nhsbenchmarking.nhs.uk/
  - http://www.berr.gov.uk/dius/innovation/benchmarking-innovation/index.html

CONSTRUCTION PROJECT MANAGEMENT

AREA OF MANAGEMENT

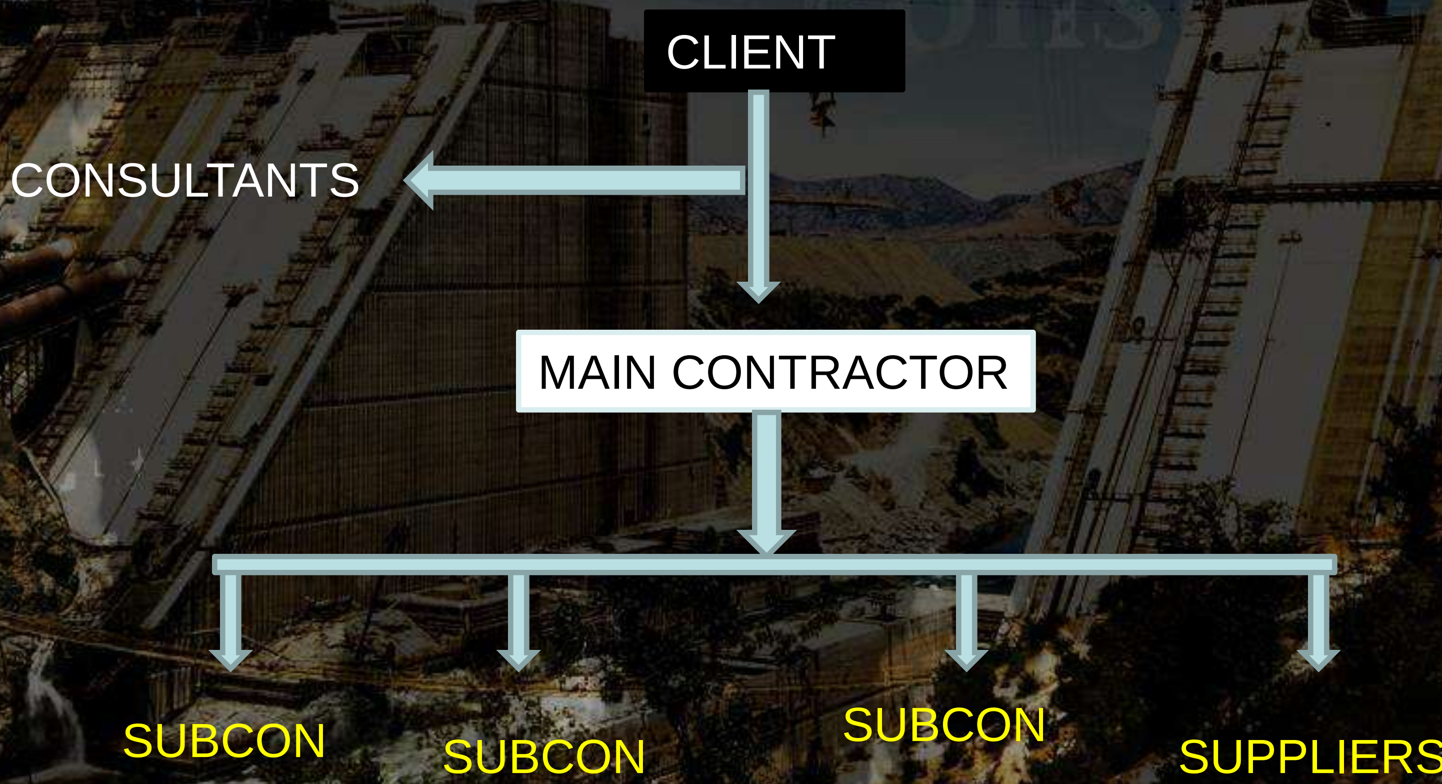


AREAS IN CONSTRUCTION STUDIES

- QUALITY MANAGEMENT
- PROCUREMENT
- CONSTRUCTION LAW
- RESOURCES MGT
- QUALITY MANAGEMENT
- CONTRACT
- PROJECT LIFE CYCLE MGT
- HUMAN RESOURCE
- FINANCIAL
- STAKEHOLDERS MANAGEMENT
- INTERNATIONAL PROJECT
- PLANNING AND SCHEDULING
- NEW MANAGEMENT PHILOSOPHY

PROJECT DELIVERY SYSTEM

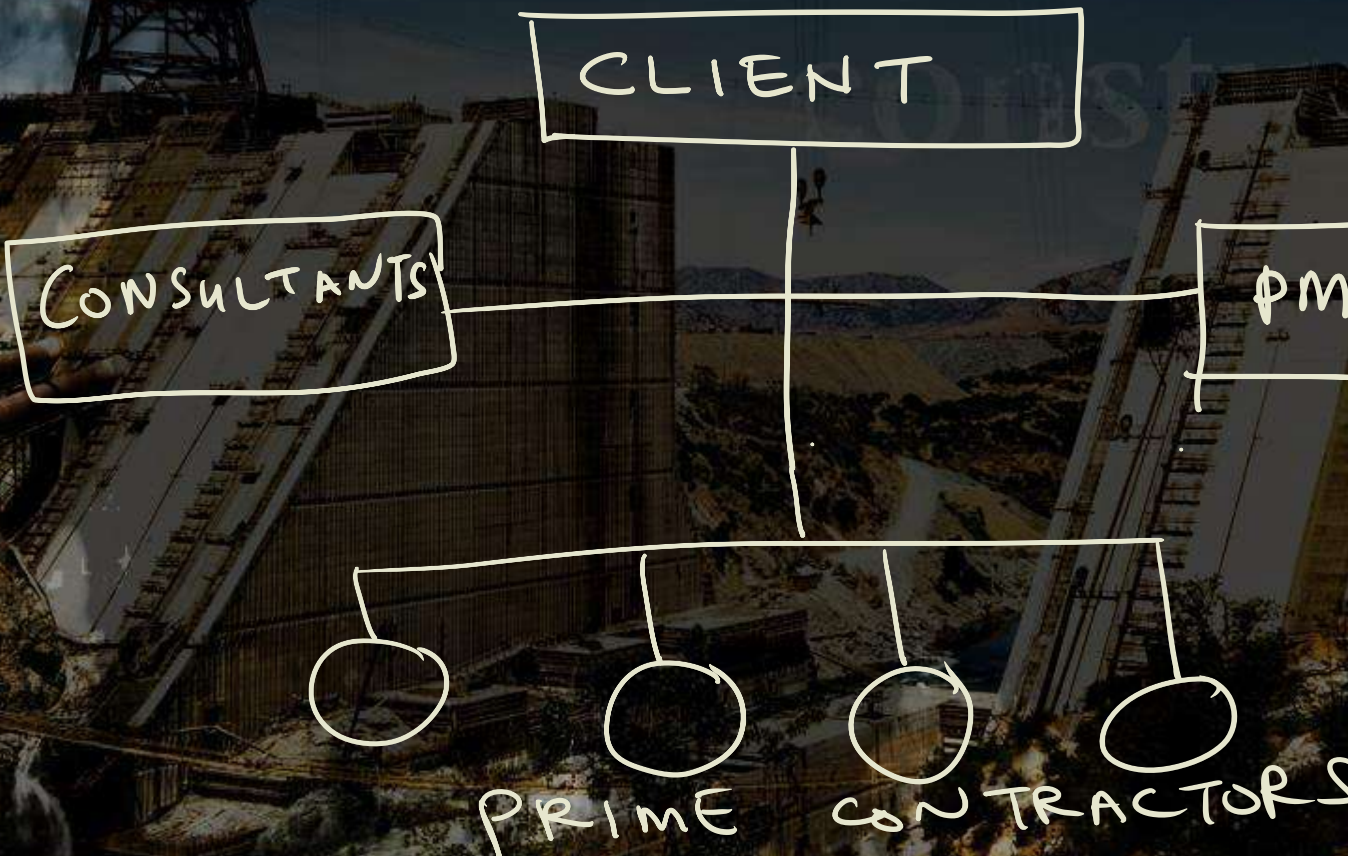
- *TRADITIONAL (DESIGN BID BUILD)*



DESIGN AND B UILD

PROJECT MGT AGENCY

(PROJECT MANAGEMENT CONSULTANT)



OTHER PROCUREMENT METHOD

Tradition, D&B, PMC

⟹ DBFO

(Design, Build, Finance, Operate)

also know as B.O.T

(Build, Operate, Transfer)

STAKEHOLDERS

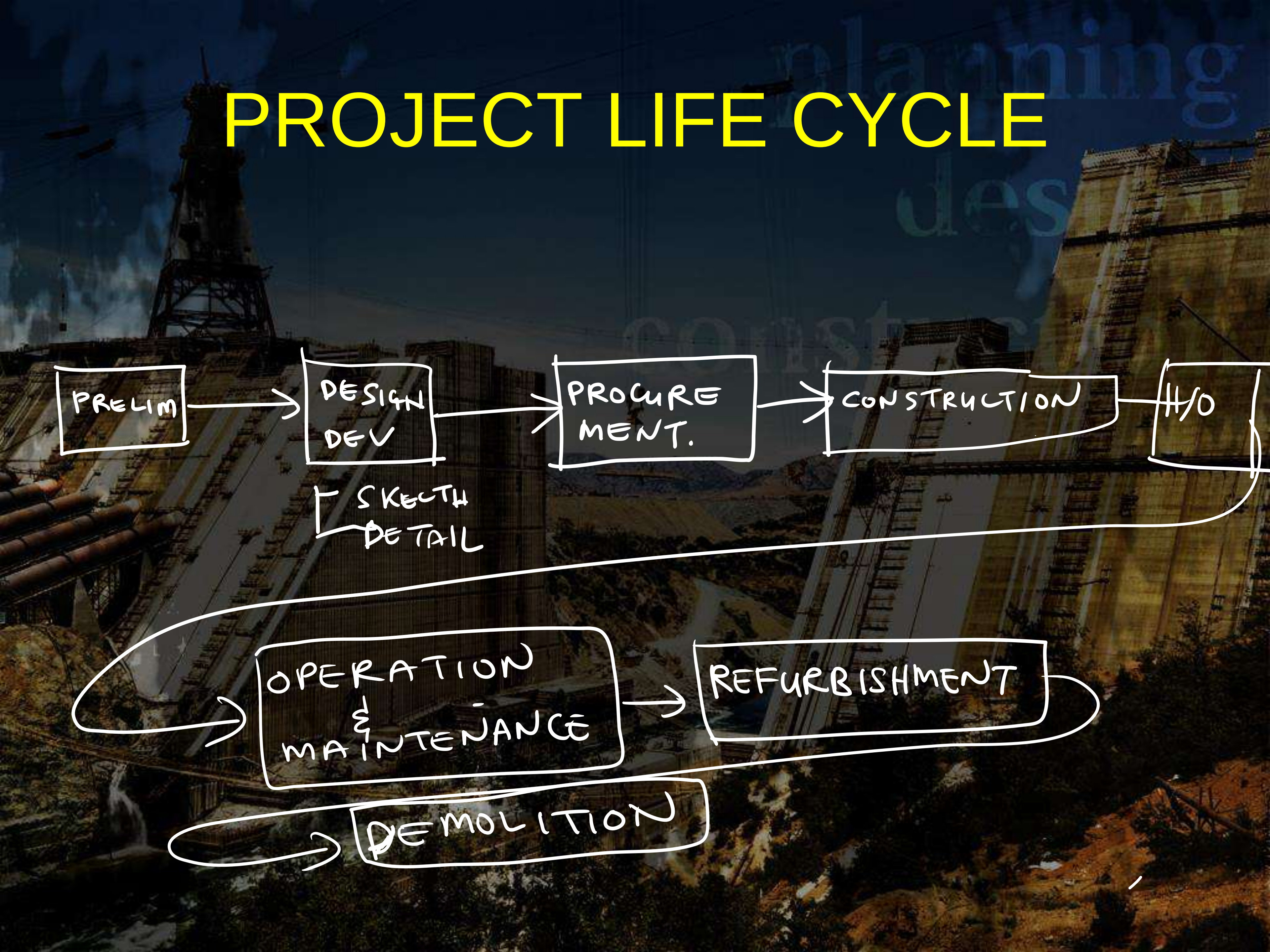
- PRIMARY
- Client
- Contractor
- Consultants
- Project Manager
- SECONDARY
- Local Authority
- Subcontractors – Suppliers, Financiers

PROJECT LIFE CYCLE

PRELIM.INERY STAGE

- Inception
- Conceptual
- Feasibilities Study
- . Planning

PROJECT LIFE CYCLE

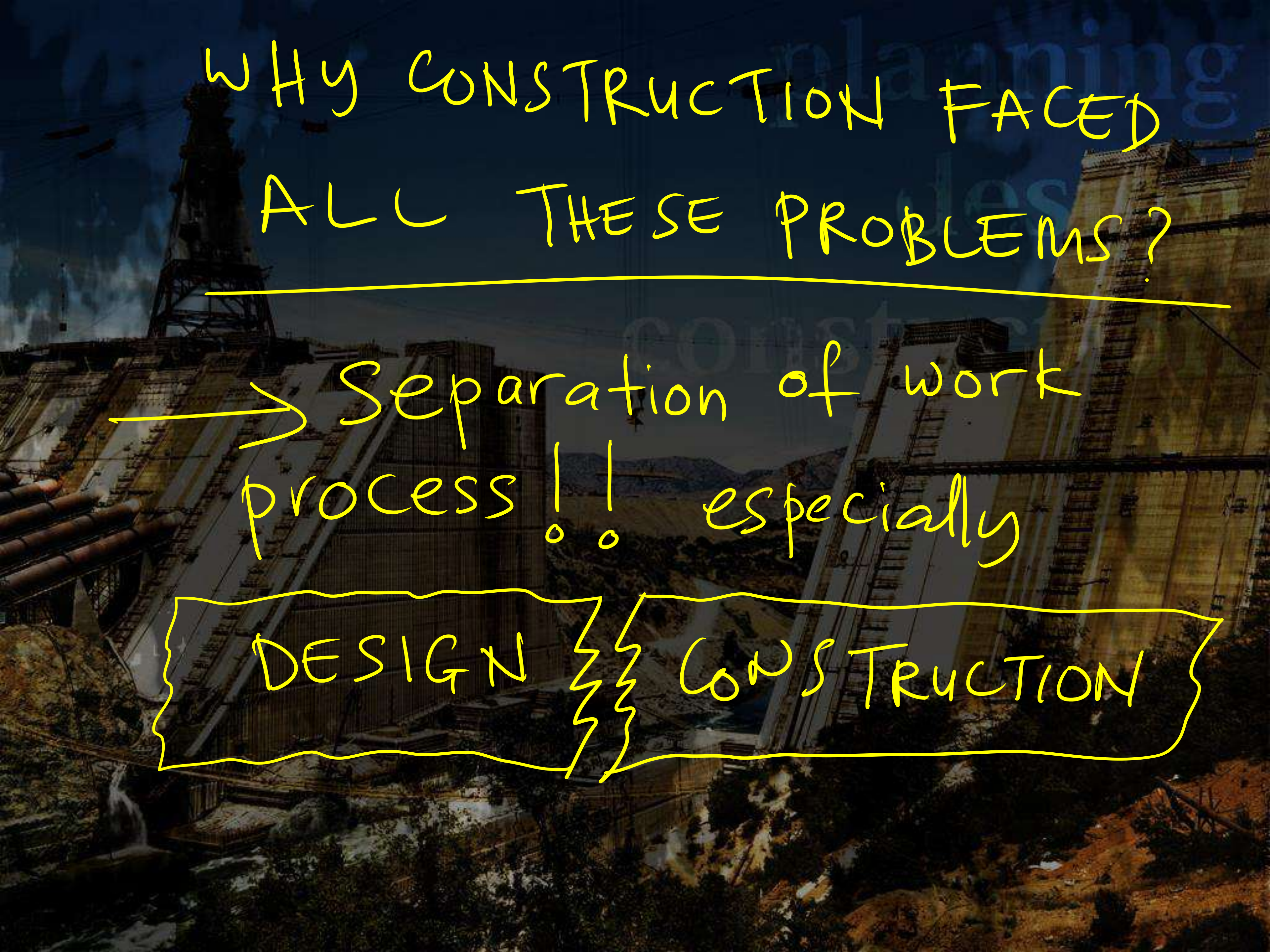


PROBLEMS FACE BY CONSTRUCTION INDUSTRY

- Quality Control is difficult
- Lack of focus to customer/End User
- Too Competitive
- Low Profit Margin
- Very Fragmented Industry
- Communication Breakdown
- Incongruent Goals & Objectives

PROBLEMS (Continues)

- Lack of transperency in Project Info.
- Passing blame and liabilities
- Lack of teamworking spirit
- Error and rework is a common phenomenum



WHY CONSTRUCTION FACED ALL THESE PROBLEMS?

→ Separation of work process !! especially

DESIGN | CONSTRUCTION

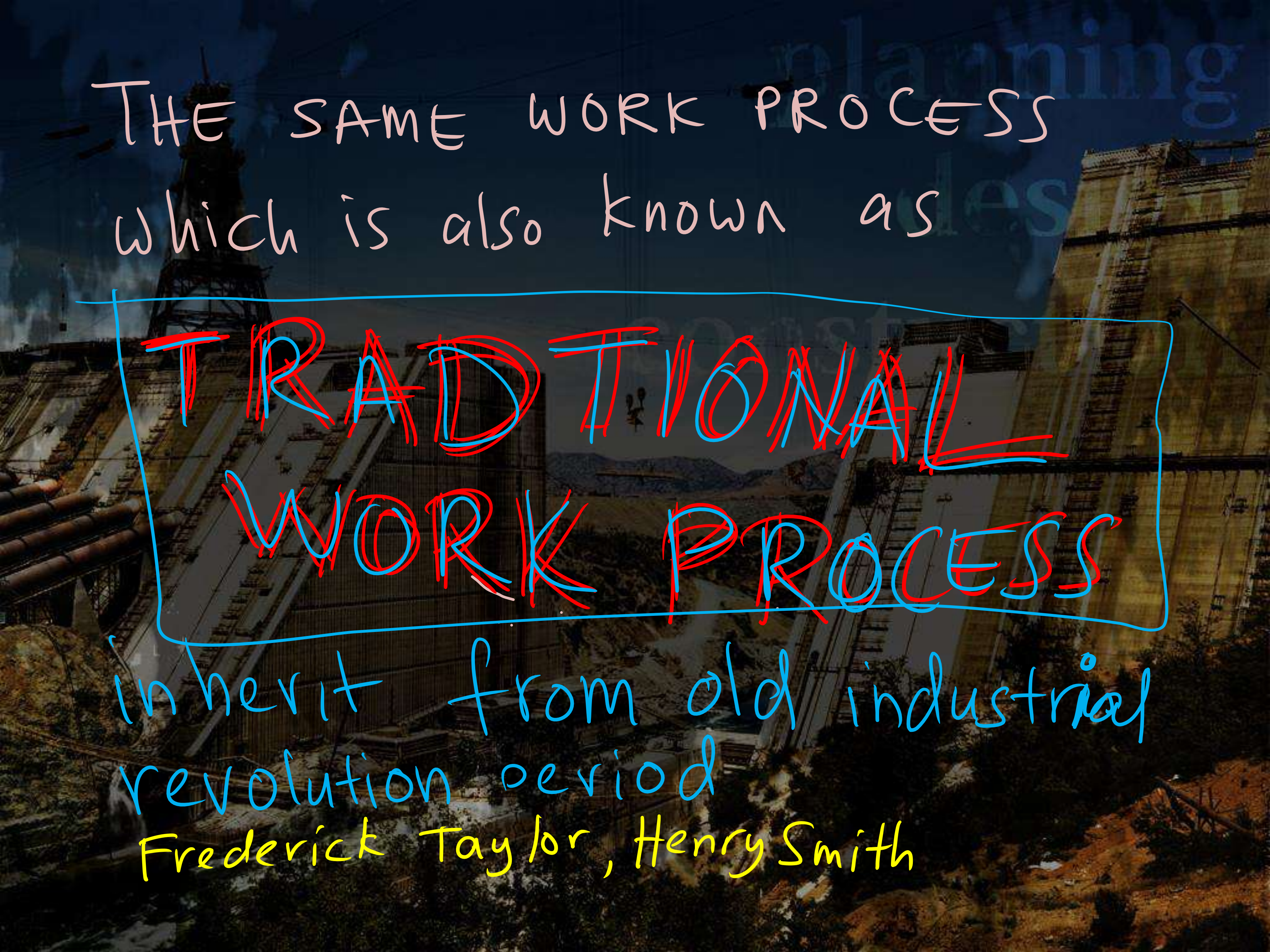
LET US LOOK AT OTHER INDUSTRY

* The same issue also faced by manufacturing _ the industry that have similiar work process

DESIGN

MANUFACTURE

MARKETING


planning
THE SAME WORK PROCESS
which is also known as
TRADTIONAL
WORK PROCESS
inherit from old industrial
revolution period
Frederick Taylor, Henry Smith

a work theory adapted from "SCIENTIFIC MANAGEMENT"

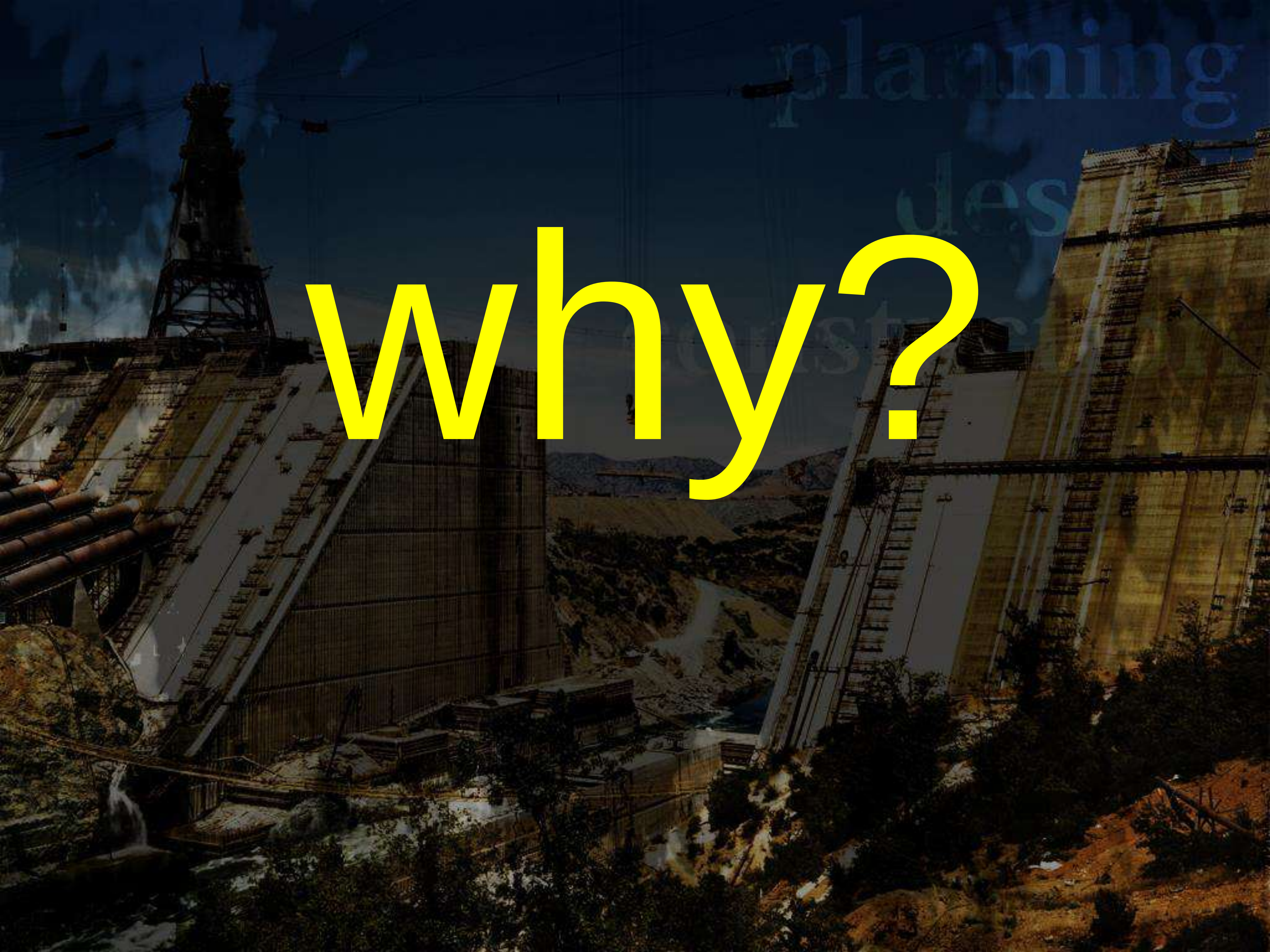
This traditional work process works last time because :

- Mass Production
  → demand for Quantity rather quality
- Lack of Competition
- Customer / End User not Knowlegable about product

OLDIES

In the past Western world conquer the knowledge and technology the dominate the production until people get bored of their products!! They started to fail to understand what customer really want!

After WWII Japanese starts to produce exactly the same products like TV and cars but with different fashion by early 90s western starts to loose their_ business to Japanese



why?

Customers becomes smarter
They dictate what they want
They buy what they prefer
They reject what the don’t want!
competition becomes tougher
more and more manufactures enter the market
the products become obsolete very fast 3-5 years!! Some in year!

THEREFORE

- LISTEN To customer
- Produce just what they want
- Produce it fast because people get bored faster now!
- They got money to buy new one
- Customer very knowledgeable
- The have a lot of choices

The Trouble Western Manufacturer

- They lost to Japs!
- They went to visit Japanese to find what went wrong!
- Describe by Wormacks in his books THE MCHINE THAT CHANGE THE WORLD what is it?
- Japs has different way of working
- Traditional work process is outdated


planning
That story is about manufacturing! They have changed ever since!

WhatS about construction? They never change They work in same old fashion based on Traditional work process

What happened then?

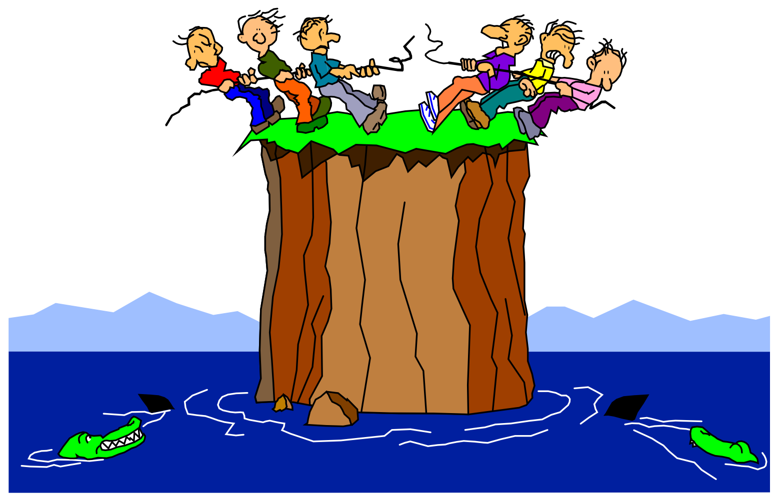
- They fight which each other
- They hate each other
- Difficult to accept changes
- Passing blame and liabilities
- Lack of focus to customer
- Error and rework is Common

Overview of Project Risk Management

- Definition of Risk Management
- Risk in the Project Cycle
- Individual Risk Profiles & Implications
- Qualitative -vs- Quantitative Risk
- Cost of Risk to an Organisation
- Risk Management Process

Project Risk Management

The avoidance or minimisation of the impact of activities that may adversely affect the project



and the exploitation of opportunities which arise

Project Management Maturity by Industry Group and Knowledge Area

KEY: 1 = LOWEST MATURITY RATING, 5 = HIGHEST MATURITY RATING

Knowledge Area	Engineering/ Construction	Telecommunications	Information Systems	Hi-tech Manufacturing
Scope	3.52	3.45	3.25	3.37
Time	3.55	3.41	3.03	3.50
Cost	3.74	3.22	3.20	3.97
Quality	2.91	3.22	2.88	3.26
Human Resources	3.18	3.20	2.93	3.18
Communications	3.53	3.53	3.21	3.48
Risk	**2.93**	**2.87**	**2.75**	**2.76**
Procurement	3.33	3.01	2.91	3.33

Ibbs, C. William and Young Hoon Kwak. Assessing Project Management Maturity, *Project Management Journal* (March 2000).

What is Risk?

- The likelihood (or probability) of an adverse event occurring
- The impact or consequence that the event may have on a project should it occur

What is risk management?

Identifying, analysing and responding to risk factors and events throughout the life of a project

Risk in the project lifecycle

What risks are there common to your projects?

- **Concept Phase**
- **Development Phase**
- **Implementation Phase**
- **Finalisation Phase**

. . . /

Risks common to all projects

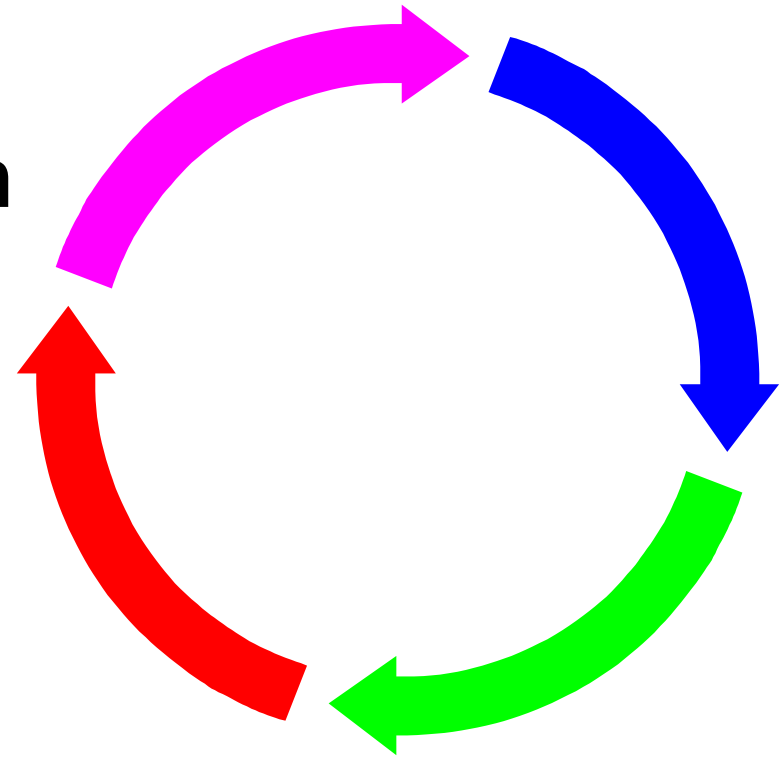
- Late completion
- Changes to procedures
- Lack of clarity in scope or plan
- Project tasks incomplete at end date
- Quality objectives not met
- High rectification or follow-up costs

Development of Risk Management

- PRE-STANDARDS
- PMBOK
- AS/NZS 4360: 1999

Risk in the Project Cycle

- Risk / Project Cycle timeline
- Status of information
  - Available data
    - Internal
    - External
- Project type



Individual Risk Profiles & Implications to Project

Individual

- Risk seeker
- Risk neutral
- Risk averse

Project Implications

- Assessing project risk
- Team impacts

Qualitative v Quantitative Risk

- **Qualitative Analysis**
  - **Standard process**
  - **Special processes**
    - **Environmental Management**
    - **OHS&R**
    - **Specific Safety Processes - Rail Safety Plans**

Qualitative v <u>Quantitative</u> Risk

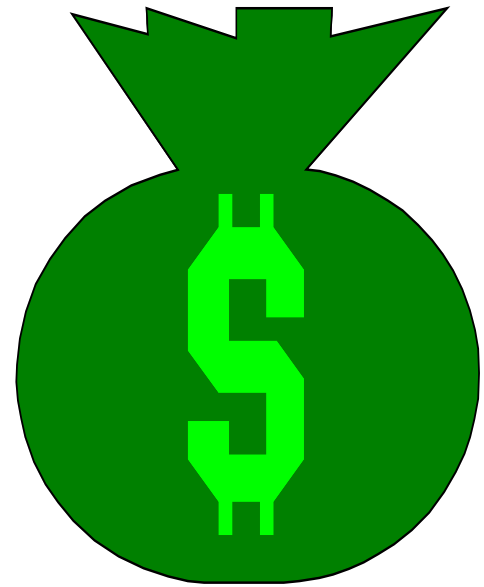
Requires Analysis of Data

- Schedule Risk
- Budget Risk
- Decision Tree Analysis
- Others

Cost of Risk to an Organisation

Factors

- Type of project
- Business area
- Project Size to Organisation
- Customers
- Other



Categories of Project Risk

1. Political
2. Scope
3. Schedule
4. Financial
5. Resources
6. Quality
7. Communications
8. Human Resources
9. Contractual
10. Technical
11. Environmental
12. Suppliers
13. Industrial Relations
14. Organisational
15. OH&S
16. Cultural

Risk Management Process

- Establish the context
- Identify risks: categories and factors
- Analyse risks: likelihood and impact/consequences
- Assess and prioritise
- Risk Treatment
- Responsibility
- Monitor and review

Risk Treatment Process

- Is risk acceptable: YES or NO … if not …
- Identify treatment options
- Evaluate treatment options
- Prepare treatment plan to reduce, transfer or avoid
- Schedule and implement response
- Is residual risk acceptable: YES or NO ...

Step 1. Identify the risk

Examine the situation to identify those risks which are evident in the project …….

Step 2. Analyse the risk

- *Determine the impact it will have on your ability to achieve your objective*

How do we do that?

Step 3. Prioritise the risk

In terms of:

- ***Likelihood – of the risk eventuating***

  (high, medium, low/unlikely, possible, likely)

- ***Impact – on safety, costs, other elements of your plan, the project as a whole etc.,*** *(critical, high, medium, low/ major, moderate, minor).*

What are the risk management options?

- ***Reduce – minimise its impact***
- ***Accept the risk- risk relatively low***
- ***Avoid the risk – risk too great***
- ***Transfer the risk – to others better able to manage***

Step 4. Plan for its management

- Decide what you want to do with the problem.
- Decide who is in the best position to handle it

What are
my options?

Step 5. Monitor and review

Follow up to ensure:

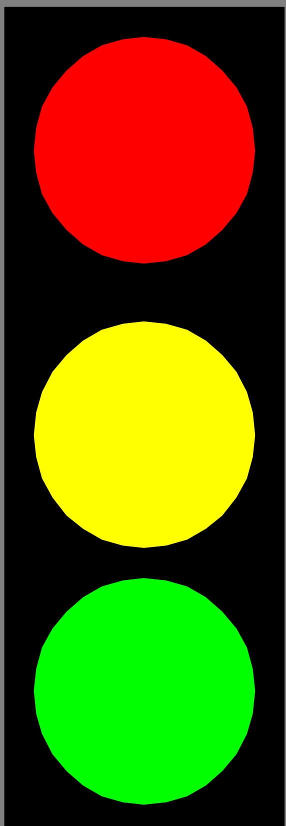
- **Your plan is being properly implemented**
- **Your plan is not causing further problems**
- **New risks are not emerging**
- **Old risks are being removed from your plan**

Step 6. Delegate responsibility

- Delegate responsibility for managing the risk to Person/people in best position to implement your plan
- Person/people with authority to implement your plan
- Person/people with responsibility for implementing your plan
- Person/people with most to lose if your plan is not implemented

LIKELIHOOD		CONSEQUENCES		
		MINOR	MODERATE	MAJOR
	LIKELY	AMBER	RED	RED
	POSSIBLE	GREEN	AMBER	RED
	UNLIKELY	GREEN	GREEN	AMBER

For more detailed explanation refer to
Risk Management AS/NZS 4360:2004
Risk Management Guidelines HB 436-2004



CONDITION	RISK LEVEL	RESPONSE
	HIGH RISK **Project in jeopardy** **Business objectives distorted**	**IMMEDIATE ACTION**
	SIGNIFICANT RISK **Time, Cost, Quality issues**	**HEIGHTENED ACTION**
	LOW RISK **Team Management**	**BUSINESS AS USUAL**

For more detailed explanation refer to
Risk Management AS/NZS 4360:2004
Risk Management Guidelines HB 436-2004

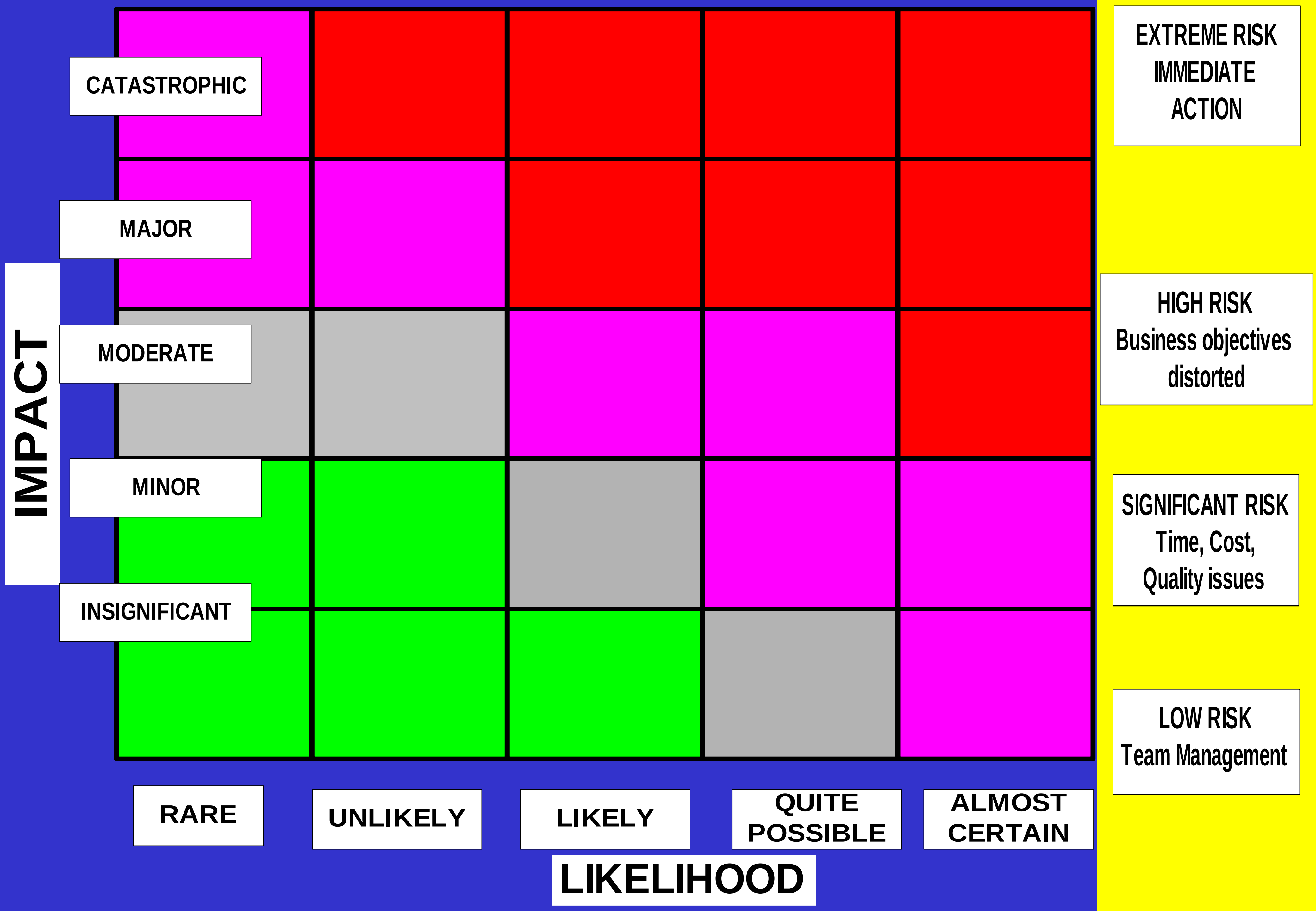
Project Risk Matrix

LIKELIHOOD		CONSEQUENCE				
		Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	5	H	H	E	E	E
Likely	4	M	H	H	E	E
Possible	3	L	M	H	E	E
Unlikely	2	L	L	M	H	E
Rare	1	L	L	M	H	H

Tolerances:

- Preferred
- Acceptable
- Undesirable
- Unacceptable

LOW Risk	MODERATE Risk	HIGH Risk	EXTREME Risk


IMPACT
CATASTROPHIC
MAJOR
MODERATE
MINOR
INSIGNIFICANT
RARE
UNLIKELY
LIKELY
QUITE POSSIBLE
ALMOST CERTAIN
LIKELIHOOD
EXTREME RISK IMMEDIATE ACTION
HIGH RISK Business objectives distorted
SIGNIFICANT RISK Time, Cost, Quality issues
LOW RISK Team Management

General Risk Mitigation Strategies for Cost, and Schedule Risks

Technical Risks	Cost Risks	Schedule Risks
Emphasize team support and avoid stand-alone project structure	Increase the frequency of project monitoring	Increase the frequency of project monitoring
Increase project manager authority	Use WBS and CPM	Use WBS and CPM
Improve problem handling and communication	Improve communication, project goals understanding, and team support	Select the most experienced project manager
Increase the frequency of project monitoring	Increase project manager authority	
Use WBS and CPM		

Risk Register

Section04

Risk Analysis

RISK MANAGEMENT TABLE

Project Title:	Date:
Poject No:	Compiled by:
Project Mgr:	Reviewed by:

Category of project ris	
1. Political	9. Contractual
2. Scope	10. Technical
3. Schedule	11. Environmental
4. Financial	12. Suppliers
5. Resources	13. Industrial relations
6. Quality	14. Organisational
7. Communications	15. OH & S
8. Human resources	16. Cultural

Likelihood rating	Impact rating	Risk rating
E. Almost certain	5. Severe	E-Extreme risk, immediate action required
D. Likely	4. Major	H-High risk, will jeoperdise project if not managed
C. Possible	3. Moderate	M-Moderate risk, will impact time, cost or quality if not mana
B. Unlikely	2. Minor	L-Low riusk, acceptable project management risk, monitor o
A. Rare	1. Insignificant	

Risk rating

Likelihood						
	E	H	H	E	E	E
	D	M	H	H	E	E
	C	L	M	H	E	E
	B	L	L	M	H	E
	A	L	L	M	H	H
		1	2	3	4	5
		Impact				

Ref No. (WBS)	Risk Event There is risk that....	Category of Risk	Likelihood Rating	Impact Rating	Risk Rating	Treatment Measures	Responsibility Party	Action Date

ACTIVITY

Review the
Risk Management Table

Prepare a
Risk Table for your project

Prepare a
Risk Grid for your project

Questions from Project Risk Management

Application to your Workplace

- Investigate your organisation's policy in terms of project risk and its assessment
- Conduct a risk assessment meeting for your current project … expand on the exercise you have just undertaken … how many factors can you really find???
- Compare your risk assessment and treatment with another (like) project in your organisation

PARTNERING

Mission of Partnering

Partnering in the construction industry is designed to replace the traditionally adversarial relationships among owners, generals, subs, architects, and engineers with more cooperative and collaborative ones. An explicit desired outcome of partnering is to avoid the possibility of litigation resulting from disputes which arise either during the design or construction phase of a project.

FINAL PRODUCT OF PARTNERING

- a high-quality product for the owner, delivered on-time and within-budget
- the protection of design integrity of the project, with all specifications met or exceeded; and
- the realization of a fair profit to the designers and contractors for their services.

Objectives of a Partnering Retreat

- 1. Get to know the fellow team members.
- 2. Identify and discuss issues of concern on the job.
- 3. Develop solutions to head off potential problems.
- 4. Develop a process to manage those problems which cannot be avoided.
- 5. Develop a Partnering Charter to guide interactions on the project.

What is "Partnering"?

It is a team building process designed to promote and ensure a win/win outcome for all the "stakeholders" (the owner, architects, engineers, contractors, subs, and suppliers) of a construction project. At the heart of partnering is a signed "charter" which guides team member behavior and attitudes throughout the life of the project.

What is a "Partnering Charter"?

It is a psychological contract or a "handshake" among men and women of honor, which defines how they agree to work with each other, and the major objectives they are attempting to accomplish.

What does a typical Charter look like?

A typical Charter starts with a mission statement for the project. The mission statement contains references to any unique aspects of the job, plus the commitment of the team members to build to the job safely, on-time, within budget, and in a quality manner which meets the owner's requirements.

The mission is followed by a set of team goals, such as, but not limited to, the following:

- ***Develop an optimized design which meets all of the owner's needs.***
- ***Develop and utilize a problem resolution process which resolves problems quickly, at the lowest possible level, and avoids all litigations.***
- ***Maintain open and honest communications with each other.***
- ***Work together cooperatively, collaboratively, and in a non-adversarial spirit.***
- ***Commit to "building it right the first time", and to do everything possible to promote pride-in-workmanship on the job.***
- ***Commit to meet regularly (at least quarterly) to review the team's success at living up to the Charter.***

Lessons Learned From Partnering

- 1. Focus on fixing the problem, and not the blame.
- 2. Set absolutely honest suspense dates.
- 3. Avoid the use of "ASAP" - and instead specify a real date/time for the task to be completed.
- 4. Summarize the agreements made before adjourning any meeting.
- 5. Get explicit closure on problem resolutions - who will do what, and when will they do it?
- 6. Work to resolve issues at the field or lowest practical level.
- 7. Use the chain-of-communications to escalate problems which resist resolution.
- 8. Never pass a suspense date without mutual agreement to change the suspense date or to escalate. Always estimate time to resolve and allow for that in setting suspense dates.

Lessons Learned From Partnering

- 9. In general, establish open, honest, timely communications.
- 10. Never let a problem fester in the hopes it will go away.
- 11. Escalate in tandem up the respective chains of command, and never unilaterally.
- 12. Notify the next level in the chain if ever a suspense date must be slipped.
- 13. Avoid any surprise bad news. (Avoid putting issues in a letter which haven't already been verbally discussed with the other party.)
- 14. Encourage keeping good documentation.
- 15. Tell each other directly if you see a problem.
- 16. Avoid hidden agendas.
- 17. When subconsultants/subcontractors need to be involved, use joint meetings to be sure that the engineer/general is kept in the control loop.

PROJECT DELIVERY SYSTEM

PROJECT CONTRACT SYSTEM VERSUS PROJECT DELIVERY SYSTEM

PROJECT CONTRACT SYSTEM DETERMINE THE TYPE OF CONTRACT BEING ADOPTED FOR THE PROJECT. THE CONTRACT SYSTEM USED INFLUENCED THE PROJECT DELIVERY SYSTEM OF THE PROJECT.

PROJECT DELIVERY SYSTEM DETERMINE HOW THE MAJOR PROJECT STAKEHOLDERS BEING ORGANISE TO ENSURE SMOOTH DELIVERY OF PROJECT. IT DESCRIBES ROLES AND RESPONSIBILITIES OF EACH PARTY WITH THE PROJECT'S CONTRACTUAL FRAMEWORK.

PROJECT CONTRACT SYSTEM

A typical construction contract consist of:

- Contract Form (General Condition of Contract)
- Technical specification
- Drawings
- Bill of quantities

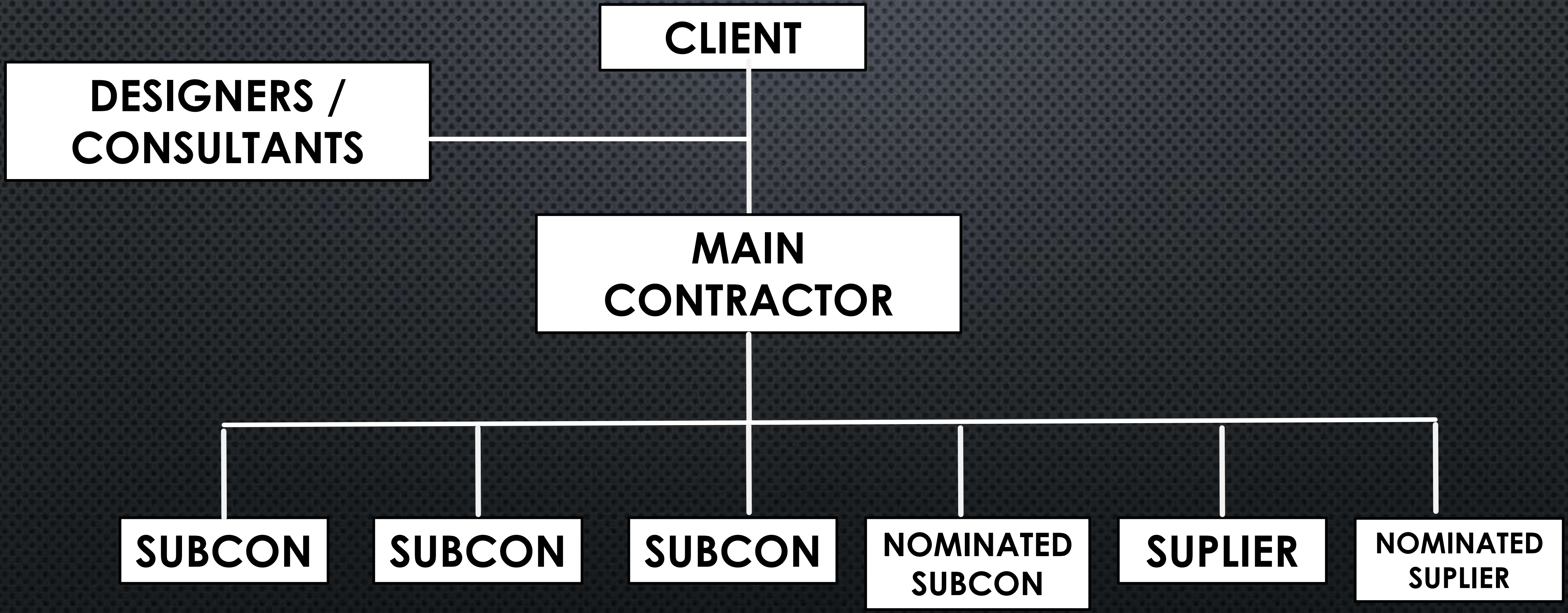
Different type of contract:

- Traditional (Design, Bid & Build)
- Design and Build
- Design & Build Turnkey
- Project Management Contract (PMC)
- BOT / DBFO/ PFI
- Cost Plus

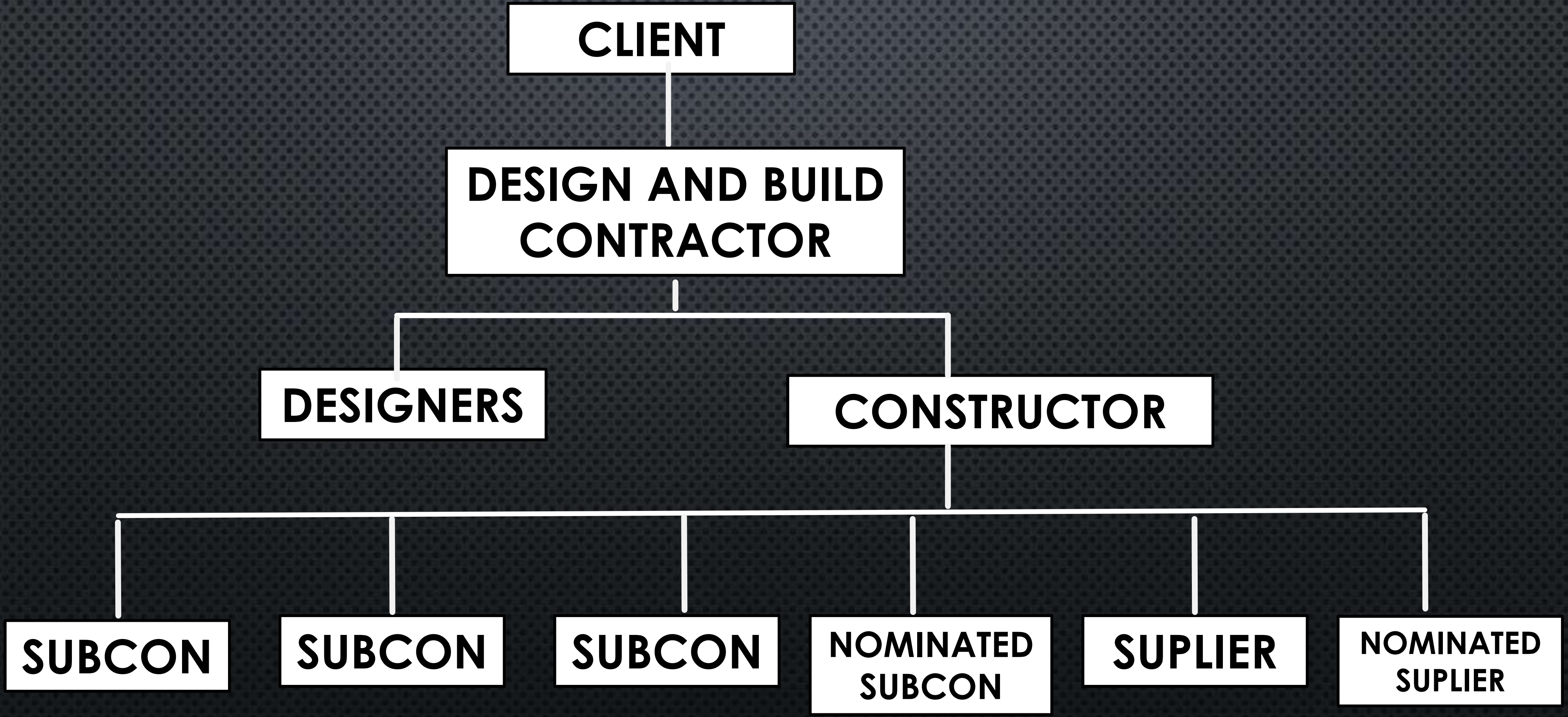
Contract form format:

- Lump Sum
- Unit Price

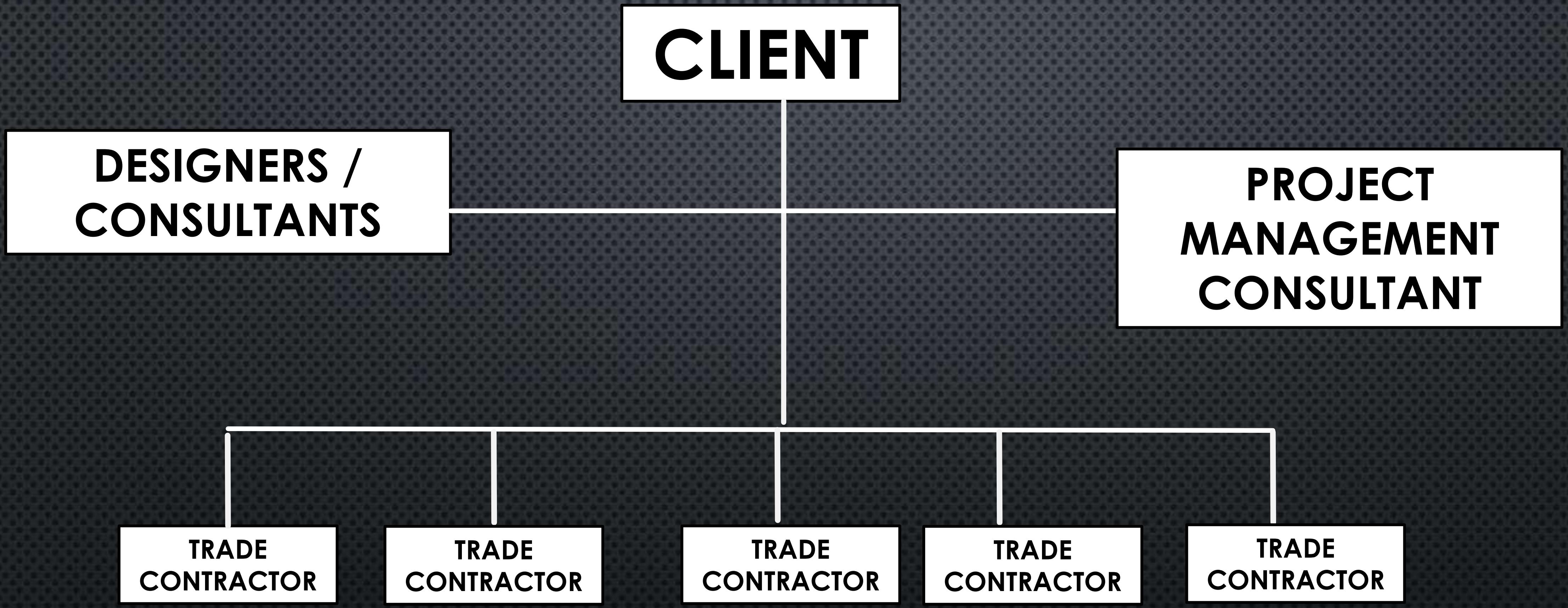
PROJECT DELIVERY SYSTEM : TRADITIONAL



PROJECT DELIVERY SYSTEM : DESGN AND BUILD



PROJECT DELIVERY SYSTEM : PMC



FAST TRACK SYSTEM

PROJECT DELIVERY FORMAT THAT CAN FOCUS OF FAST DELIVERY PROJECT BASED FRAGMENTED DESIGN AND CONSTRUCTION PHASES. CAN BE IMPLEMENTED USING TRADITIONAL, DESIGN AND BUILD OF PMC SYSTEM. THE OBJECTIVE OF THE FAST TRACK SYSTEM IS TO SHORTERN THE OVERALL PROJECT COMPLETION TIME.

COST PLUS CONTRACT SYSTEM

All contract system estimated the project contractual value before the works commence.

This can be achieved if the scope and quantum of work can be accurately estimated based on the information available. However some project do not have clear information about the exact quantity of works required. Therefore the contractor cannot commit to the work because it involved a lot of risk of cost escalation as well as time. Therefore the appropriate contract method to ensure fairness and justice especially to contractors is by paying them based on the value of work done plus the profit margin allocation as agreed by client and contractor.

VARIOUS CLAUSES USED IN COST PLUS CONTRACT

- Cost plus percentage of fee
- Cost plus fix fee
- Cost plus sliding scale of fee
- Cost plus guarantee ceiling price

B.O.T CONTRACT

A typical contract requires contractor to finance the project and the client will reimbursed using interim progress payment system or Lump Sum upon completion of partial or whole work as agreed by both parties.

However BOT contract require the client to allocate the site or help the contractor (normally a consortium of contractors) to acquire the site only. The contractor will do the design and finance cost of construction. They will not be directly reimbursed. However the agreement will allocate a certain agreed “concession period” of time for the contractor to generate income from the project to recover their cost and profit before they officially hand over the project to the client.

REVIEWING THE POTENTIAL OF APPLYING LEAN PRODUCTION PRINCIPLES TO MALAYSIAN CONSTRUCTION INDUSTRY

WHAT IS LEAN PRODUCTION?

"a process eliminating unnecessary steps, aligning all steps in an activity and continually striving for improvement"

Womack and Jones (1994)

Conceptual framework

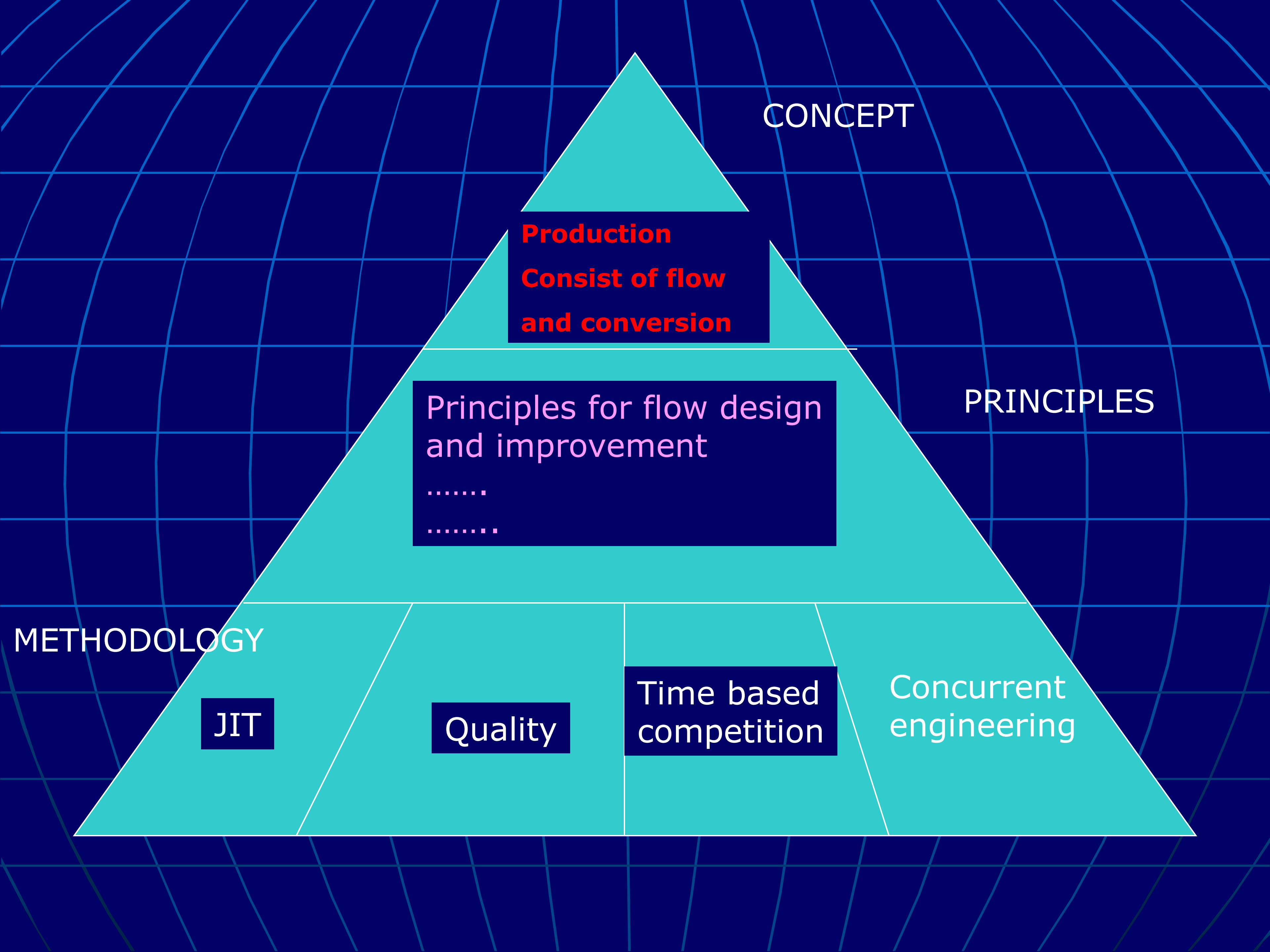
Production system → conversion (add value)

→ flow (non value adding: waiting, Moving, inspection

Traditionally: All activity are considered as conversion activity or Value added activities

Lean Objectives

- Reduce overall cost
- Reducing manufacturing cycle
- Reducing waste in all aspect of production eg: Time, Process, Information, etc.
- Doing just the right thing and produce just the right thing.
- Designing and operating the right process
- Doing right thing the first time
- Focus on value


CONCEPT
Production
Consist of flow
and conversion
PRINCIPLES
Principles for flow design and improvement
…….
……..
METHODOLOGY
JIT
Quality
Time based competition
Concurrent engineering

WASTE IN WORK PROCESS

- MISTAKES
- WORKING OUT OF SEQUENCE
- REDUNDANT ACTIVITY
- REDUNDANT MOVEMENT
- DELAY OR PREMATURE INPUT
- PRODUCT OR SERVICES THAT DOES NOT MEET CUSTOMER NEEDS

BASIC LEAN PRINCIPLES

- Identify product value
- Optimise the value steam
- Make the product flow
- Use pull logistics
- Pursue perfections

Lean principles (Koskela, 1992)

- Reduce share of non value adding activities
- Increase output through systematic consideration of customer requirements
- Reduce variability
- Reduce cycles times
- Simplify by minimizing the number of steps, part and linkages

Lean principles (Koskela, 1992) cont.

- Increase output flexibility
- Increase process transparency
- Focus control on complete process
- Built continuous improvement into process
- Balance flow improvement with conversation improvement
- Benchmark

Lean Construction

(The term adopted from Lean Production emerged in mid 1990)

Principles (as outline by Construction Best Practice, UK):

- *Eliminate waste*
- *Specify value from ultimate customer*
- *Clearly identify the process that delivers what the customers values and eliminate all non value adding*
- *Let the customer pull – don’t make anything until it is needed, then make it quickly*
- *Pursue perfection by continuous improvement*

Reengineering paradigm

Fundamental rethinking and radical redesign of business processes to achieve dramatic improvement in critical contemporary measure of performance such as cost, quality, service and speed.

- Fundamental
- Radical
- Dramatic
- Process

Competition intensified
Change becomes constant
customer

THE CONVENTIONAL AND NEW PRODUCTION PHILOSPHY

	CONVENTIONAL	LEAN
CONCEPTUALIZATION OF PRODUCTION	Production consist of conversion	Production consist of conversion and flows: there vale added and non value added activities
FOCUS OF IMPROVEMENT	Cost of activities	Cost, time and value of flows
Focus of improvement	Increase of efficiency by implementing new tech	Elimination or supression of non value added activities, increase of efficiency of value adding activities thru cont. improvement and new tech.

The study

- Rationale

Typical need to review current practice in construction and promoting ways to improve the industry performance

TYPICAL PROBLEMS FACED BY THE INDUSTRY

- HIGH DEGREE OF FRAGMENTATATION
- POOR COMMUNICATION PROCESS
- ADVERSARIAL NATURE
- LACK OF FOCUS TOWARD CUSTOMER/END USER REQUIREMENT
- DELAY
- QUALITY PROBLEMS
- ETC

Methodology

- Face to face interview
- Questionnaire survey

Result: Main causes of waste

- **Poor planning and supervision**
- **Poor design**
- **Ineffective work**
- **Unnecessary labour and material handling**
- **Material and machinery spending**
- **Lack of coordination in work process**

Result: Common type of waste

- Rework
- Error
- Activity delays
- Extra processing (bureaucratic)
- Unnecessary work

Result: Achieving Lean

- Teamwork
- Redesign of planning system to assure reliable material and information flow
- Benchmarking
- Integration of design and construction process
- Used of tools like JIT, etc.
- Transparency in working system
- Enhance information sharing
- Standardization and pre-assembly

Result: Inhibitors

- Difficult to change to new ways of working
- Lack of knowledge and skill
- Lack of support from top management
- Investment issue
- The believe that construction is too complex
- Wait and see attitude
- Cannot quantify tangible benefit out of it
- Lack of confidence to the effectiveness of the new system

Project Communications Management

Importance of Good Communications

- The greatest threat to many projects is a failure to communicate
- Our culture does not portray construction professionals as being good communicators
- Research shows that construction professionals must be able to communicate effectively to serve their customers' need
- Transparent, timely and accurate information are critical for all stakeholders in construction

Project Communications Management Processes

- Communications planning: determining the information and communications needs of the stakeholders
- Information distribution: making needed information available in a timely manner
- Performance reporting: collecting and disseminating performance information
- Administrative closure: generating, gathering, and disseminating information to formalize phase or project completion

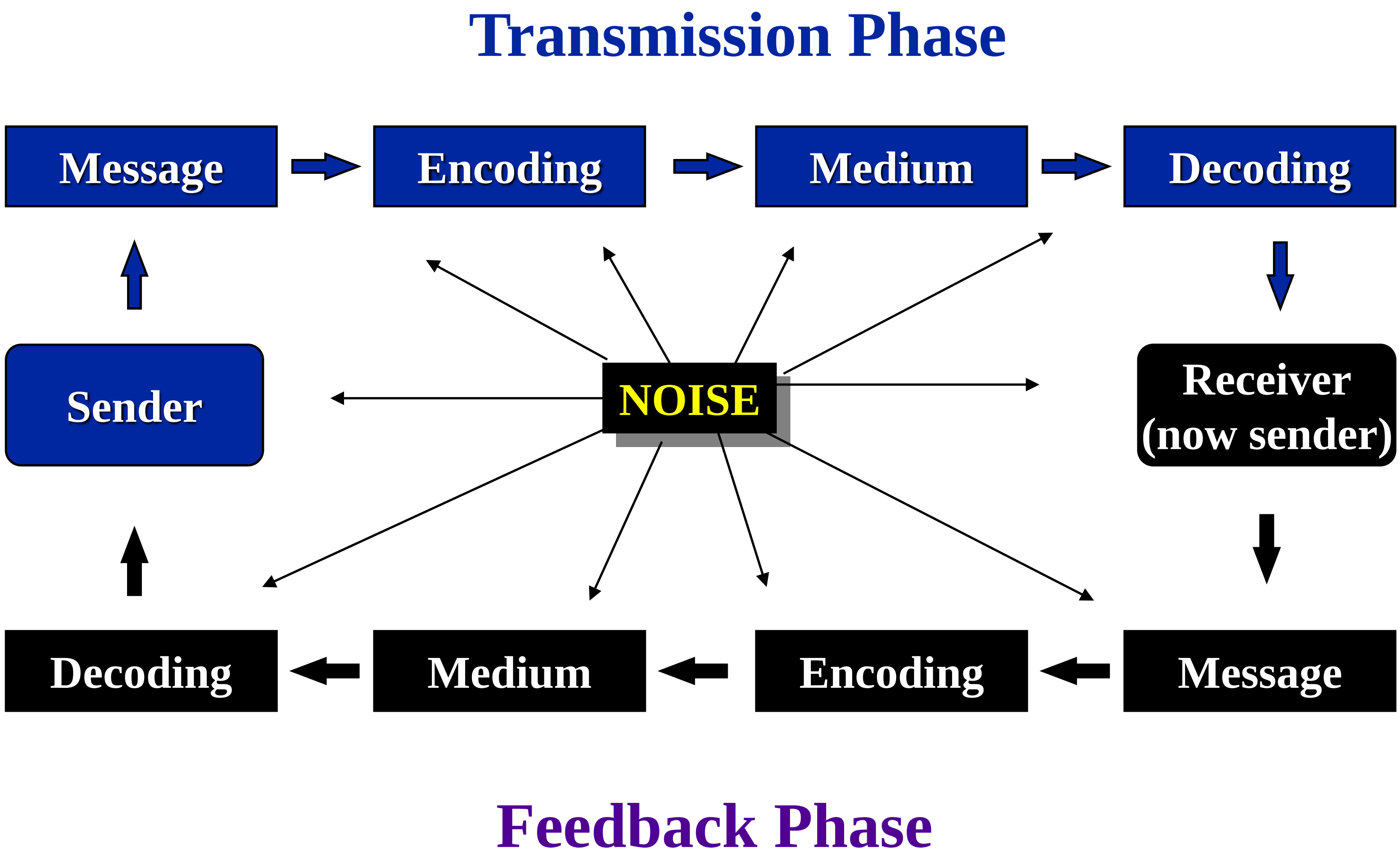
The Communication Process

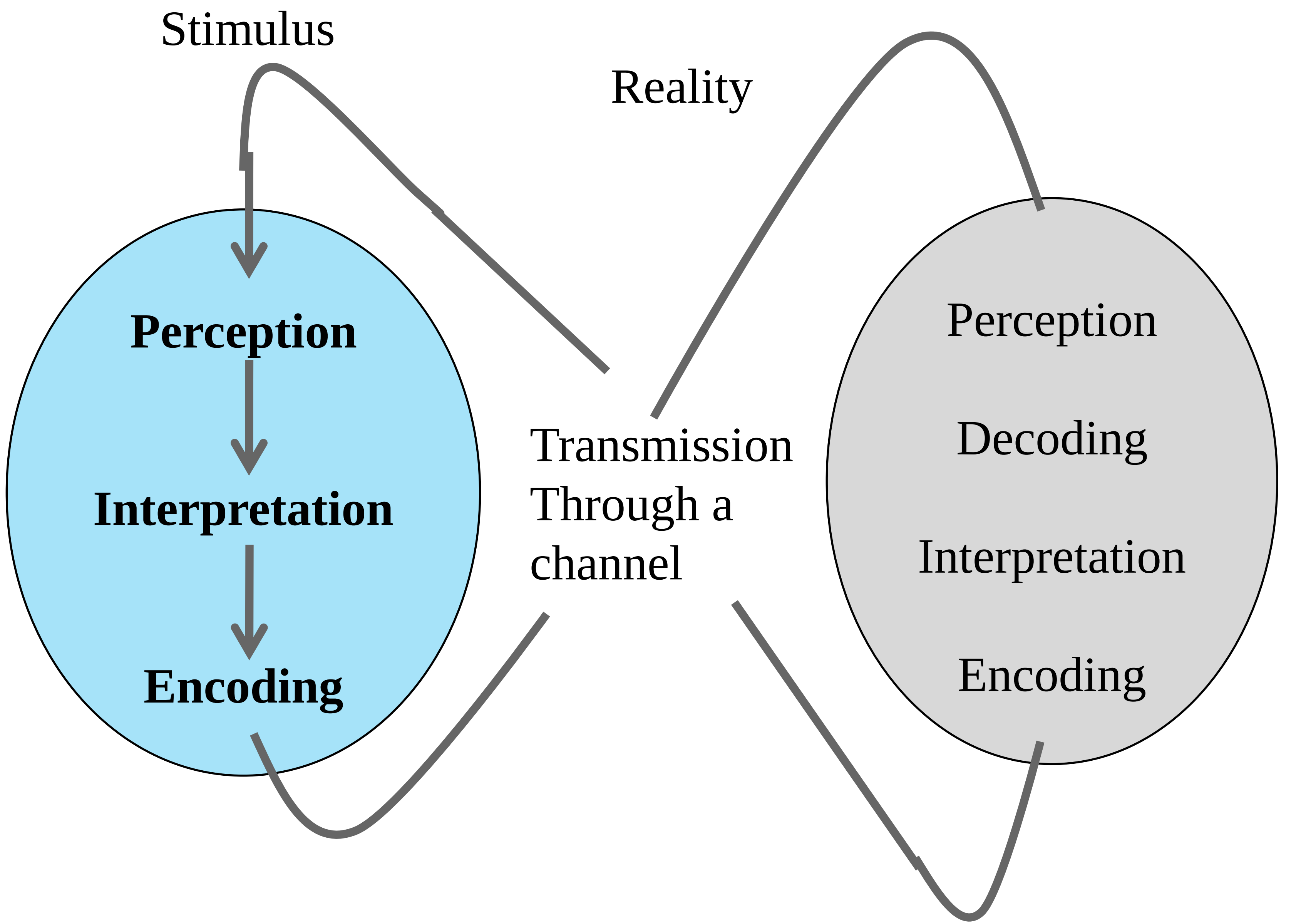
– Communication consists of two phases:
  1. **Transmission phase:** information is shared by 2 or more people.
  2. **Feedback phase:** a common understanding is assured.
– Starts with the Sender who wants to share information.
  - Sender must decide on a message to share
  - Sender also puts the message into symbols or language, a process called encoding.

Noise: anything harming the communication process.

The Communication Process

Figure 15.1




Stimulus
Reality
Perception
Interpretation
Encoding
Transmission Through a channel
Perception
Decoding
Interpretation
Encoding

The Communication Process

- Messages are transmitted over a medium to a receiver.
  - **Medium:** pathway the message is transmitted on (phone, letter).
  - **Receiver:** person getting the message.
- Receiver next decodes the message.
  - **Decoding** allows the receiver to understand the message.
  - This is a critical point, can lead to mis-understanding.
- Feedback is started by receiver and states that the message is understood or that it must be re-sent.

Communication Issues

- **Encoding** of messages can be done verbally or non-verbally
  - **Verbal:** spoken or written communication.
  - **Nonverbal:** facial gestures, body language, dress.
- Sender and receiver communicate based on their **perception**.
  - Subjective perception can lead to biases and stereotypes that hurt communication.
  - Effective Managers avoid communicating based on a pre-set belief.

Dangers of Ineffective Communication

- Managers spend most of their time communicating so both they and the subordinates must be effective communicators. To be effective:
- Select an **appropriate medium** for each message.
  - There is no one "best" medium.
  - Consider **information richness**: the amount of information a medium can carry.
    - Medium with high richness can carry much information to aid understanding.
  - Is there a need for a **paper/electronic trail** to provide documentation?

Communications Planning

- Every project should include some type of communications management plan, a document that guides project communications
- Creating a stakeholder analysis for project communications also aids in communications planning

Communications Management Plan Contents

- A description of a collection and filing structure for gathering and storing various types of information
- A distribution structure describing what information goes to whom, when, and how
- A format for communicating key project information
- A project schedule for producing the information
- Access methods for obtaining the information
- A method for updating the communications management plans as the project progresses and develops
- A stakeholder communications analysis

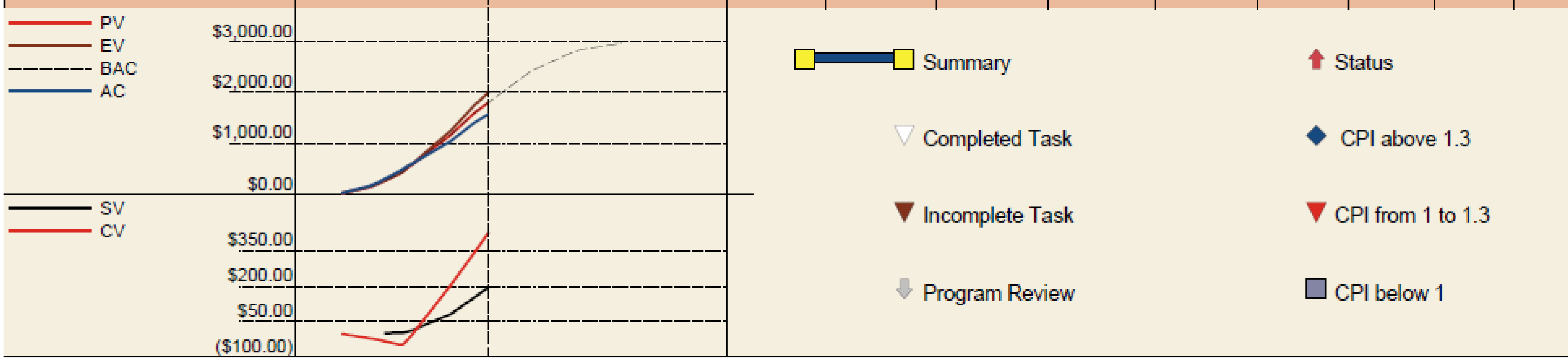
Sample of Dashboard Report

Sample of Dashboard Report

Earned Value and Performance Review

Schedule Variance = EV - PV   Cost Variance = EV - AC
Cost Performance Index = EV / AC   Schedule Performance Index = EV / PV

Project/ Tasks	2005 March April May	Total Budget	Planned Value	Actual Costs	Earned Value	PRCNT CMPLT	SV	CV	CPI	SPI
Project ABC	3/10 5/8	$2,975.00	$1,808.97	$1,575.00	$2,004.73	67.39%	$195.77	$429.74	1.27	1.11
Task 1		$300.00	$300.00	$350.00	$300.00	100.00%	$0.00	($50.00)	0.86	1.00
Task 2		$400.00	$400.00	$400.00	$400.00	100.00%	$0.00	$0.00	1.00	1.00
Task 3		$250.00	$133.72	$175.00	$139.53	55.81%	$5.81	($35.47)	0.80	1.04
Task 4		$725.00	$483.33	$200.00	$563.89	77.78%	$80.56	$363.89	2.82	1.17
Task 5		$400.00	$200.00	$100.00	$210.53	52.63%	$10.53	$110.53	2.11	1.05
Task 6		$350.00	$169.70	$200.00	$222.73	63.64%	$53.03	$22.73	1.11	1.31
Task 7		$550.00	$122.22	$150.00	$168.06	30.56%	$45.84	$18.06	1.12	1.38



Information Distribution

- Getting the right information to the right people at the right time and in a useful format is just as important as developing the information in the first place
- Important considerations include
  - using technology to enhance information distribution
  - formal and informal methods for distributing information

What Went Wrong?

A well publicized example of misuse of e-mail comes from the 1998 Justice Department's high profile, antitrust suit against Microsoft. E-mail emerged as a star witness in the case. Many executives sent messages that should never have been put in writing. The court used e-mail as evidence, even though the senders of the notes said the information was being interpreted out of context.

Harmon, Amy, "E-mail comes back to haunt companies," November 29, 1998

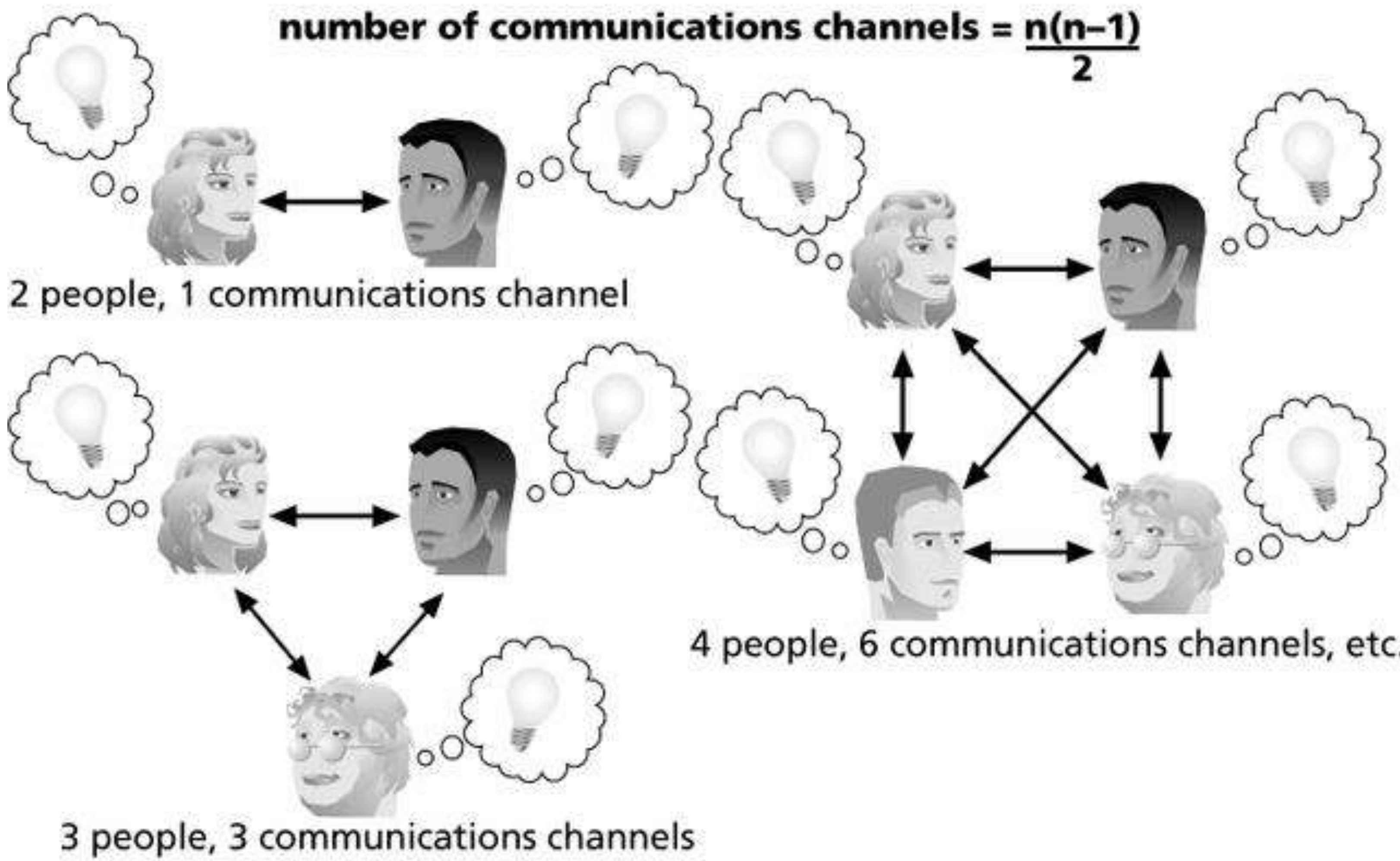
Table 9-2. Media Choice Table

KEY: 1 = EXCELLENT   2 = ADEQUATE   3 = INAPPROPRIATE

How well medium is suited to:	Hard Copy	Telephone Call	Voice Mail	E-mail	Meeting	Web Site
Assessing commitment	3	2	3	3	1	3
Building consensus	3	2	3	3	1	3
Mediating a conflict	3	2	3	3	1	3
Resolving a misunderstanding	3	1	3	3	2	3
Addressing negative behavior	3	2	3	2	1	3
Expressing support/appreciation	1	2	2	1	2	3
Encouraging creative thinking	2	3	3	1	3	3
Making an ironic statement	3	2	2	3	1	3
Conveying a reference document	1	3	3	3	3	1
Reinforcing one s authority	1	2	3	3	1	2
Providing a permanent record	1	3	3	1	3	1
Maintaining confidentiality	2	1	2	3	1	3
Conveying simple information	3	2	1	1	2	3
Asking an informational question	3	2	1	1	3	3
Making a simple request	3	3	1	1	3	3
Giving complex instructions	3	3	3	2	1	2
Addressing many people	2	3	3 or 1*	2	3	1

Galati, Tess. Email Composition and Communication (EmC2) Practical Communications, Inc. (www.praccom.com) (2001).
*Depends on system functionality

Figure 9-1. The Impact of the Number of People on Communications Channels



Performance Reporting

- Performance reporting keeps stakeholders informed about how resources are being used to achieve project objectives
  - Status reports describe where the project stands at a specific point in time
  - Progress reports describe what the project team has accomplished during a certain period of time
  - Project forecasting predicts future project status and progress based on past information and trends
  - Status review meetings often include performance reporting

Administrative Closure

- A project or phase of a project requires closure
- Administrative closure produces
  - project archives
  - formal acceptance
  - lessons learned

Suggestions for Improving Project Communications

- Manage conflicts effectively
- Develop better communication skills
- Run effective meetings
- Use templates for project communications

Conflict Handling Modes, in Preference Order

- Confrontation or problem-solving: directly face a conflict
- Compromise: use a give-and-take approach
- Smoothing: de-emphasize areas of differences and emphasize areas of agreement
- Forcing: the win-lose approach
- Withdrawal: retreat or withdraw from an actual or potential disagreement

Conflict Can Be Good

Conflict often produces important results, such as new ideas, better alternatives, and motivation to work harder and more collaboratively

- Groupthink can develop if there are no conflicting viewpoints
- Research by Karen Jehn suggests that task-related conflict often improves team performance, but emotional conflict often depresses team performance

Developing Better Communication Skills

- Companies and formal degree programs for IT professionals often neglect the importance of developing speaking, writing, and listening skills
- As organizations become more global, they realize they must invest in ways to improve communication with people from different countries and cultures
- It takes leadership to improve communication

Running Effective Meetings

- Determine if a meeting can be avoided
- Define the purpose and intended outcome of the meeting
- Determine who should attend the meeting
- Provide an agenda to participants before the meeting
- Prepare handouts, visual aids, and make logistical arrangements ahead of time
- Run the meeting professionally
- Build relationships

Using Templates for Project Communications

- Many technical people are afraid to ask for help
- Providing examples and templates for project communications saves time and money
- Organizations can develop their own templates, use some provided by outside organizations, or use samples from textbooks

Figure 9-2. Sample Template for a Project Description

Project X Descripton

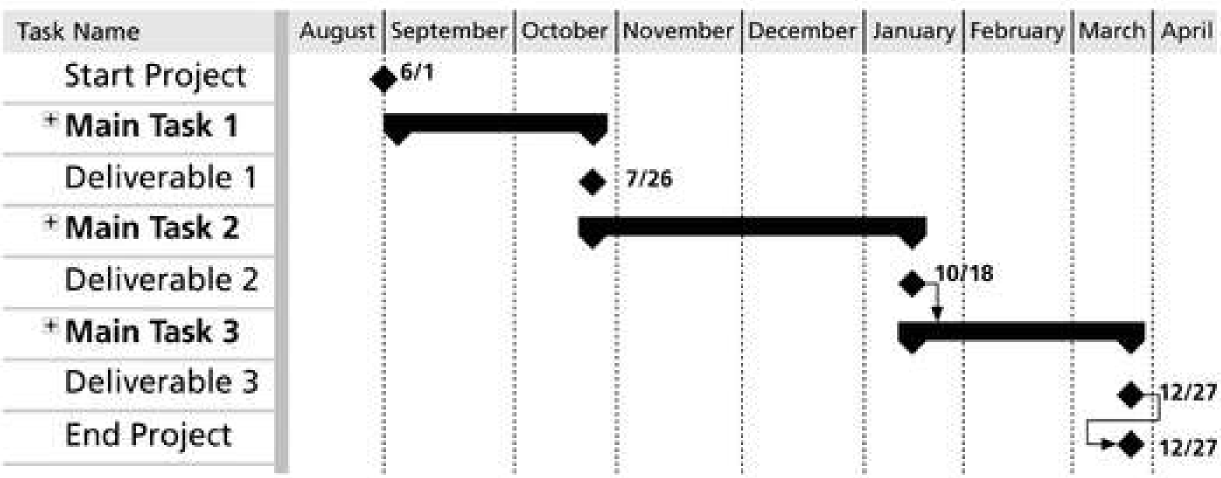
Objective: Describe the objective of the project in one or two sentences. Focus on the business benefits of doing the project.

Scope: Briefly describe the scope of the project. What business functions are involved, and what are the main products the project will produce?

Assumptions: Summarize the most critical assumptions for the project.

Cost: Provide the total estimated cost of the project. If desired, list the total cost each year.

Schedule: Provide summary information from the project s Gantt chart, as shown. Focus on summary tasks and milestones.



Project 98 file

Sample Construction Report

Progress Report

•Daily construction report

•Monthly Report

•Construction Site Diary

Miscellaneous Records:

•Manufacturers Certificates

•Laboratory Test certificates

•Concrete transit mix delivery tickets

•Records of Pile Driving

•Record of Structural Welding

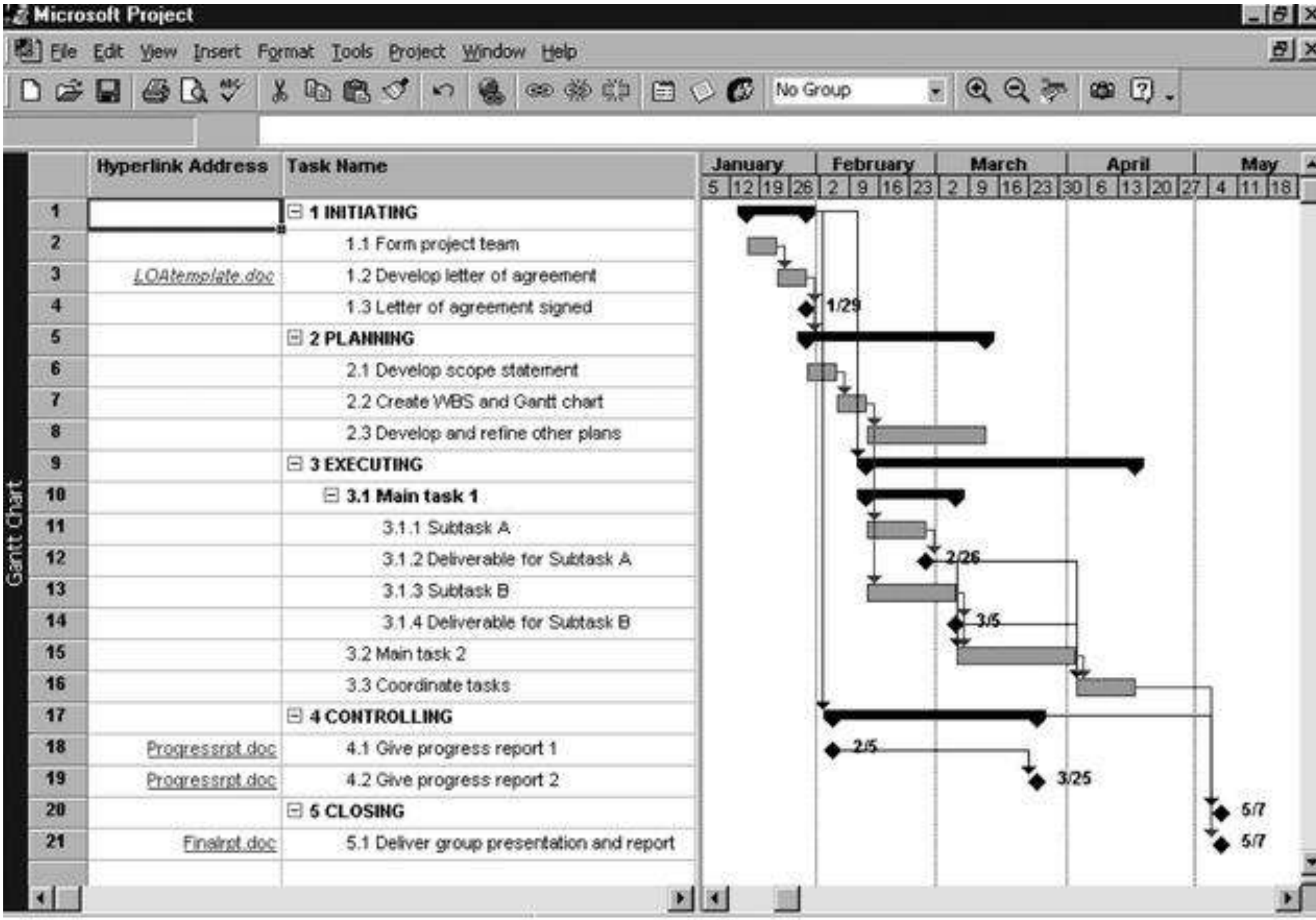
•Fabrication plants inspections

•Special inspector report

•Weld radiograph

•Accetance certificates by public agency

Figure 9-3. Gantt Chart Template for a Class Project



Developing a Communications Infrastructure

- A communications infrastructure is a set of tools, techniques, and principles that provide a foundation for the effective transfer of information
  - Tools include e-mail, project management software, groupware, fax machines, telephones, teleconferencing systems, document management systems, and word processors
  - Techniques include reporting guidelines and templates, meeting ground rules and procedures, decision-making processes, problem-solving approaches, and conflict resolution and negotiation techniques
  - Principles include using open dialog and an agreed upon work ethic

Using Software to Assist in Project Communications

- There are many software tools to aid in project communications
- The most useful one is Planning Softwareincludes several features to enhance communications:
- MS Project
- Primavera

Groupware

- Lotus Notes
- MS Sharepoint

What is Benchmarking

A continuous systematic process of evaluating the product, service and work processes of organisations that are recognised as representing as the best practices for the purpose of organisational improvement

Definition of benchmarking

'The practice of being humble enough to admit that someone is better at something and being wise enough to try to learn how to match and even surpass them at it' (American Productivity & Quality Centre) `Benchmarking is the process of continuously measuring and comparing an organisation against business leaders anywhere in the world to get information that help the organisation to take action to improve its performance'

Why best practice

- Best practice refers to techniques, methods or processes that are more effective at delivering a desired outcome.
- Incorporating best practice into your organization can lead to greater efficiency and effectiveness and a happier customer.

What is best practice?

The methods used in work processes that produce outputs which best meet customer requirements in a particular field.

Introduction to Benchmarking

What is a benchmark?
A reference value against which performance is compared Example:

- normal heartbeat is 6O-80 per minutes;
- normal working hours is eight hours per day;
- normal walking speed is 2-3 miles per hour;

and etc..
Benchmark is the conversion of best practices into measurement of best performance.

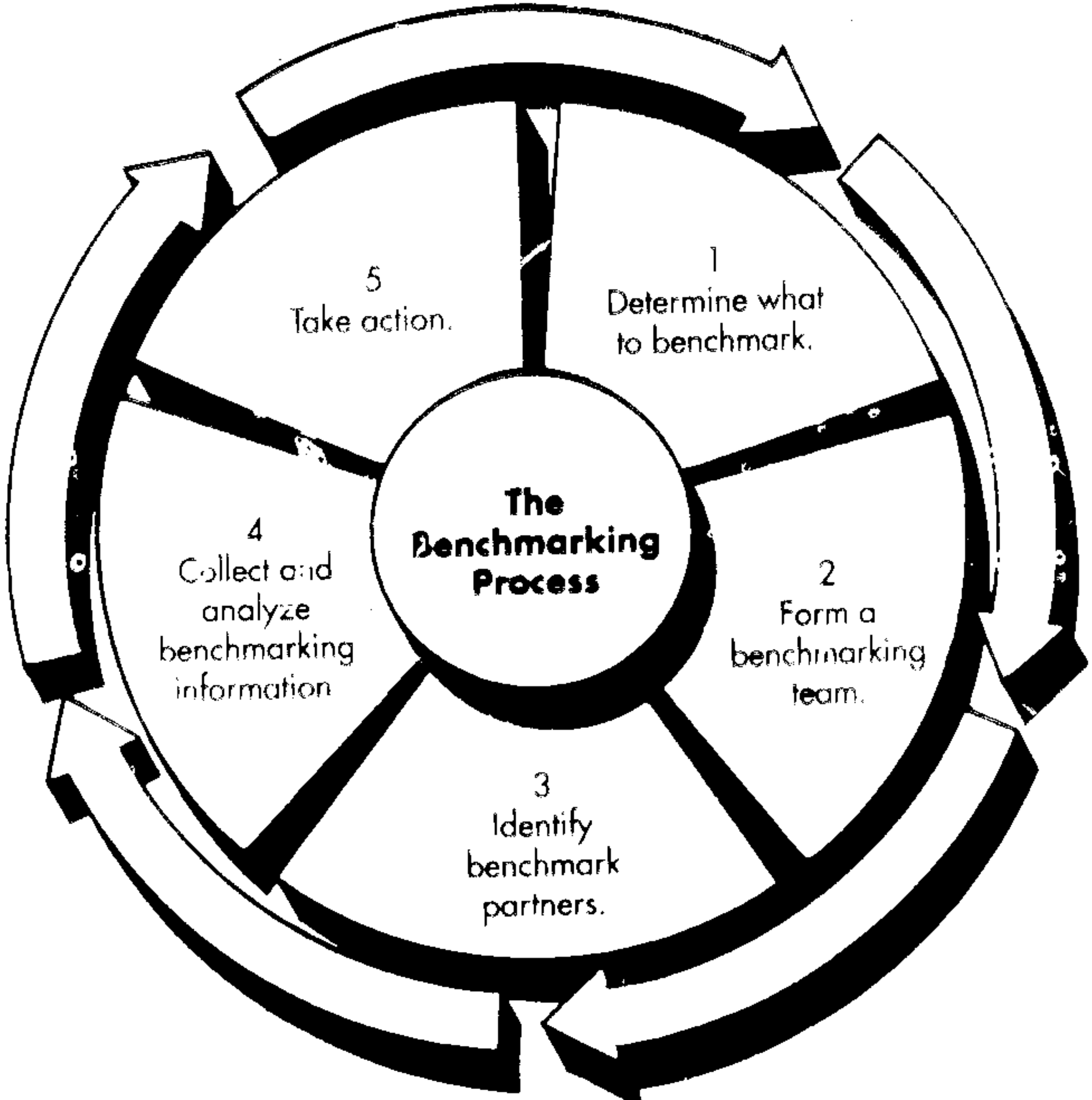
Benefits of Benchmarking

- Benchmarking helps identify the gaps between the organization that is undertaking the benchmarking assessment and best practice.
- Undertaking benchmarking can lead to improvements being incorporated into processes and systems delivering gains in efficiency and effectiveness
- Benchmarking can help align improvement activity with strategic goals and objectives

Exhibit 1-7. Benchmarking: what it is and what it isn't.

Benchmarking Is	Benchmarking Isn't
• A continuous process	• A one-time event
• A process of investigation that provides valuable information	• A process of investigation that provides simple answers
• A process of learning from others; a pragmatic search for ideas	• Copying, imitating
• A time-consuming, labor-intensive process requiring discipline	• Quick and easy
• A viable tool that provides useful information for improving virtually any business activity	• A buzzword, a fad

Exhibit 2-1. The five-stage benchmarking process.



WHO ARE THE BEST COMPETITORS?

Best competitor

A company with which you are directly competing which is considered an industry leader

Process

- Prepare a list of companies to be benchmarked
- Select the competitors

WHAT IS THE DATA COLLECTION METHOD?

Process

- Prepare a list or questions
- Answer the questions for own operation
- Search for data in existing, completed studies
- Review method of conducting research
- Select methods of conducting" research
- Determine who will conduct the research
- Review the legal requirements of gathering data

Stage 7: Determining What to Benchmark

What to benchmark; Xerox's ten questions.

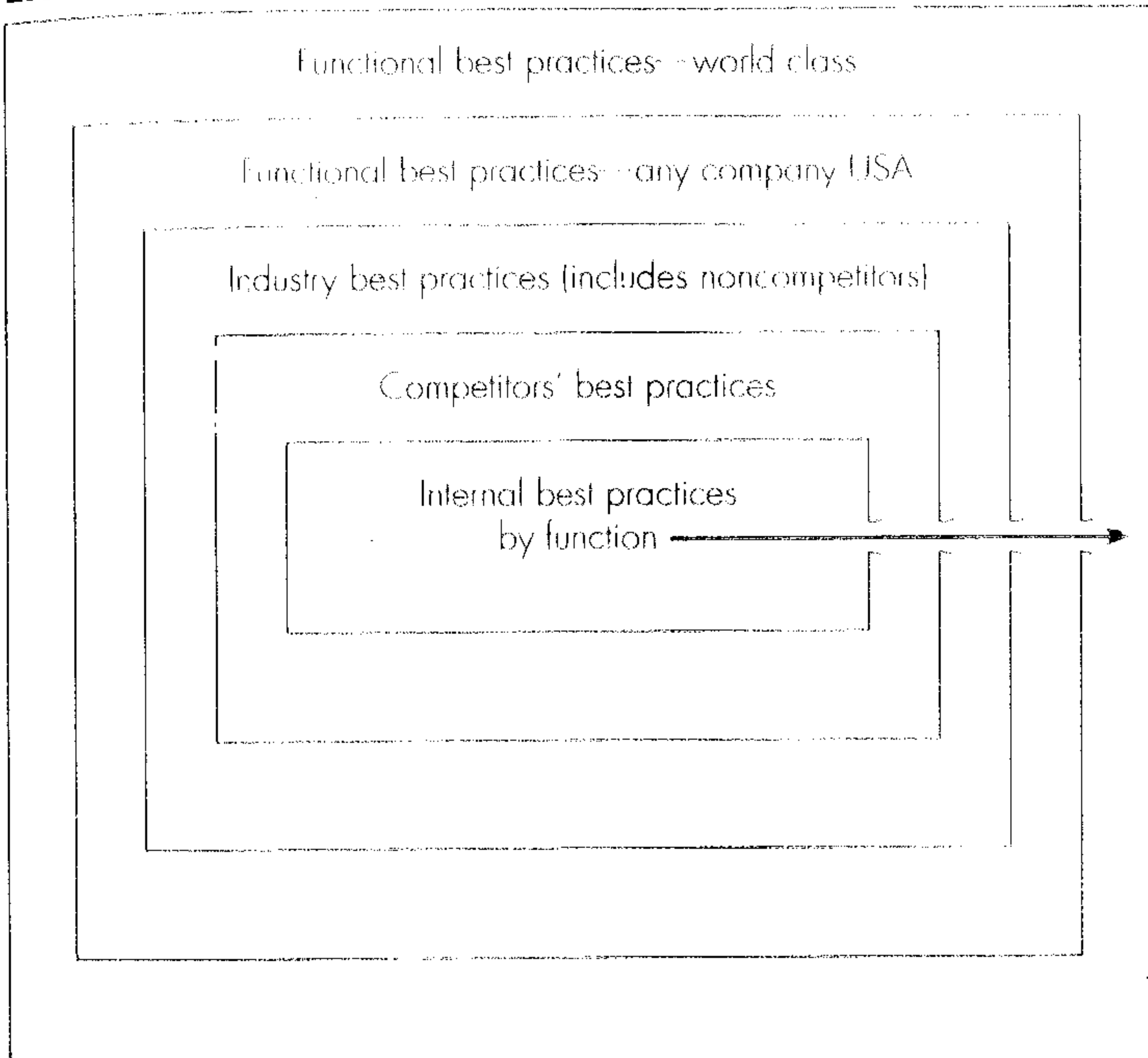
1. What is the most critical factor to my function's/organization's success (e,g,, customer satisfaction, expense to revenue ratio, return on asset performance)?
2. What factors ore causing the most trouble (e,go, not performing to expectations)?
3. What products or services care provided to customers?
4. What factors account for customer satisfaction?

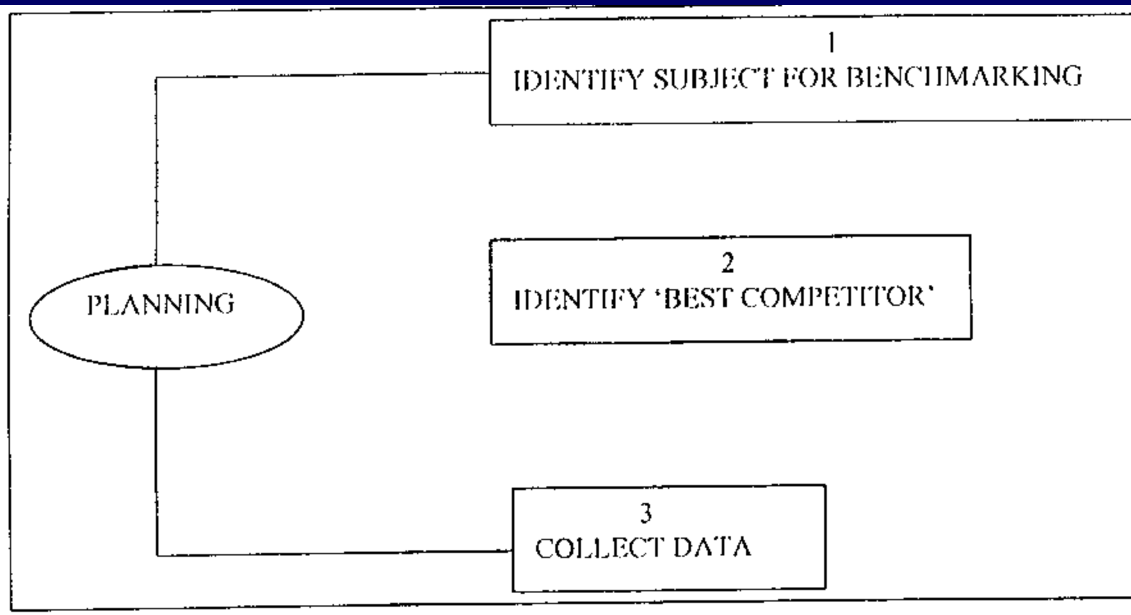
5. What specific problems (operational) have been identified in the organization?

- 6. Where are the competitive pressures being felt in the organization?
- 7. What are the major costs (or cost "drivers") in the organization?
- 8. Which functions represent the highest percentage of cost?
- 9. Which functions have the greatest room for improvement?
- 10. Which functions have the greatest effect (or potential) for differentiating the organization from competitors in the marketplace?
- ties.

- Later, benchmarking information can be useful w hen identifyig solutions or actions in the problem-solving cycle. I 'he benchmarking process can help expand the pool of ideas regarding what actions can be taken to address a specific problem. Other organizations that - manage or confront the same types of CSps may cooperate by providing you, with ideas on how to address your particular problem or opportunity.
- The integration of benchmarking with other types of total quality tools and techniques (such as problem solving) presents one of the greatest o.1portunities to link CSFs with meaningful business res0-s,
- "Apples to Apples"- Identifying Specific CSFs
- As you begin to identify the CSFs that will drive your benchmarking activity, it is important to be as specific as possible in your definitions and your metrics. This level of specificity is important at a11 stages of the

Exhibit 1-4. Thinking "out of the box."





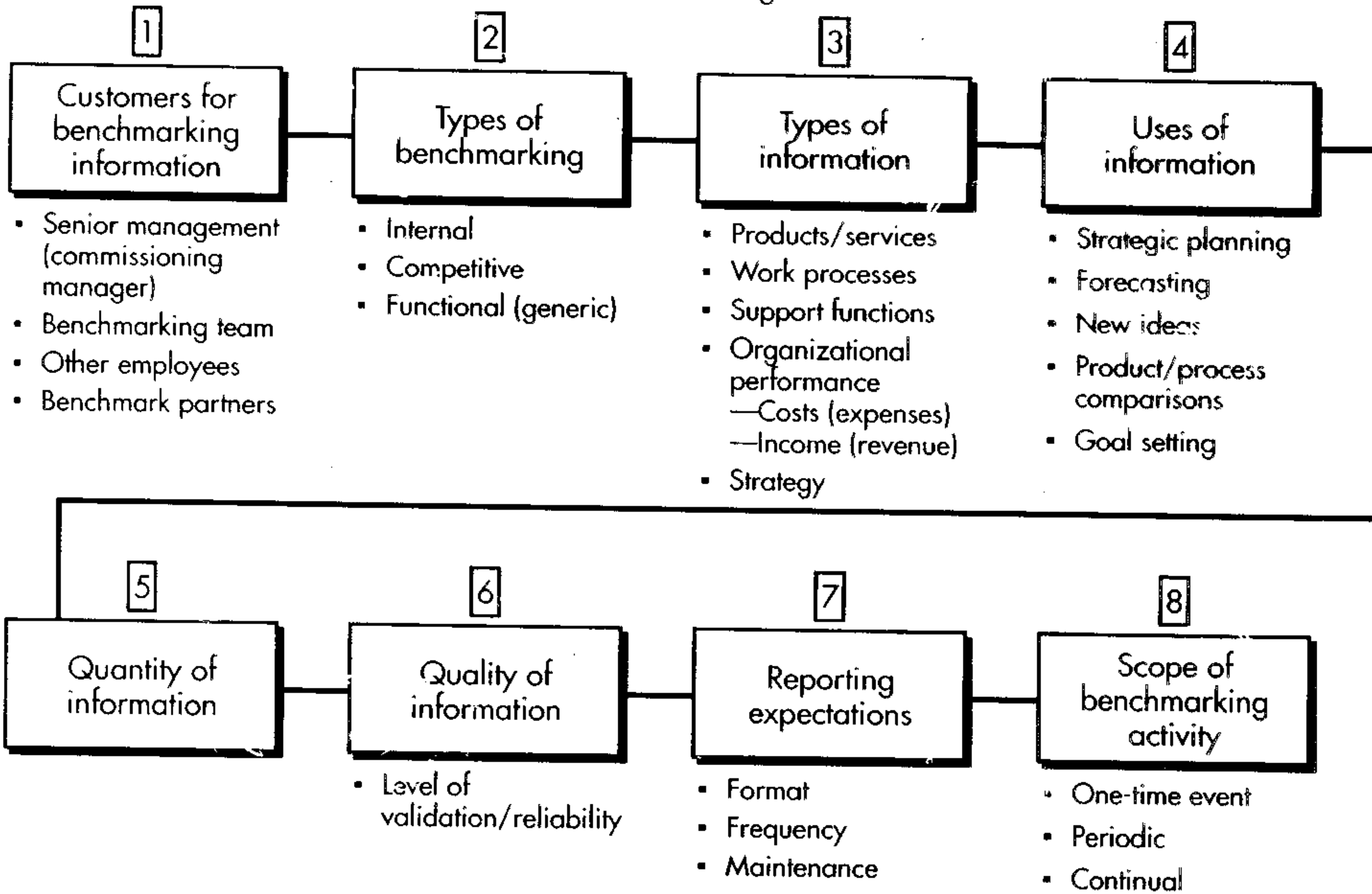
Subject

Product or services you produce, in which you can identify the critical factor that influence the success of your operation.

Process

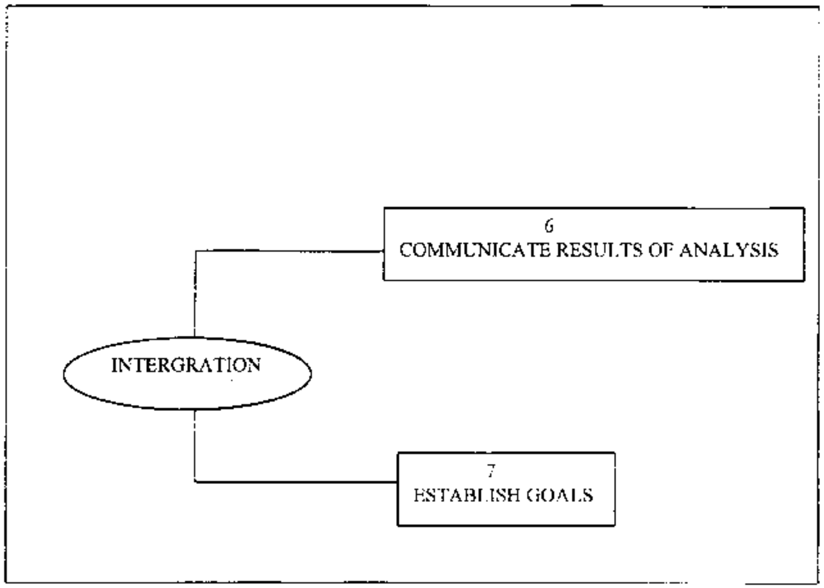
- Brainstorm the issue to be benchmarked
- Select the business process for benchmarking
- Determine measurements (indicators of performance)
- Summarise the purpose of the study

Exhibit 3-2. Customer requirements for benchmarking.



THE BENCHMARKING PROCESS

The object of this phase is to use the data gathered to define the goals necessary to gain or maintain superiority and to incorporate these goals into your formal planning process



HOW ARE THE RESULTS OF THE ANALYSIS COMMUNICATED?

Results Communicated

The goal of this step is to obtain acceptance of the analysis by directly impacted management

Process

- Determine the audience for the communication

- Determine the method of communication
- Organise your analysis
- Obtain acceptance

THE BENCHMARKING PROCESS

During this phase, the strategies and action plans established through the benchmarking process are implemented and periodically assessed with reports of your progress in achieving them.

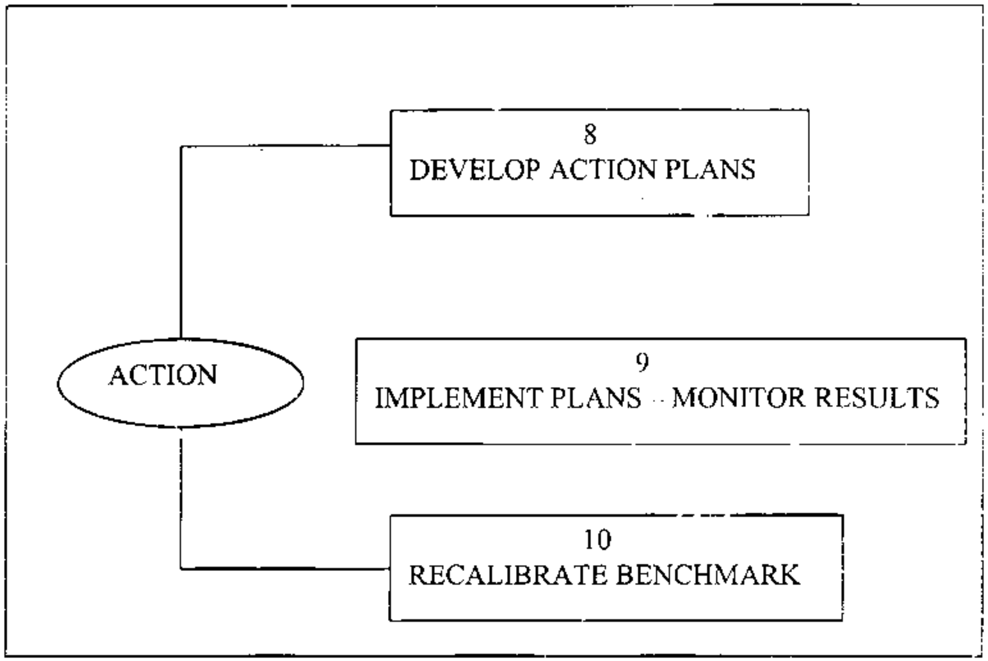
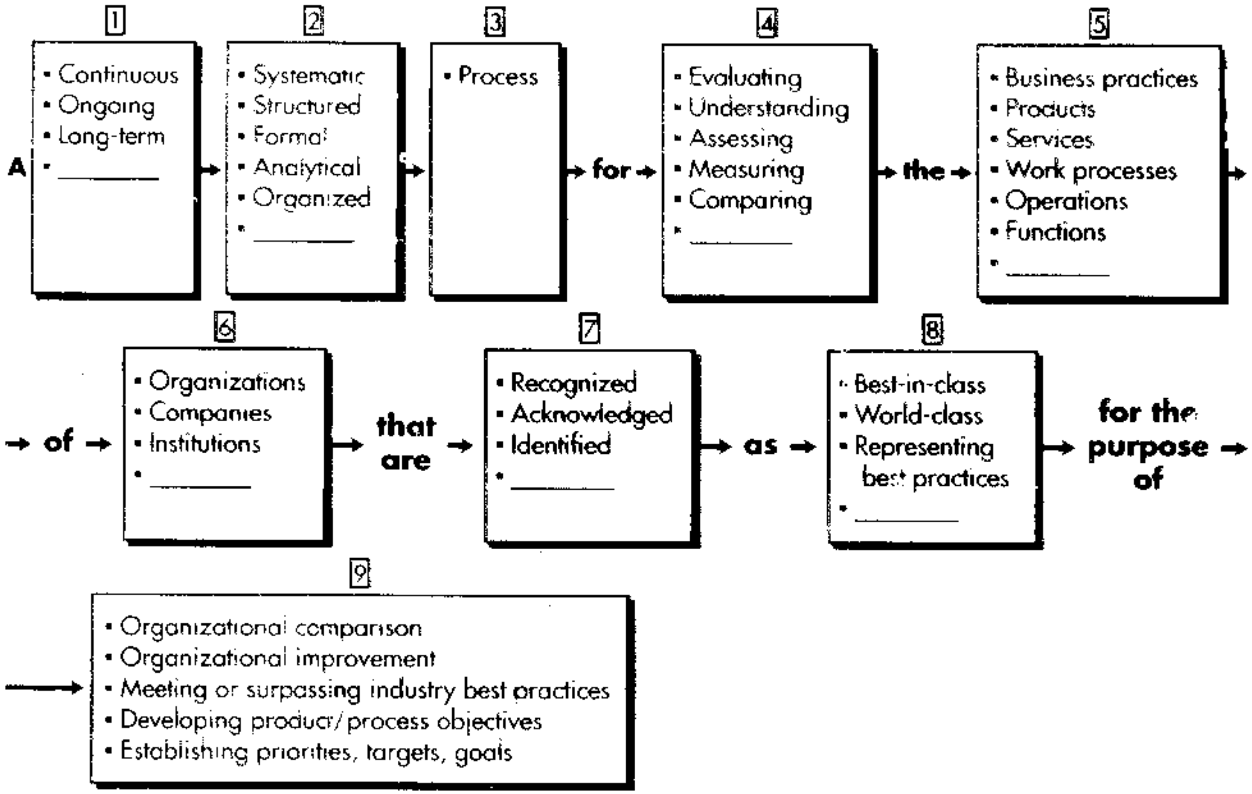


Exhibit 1-1. The benchmarking menu.



Introduction to Lean Manufacturing

One Page Overview

- The purpose of lean is to *remove all forms of waste from the value stream*.
  - Waste includes cycle time, labor, materials, and energy.
- The chief obstacle is the fact that waste often hides in plain sight, or is built into activities.

Contents

Benefits of Lean Manufacturing

- Lean manufacturing delivers an *insurmountable competitive advantage* over competitors who don't use it effectively.

Benefits of Lean Manufacturing

(1) Lower production cost ➔ higher profits and wages
- Cost avoidance flows directly to the bottom line.

(2) Supports ISO 14001 and "green" manufacturing
- Reduction of material waste and associated disposal costs ➔ higher profits

(3) Shorter cycle times: make-to-order vs. make-to-stock

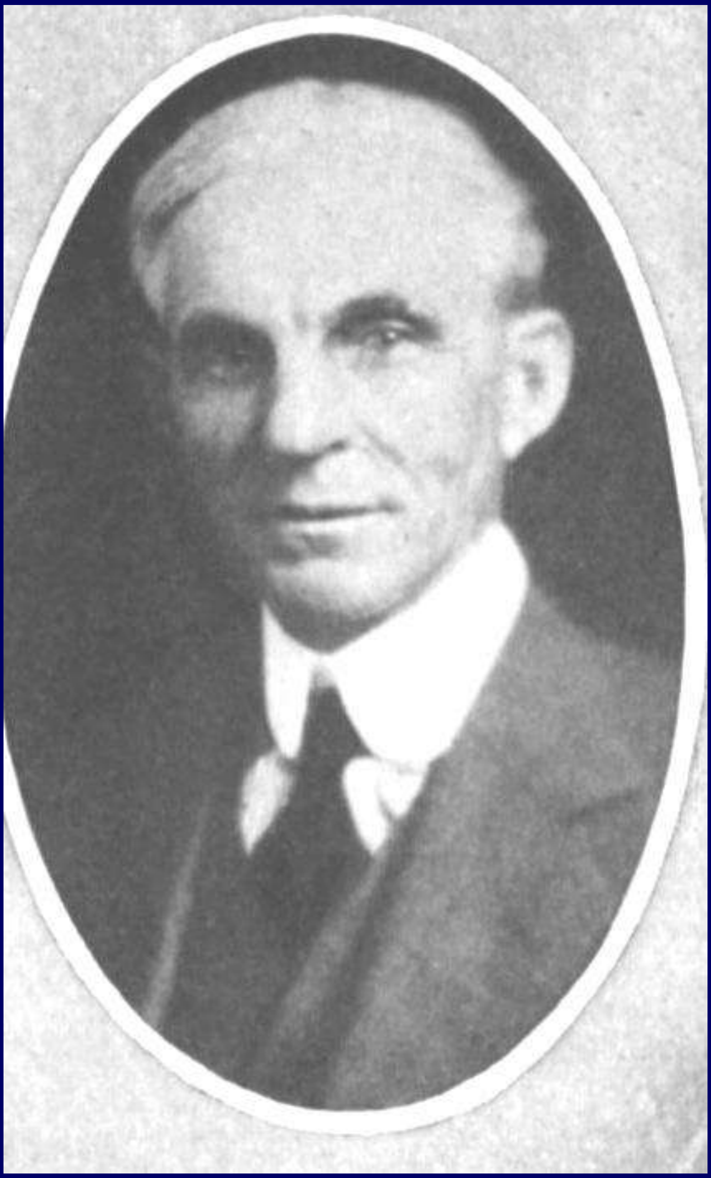
Bottom Line and the Language of Money

- The first comprehensive implementation of lean manufacturing yielded:
  - Stock appreciation of 63 percent per year, for 16 years (not counting dividends)
  - 7.2 percent annual wage growth
- The next section will discuss lean manufacturing's origins.

The Origin of Lean Manufacturing

Discussion question:
Who created the Toyota Production System?

The Creator of the Toyota Production System



Origin of the Toyota Production System

- Taiichi Ohno said openly that he got the idea from Henry Ford's books and the American supermarket.
  - Ford's *My Life and Work* (1922) describes just-in-time (JIT) and other lean concepts explicitly.
  - Depletion of supermarket shelf stock triggers replenishment; it is a "pull" system like kanban or Drum-Buffer-Rope.

Bottom Line Results of the TPS

- The Ford Motor Company's original stock grew 63% per year (not counting dividends) and 7.2% annual wage growth.
- Toyota recently superseded General Motors as the world's largest automobile company.
- The next section will show how the TPS delivers these results.

What is Lean Manufacturing?

A *systematic approach* to *the identification and elimination all forms of waste* from the value stream.

Concept of Friction, Waste, or Muda

Understanding of friction, waste, or *muda* is the foundation of the lean Manufacturing.

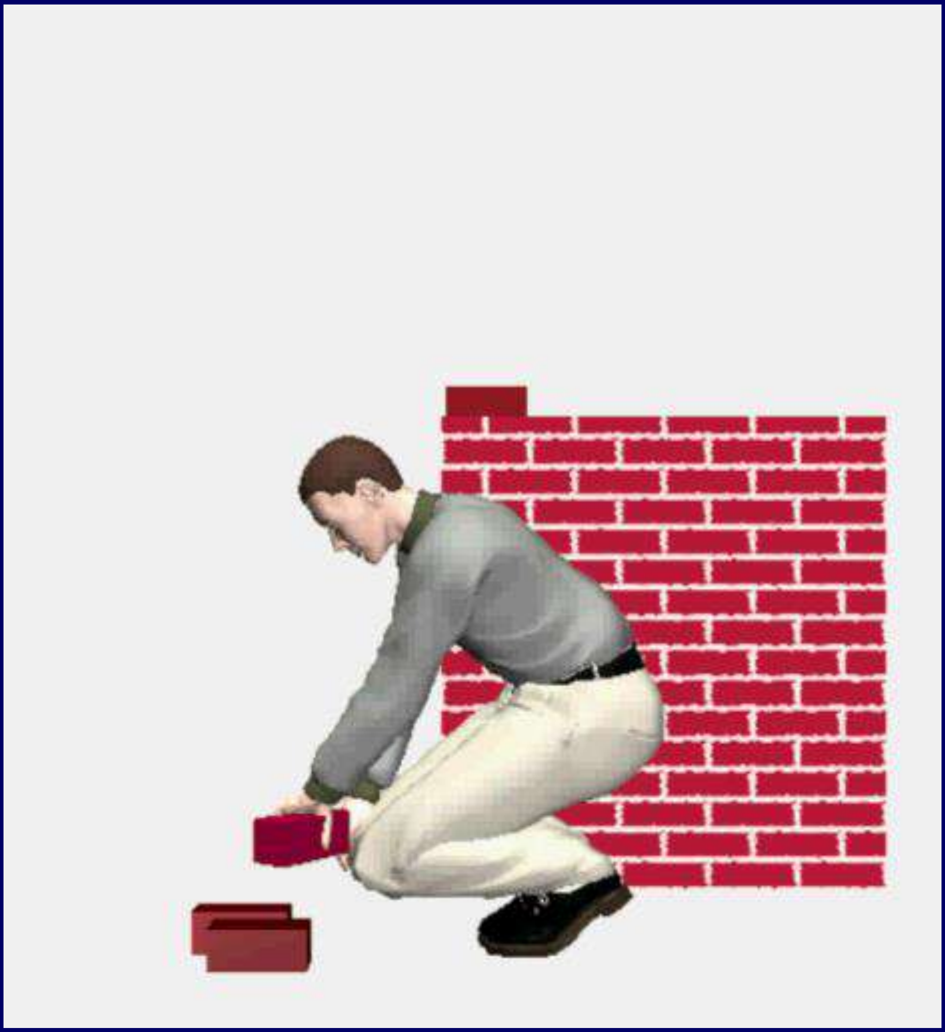
The First Step is to Recognize the Waste

- This principle has been stressed by:
  - Henry Ford
  - Taiichi Ohno (Toyota production system)
  - Tom Peters (*Thriving On Chaos*)
  - Shigeo Shingo
  - J. F. Halpin (*Zero Defects*)

Waste Often Hides in Plain View

- We cannot eliminate the waste of material, labor, or other resources until we recognize it as waste.
  - A job can consist of 75 percent waste (or even more).
- Classic example: brick laying in the late 19th century

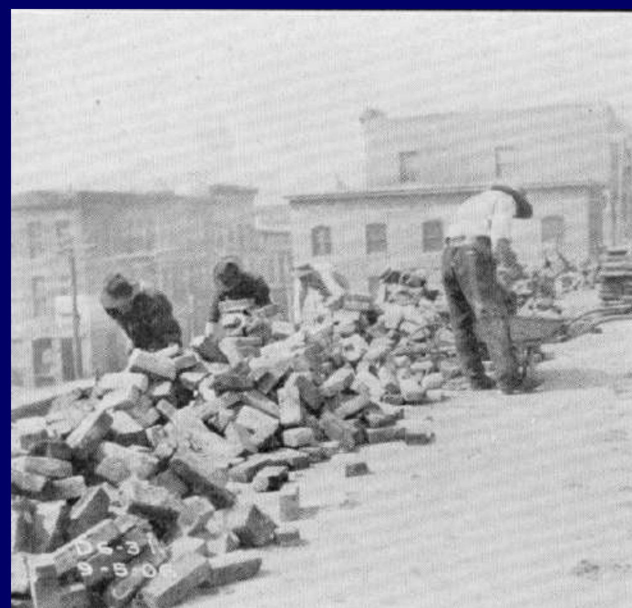
Waste is Often Built Into Jobs

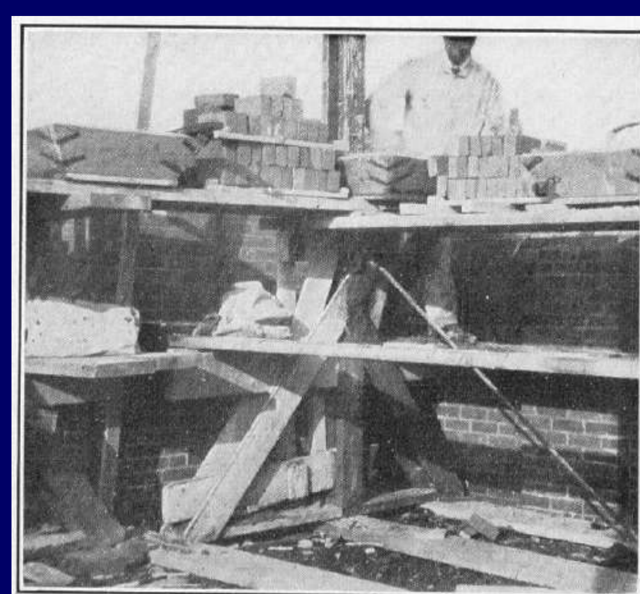


Pre-Gilbreth Bricklaying

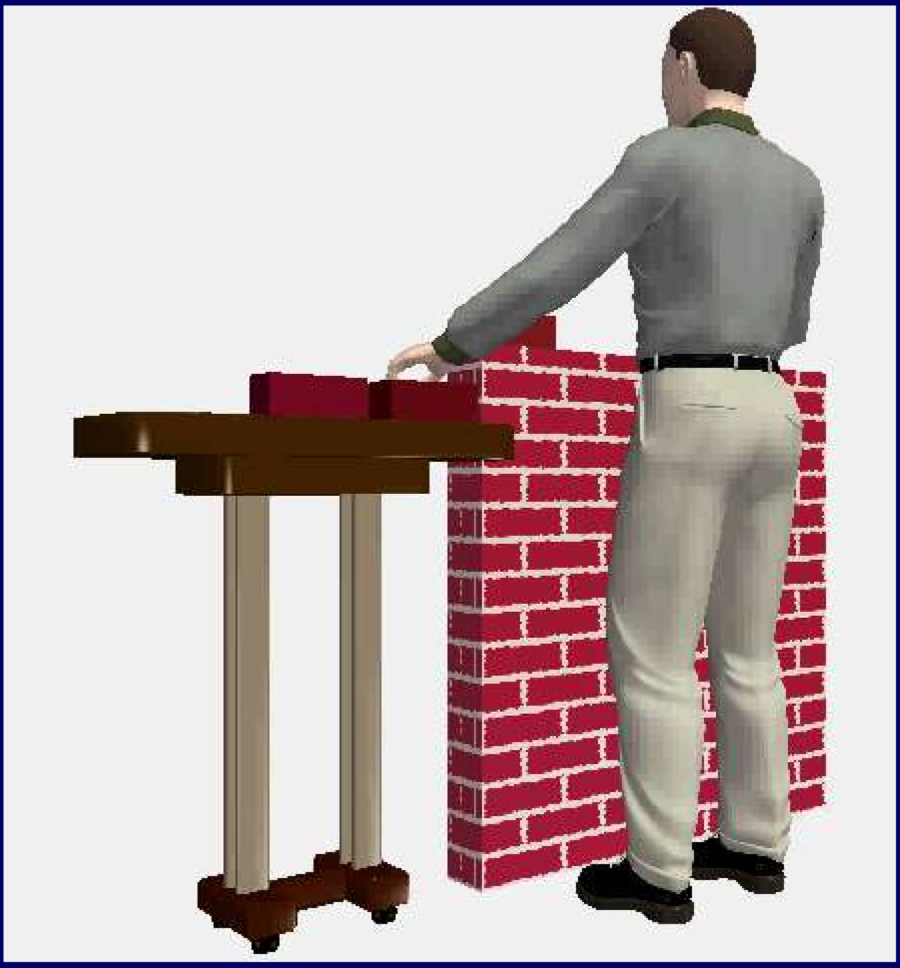
This is a Real Example

- Top: "The usual method of providing the bricklayer with material" (Gilbreth, *Motion Study*, 1911).
- Bottom: "Non-stooping scaffold designed so that uprights are out of the bricklayer's way whenever reaching for brick and mortar at the same time."





Post-Gilbreth Brick Laying

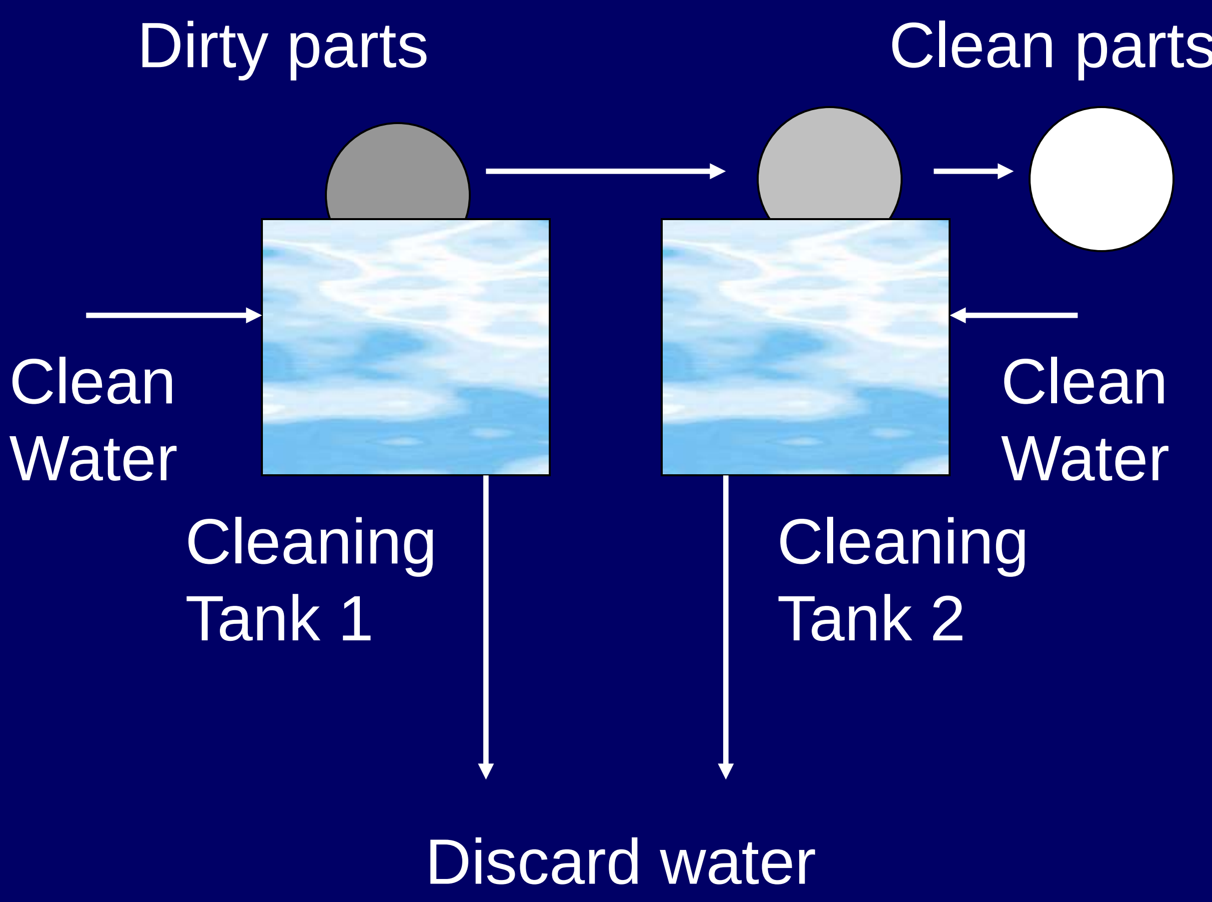


The solution is obvious (in retrospect), but first we have to know that we have a problem!

Another Example: Fabric Folding

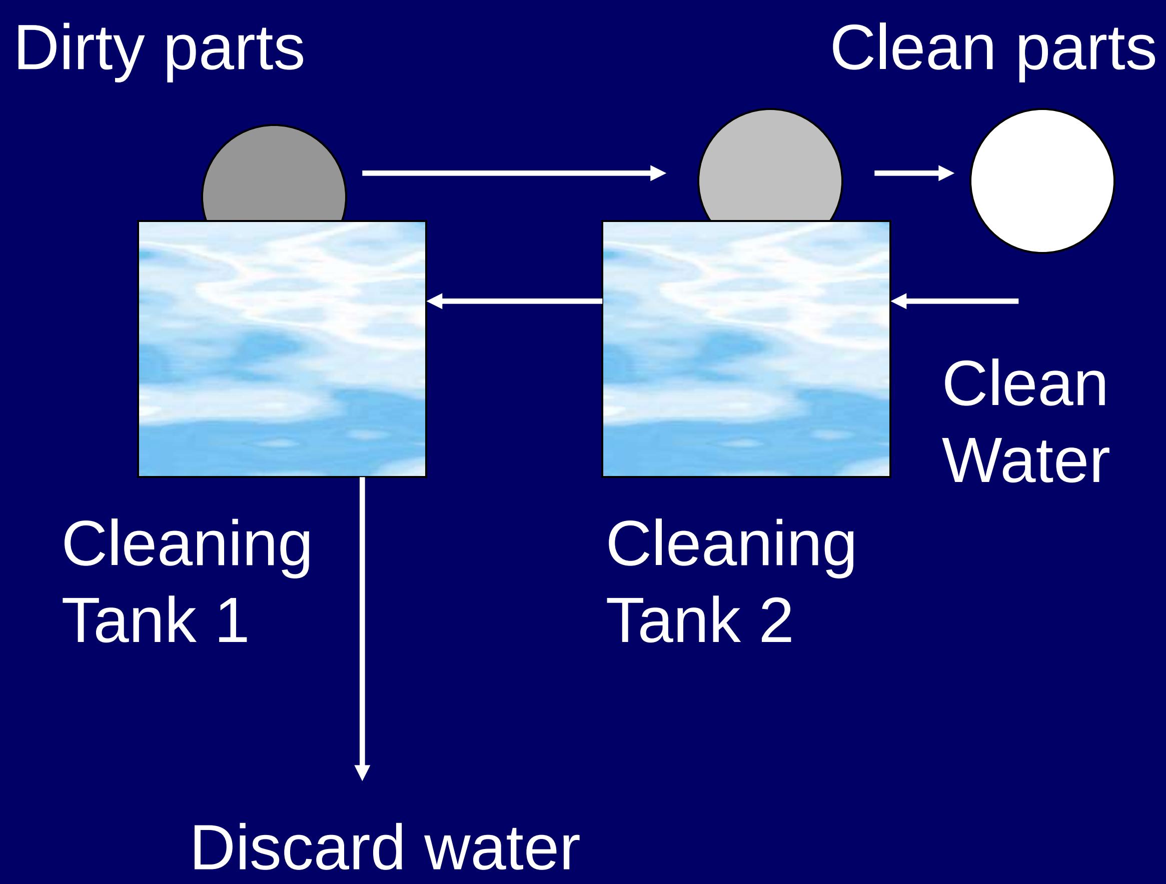
Redesign of this job to eliminate the need to walk doubled its productivity. We will see that material waste also hides in plain sight.

Material Waste Hides in Plain Sight



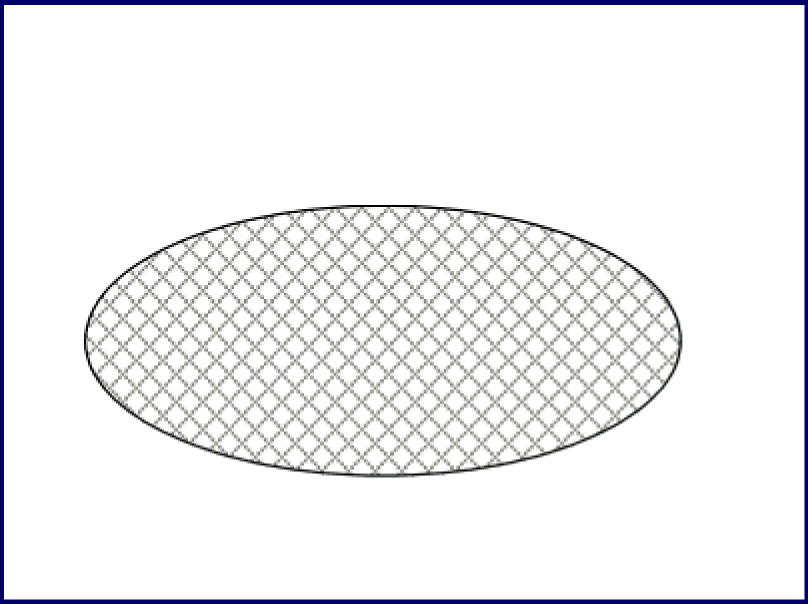
The parts get clean, so no one questions this. What is wrong with this picture?

Why Not Make the Water Work Twice?



The *almost* clean water from the second tank is good enough for use in the first tank. Water usage can be cut 50 percent.

Spin Coating of Semiconductor Wafers



The *product* is the coated wafer, and "the job has always been done this way" in the semiconductor industry. This is how waste hides in plain view.

Lessons so far

- **Waste often hides in plain view.**
  - People become used to "living with it" or "working around it."
  - Definition for employees at all levels: **If it's frustrating, a chronic annoyance, or a chronic inefficiency, it's friction.** (Levinson and Tumbelty, 1997, *SPC Essentials and Productivity Improvement*, ASQ Quality Press)

TPS Definitions of Waste

1. Overproduction
2. Waiting, including time in queue
3. Transportation (between workstations, or between supplier and customer)
4. Non-value-adding activities
5. Inventory
6. Waste motion
7. Cost of poor quality: scrap, rework, and inspection

Waste (notes page)

Waiting as a Form of Waste

- Of the total cycle time or lead time, how much involves value-adding work?
  - How much consists of waiting?

The Value-Adding "Bang!"

- Masaaki Imai uses "Bang!" to illustrate that the value-adding moment may consist of a literal "Bang!"
  - Contact between tool and work
  - Contact between golf club and ball

Imai's Golf Analogy

- In a four hour golf game, the golf club is in contact with the ball for less than two seconds.
  - *The same proportion of value-adding to non-value-adding time prevails in many factories*.
- Additional analogies:
  - Waiting for other players = waiting for tools
  - Walking = transportation
  - Selecting a club and addressing the ball = setup

The Value-Adding "Bang," Continued

- In a factory, the value-adding "Bang!" takes place when, for example, a stamping machine makes contact with the part.
  - *All other time, such as waiting, transportation, and setup, is non-value-adding*.
  - The proportion of value-adding to non-value-adding time may in fact be similar to that in a typical golf game!

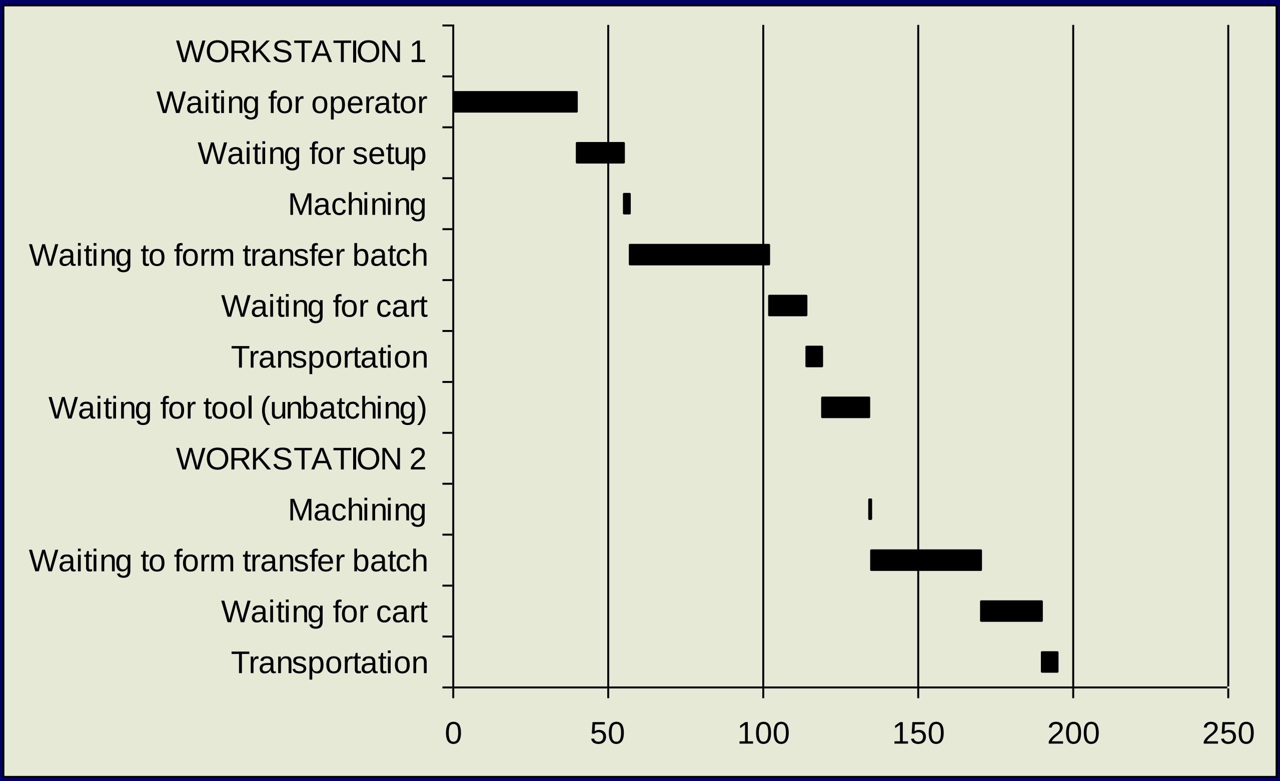
Cycle Time Accounting

- The basic idea is to attach a "stopwatch" to each job (or sample jobs) to determine exactly how the work spends its time.
  - In practice, the production control system should handle this.
  - The Gantt Chart may be modified to display the times by category.

Cycle Time Accounting, Continued

- The clock starts the instant a job begins an activity and stops the instant it ends.
  - If the work waits for a tool or operator, this is a *delay* and not *processing*.
  - When work is gated out of an operation, it usually *waits* for transportation (delay) or is in transit (transportation).
  - Placement of the work in the tool is *handling*, not *processing*.

Gantt Chart Modification



Only machining is value-adding time. This Gantt format of the cycle time makes non-value-adding time highly visible.

Waste: Summary

- This section has shown how wastes of material, labor, and cycle time can hide in plain view.
- Cycle time reduction can yield decisive competitive advantages, including make to order as opposed to make to forecast.
- The next section will cover "Green" manufacturing.

Green is the Color of Money

"…we will not so lightly waste material simply because we can reclaim it—for salvage involves labour. *The ideal is to have nothing to salvage*."

—Henry Ford, *Today and Tomorrow*

The Birth of Green Manufacturing

- Henry Ford could probably have met ISO 14001 requirements in an era when he could have legally thrown into the river whatever wouldn't go up the smokestack.
  - "He perfected new processes—the very smoke which had once poured from his chimneys was now made into automobile parts." Upton Sinclair, *The Flivver King*

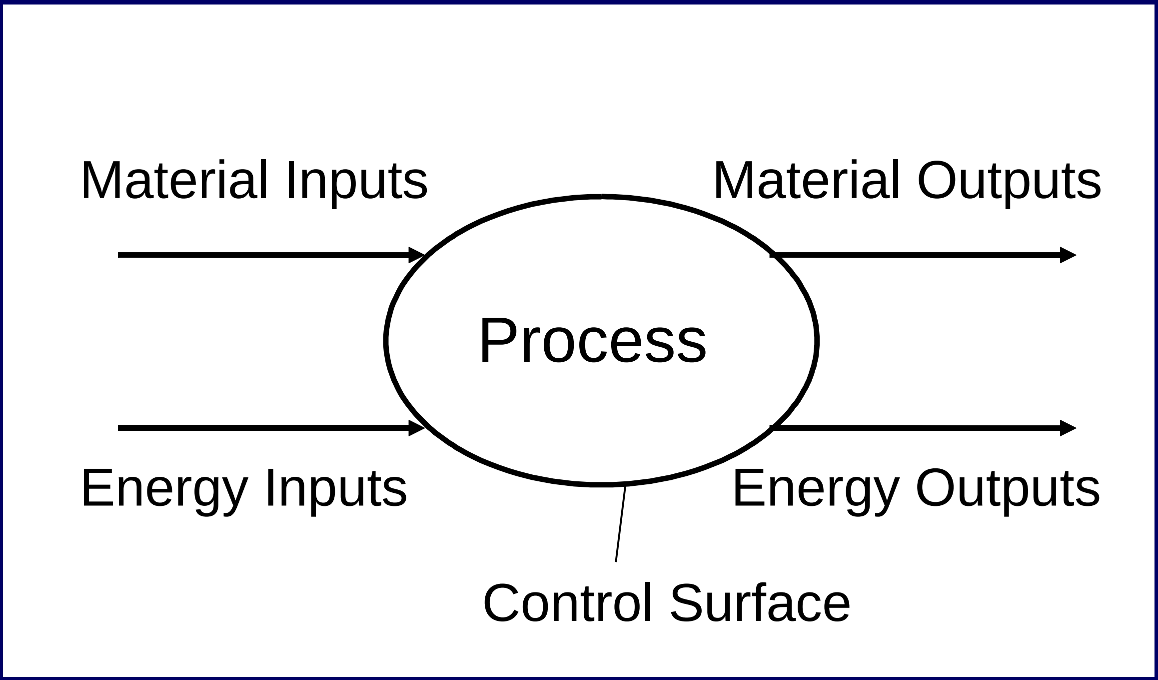
Ford's Green Manufacturing

- Recovery and reuse of solvents
- Distillation of waste wood for chemicals yielded enough money to pay 2000 workers.
  - Kingsford charcoal
- Design of parts and processes to minimize machining waste
- Reuse of packaging materials
- Slag ➔ paving materials and cement

Identification of Material and Energy Wastes

- Material and energy waste can easily be built into a job.
- Elimination of these wastes is central to "green" manufacturing and the ISO 14001 standard and, more importantly, very profitable.
- We cannot, however, remove this waste before we identify it.

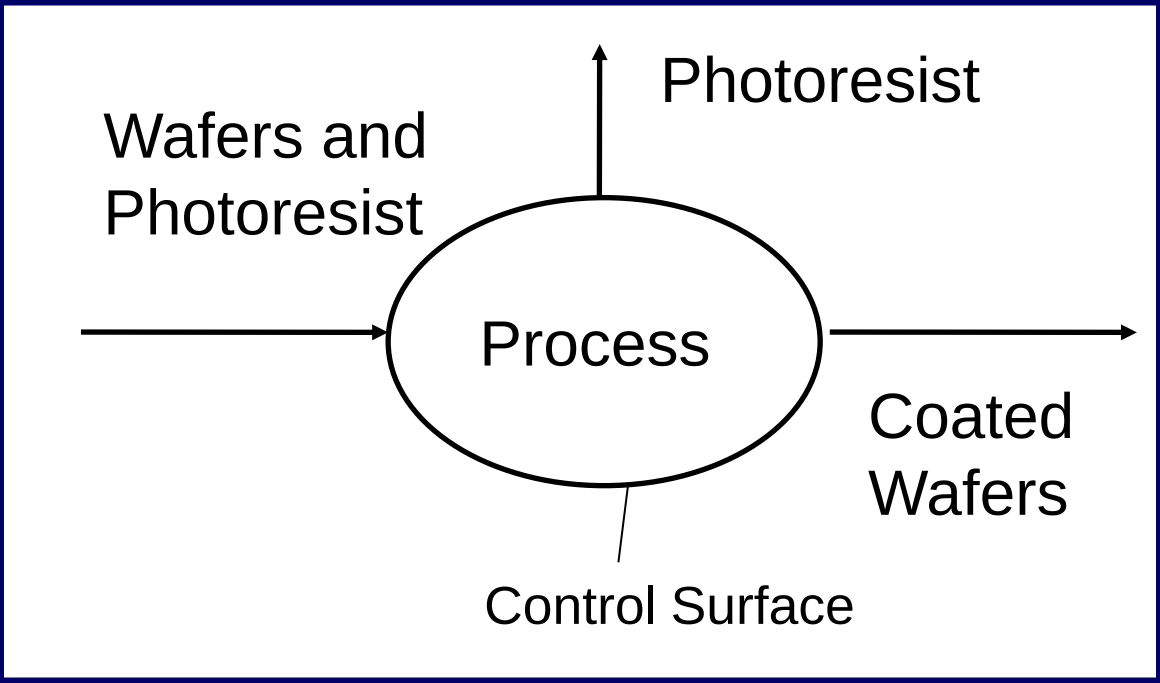
Control Surface Approach



The *material and energy balance* is standard practice for chemical process design. *Outputs must equal inputs*.

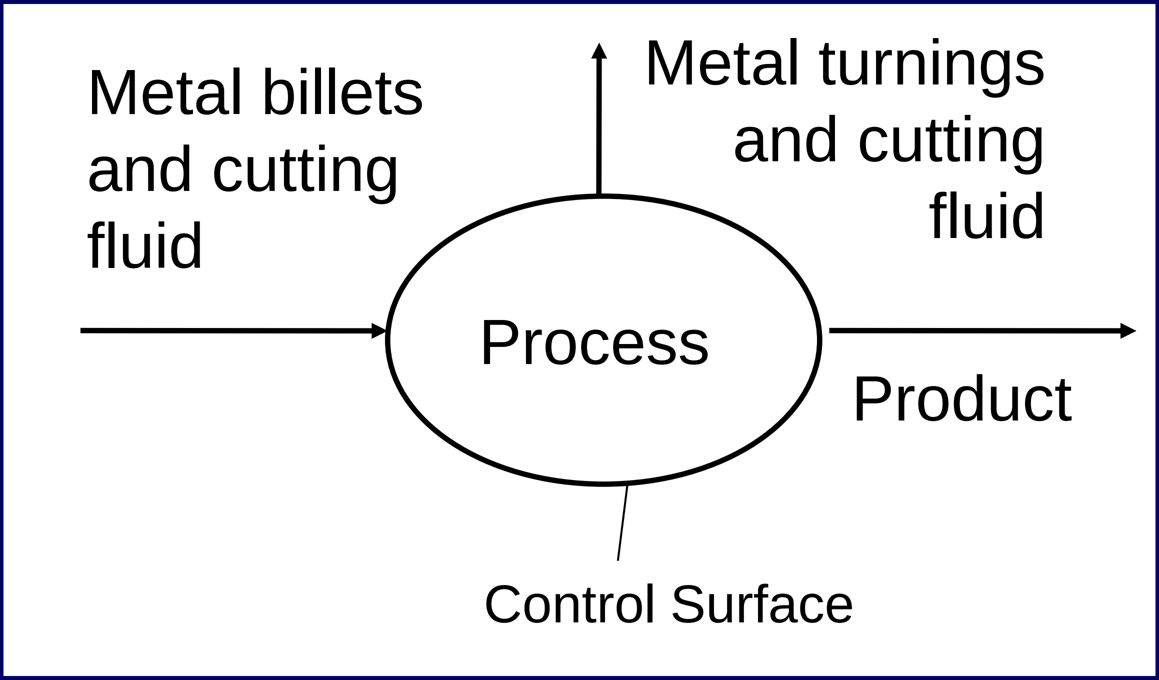
Material outputs, for example, include everything that is thrown away, as well as the product.

Example: Spin Coating of Semiconductor Wafers



The control surface analysis forces the waste to become visible, and causes people to ask if there is a practical way to avoid it.

Example: Machining



The waste that is usually taken for granted (metal chips and used cutting fluid) suggests product or process redesign to reduce machining.

Discussion Question

- Do you know of processes in which materials are thrown away (or recycled)?
  - If so, can the process or product be redesigned to reduce the waste?
  - Could the discarded materials be reused or recycled in some manner?
- Can energy-intensive processes be made more efficient?

Lean Manufacturing Techniques

Some principles and activities for lean manufacturing

Design for Manufacture

- Synergistic with ISO 9000:2000 7.3, Design Control.
- Involve manufacturing, customers, and other related departments in the design process.
  - Don't "throw the design over the wall" to manufacturing. The design must be manufacturable by the equipment in the factory.
  - Process capability: Design for Six Sigma

5S-CANDO

- 5S-CANDO, a systematic approach to cleaning and organizing the workplace, suppresses friction.
- Seiri = Clearing up
  - "When in doubt, throw it out."
- Seitori = Organizing (Arranging)
  - "A place for everything and everything in its place."
- Seiso = Cleaning (Neatness)
- Shitsuke = Discipline
- Seiketsu = Standardization (Ongoing improvement, holding the gains)

Visual Controls

- "Basically, the intent is to make the status of the operation clearly visible to anyone observing that operation" (Wayne Smith, 1998).
- Visual controls are like a nervous system (Suzaki, 1987)
- "Visual controls identify waste, abnormalities, or departures from standards" (Caravaggio, in Levinson, 1998)

Examples of Visual Controls

- 5S-CANDO (arranging)
- Jidoka or autonomation
  - Andon lights and buzzers announce tool status.
- JIT: kanban squares, cards, containers.
  - Lines on the floor to mark reorder points
- Safety: colored labels for materials
- Statistical process control charts: should be clearly visible.

Visible Management

- A visible production management system should indicate:

(1) What the operation is trying to make

- Measure the takt rate, or desired production per unit time.

(2) What the operation is achieving

(3) What problems hinder the production goal?

- American workplaces used such controls prior to 1911.

"Pull" Production Control Systems

- Just-In-Time (JIT)
  - First described by Henry Ford in *My Life and Work* (1922)
- Kanban
- Drum-Buffer-Rope (Goldratt)

- All reduce inventory and its carrying costs, along with cycle time.
- Tie-in with small lot and single unit processing

Drawbacks of Batch Processing

- Running equipment (e.g. a heat treatment furnace) at less than full load wastes capacity. Waiting for a full load wastes time.
  - Waste of capacity is not a problem except at a constraint operation (Goldratt's Theory of Constraints).
- Batches introduce waiting time when they arrive at single-unit tools en masse.
  - Batch-and-queue forces extra cycle time (waiting) into the operation.

Single-Unit Processing Reduces Cycle Time

- Wayne Smith (1998) defines *manufacturing cycle efficiency* as (Value-adding time)÷(Total cycle time)
  - This is often <u>less than 1 percent</u>.
  - Remember Masaaki Imai's "value-adding Bang!" concept
  - Golf analogy: the club head is <u>in contact with the ball</u> for less than two seconds in a typical game.

Single-Minute Exchange of Die (SMED)

- Left column: non-value-adding setup and load/unload activities
- Right column: value-adding machining activities

THE MIDVALE STEEL CO.

Form D—124. Machine Shop........................18..........

ESTIMATES FOR WORK ON LATHES

OPERATIONS CONNECTED WITH PREPARING TO MACHINE WORK ON LATHES AND WITH REMOVING WORK TO FLOOR AFTER IT HAS BEEN MACHINED

OPERATIONS	TIME IN MINUTES	
Putting chain on, Work on Floor		
Putting chain on, Work on Centers		
Taking off chain, Work on Floor		
Taking off chain, Work on Centers		
Putting on Carrier		
Taking off "		
Lifting Work to Shears		
Getting Work on Centers		
Lifting Work from Centers to Floor		

NAME ....

Sketch .... Number............

Order.............. Weight............

Metal.............. Heat No. ....

Tensile Strength.... Chem. Comp.......

Per cent. of Stretch ....

HARDNESS, Class.................

OPERATIONS CONNECTED WITH MACHINING WORK ON LATHES

OPERATIONS	Speed	Feed	Cut	Tool	Inches	Minutes
Turning Feed In						
" " "						
" Hand Feed						
" " "						
Boring Feed In						
" " "						
" Hand Feed						

SMED Principles and Benefits

1. <u>Internal setup</u> requires the tool to stop.
   - Reduce internal setup time, or convert internal to external setup.
2. <u>External setup</u> can be performed while the tool is working on another job.
3. SMED reduces cycle time by facilitating smaller lot sizes, mixed model production, and/or single-unit flow

Error-Proofing (Poka-Yoke)

- Error-proofing makes it difficult or impossible to do the job the wrong way.
- Slots and keys, for example, prevent parts from being assembled the wrong way.
- Process recipes and data entry also can be error-proofed.

Summary and Conclusion

Most of lean manufacturing is common sense!

Summary

- Business activities can contain enormous quantities of built-in waste (muda, friction).
- The greatest obstacle to the waste's removal is usually failure to recognize it.
- Lean manufacturing includes techniques for recognition and removal of the waste.
- This delivers an overwhelming competitive advantage.

CONCURRENT ENGINEERING PHILOSOPHY

Concurrent engineering (CE) is a relatively new term being applied to the engineering design philosophy (Smith, 1997). It is also commonly known as Simultaneous Engineering or Parallel Engineering. There are also other names that are associated with CE such as: Concurrent Design; Life Cycle Engineering; Design for Manufacture, and Unified Life Cycle Engineering (Dowlatshashi, 1994).

The principal idea behind the development of CE is to reduce the product development time (Prasad, 1995a). However Stalk and Webber (1993) argue that shortening development lead time is in itself not the only goal. It has to be combined with other competitive advantages such as better customer orientation; improved product quality; and lower development cost.

CE PRINCIPLES	AUTHOR	STATEMENT
Need for integrating with other functions	Purdey (1947)	**"Co-operation [between product design and manufacturing engineering organisations] appear to me an essential for best results. It should begin in the early stages of product design and continue as long as the product being produced."**
Use of multifunctional teamwork strategy to accomplish integration	Thompson (1945)	**"Close co-operation with the production department during the development of design is essential if the maximum degree of productivity efficiency is to be obtained. In fact, it is considered good practice to have one or more production planners stationed within the engineering department, to work with the designers and approve each drawing for adaptability to production and feasibility of manufacture."**
Including voice of customer in the design process	Brady (1931)	**"Machine designers, and engineers responsible for the engineering development of many kinds of metal products should have awakened to their responsibilities in putting sales appeals into their product long before they did."**
Lead time	Fernstrom et al. (1935)	**"Life quickened [around the turn of century] and complexities developed at such pace that the problem of making product design cope properly with changing conditions now involves the complete depiction and development of a product from the original idea to the point of use."**

Definition of concurrent engineering

The term "Concurrent Engineering" was originally devised by Institute for Defense Analysis (IDA), The IDA definition of CE is the most widely accepted by the manufacturing community as follows:

"Concurrent engineering is a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from concept through disposal, including quality, cost, schedule, and user requirements".

definition of CE is made by Cleetus (1996):

"CE is a systematic approach to integrated product development that emphasises responsiveness to customer expectation and embodies team values of co-operation, trust sharing in such a manner that decision making proceeds with large intervals of parallel working by all life cycle perspectives synchronised by comparatively brief' exchanges to produce consensus".

RECURRENT ELEMENT APPEAR IN CE DEFINITION	WHO QOUTES IT?
Concurrent design and product development process	Winner et.al 1988, Knight and Jackson 1989, Wallace 1990, Ruding 1990, Eversheim 1990, Lawon and Miller 1992, Stephanon and Spiegl 1992, Cleetus 1992.
Shorten lead time in the product development process	Knight and Jackson 1989, Yamazoe, 1990, Eversheim 1990, Adachi et al 1995, Barkan 1988, Evans 1988, Stauffer 1988, Winner et. al 1988,
Use of teamwork (team environment) from outset stage and cross functionality nature of the team.	Walklet 1989, Yamazoe, 1990, Wallace 1990, Schonwald, 1990, Eversheim 1990, Lawson and Miller 1992, Cleetus 1992, Turino 1992.
Consideration of downstream (e.g. manufacturing) issue during upstream (e.g. design) phase	Winner et.al 1988, Stephanon and Spiegl 1992, Kannapan and Marshek 1992, Darr and Birmingham 1994.
Emphasise response to customer expectation	Yamazoe, 1990, Wallace 1990, Cleetus 1992, Creese and Moore 1990.

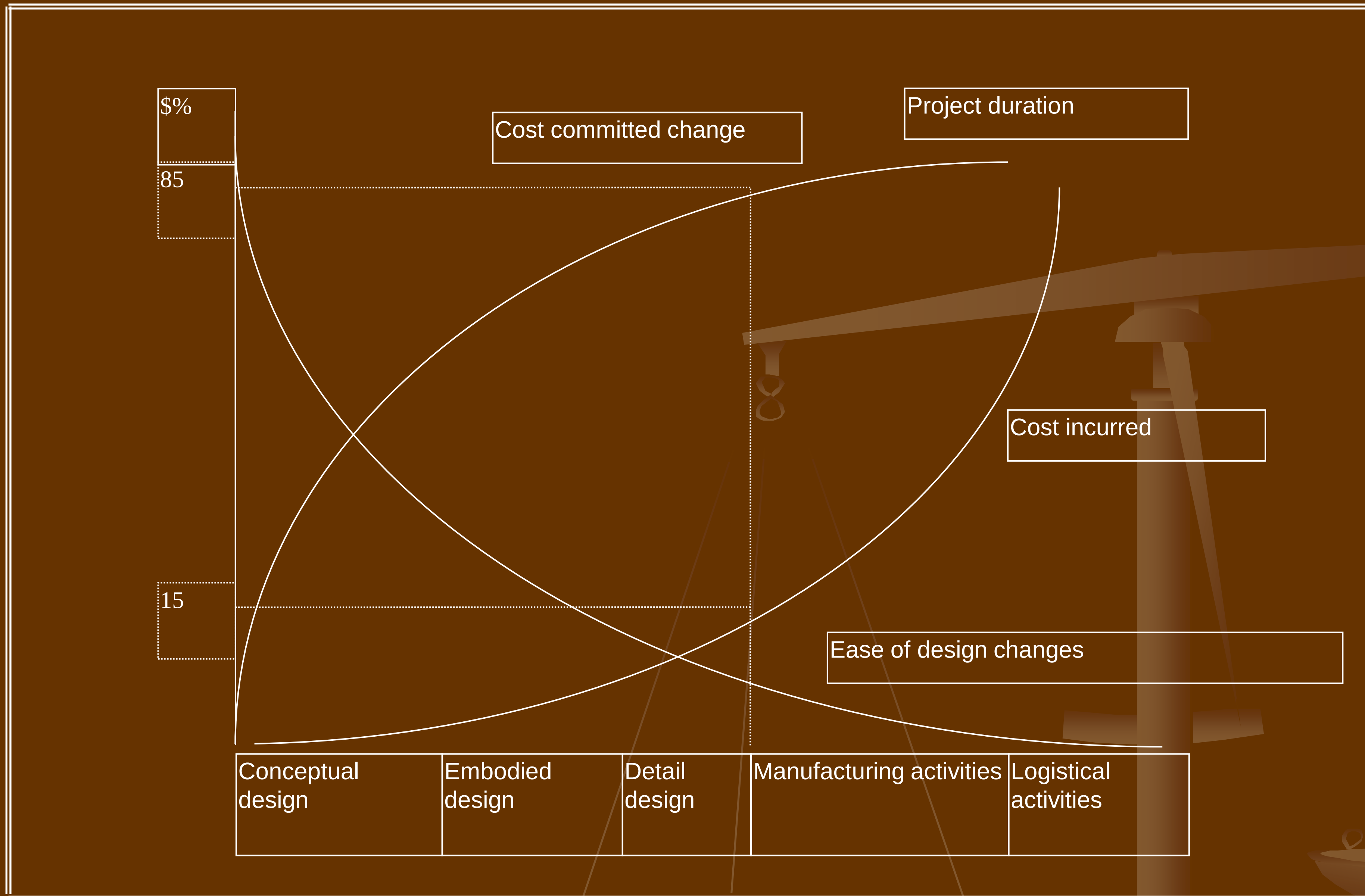
Fundamental element of CE

Prasad (1995a) presents eight principles of CE as follows:

- Early problem discovery
- Early decision making
- Work structuring
- Teamwork affinity
- Knowledge leveraging
- Common understanding
- Ownership (Team ownership of the products)
- Constancy of purpose (Consistency of goals between different departments represented in the team)

The four principles described by Smith (1997) are as follows:

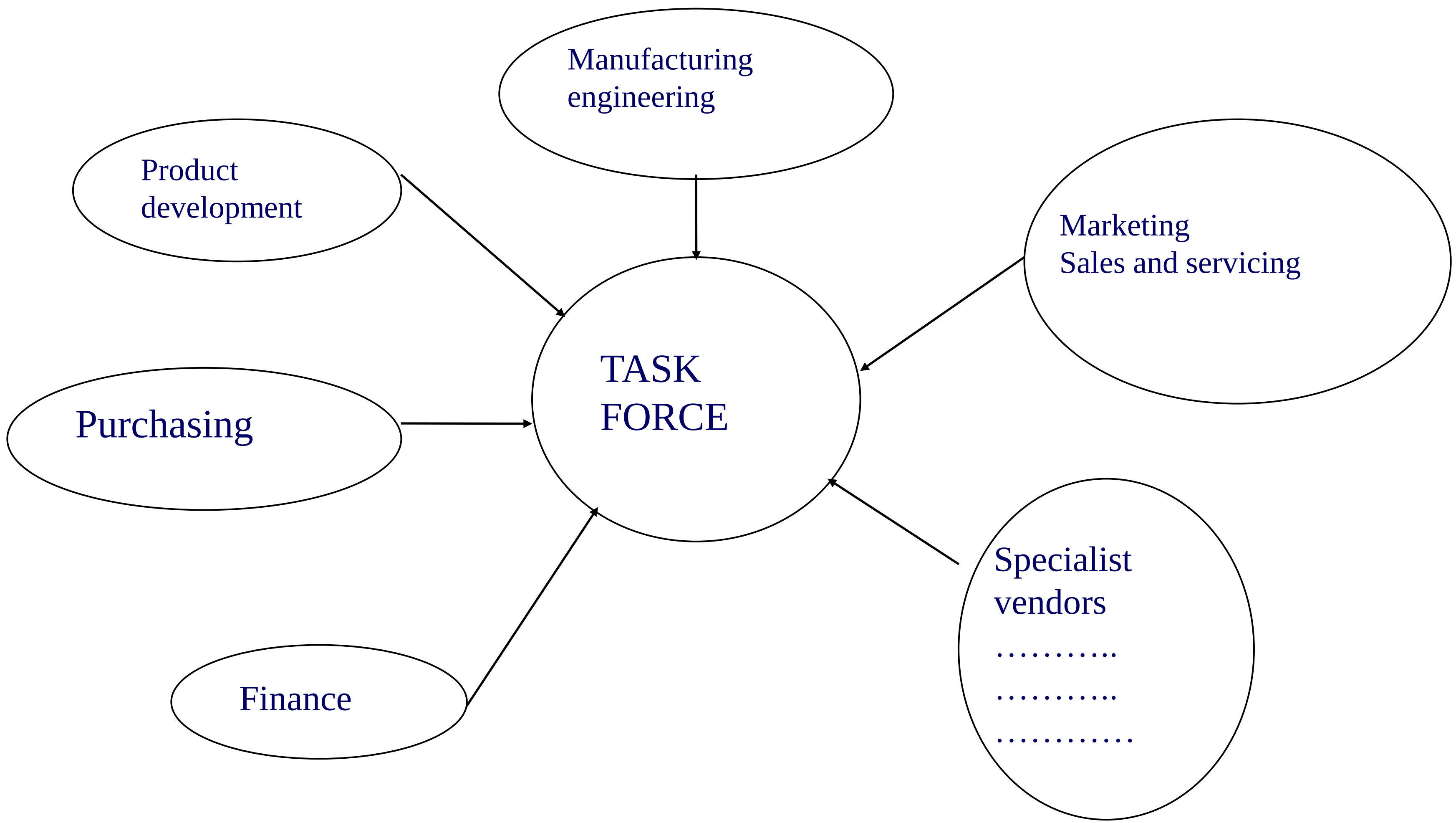
- Consideration of downstream requirement during the design development
- The use of cross functional teamwork
- Consideration of the customer requirements in the product development
- Use of lead time as source of competitive advantage

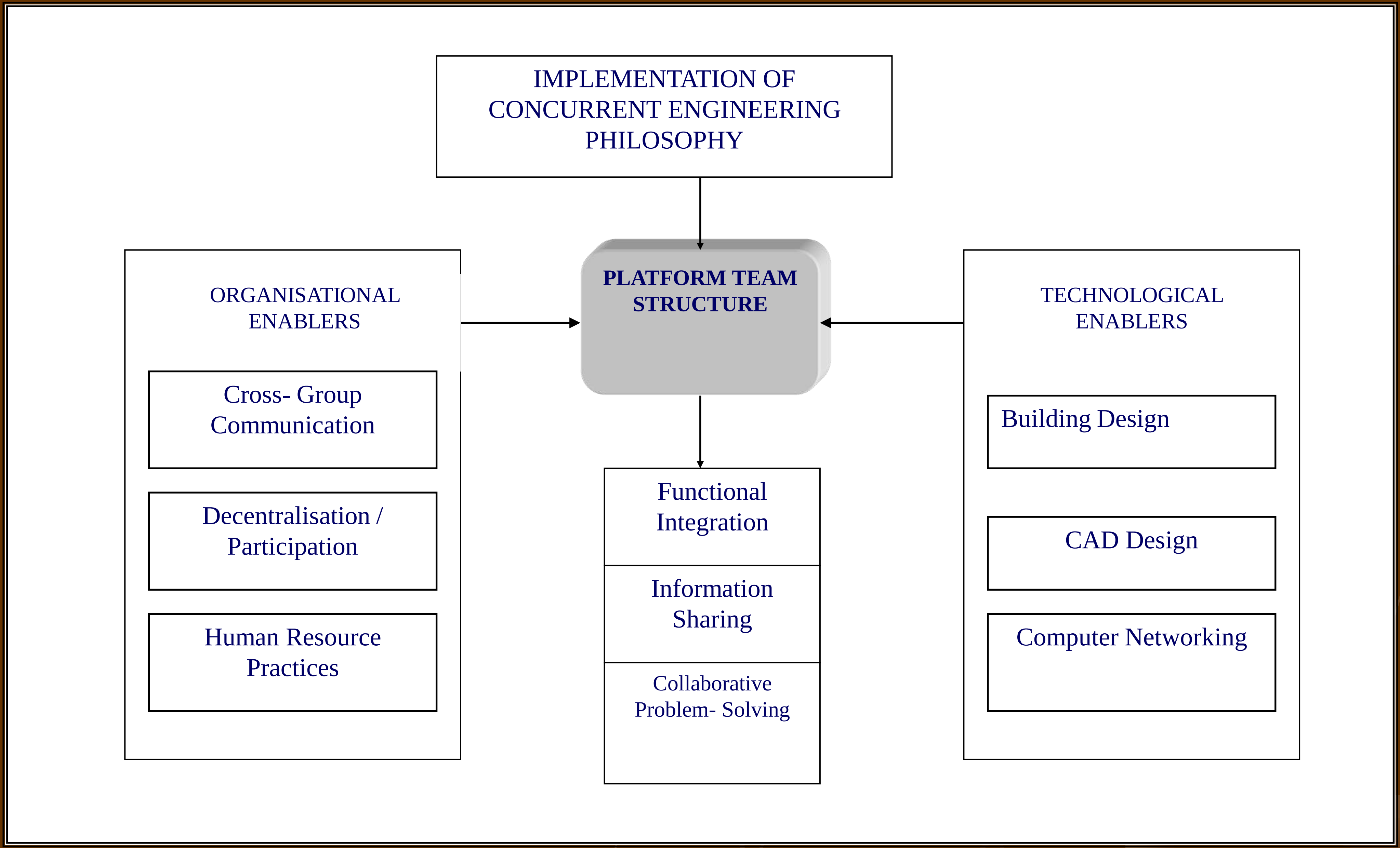


The influence of design in determining the downstream project cost. (Dowlatshasi, 1994)

The importance of early consideration of downstream requirements

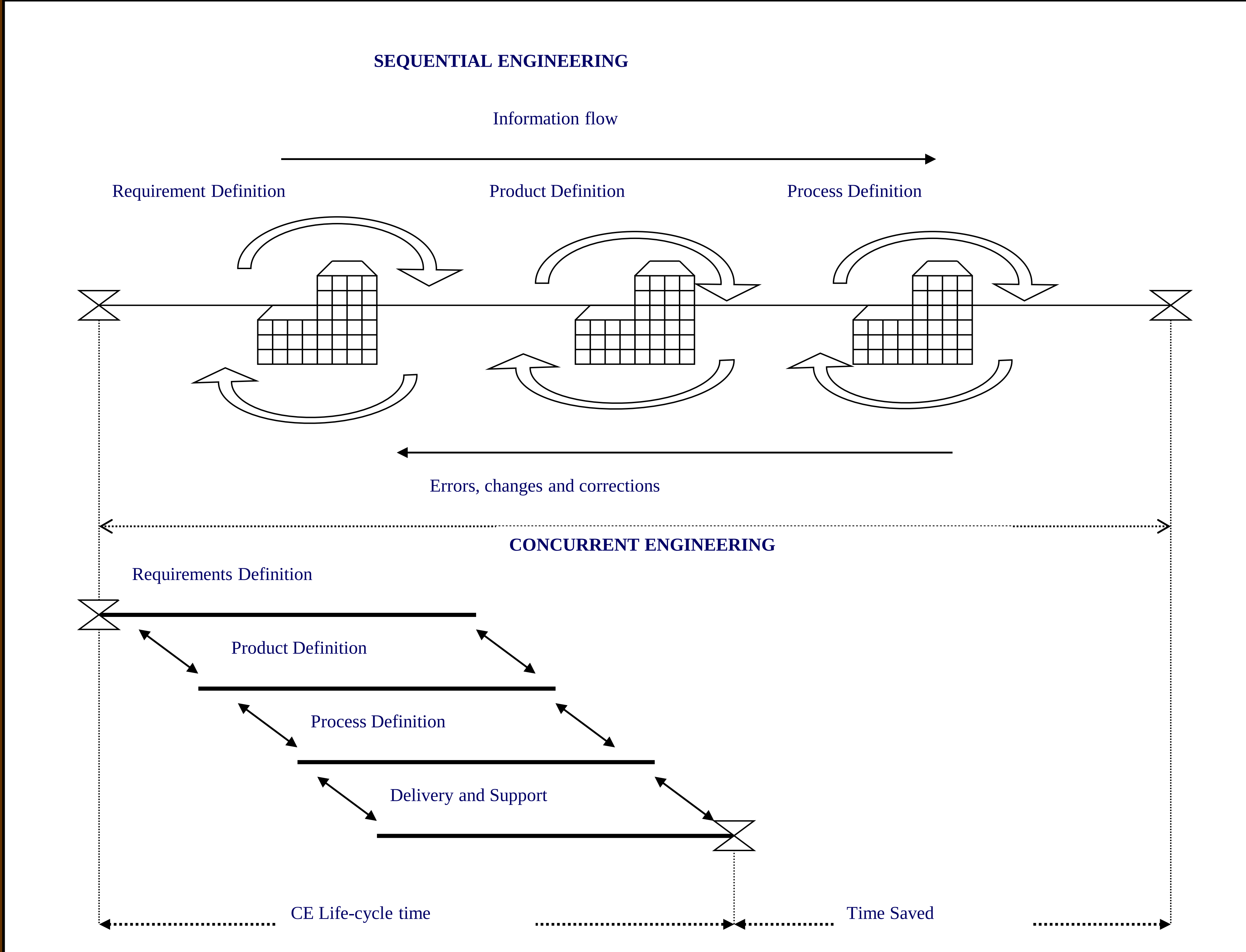
	Statement	Quoted by
1	80% of final production cost of 2000 component determined at the design stage in a study at Rolls Royce.	Corbett (1986)
2	It is estimated by Ford Motor Company that 70% of all production savings among the four manufacturing elements of design, material, labour and overhead, stem from improvements in design.	Cohodas (1988)
3	A study revealed that product design is responsible for 5% of a product's cost but it can determine 75% of all manufacturing costs and 80% of a product's quality performance.	Huthwaite (1988)
4	A study shows that 70% of the life cycle cost of a product is determined at the design stage.	Nevins and Whitney (1989)
5	It is believed that 40% of all quality problems can be traced to poor design.	Dixon and Duffey, (1990).
6	As much as 70 -80% of manufacturing productivity can be determined at the design stage.	Suh (1990)


Manufacturing
engineering
Product
development
Marketing
Sales and servicing
TASK
FORCE
Purchasing
Specialist
vendors
………..
………..
…………
Finance



Conceptual model to support CE Cross Functional Team in CE implementation (Hadad, 1996)

Company	Teamwork Structure
Marconi Instruments Ltd.	•Team operates within highly autonomous business unit structure. •The organisation still maintains core service unit. •Team members comprise of representatives from various design and Engineering functions. •Other members are also co-opted from other support unit. •Team members are co-located.
Lucas Aerospace Actuation Division (LAAD)	•Core service unit permanently incorporated into LAAD team •Team consists of full time members from design, draughting, manufacturing, stress performance and commercial •Team are co-located
Instron Ltd.	•Maintain identifiable functional unit •Team created across the functional team
Design to Distribution Ltd. (D2D)	•Heavyweight teams superimposed on functional structure •Extensive use of communication technology and a project team developed on virtual team basis. •Team members comprise from manufacturing, mechanical design, firmware, hardware, software designer and test engineer.
Rolls-Royce	•Full time , autonomous team •Very large team often in the order of 100 people •Membership comprises from design and development engineers and manufacturing and purchasing representatives. •Team also supported by other specialists


SEQUENTIAL ENGINEERING
Information flow
Requirement Definition
Product Definition
Process Definition
Errors, changes and corrections
CONCURRENT ENGINEERING
Requirements Definition
Product Definition
Process Definition
Delivery and Support
CE Life-cycle time
Time Saved

Company	Quality	Cost	Time
Aerojet Ordinance	400% yield improvements on munitions program (Pennel & Winner 1989)	-	-
Dere & Company	66% reduction in number of inspectors. (Pennel & Winner 1989)	Reduced product development costs by 30%. Scrap rework cost reduced by 60%. (Pennel & Winner 1989)	60% savings in development time (Zangwill, 1993)
IBM	Fewer engineering changes; guaranteed producibilty and testability (Zangwill, 1993)	Reduced direct labour cost in system assembly by 50% (Pennel & Winner 1989)	40% reduction in electronic design cycle (Zangwill, 1993)
Hewlett Packard Instrument Division	Product failure rate reduced by 60%; scrap and rework reduced by 75% (Zangwill, 1993)	Inventory reductions of 62% (Pennel & Winner 1989). Product field failure rate reduced by 60%, scrap and rework reduced by 75% (Zangwill, 1993).	Reduced development cycle time by 35% (Zangwill, 1993).
Boeing Ballastic Systems Division	Floor inspection ration decrease by 66%; material shortages reduced from 12% to 0; and 99% defect free operation (Zangwill 1993)	Reduced labour rates by $28/hour, cost saving of 30% to 40% (Zangwill, 1993)	Part and materials lead time reduced by 30%; one part of design analysis reduced by over 90% (Zangwill, 1993)
Northtrop	Number of engineering changes reduced by 45%. Defects reduced by 35% (Zangwill, 1993)	30% saving on bid on a major product (Zangwill, 1993)	Part and assembly schedule reduced by 50% on two major subassemblies; span time reduced by 60% (Zangwill, 1993)

APPLYING CE TO CONSTRUCTION

The major difference between the teamwork concept in CE compared to the traditional teamwork concept for a construction project lies within the following factors:

- the removal of functional boundaries;
- the formation of the team from is made from the inception stage of the project;
- the main objective of the formation of the team is to enable the members to contribute in the design stage;
- team members may comprise of a wider range of members to include the client, major sub-contractors and major suppliers;
- the team is normally given adequate authority to make important design decisions; and
- the team support process changes from the traditionally design then build approach to more flexible concurrent (overlapping) development of project task.

inhibitors implementing CE to construction:

1. Psychological impact of fear to change and unwillingness to accept the risk associated to it.
2. Fear of losing power to control and domination over the project design and planning phase by the traditional project manager or designer.
3. Lack of knowledge of concurrent engineering concepts and practice.
4. Fear of lack of budget to support the use of IT tools especially in the small project.
5. Concern over the legal implications resulted from CE implementation.

Limitation of the current Design and Build procurement approach

- Clients incur extra costs in retaining a set of consultants at the early stages of the project.

- The outline design which forms the basis of tenders is based on the initial consultants interpretation of client requirements - this may be distorted and could mislead the tendering consortia.

- The outline design inhibits the ingenuity and creativity of the tendering consortia by limiting them to the initial consultants' vision of the desired facility.

- There is a significant amount of rework and duplication inherent in existing procedures, particularly where the initial consultants are not novated to the successful contractor.

- The expertise of the successful consortium is not fully exploited in the most influential stage of the design process -conceptual and preliminary design

- Delays often arise due to the initial time spent developing the outline design, time spent by the successful consortium in clarifying client requirements and liasing with the initial consultants and time spent seeking approval for alternative materials and design changes.

- There is great potential for disputes and claims at the construction stage due to the client's requirements not being well-defined at the early stages. These problems often relate to cost, quality and performance requirements
- Quality, value for money and client satisfaction are not guaranteed by existing procedures.

According to Carter (1992), CE can be applied to any organisation by balancing the following three important concepts:

1. The organisation structure must be able to support the development team which should operate as a single entity.
2. An efficient communication structure is required to support free and speedy information exchange between team members.
3. An analysis of the product development life cycle should be carried out during the conception and design stages.

Evbuomwan and Anumba (1997) suggest the following key issues that must be address to implement CE in construction. The issues are:

1. The need to focus on the customer/owner/client.
2. The need to integrate the activities of the various functional disciplines involved in the project.
3. Carrying out competitive benchmarking of design and construction practices and processes.
4. Focussing on the quality, cost and delivery of projects.
5. Concurrently developing the design of the project along with the fabrication, construction and erection processes.
6. Establishing strategic relationships with materials and component suppliers and sub-contractors.
7. Integration of CAD and other design tools for concurrent engineering.
8. Use of modern project management techniques to enable paralleling and overlapping of the design and construction activities.
9. Integration and commonalization of design knowledge, data and information;
10. The use of new materials and technologies;
11. The effective use of computer hardware and software.

OVERVIEW OF PROJECT MGT

WHAT IS PROJECT?

projects are temporary and unique.

A project can thus be defined in terms of its distinctive characteristics—a project is a temporary endeavour undertaken to create a unique product or service.

***Temporary means that every project has a* definite beginning and a definite end.**

***Unique means that the product or service is* different in some distinguishing way from all similar products or services.**

Project Definition from PMBOK

- Have specific objective to be completed within certain specifications
- Have define start or end date
- Have funding limits (if applicables)
- Consume human and non human resources
- Multifunctional (cross several functional line)

PROJECT MANAGEMENT

The project management approach is relatively modern. It is characterized by methods of restructuring management and adapting special management techniques, with the purpose of obtaining better control and use of existing resources.

project planning and project monitoring

Project management, on the other hand, involves project planning and project monitoring and includes such items as:

- Project planning
- Definition of work requirements
- Definition of quantity and quality of work
- Definition of resources needed
- Project monitoring
- Tracking progress
- Comparing actual outcome to predicted outcome
- Analyzing impact
- Making adjustments

Industry Context

- Multiple Disciplines
- Unique and Evolving Project Team
- Generally One—of a--kind Projects
- High Social/Political/ High Social/Political/Env Env. Implications . Implications
- Increasing sophistication of designs Increasing sophistication of designs

High

- Time pressure
- Cost and cost pressure (low profit)
- Complexity
- Uncertainty/Risk (cost, schedule, quality)
- Turnover of cost, Conflict & Litigation

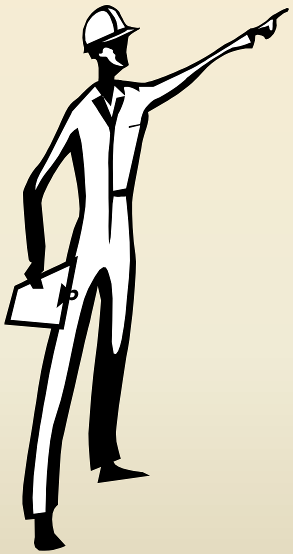
Major Issue to address in PM

- Meeting project constraint :
  - Time
  - Cost
  - Quality
  - Scoping
- Stakeholders management
- Meeting customer end users requirement
- Innovative idea generation
- Dealing with ethical Issue
- Political/social environment

Role of a Project Manager

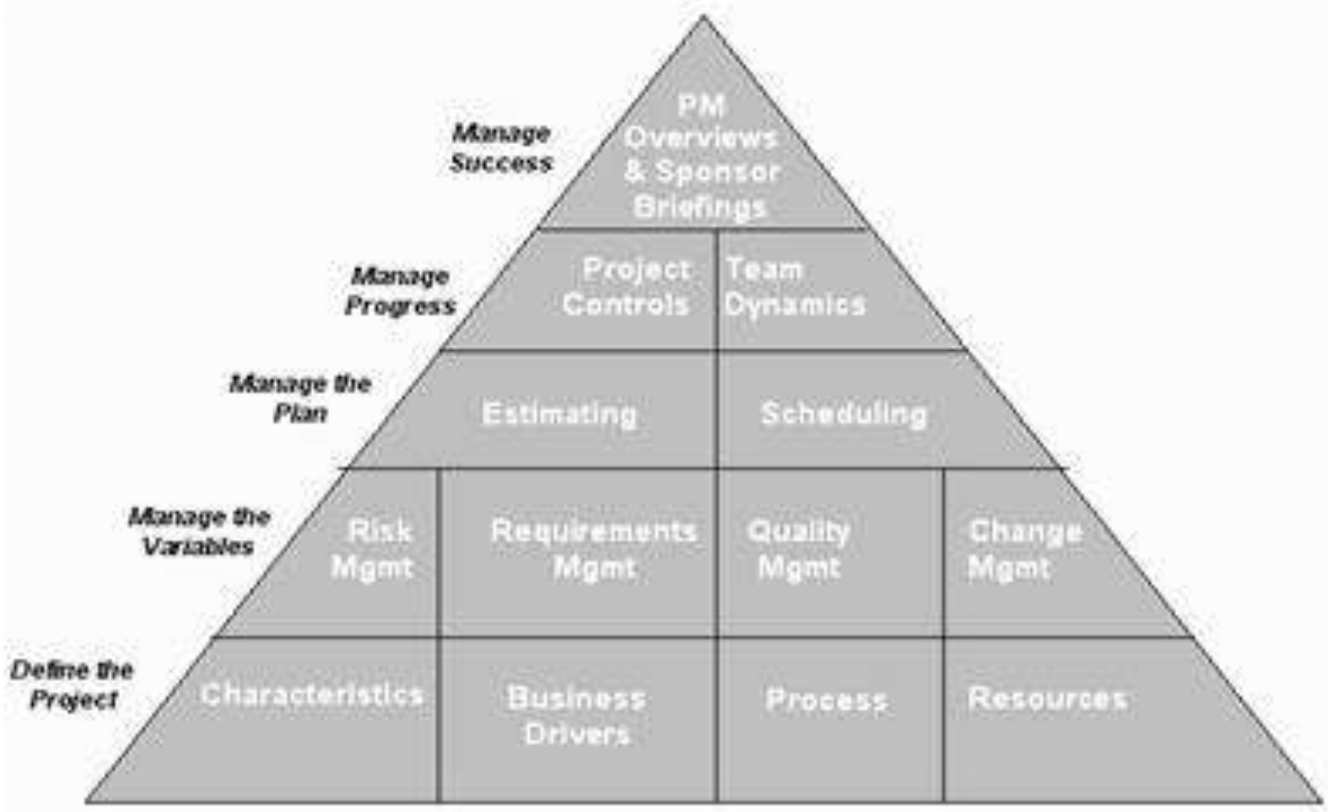
Process Responsibilities

- Project issues
- Disseminating project information
- Mitigating project risk
- Quality
- Managing scope
- Metrics
- Managing the overall work plan



People Responsibilities

- Implementing standard processes
- Establishing leadership skills
- Setting expectations
- Team building
- Communicator skills



PM Overviews & Sponsor Briefings
Manage Success
Project Controls
Team Dynamics
Manage Progress
Manage the Plan
Estimating
Scheduling
Manage the Variables
Risk Mgmt
Requirements Mgmt
Quality Mgmt
Change Mgmt
Define the Project
Characteristics
Business Drivers
Process
Resources

Successful project management can then be defined as having achieved the project objectives:

Within time

Within cost

At the desired performance/technology level

While utilizing the assigned resources effectively and efficiently

Accepted by the customer

PROJECT-DRIVEN VERSUS NON—PROJECT-DRIVEN ORGANIZATIONS

- Project-Based and Non—Project- either project- or non—project-driven (PMBOK)

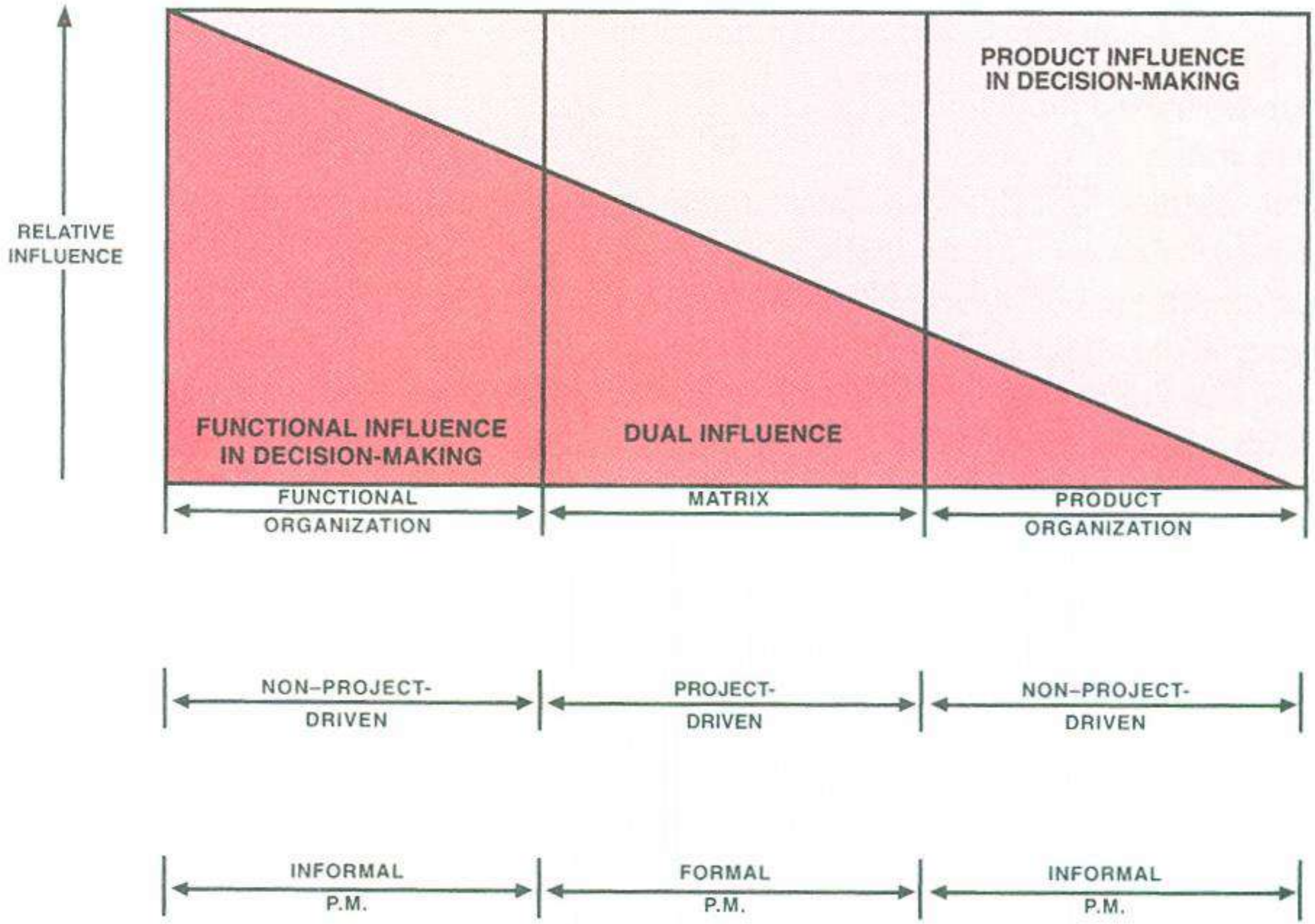


FIGURE 1–6. Decision-making influence.

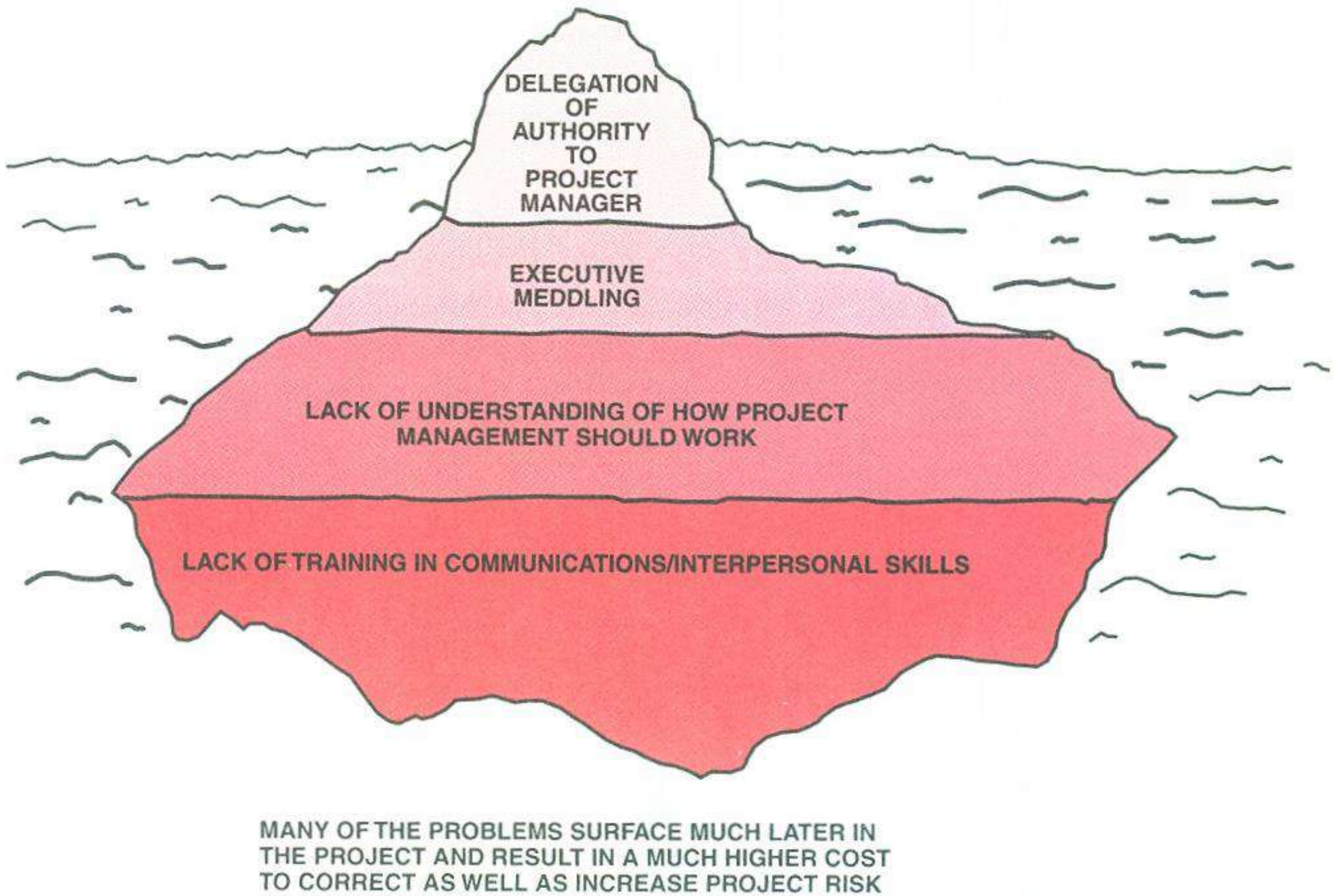


FIGURE 1–5. The tip-of-the-iceberg syndrome for matrix implementation.

Non—project-driven organizations

Non—project-driven organizations may also have a steady stream of projects, all of which are usually designed to enhance manufacturing operations. Some projects may be customer-requested, such as:

- The introduction of statistical dimensioning concepts to improve process control
- The introduction of process changes to enhance the final product
- The introduction of process change concepts to enhance product reliability

Project management in a non—project-driven organization is generally more difficult for these reasons:

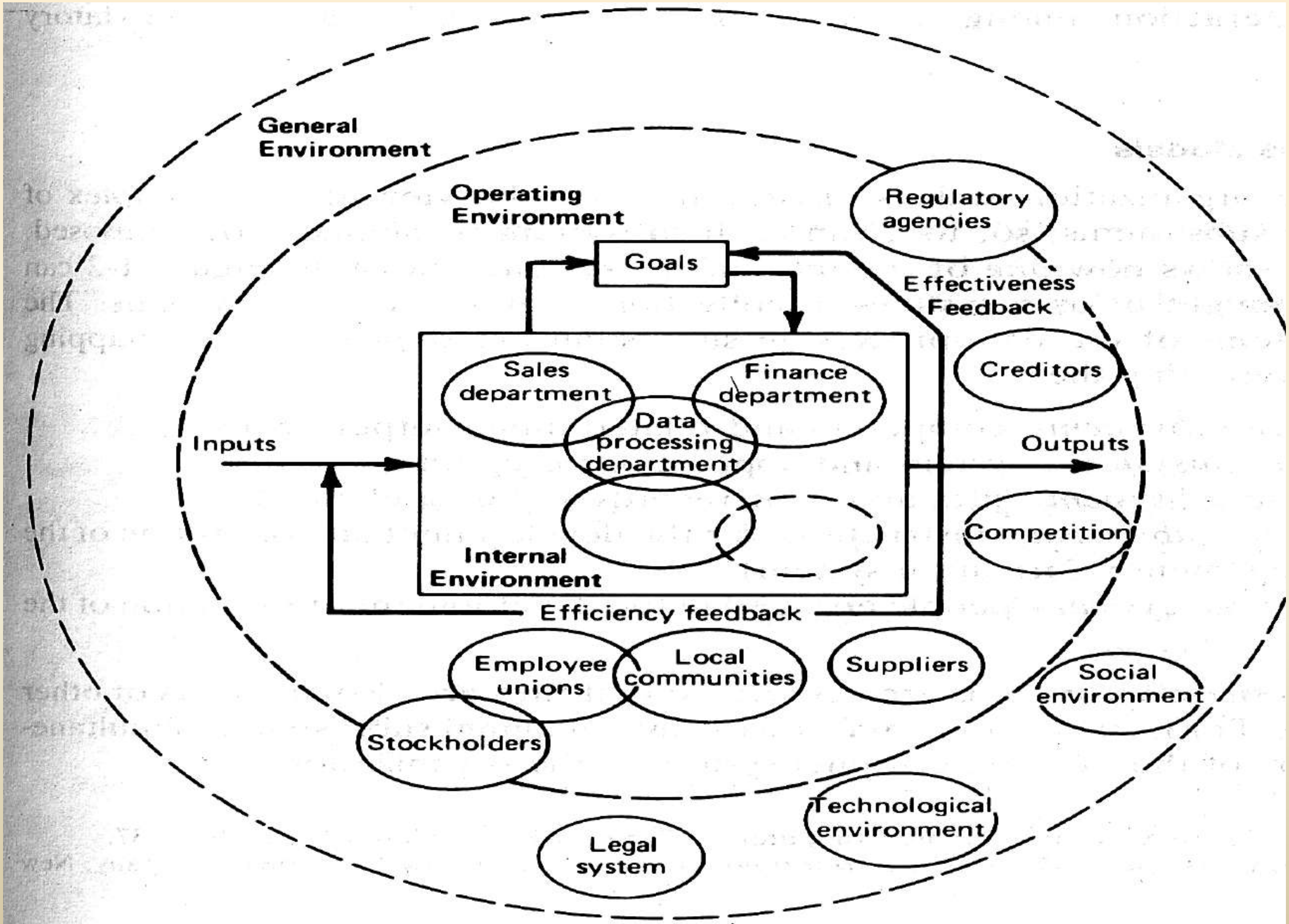
- Projects may be few and far between.
- Not all projects have the same project management requirements and therefore they cannot he managed identically. This difficulty results from poor understanding of project management and a reluctance of companies to invest in proper training.
- Executives do not have sufficient time to manage projects themselves, yet refuse to delegate authority.
- Projects tend to be delayed because approvals most often follow the vertical chain of command. As a result, project work stays too long in functional departments.
- Because project staffing is on a “local” basis, only a portion of the organization understands project management and sees the system in action.
- There is heavy dependence on subcontractors and outside agencies for project management expertise.

General management

•responsible for managing the status quo
•authority defined by management structure consistent set of tasks
•responsibility limited to their own function
•works in 'permanent' organisational structures
•tasks described as `maintenance'
•main task is optimisation
•success determined by achievement of interim targets
•limited set of variables

Project management

- responsible for overseeing change
- lines of authority 'fuzzy'
- ever-changing set of tasks
- responsibility for cross-functional activities
- operates within structures which exist for the life of the project
- predominantly concerned with innovation
- main task is the resolution of conflict
- success determined by achievement of stated end-goals
- contains intrinsic uncertainties


General Environment
Operating Environment
Goals
Regulatory agencies
Effectiveness Feedback
Sales department
Finance department
Data processing department
Creditors
Inputs
Outputs
Competition
Internal Environment
Efficiency feedback
Employee unions
Local communities
Suppliers
Social environment
Stockholders
Technological environment
Legal system

Momentum in project life cycle

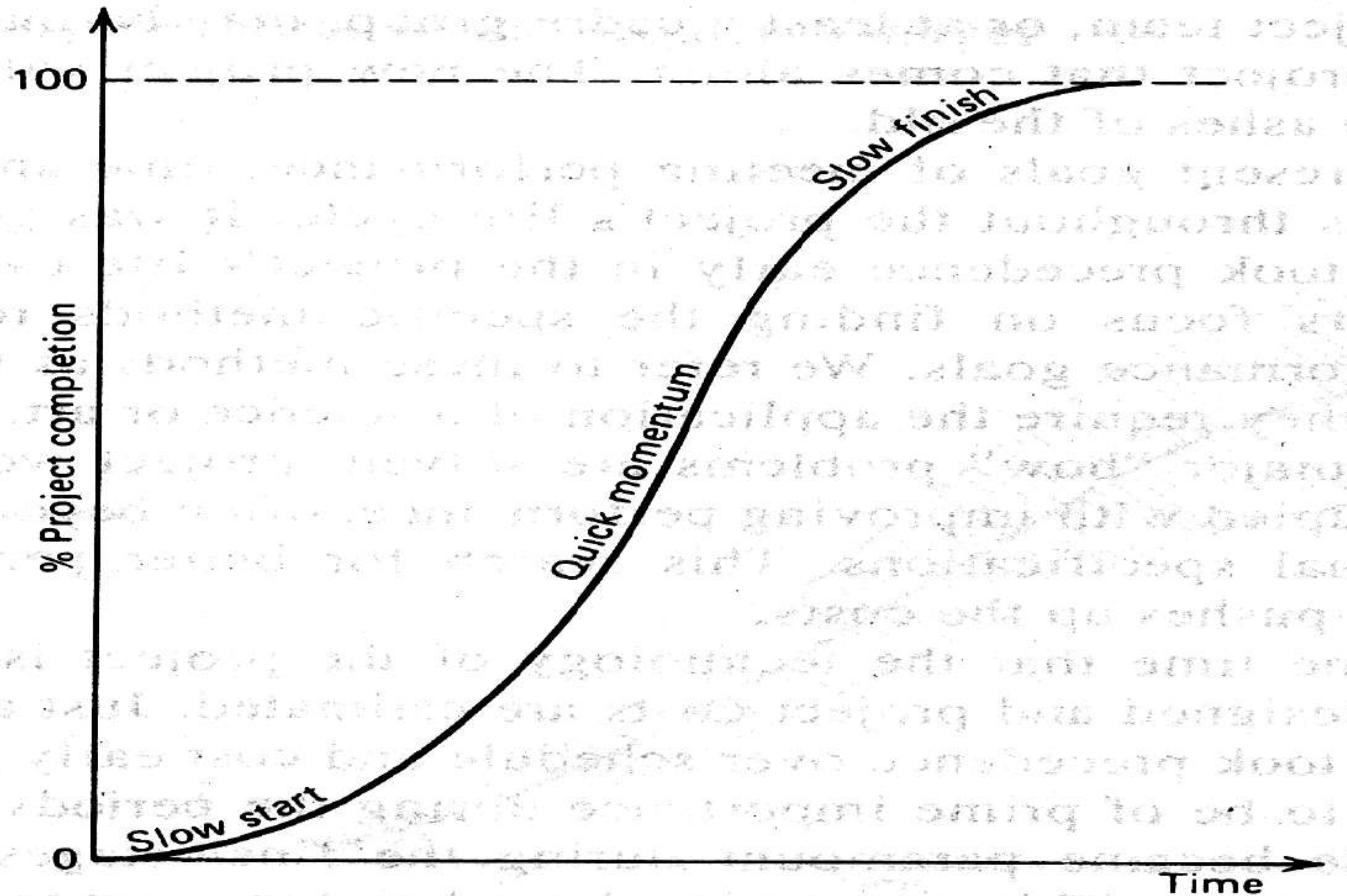


Figure 1-2 The project life cycle.

Benefits from project management

- Identification of functional responsibilities to ensure that all activities are accounted for, regardless of personnel turnover
- Minimizing the need for continuous reporting
- Identification of time limits for *scheduling*
- Identification of a methodology for trade-off analysis
- Measurement of accomplishment against plans
- Early identification of problems so that corrective action may follow
- Improved estimating capability for future planning
- Knowing when objectives cannot be met or will be exceeded

Obstacles in PM

Unfortunately, the benefits cannot be achieved without overcoming obstacles such as:

- Project complexity
- Customer's special requirements and scope changes
- Organizational restructuring
- Project risks
- Changes in technology
- Forward planning and pricing

STAKEHOLDERS

Organizational stakeholders

- Executive officers
- Line managers
- Employees
- Unions

Product/market stakeholders

- Customers
- Suppliers
- Local committees Governments (local, state, and federal)
- General public

STAKEHOLDERS

Capital market stakeholders

- Shareholders
- Creditors
- Banks

DEFINING PROJECT SUCCESS

- Within the allocated time period
- Within the budgeted cost
- At the proper performance or specification level
- With acceptance by the customer/user
- With minimum or mutually agreed upon scope changes
- Without disturbing the main work flow of the organization
- Without changing the corporate culture

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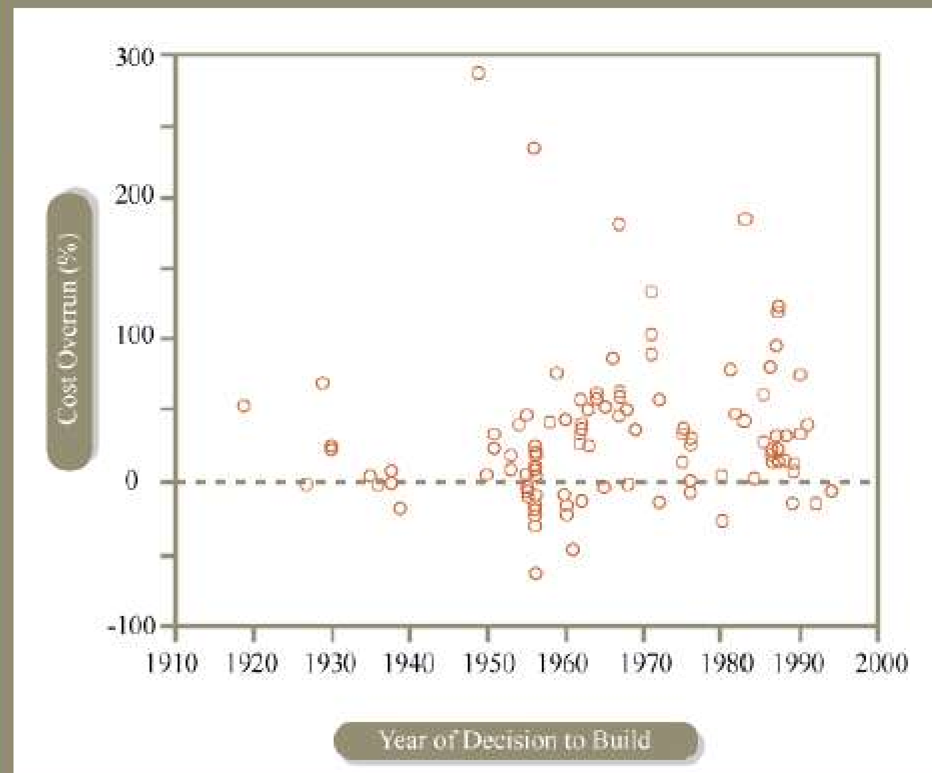
Financial Services

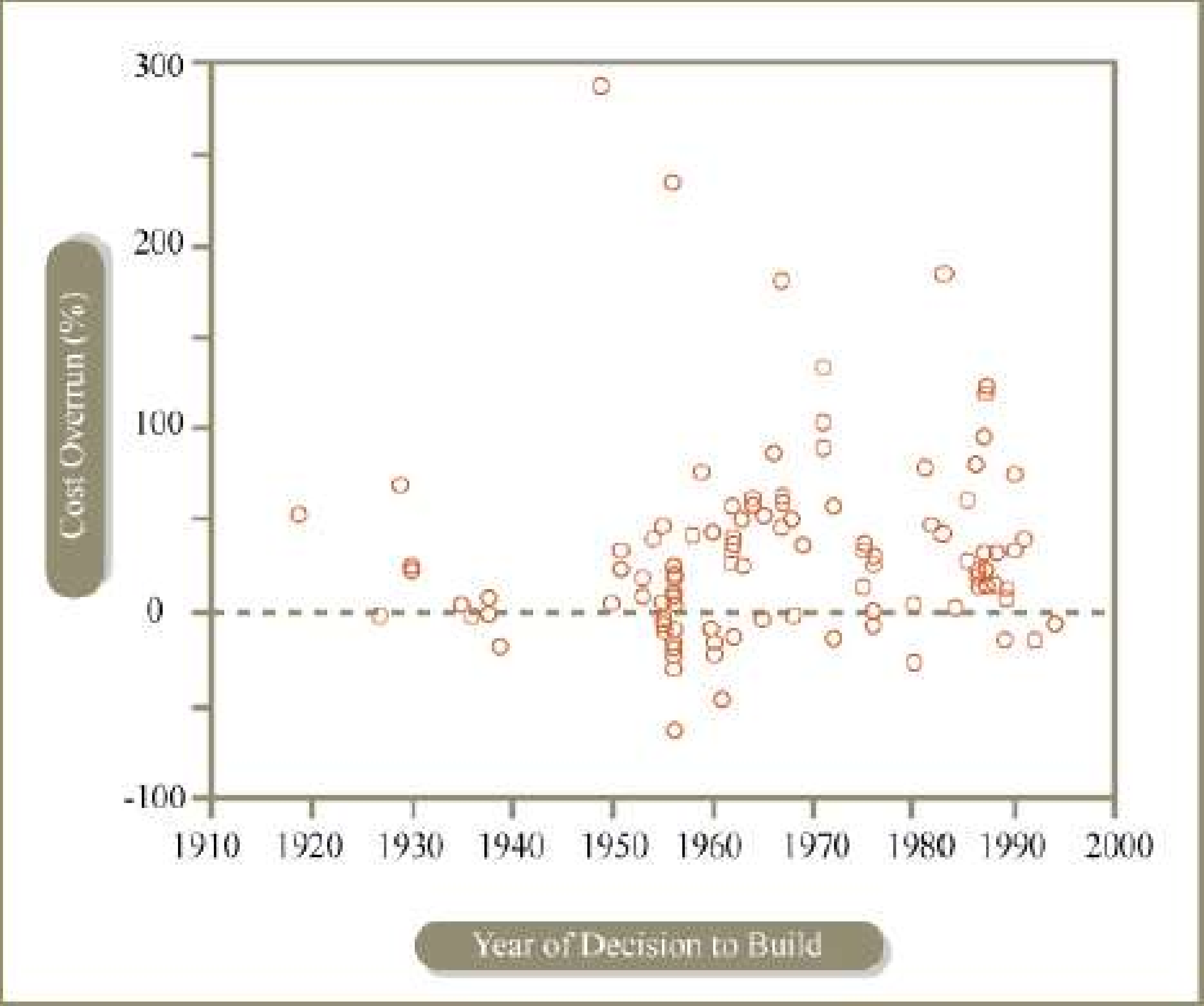
Uncertainty in Construction
Uncertainty in Final Project Cost I



A century of cost overrun in 111 projects (constant prices)

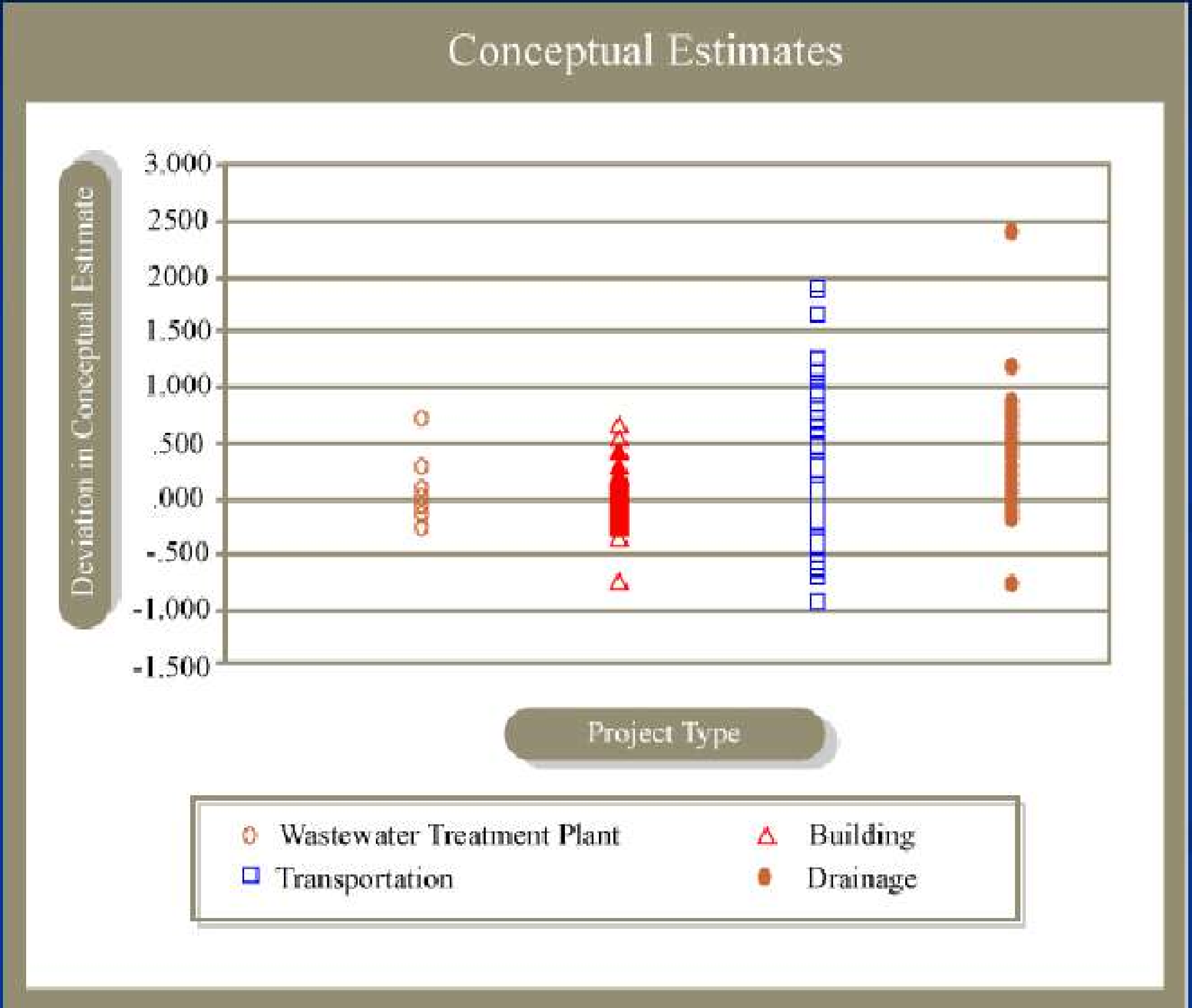
Uncertainty in Final Project Cost II

Uncertainty in Construction
Uncertainty in Final Project Cost I



A century of cost overrun in 111 projects (constant prices)

Uncertainty in Final Project Cost II



UNCERTAINTY IN FINAL COST III

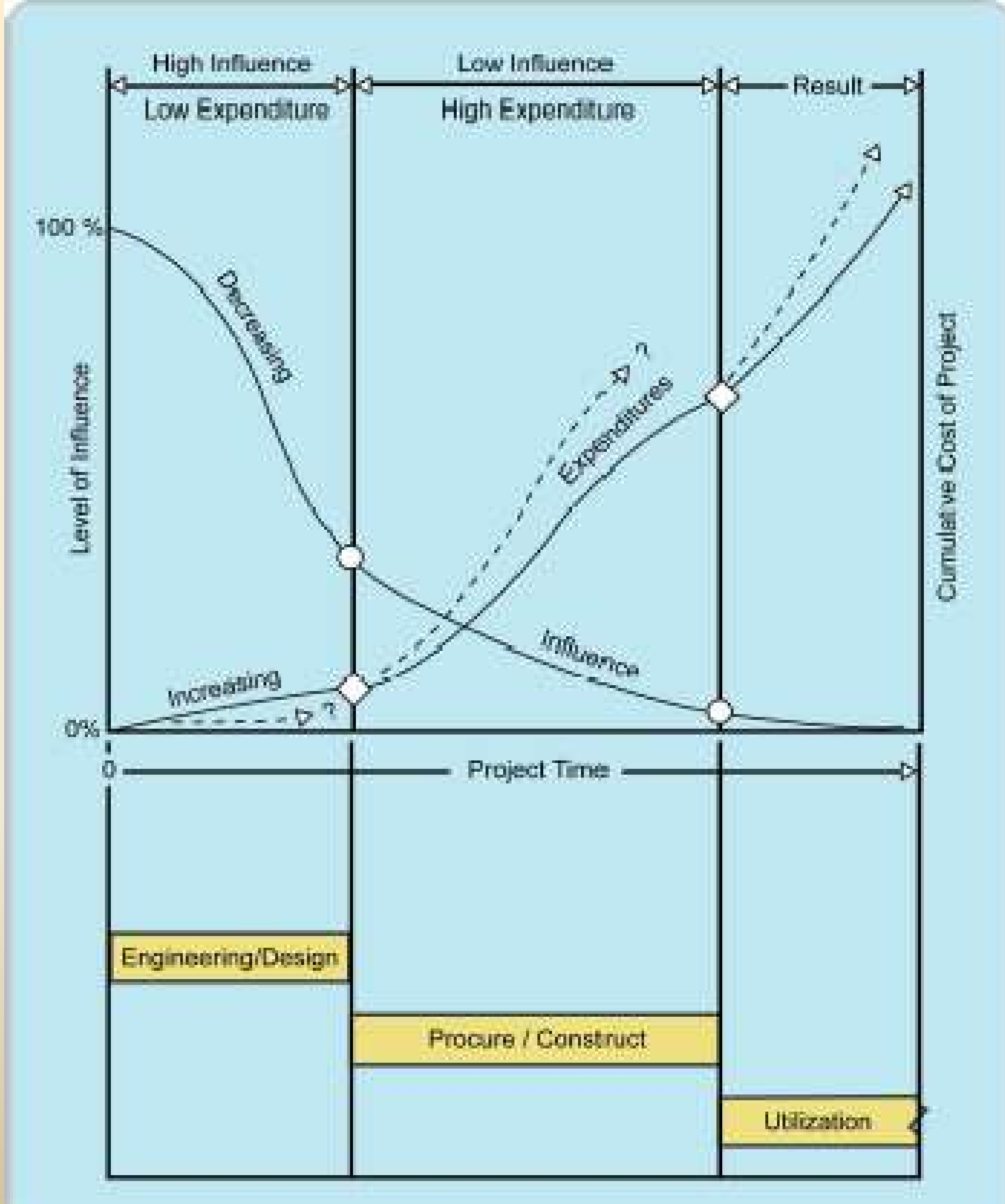
A calamitous history of cost overrun

Spectacular Projects with Spectacular Cost Overruns

PROJECT	COST OVERRUN (%)
Suez Canal	1,900
Sydney Opera House	1,400
Concorde Supersonic Aeroplane	1,100
Panama Canal	200
Brooklyn Bridge	100

Sources: Peter Hall, 'Great Planning Disasters Revisited', p. 3; Robert Summers, 'Cost Estimates as Predictors of Actual Costs: A Statistical Study of Military Developments', in Thomas Marschak *et al.*, eds., *Strategy for R&D: Studies in the Microeconomics of Development* (Berlin: Springer-Verlag, 1967), p. 148; and Mette K. Skamris, 'Economic Appraisal of Large-Scale Transport Infrastructure Investments', Ph.D dissertation (Aalborg: Aalborg University, 2000).

Project Expenditure



Recurrent Theme

- Complexity
- Performance ($, time, quality)
- Uncertainty and Risk
- Incentive
- Conflict
- Crucial role of qualitative and quantitative factors

Causes of Project Failure

- Failure to establish upper-management commitment to the project
- Lack of organization's commitment to the system development methodology
- Taking shortcuts through or around the system development methodology
- Poor expectations management
- Premature commitment to a fixed budget and schedule
- Poor estimating techniques
- Over optimism
- The mythical man-month (Brooks, 1975)
- Inadequate people management skills
- Failure to adapt to business change
- Insufficient resources
- Failure to "manage to the plan"

Project Success

“ The technical aspects, timing, and cost were the three critical areas of performance measurement for our project managers. In today’s world, that is not sufficient. We have to also be concerned with environmental and safety regulations, the quality, customer satisfaction, and delivering the productivity for the manufacturing operations. So a project now has at least eight measurable and critical parameters around which we gauge success. “

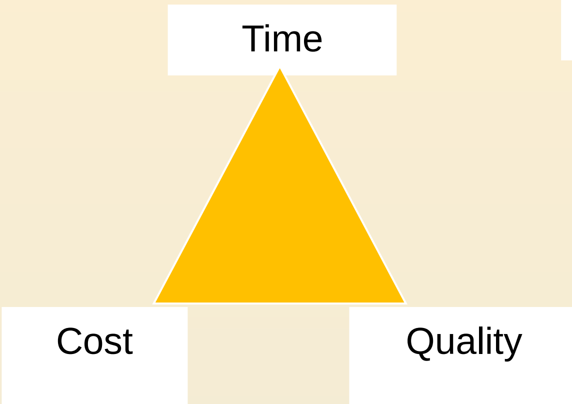
Brian Vannoni, formerly of General Electric Plastics.

Project success	=	Project management success	+	Project product success

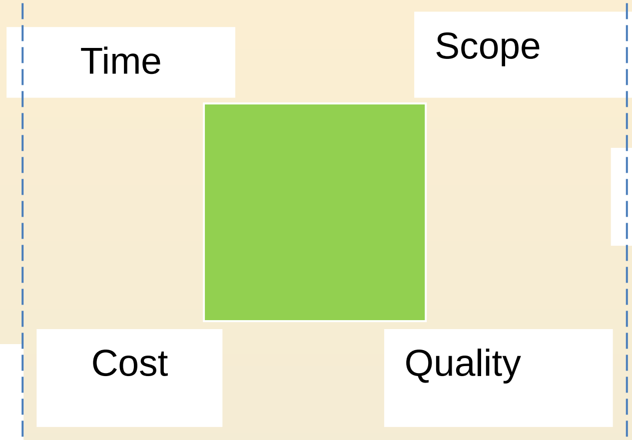
Baccarini (1999)

Project Management Success	Project Product Success
Meeting time cost and quality objectives	Meeting the project owner’s strategic organizational objectives
Quality of the project management process	Satisfaction of users’ needs
Satisfying project stakeholders needs related to the project management process	Satisfaction of stakeholders, needs when related to the product

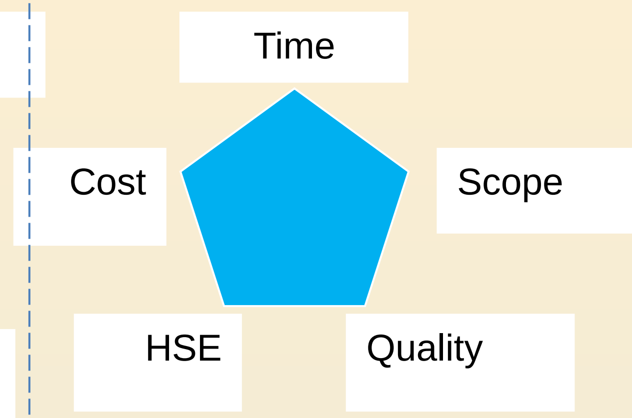
(Jayasuria, 2010)



Project Management's Classic Triangle of Success

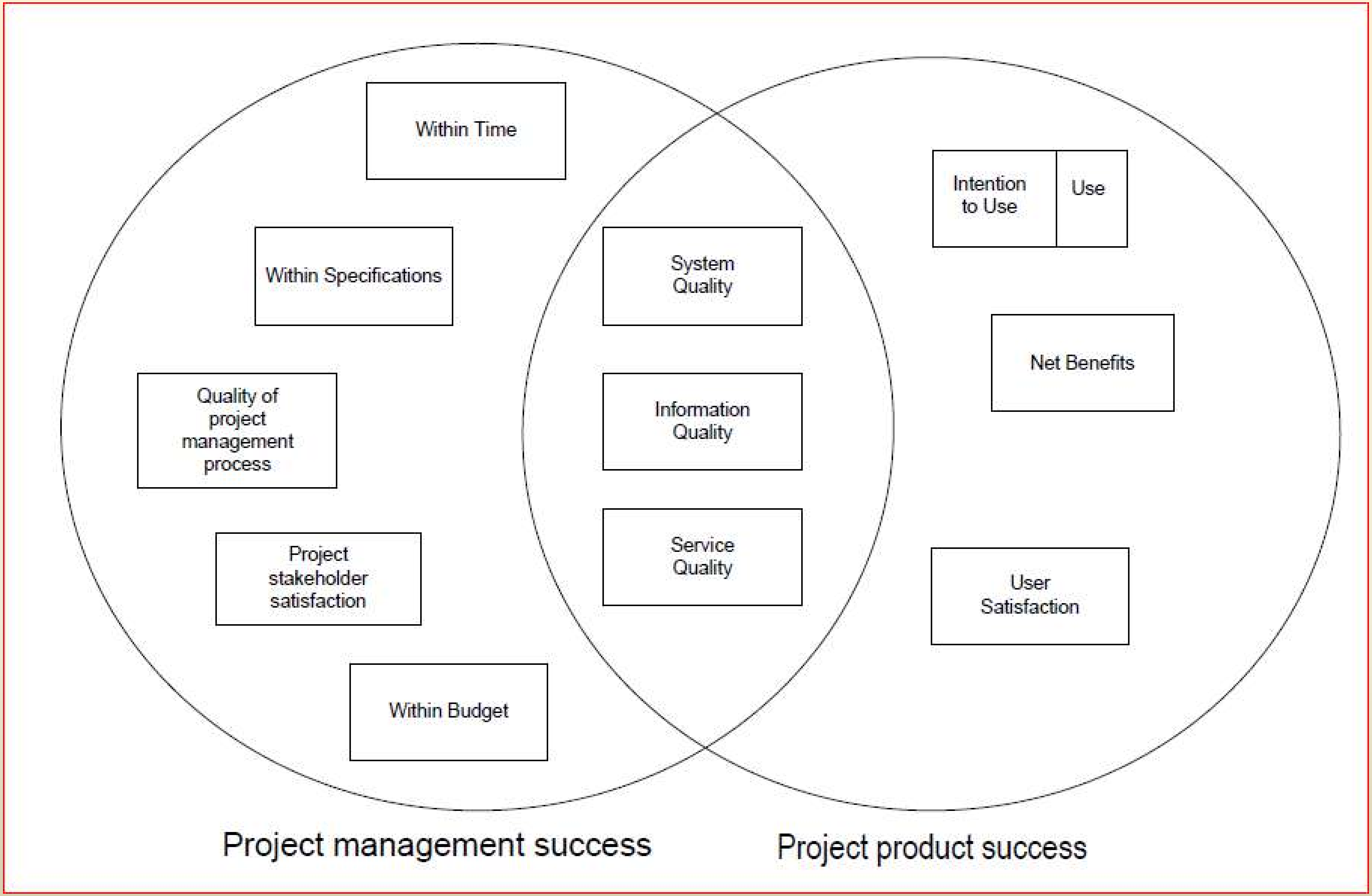


Four Criteria for Project Management Success



Five Criteria for Project Management Success

(Dinsmore and Cooke-Davies, 2006)


Within Time
Within Specifications
Quality of project management process
Project stakeholder satisfaction
Within Budget
System Quality
Information Quality
Service Quality
Intention to Use
Use
Net Benefits
User Satisfaction
Project management success
Project product success

Project that meet traditional success criteria and a success project

PT Newmont Nusa Tenggara's Batu Hijau Copper was commissioned in September 1999.

It was extremely complex construction project located at remote Indonesia Island of Sumbawa.

It was complete one month ahead of schedule and $100 million under budget.

It was considered successful.

Producing a cash flow from operations exceeding 200%

Batu Hijau Copper Concentrator

Project that not meet traditional success criteria but a success project

One of the most recognized buildings in the world.

Failure from project management perspective.

Construction started ain 1959, it was estimated to cost $7 million and take 4 years to build.

It was finally completed in 1973 for over $100 million.

Sydney Opera House

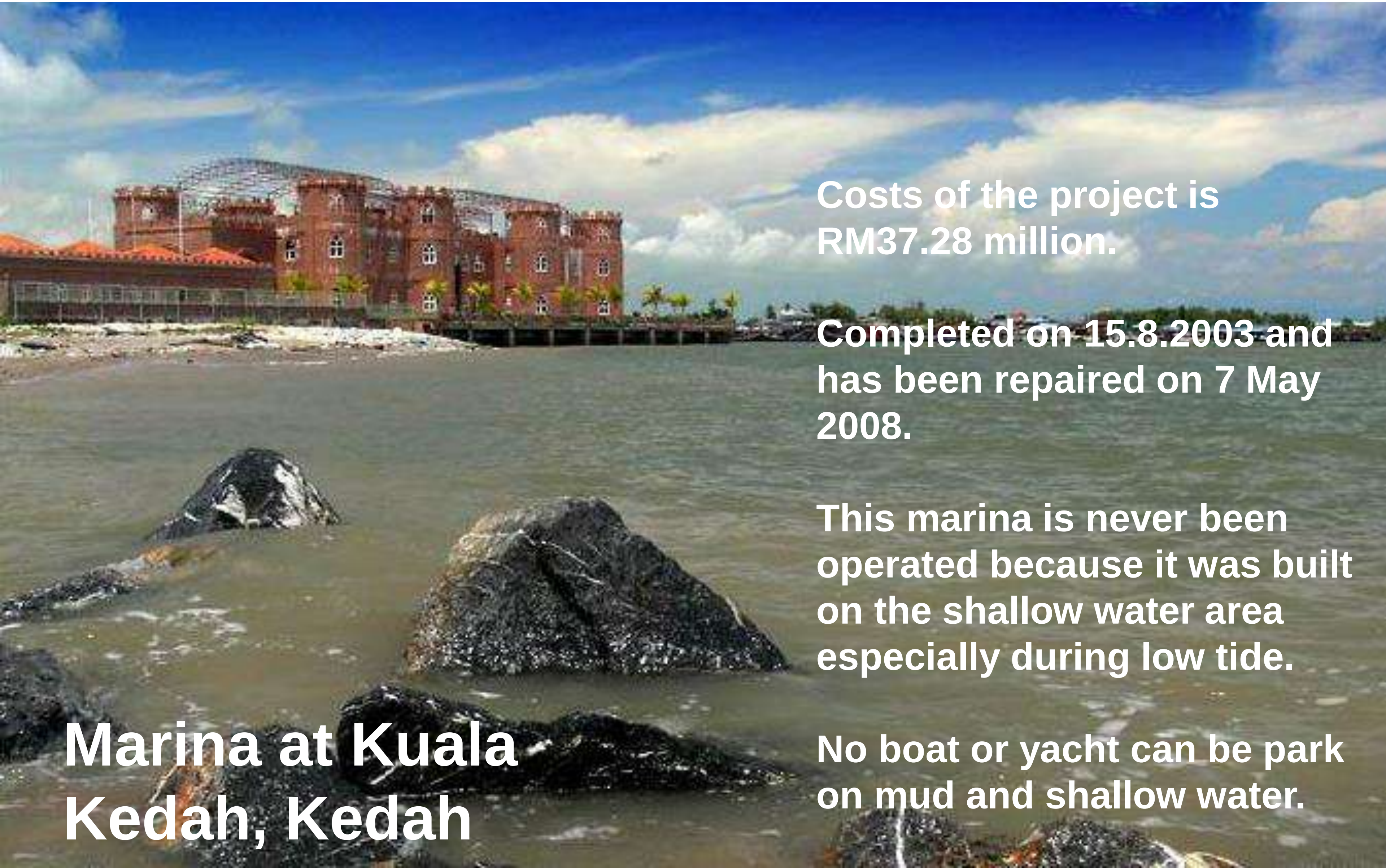
Sydney Opera House.

Sydney Opera House. With its graceful sails dominating Sydney Harbor, the Sydney Opera House is arguably one of the most recognized buildings in the world.

Yet, from a project management perspective, it was a spectacular failure. When construction started in 1959, it was estimated to cost $7 million, and take four years to build. It was finally completed in 1973 for over $100 million

(Architecture Week, 2003).

Project that meet traditional success criteria but not a success project



Costs of the project is RM37.28 million.

Completed on 15.8.2003 and has been repaired on 7 May 2008.

This marina is never been operated because it was built on the shallow water area especially during low tide.

No boat or yacht can be park on mud and shallow water.

Marina at Kuala Kedah, Kedah

2002 Olympic Winter Games.

2002 Olympic Winter Games. The 2002 Olympic Winter Games was a very successful project from a project management perspective:

- winning designation as PMI's 2003 International Project of the Year (Foti, 2004).
- it deviated from the conventional approach to "success" with respect to its cost performance. The project managers boast that they turned a $100 million deficit into a $400 million surplus,
- Clearly, success was measured by profitability, not by achieving a specific cost target.

JUST IN TIME

DEFINING JIT

- JIT is basically a disciplined approach to improving overall productivity and eliminating waste.

- It provides for the cost-effective production and delivery of only the necessary quantity of parts at the right quality, at the right time and place, while using a minimum amount of facilities, equipment, materials and human resources (Voss, 1987).

- It is an aggressive philosophy which stimulates workers to identify and resolve problems and operational weaknesses which hinder organizational effectiveness and efficiency (Schonberger, 1982; Hall. 1983).

A key element of JIT is simplification. JIT is seen as a philosophy of total pride in making the business lean. more simple and effective to operate, and with a higher degree of integration (Mortimer, 1986). JIT is in fact simplicity, efficiency and minimum waste.

The concept of JIT manufacturing systems is described by Schonberger (1982) as follows:

produce and deliver finished goods just in time to be sold, sub-assemblies just in time to be assembled into finished goods, fabricated parts just in time to go into sub-assemblies and purchased materials just in time to be transformed into fabricated parts. Like perfect quality, absolute just-in-time performance is never attained but rather is an ideal to be pursued aggressively.

JIT in the narrow sense means having only the necessary part at the necessary place at the necessary time.

Hall (1983) suggests the following principle of the Japanese manufacturing system:

1 Produce what the customer desires.
2 Produce products only at the rate the customer wants them.
3 Produce with perfect quality.

4 Produce instantaneously - with zero unnecessary lead time.

5 Produce with no waste of labour, materials or equipment; every mop has a purpose so there is zero idle inventory.

6 Produce by methods that allow for the development of people.

Monden (1983), who is more concerned with the technical aspects of JIT identifies the following as important basic elements of the JIT production system:

- 1 Smoothing of production - an effort should be made to minimise the fluctuations of production from a workstation to the next workstation If the subsequent process withdraws materials in a fluctuating mann with regard to quantity and time, then it becomes essential for tl preceding workstation to have enough inventory to meet this fluctuating demand.

- 2 Standardization of jobs.

- 3 Process designing - the machine layout should be re-arranged improve on the process and work flows to allow mufti-function workers to perform mufti-operations and operate on many machines. JIT, each worker is familiar with many functions and machine operations and can assist in time of troubles.

As a management philosophy, JIT is mainly concerned with creating the right environment for effective operations.

The first environment area is strategic. This covers the major, fundamental issues that govern the operation of the organization. Examples are the choice of products to be manufactured, the control mechanisms for the factory and the cost of production, including set-up time, scrap and other quality costs.

The second area is tactical, which is concerned with actions and decisions that have a relatively small impact on the operation of the organization. Examples are deciding job priority for a particular process or determining quantum to be purchased from an external supplier. The JIT approach seeks to focus attention away from the detailed tactical decision-making towards the more strategic areas to bring about greater effectiveness in the manufacturing processes.

- There is no one way of conceptualizing or classifying the principles of JIT The views of some key authors on Japanese manufacturing systems are presented here in order to distill from these views some general guiding principles of JIT for application.
- Professor Robert W. Hall (1983) in his seminal work on "Zer Inventories" states that JIT is not confined to a set of techniques ft improving production defined in the narrow sense as material conversion. is a way to visualize the physical operations of the company from raw material to customer delivery.