Total Quality Management

Introduction

- **Total** – Made up of the whole(or) Complete.
- **Quality** – Degree of Excellence a product or service provides to the customer in present and future.
- **Management** – Act , art, or manner of handling , controlling, directing, etc.

TQM is the art of managing the whole to achieve excellence.

"TQM is a management approach for an organization, centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to society."

Definition

TQM is composed of three paradigms:

Total: Organization wide

Quality: With its usual Definitions, with all its complexities (External Definition)

Management: The system of managing with steps like Plan, Organise, Control, Lead, Staff, etc.

Definition

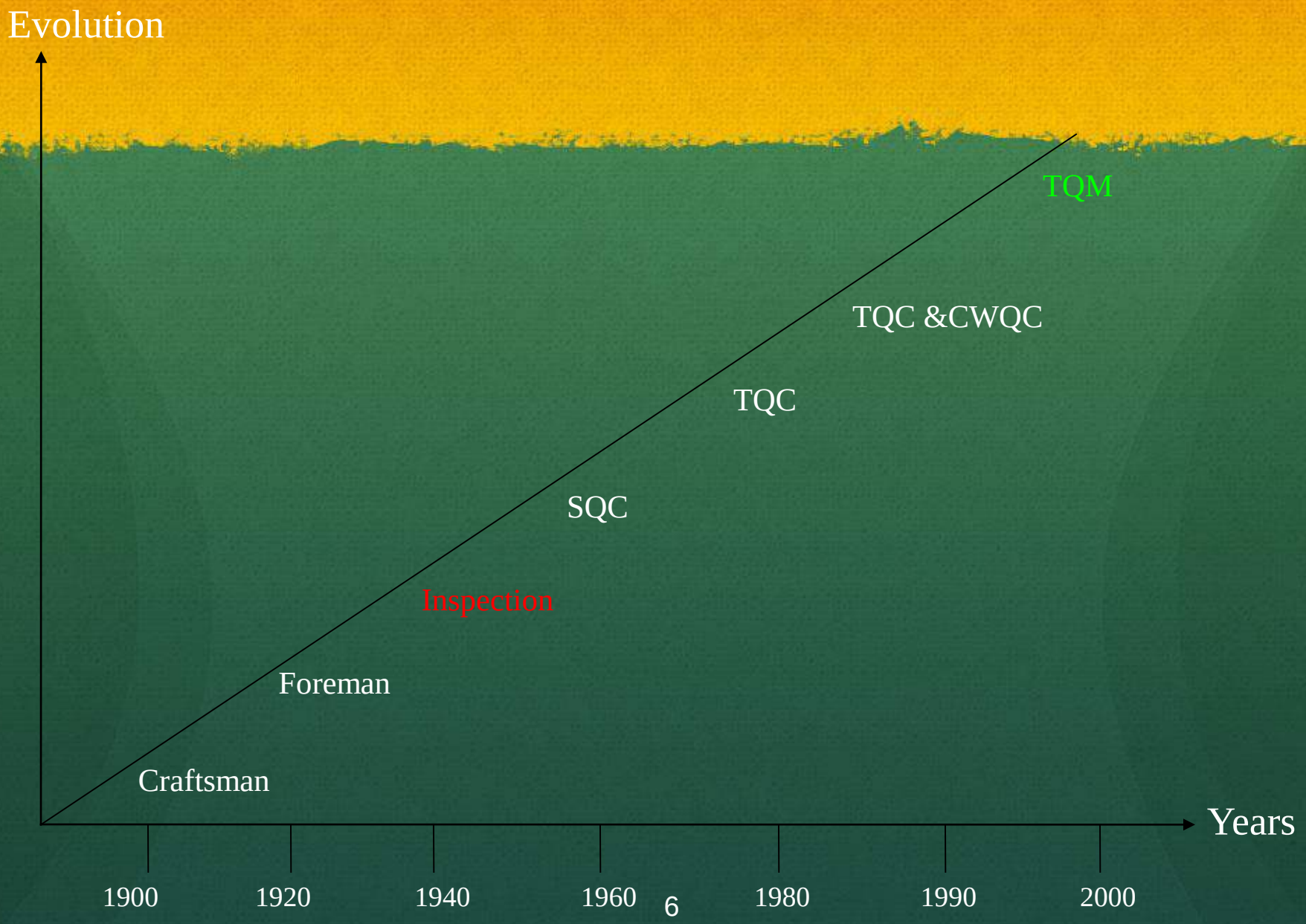
Total Quality Management (**TQM**) is a management strategy aimed at embedding awareness of quality in all organizational processes.

Explanation

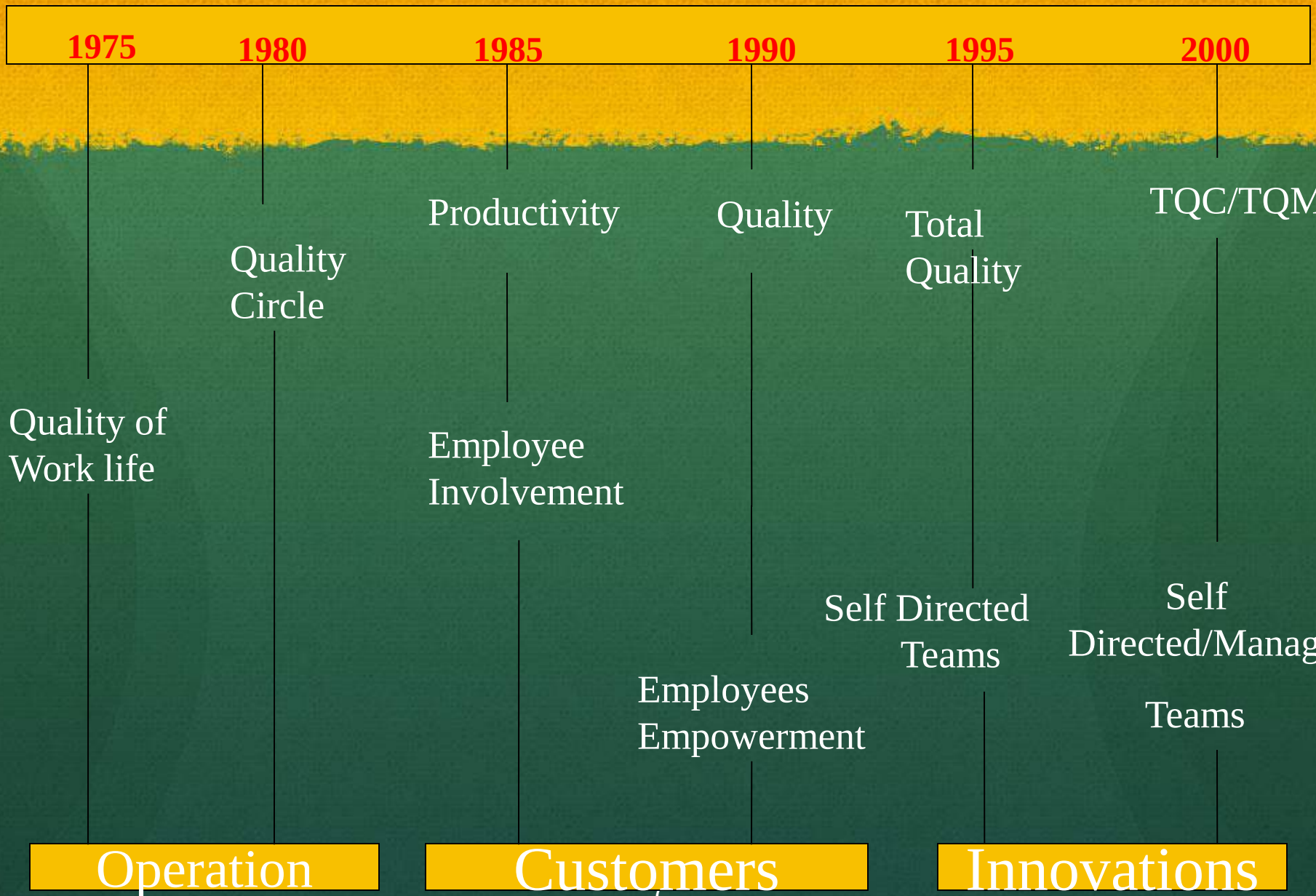
TQM requires that the company maintain this quality standard in all aspects of its business.

This requires ensuring that things are done right the first time and that defects and waste are eliminated from operations.

Evolution of quality Era



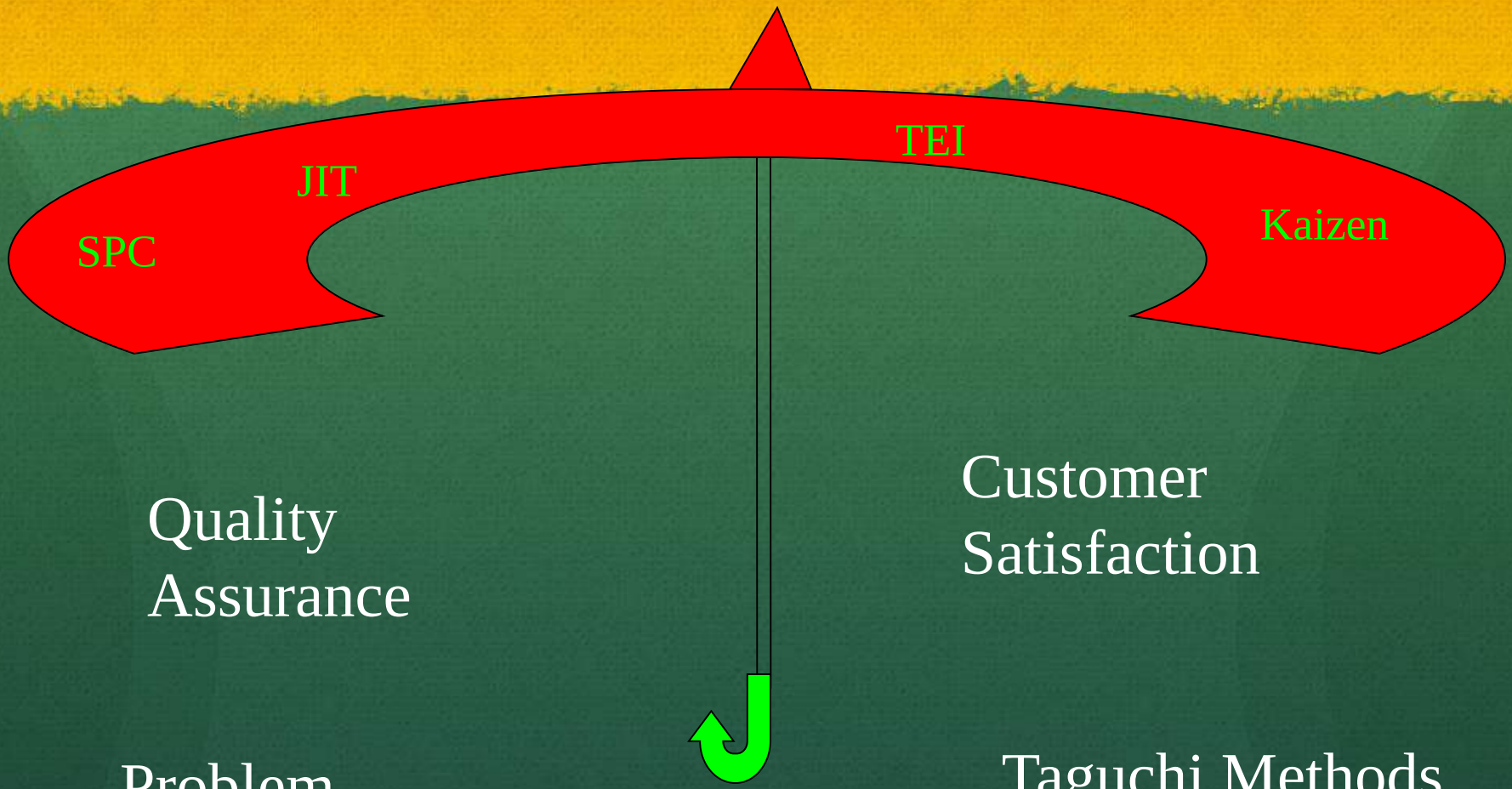
Evolution of quality –Means & Focus



Kano's Model

Figure 1. Kano Model

Umbrella Model of TQM



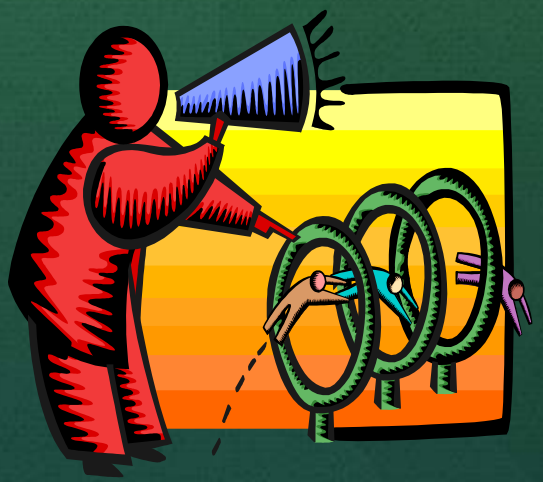
JIT

Benefits :

1. Product cost
2. Quality
3. Design
4. Productivity improvement
5. Higher production system flexibility
6. Administrative ease and simplicity

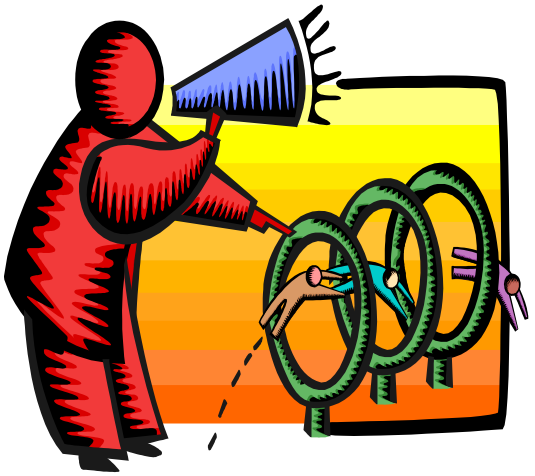
Basic Approach

- A committed and involved management to provide long-term top - to - bottom organizational support.
- An unwavering focus on the customer, both internally and externally. (explain ic* and ec*)
- Effective involvement and utilization of the entire work force.

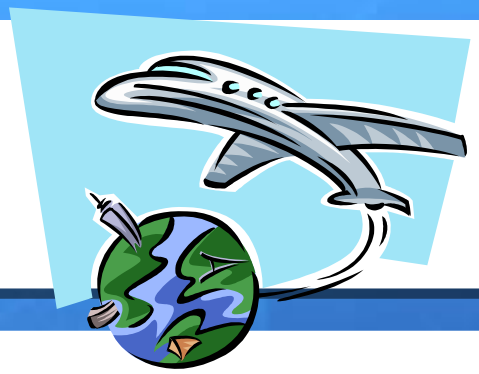


Basic Approach

- Continuous improvement of the business and production process.
- Treating supplier as partners.
- Establish performance measures for the processes.

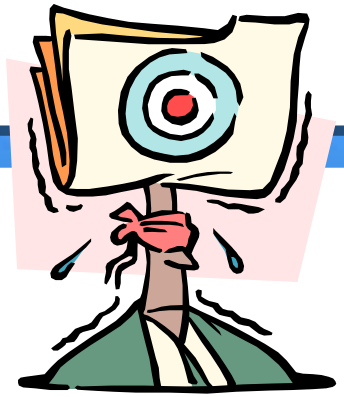


New and Old Cultures



Quality Element	TQM
Definition –	Product Customer
+ Priorities -	Service & Cost Quality
+ Decisions-	Short Long
+ Emphasis-	Detection Prevention

Real Life



- TQM has being implemented in TVS Group.
- Boeing Aircraft
- Reliance
- Tata L & T HMT
- ITI

Guru's of TQM

- Walter.A.Shewhart -TQC &PDSA
- W.Edwards Deming- 14 Points & PDCA
- Joseph.M.Juran-Juran's Trilogy
- A.Feiganbaum-Customer requirement,CWQC,Employee Involvement, TQC.

Guru’s of TQM

- Ishikawa-Disciple of Juran. TQC in Japan, SPC, Cause &Effect Diagram, QC.
- Philips.B.Crosby. Four Absolutes-Quality-Req,
- Taguchi.G-Loss Function.

Definitions

ISO 9000:2000

Quality is the degree to which a set of inherent characteristics fullfils requirements.

Quantified

Q=P/E P-Performance

E-Expectations

- **Joseph M. Juran Quality is fitness for use or purpose**

Definitions

And distribution of consistently low cost and products and services that customers need and want.

Dimensions of Quality

Product- TV

Performance - Primary Characteristics,such as brightness

Features –Secondary Characteristics,Remote Control

Conformance-Meeting Specifications or Standards

Reliability –Consistency of Performance over time-fail

Durability- Useful life ,include Repair. Service

Dimensions of Quality

Durability- Useful life ,include repair.

Service-Resolution of problems,ease of repair.

Response- Human relations with Customers.

Aesthetics-Sensory Features.

Reputation- Past performance, Company Image.

Quality Cost

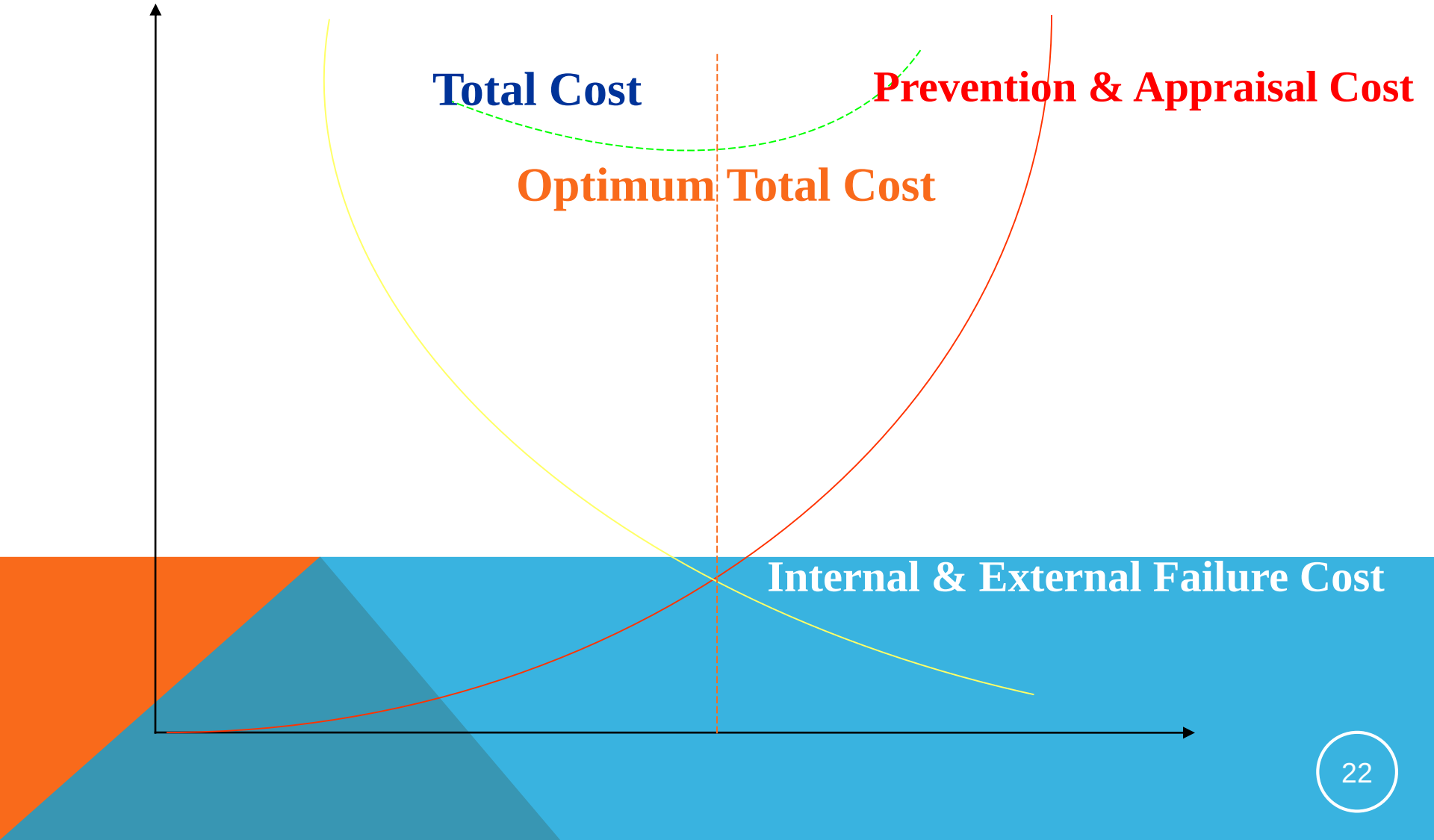
Prevention Cost –Planning, Document, Control, Training

Appraisal Cost –Inspection & Tests, Installation, Calibration, M/c Depreciation, Reports & Rejects.

Internal Failure Cost – Scraps, Repair Rework, Design Changes, Defect Failure Analysis, Retests & ReInspection, Downgrading, Down Time.

External Failure Cost – Complaints, Goodwill, Failures, Services & Replacement, Guarantee & Warranty, Compensation, Recall, Loss of Sales, Seconds Sales.

Economics of Quality of Conformance



Obstacles

Top management commitment

Changing Organization Culture

Improper planning

Continuous Training & Education

Obstacles

Organization Structure & Departments

Data's & Facts For Effective Decisions

Internal & External Customers-Dissatisfaction

Empowerment & Teamwork

Continuous Improvement

Benefits

Improved Quality

Employee Participation

Team Work

Internal & External Customer Satisfaction

Productivity ,Communication

Profitability & Market Share

History of quality management

…To know the future, know the past!

- **Before Industrial Revolution, skilled craftsmen served both as manufacturers and inspectors, building quality into their products through their considerable *pride in their workmanship*.**
- **Industrial Revolution changed this basic concept to *interchangeable parts*. Likes of Thomas Jefferson and F. W. Taylor ("scientific management" fame) emphasized on production efficiency and decomposed jobs into smaller work tasks. Holistic nature of manufacturing rejected!**

History of quality management

- ***Statistical approaches to quality control*** **started at Western Electric with the separation of inspection division. Pioneers like Walter Shewhart, George Edwards, W. Edwards Deming and Joseph M. Juran were all employees of Western Electric.**
- **After World War II, under General MacArthur's Japan rebuilding plan, Deming and Juran went to Japan.**
- **Deming and Juran introduced statistical quality control theory to Japanese industry.**
- **The difference between approaches to quality in USA and Japan: Deming and Juran were able to *convince the top managers the importance of quality*.**

History of quality management

- **Next 20 odd years, when top managers in USA focused on marketing, production quantity and financial performance, *Japanese managers improved quality* at an unprecedented rate.**
- **Market started preferring Japanese products and American companies suffered immensely.**
- **America woke up to the quality revolution in early 1980s. *Ford Motor Company consulted Dr. Deming* to help transform its operations.**

(By then, 80-year-old Deming was virtually unknown in USA. Whereas Japanese government had instituted The Deming Prize for Quality in 1950.)

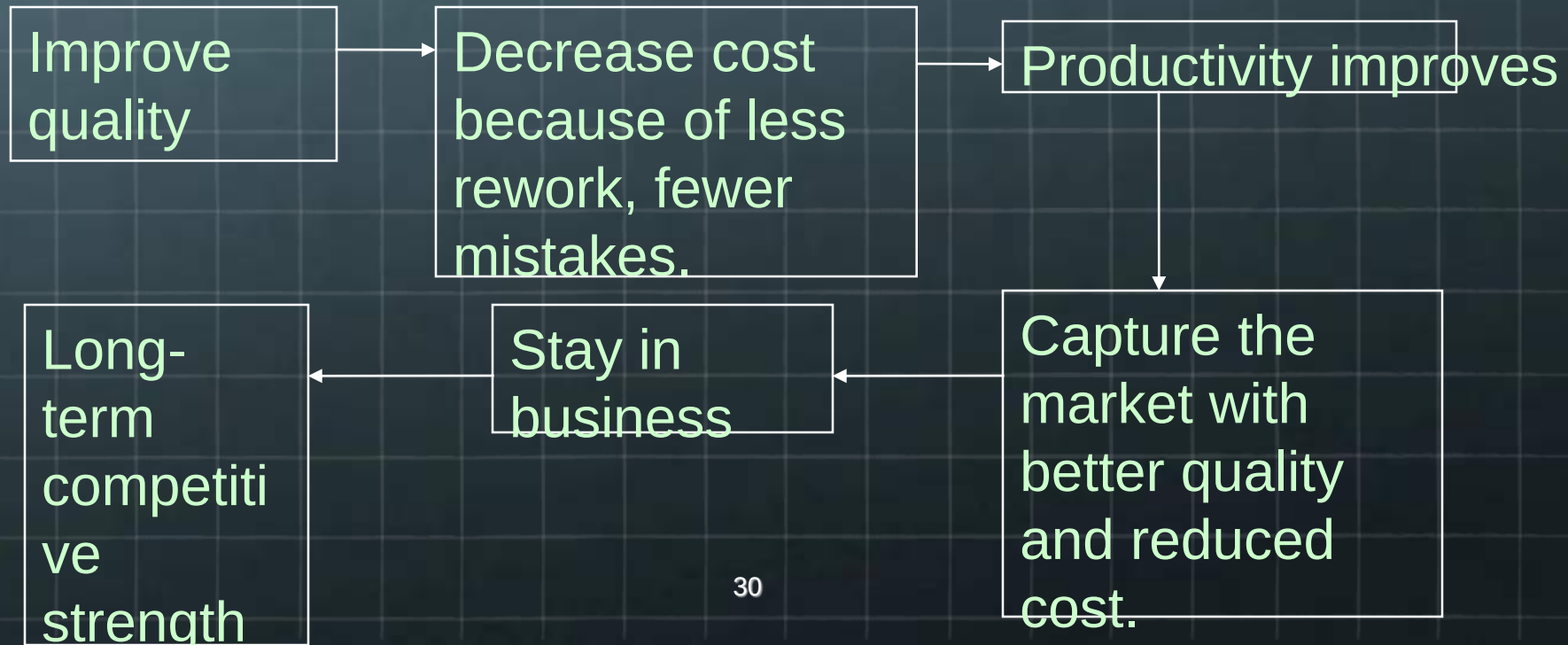
History of quality management

- Managers started to realize that "quality of management" is more important than "management of quality." Birth of the term *Total Quality Management (TQM).*
- *TQM – Integration of quality principles into organization's management systems.*
- Early 1990s: Quality management principles started finding their way in *service industry*. FedEx, The Ritz-Carton Hotel Company were the quality leaders.
- *TQM recognized worldwide*: Countries like Korea, India, Spain and Brazil are mounting efforts to increase quality awareness.

Evolution of TQM philosophies

- **The Deming Philosophy**

Definition of quality, "A product or a service possesses quality if it helps somebody and enjoys a good and sustainable market."



Total Quality Management (TQM)

Deming's 14 Point Plan for TQM

1	Create constancy of purpose	8	Drive out fear
2	Adopt the new philosophy	9	Eliminate boundaries
3	Cease inspection, require evidence	10	Eliminate the use of slogans
4	Improve the quality of supplies	11	Eliminate numerical standards
5	Continuously improve production	12	Let people be proud of their work
6	Train and educate all employees	13	Encourage self-improvement
7	Supervisors must help people	14	Commit to ever-improving quality

The Deming philosophy

14 points for management:

1. **Create and publish to all employees a *statement of the aims and purposes* of the company. The management must demonstrate their commitment to this statement.**
2. ***Learn* the new philosophy.**
3. **Understand the *purpose of inspection* – to reduce the cost and improve the processes.**
4. ***End* the practice of awarding business on the *basis of price tag* alone.**
5. ***Improve constantly* and forever the system of production and service.**

The Deming philosophy

6. Institute training
7. Teach and institute *leadership*.
8. Drive out fear. Create an *environment of innovation*.
9. *Optimize the team efforts* towards the aims and purposes of the company.
10. Eliminate exhortations for the workforce.
11. Eliminate *numerical quotas* for production.
12. Remove the barriers that rob *pride of workmanship*.
13. Encourage *learning and self-improvement*.
14. Take action to accomplish the transformation.

The Deming philosophy

- "A System of Profound Knowledge"

1. **Appreciation for a system** - A system is a set of functions or activities within an organization that work together to achieve organizational goals. Management's job is to *optimize the system*. (not parts of system, but the whole!). System requires *co-operation*.

2. **Psychology** – The designers and implementers of decisions are *people*. Hence understanding their psychology is important.

The Deming philosophy

3. **Understanding process variation – A production process contains many sources of variation. *Reduction in variation improves quality*. Two types of variations- *common causes and special causes*. Focus on the special causes. Common causes can be reduced only by change of technology.**

4. **Theory of knowledge – Management decisions should be driven by *facts, data and justifiable theories*. Don't follow the managements fads!**

The Juran philosophy

- Pursue quality on two levels:

1. The *mission of the firm* as a whole is to achieve high *product quality*.
2. The *mission of each individual department* is to achieve high *production quality*.

- Quality should be talked about in a language senior management understands: money (cost of poor quality).
- At operational level, focus should be on conformance to specifications through elimination of defects- use of statistical methods.

The Juran philosophy

Quality Trilogy –

1. ***Quality planning*: Process of preparing to meet quality goals. Involves understanding customer needs and developing product features.**
2. ***Quality control*: Process of meeting quality goals during operations. Control parameters. Measuring the deviation and taking action.**
3. ***Quality improvement*: Process for breaking through to unprecedented levels of performance. Identify areas of improvement and get the right people to bring about the change.**

The Crosby philosophy

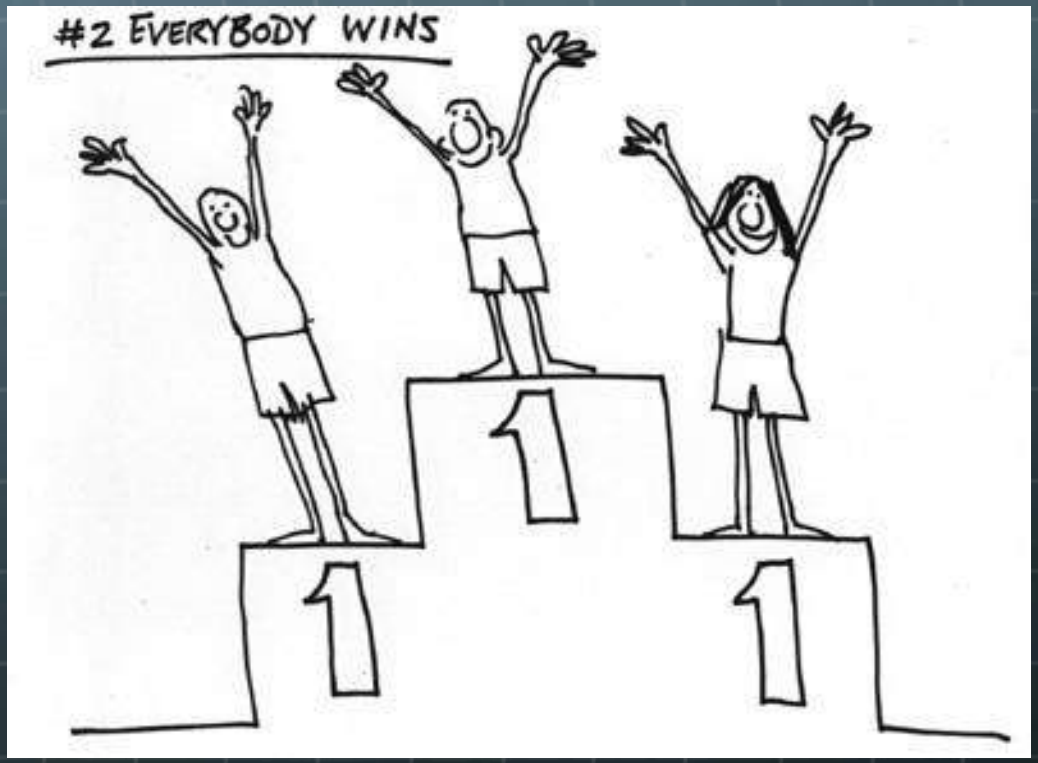
Absolute's of Management

- **Quality means *conformance to requirements* not elegance.**
- **There is no such thing as *quality problem*.**
- **There is no such thing as economics of quality: it is always cheaper to do the *job right the first time*.**
- **The only performance measurement is the *cost of quality*: the cost of non-conformance.**

Basic Elements of Improvement

- ***Determination* (commitment by the top management)**
- ***Education* (of the employees towards Zero Defects (ZD))**
- ***Implementation* (of the organizational processes towards ZD)**


Lower Costs
(Less re-work, fewer mistakes/delays)
Productivity Improves
Capture Market Share
Stay in Business
Provide More Jobs!
Improve Quality


#2 EVERYBODY WINS
1
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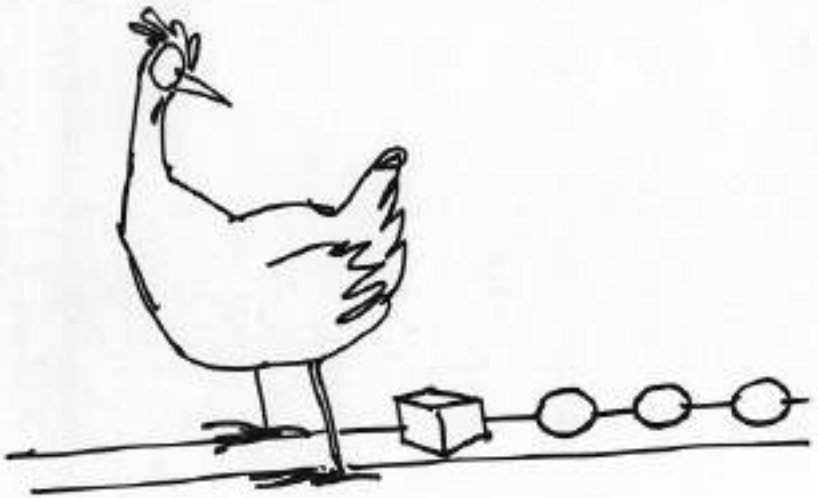
1

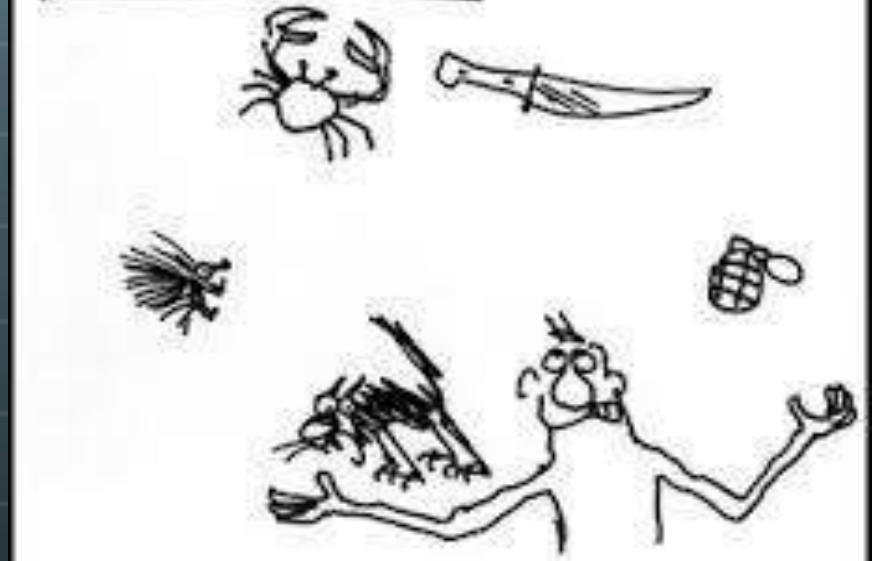
#3 DESIGN QUALITY IN



#4 DON'T BUY ON PRICE TAG ALONE

#5 CONTINUOUS IMPROVEMENT

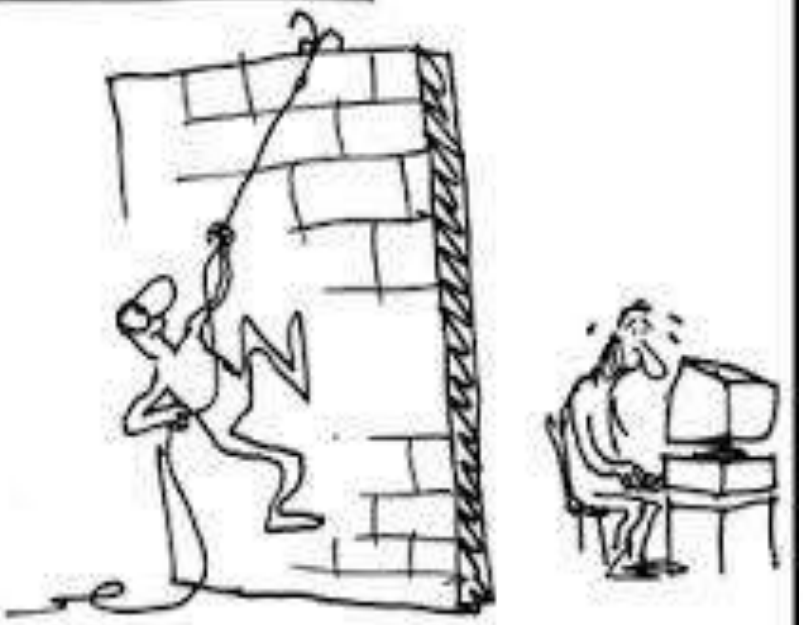
#6 TRAINING FOR SKILLS



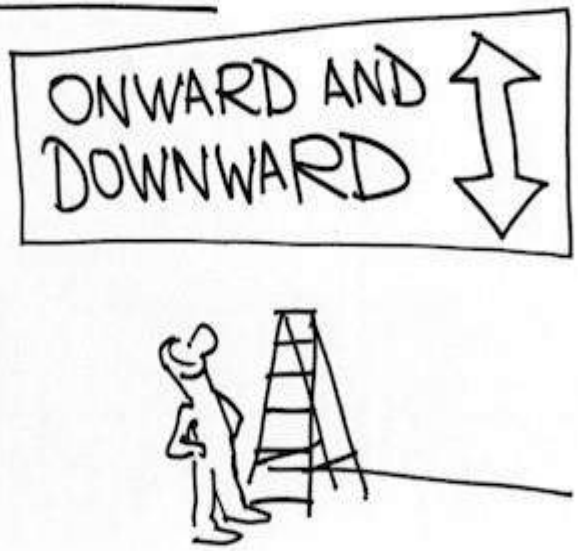
#7 INSTITUTE LEADERSHIP

#8 DRIVE OUT FEAR

#9 Break Down Barriers

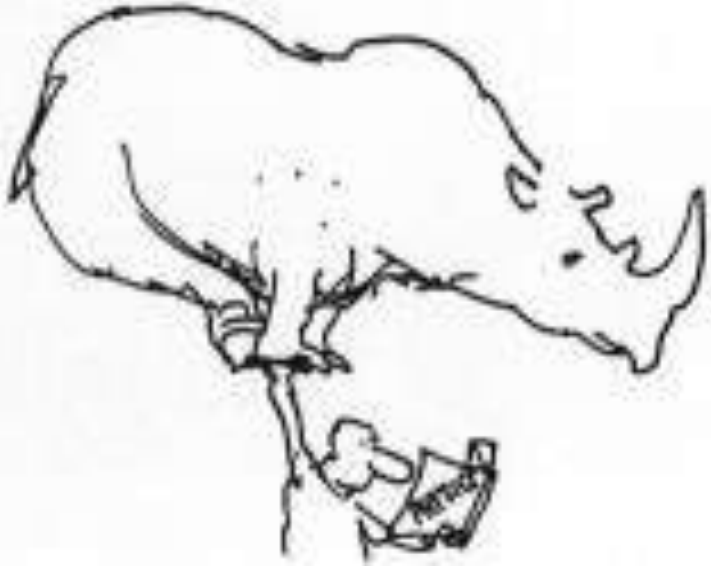


#10 Eliminate Slogans



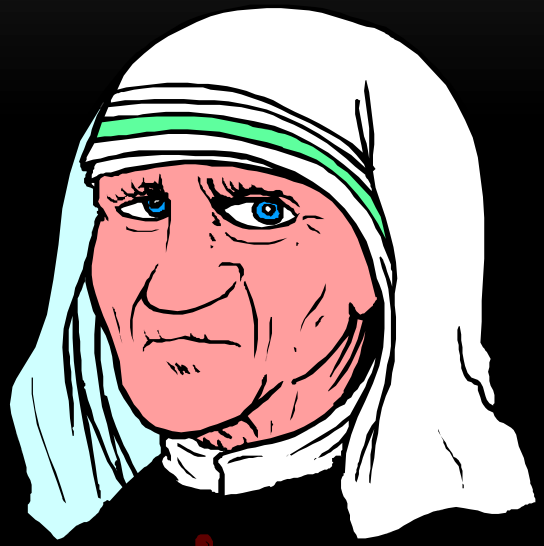
#12 JOY IN WORK

#13 CONTINUING EDUCATION



#14 ACCOMPLISH THE TRANSFORMATION

LEADERSHIP



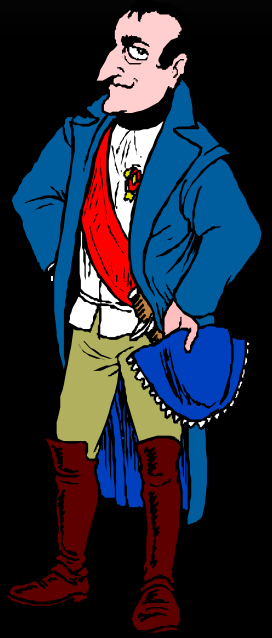
WHAT IS LEADERSHIP?

Leading people

Influencing people

Commanding people

Guiding people



Leadership is the ability of an individual or a group of individuals to influence and guide followers or other members of an organization.

TYPES OF LEADERS

- **Leader by the position achieved**
- **Leader by personality**
- **Leader by moral example**
- **Leader by power held**
- **Intellectual leader**
- **Leader because of ability to accomplish things**

CHARACTERISTICS OF QUALITY LEADERS

- **Priority Attention to External & Internal Customers**
- **Empower Subordinates**
- **Improvement Than maintenance**
- **Prevention than Cure**
- **Coordination than Competition among Depts**
- **Training & Guide Than Directing& Controlling**

CHARACTERISTICS OF QUALITY LEADERS

- Learn from problems
- Communication –Top to lower Mgt- vice versa
- Commitment to Quality
- Suppliers Based Quality not Price
- Organization Structure –Quality
- Encourage Team Work

LEADERSHIP CONCEPTS

- **To become successful ,leader requires to**

  understand human natures-Basic needs,wants and abilities of people

- **Gives Security & independence,rewards & punishments,word of praise,Trust& distrust.**

MANAGERS VS. LEADERS

Managers

- Focus on things
- Do things right
- Plan
- Organize
- Direct
- Control
- Follows the rules

Leaders

- Focus on people
- Do the right things
- Inspire
- Influence
- Motivate
- Build
- Shape entities

COMMON ACTIVITIES

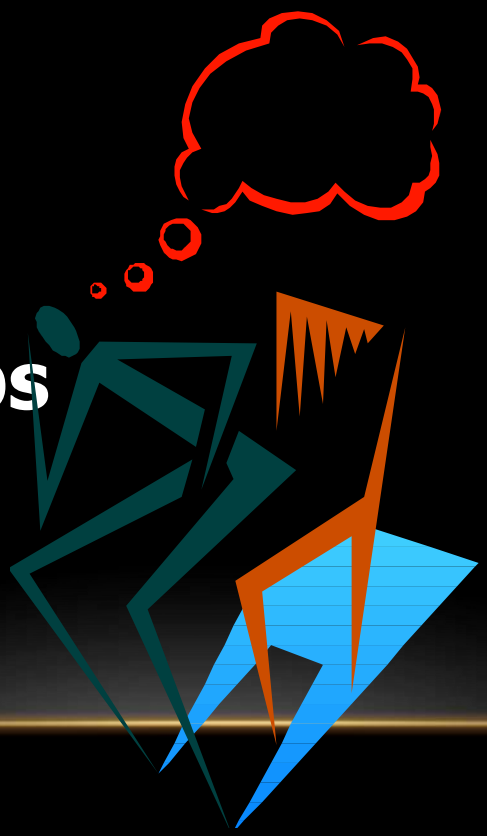
- Planning
- Organizing
- Directing

  Controlling

PLANNING

Manager

- Planning
- Budgeting
- Sets targets
- Establishes detailed steps
- Allocates resources



Leader

- Devises strategy
- Sets direction
- Creates vision

ORGANIZING

Manager

- Creates structure
- Job descriptions
- Staffing
- Hierarchy
- Delegates
- Training

Leader

- Gets people on board for strategy
- Communication
- Networks

DIRECTING WORK

Manager

- Solves problems
- Negotiates
- Brings to consensus

Leader

- Empowers people
- Cheerleader

CONTROLLING

Manager

- Implements control systems
- Performance measures
- Identifies variances
- Fixes variances

Leader

- Motivate
- Inspire
- Gives sense of accomplishment

NEW LEADERS TAKE NOTE

- General Advice
  - Take advantage of the transition period
  - Get advice and counsel
  - Show empathy to predecessor
  - Learn leadership
- Challenges
  - Need knowledge quickly
  - Establish new relationships
  - Expectations
  - Personal equilibrium

NEW LEADER TRAPS

- Not learning quickly
- Isolation
- Know-it-all
- Keeping existing team
- Taking on too much
- Captured by wrong people
- Successor syndrome

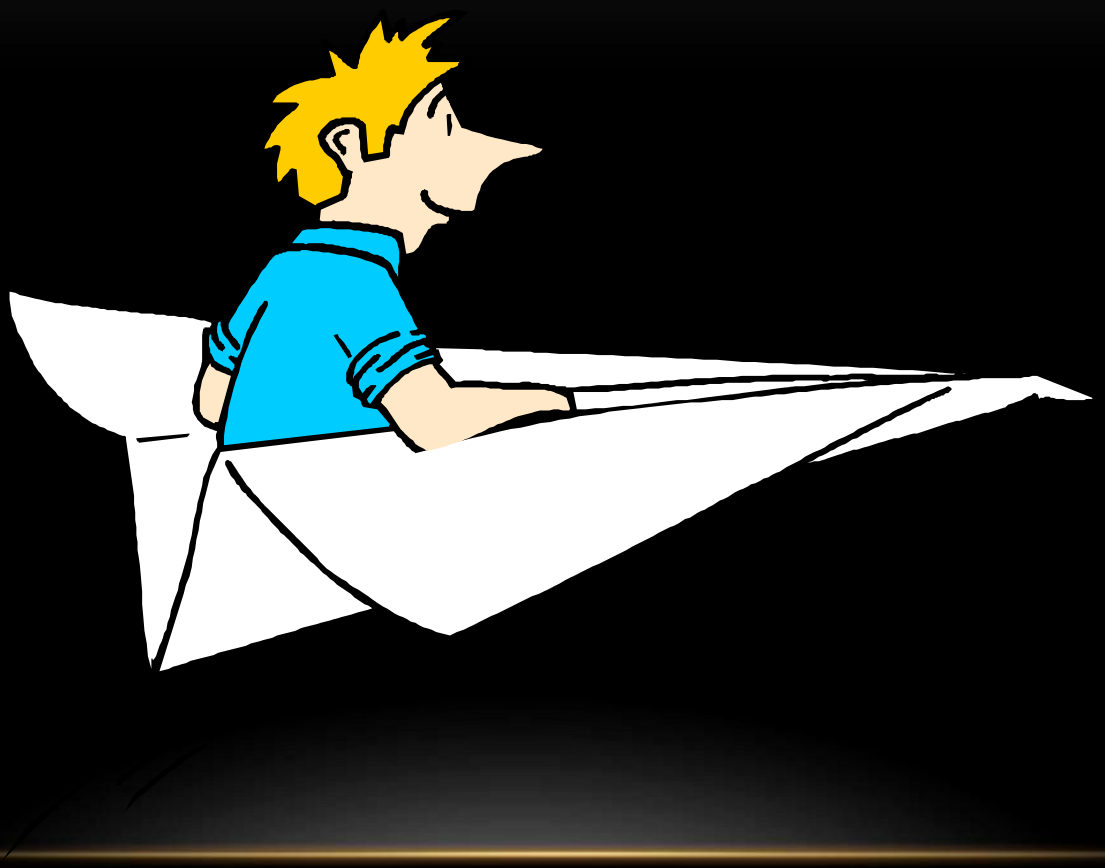
CORE TASKS

- Create Momentum
- Master technologies of learning, visioning, and coalition building
- Manage oneself

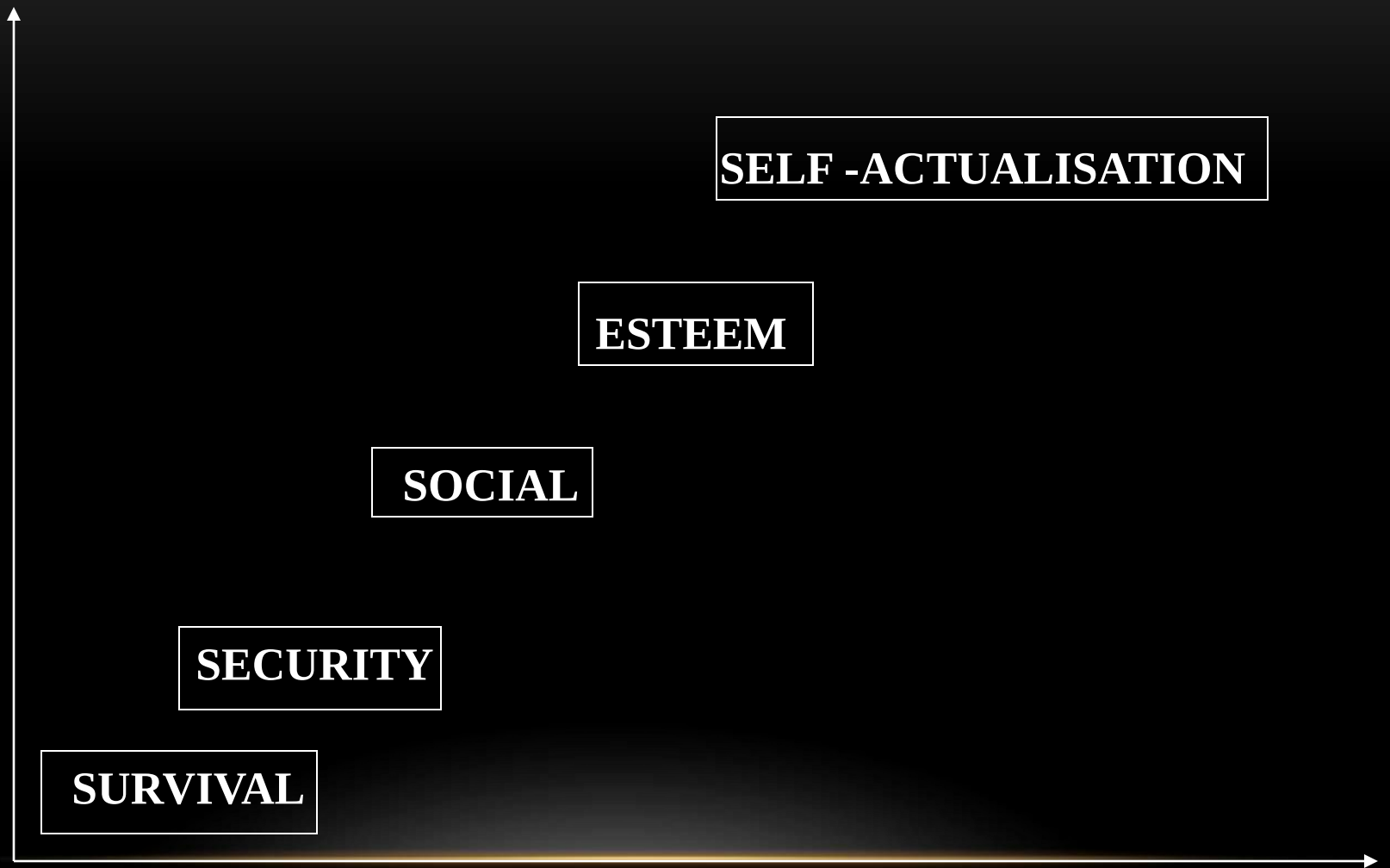
MANAGE ONESELF

- Be self-aware
- Define your leadership style
- Get advice and counsel
  - Advice is from expert to leader
  - Counsel is insight
- Types of help
  - Technical
  - Political
  - Personal
- Advisor traits
  - Competent
  - Trustworthy
  - Enhance your status

HOW FAR CAN YOU GO?



Maslow’ s Need Theory



HERZBERG’S TWO-FACTOR THEORY

MOTIVATORS

- Recognition,
- Responsibility
- Achievement
- Promotion
- Work Environment

HYGIENE or DISSATISFIERS FACTORS

- Low Salary
- Minimum Benefits
- Poor Working Conditions,
- I ll Defined Organization Policies
- Partiality Perks

MOTIVATED WORK FORCE

- Know Thyself
- Know your Employees
- Establish a Positive Attitude
- Share the goal
- Monitor Progress
- Develop Interesting Work-Job Rotation, Enlargement & Enrichment.
- Communicate & Celebrate Success

TEAMS

DEFINITION

A Team is defined as a group of people working together to achieve common Objectives or Goals.

WHY TEAMS WORK

- **More Knowledgeable**
- **Special Abilities Pool Together**
- **More Interaction More Cordial Relationship & Better Job**
- **Better Communication**

TYPES OF TEAMS

1. Process improvement TEAMS : focus attention on process which is already being done; for individual process or sub- process.
2. Cross- functional TEAMS: they are formed at the TOP MANAGEMENT LEVEL for solving complex problem , consists of 6-10 members from various DEPT.
3. Natural Work TEAMS: Team members are not volunteered…. Motivation by the managers are very important;
4. Self-directed/ Self managed Teams: group of individuals who work together continuously, team coordinator is selected within the TEAM

CHARACTERISTICS OF SUCCESSFUL TEAMS

1. SPONSOR
2. TEAM CHARTER
3. TEAM COMPOSITION
4. TRAINING
5. GROUND RULES
6. CLEAR OBJECTIVES
7. ACCOUNTABILITY
8. WELL- DEFINED DECISION PROCEDURES
9. RESOURCES
10. TRUST , COHESIVENESS
11. EFFECTIVE PROBLEM SOLVING , BALANCED PARTICIPATION
12. OPEN COMMUNICATION ,APPROPRIATE LEADER SHIP

TEAMS

Advising
Innovating
Promoting
Developing
Organizing
Producing
Inspecting
Maintaining
Linking

Barriers to Team Progress

- Insufficient Training
- Incompatible Compensation
- First Line Supervisor Resistance
- Lack of Planning
- Lack of Management Support
- Project Scope Too Large
- No Clear Measure of Success
- No Sufficient Time Given

EMPLOYEE INVOLVEMENT

The direct participation of staff to help an organization fulfill its mission and meet its objectives by applying their own ideas, expertise, and efforts towards solving problems and making decisions.

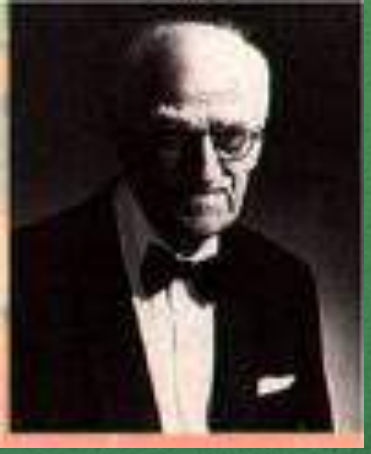
Motivation:- By Needs, Desire, Monetary Benefits, Incentives, Promotions, Facilities, Recognition, Etc.

Need For Employee Involvement

- To take Right Decision Making
- Full Knowledge & Skill to be used
- Solve Problems
- Morale & Commitment
- Leadership
- Creativity & Innovation

Benefits of Employee Involvement

- Empowering
- Better Decisions
- Better improvement
- Corrective Action
- Effective Cooperation &Communication
- Loyalty Increases & Floating Population Reduces
- More Money to Share



Continuous Process Improvement

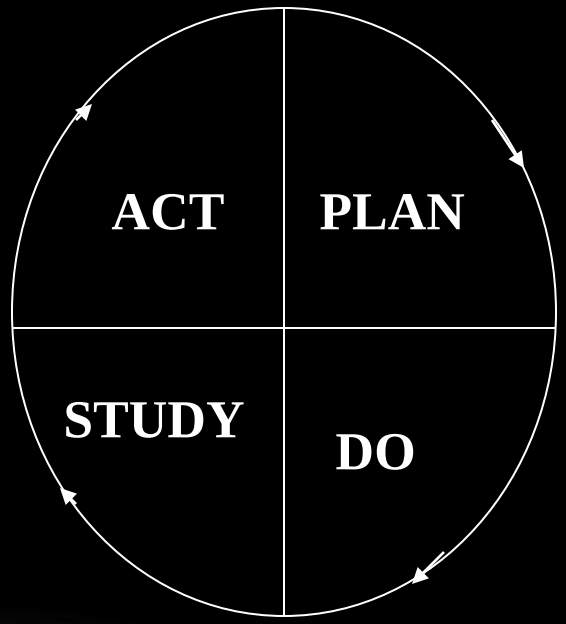
- Achieve Perfection
- Work as Process to make it Effective, Efficient, and Adaptable
- Changing Customer Needs
- Control in process-Reduce Scrap, Time, Idle of Resources
- Eliminate Non Conformance in All Phases
- Bench Marking
- Innovation
- Statistical Tools, QFD,FMEA. Taguchi Loss Function

TYPES OF PROBLEMS

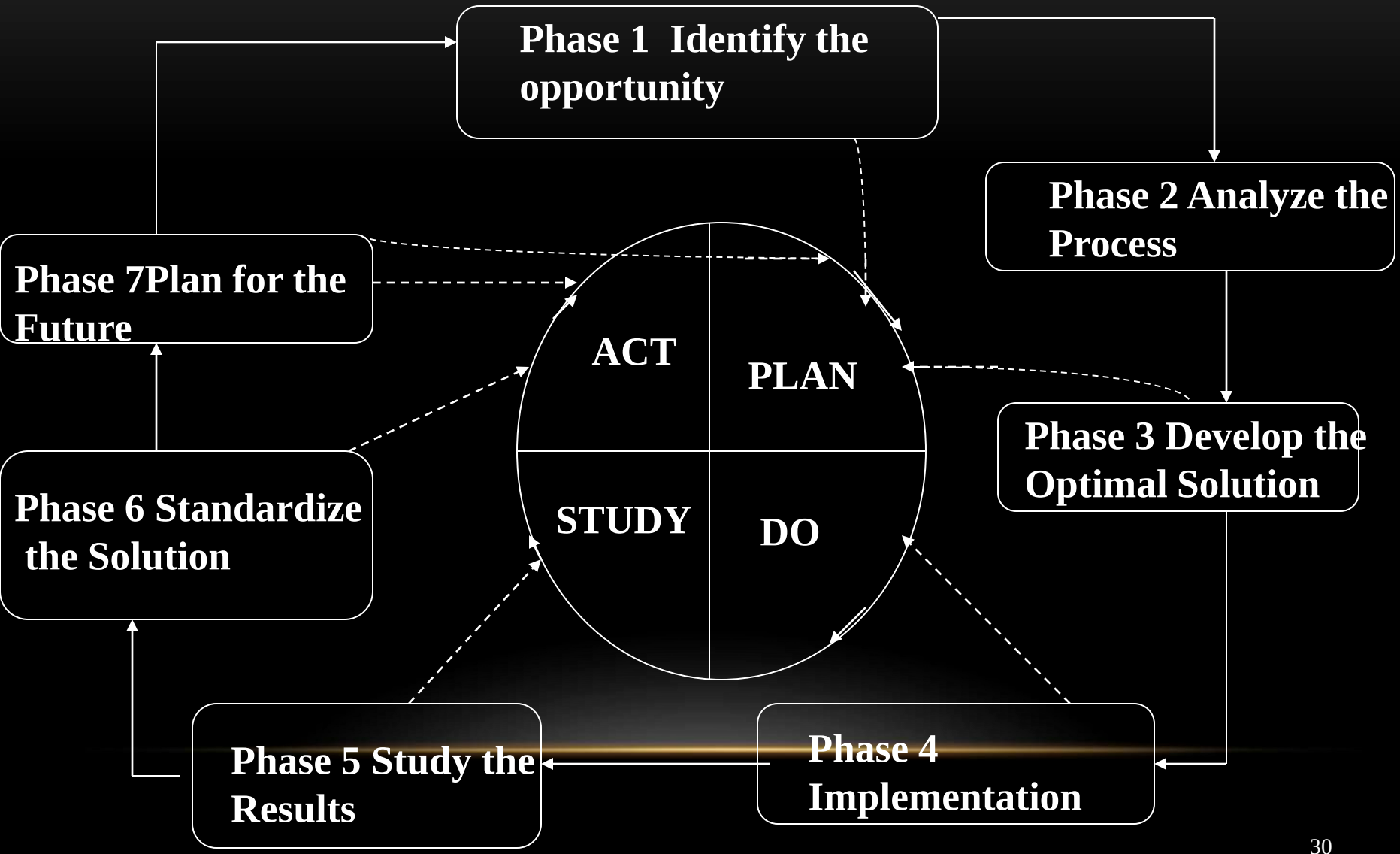
- Compliance
- Unstructured
- Efficiency
- Process Design
- Product Design

Shewhart's PDSA CYCLE in 1930

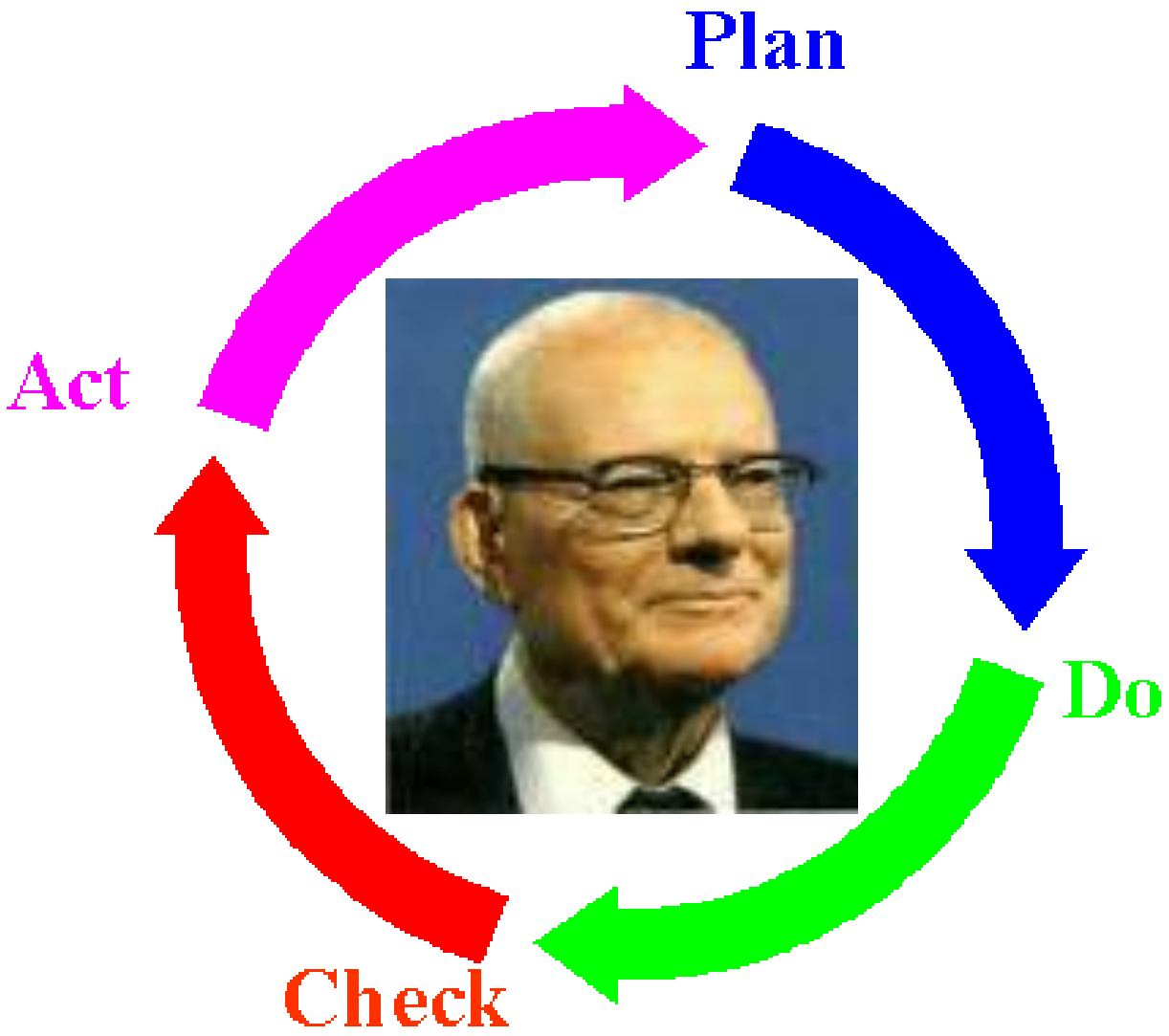
- PLAN
- DO
- STUDY
- ACT



CONTINUOUS PROCESS IMPROVEMENT CYCLE



Deming Wheel



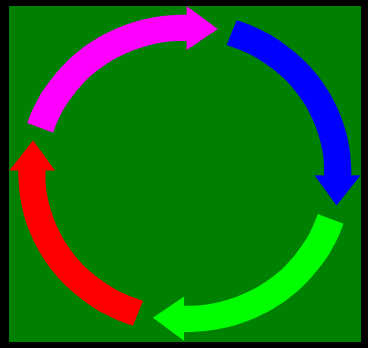
The Deming Cycle or PDCA Cycle

PLAN

Plan a change to the process. Predict the effect this change will have and plan how the effects will be measured

DO

Implement the change on a small scale and measure the effects



CHECK

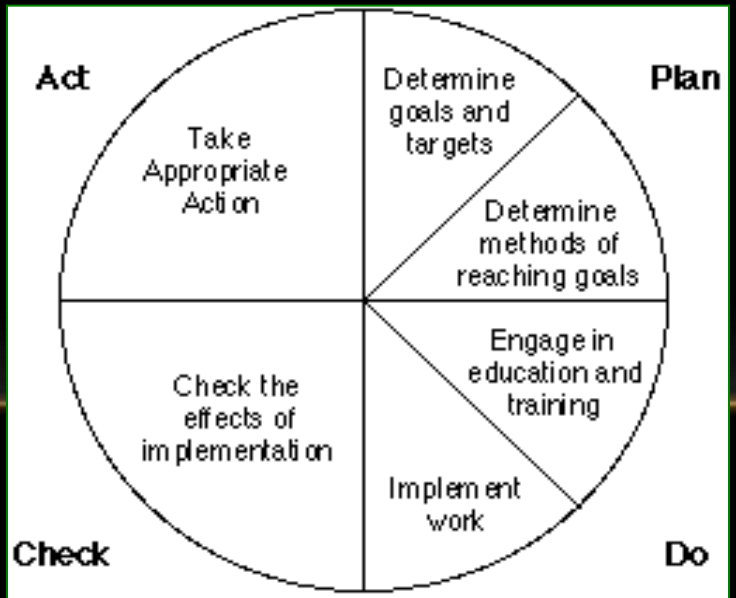
Study the results to learn what effect the change had, if any.

ACT

Adopt the change as a permanent modification to the process, or abandon it.

Kaoru Ishikawa has expanded Deming's four steps into six:

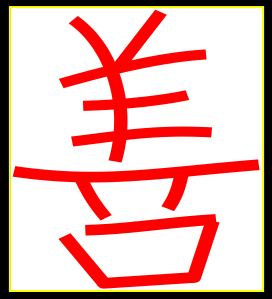
- ❖**Determine goals and targets.**
- ❖**Determine methods of reaching goals.**
- ❖**Engage in education and training.**
- ❖**Implement work.**
- ❖**Check the effects of implementation.**
- ❖**Take appropriate action.**



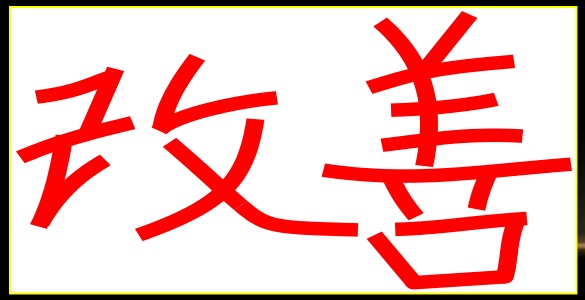
QUALITY IMPROVEMENT STRATEGIES

- Repair
- Refinement
- Renovation
- Reinvention

KAI — **Change**



ZEN — **Good**
(for the better)



KAIZEN = Continual Improvement

KAIZEN UMBRELLA-CONTINUOUS IMPROVEMENT

- Customer Orientation
- 5 S
- TQC
- Zero Defect
- TPM
- QC’ s
- JIT
- Quality Improvements

JUST IN TIME

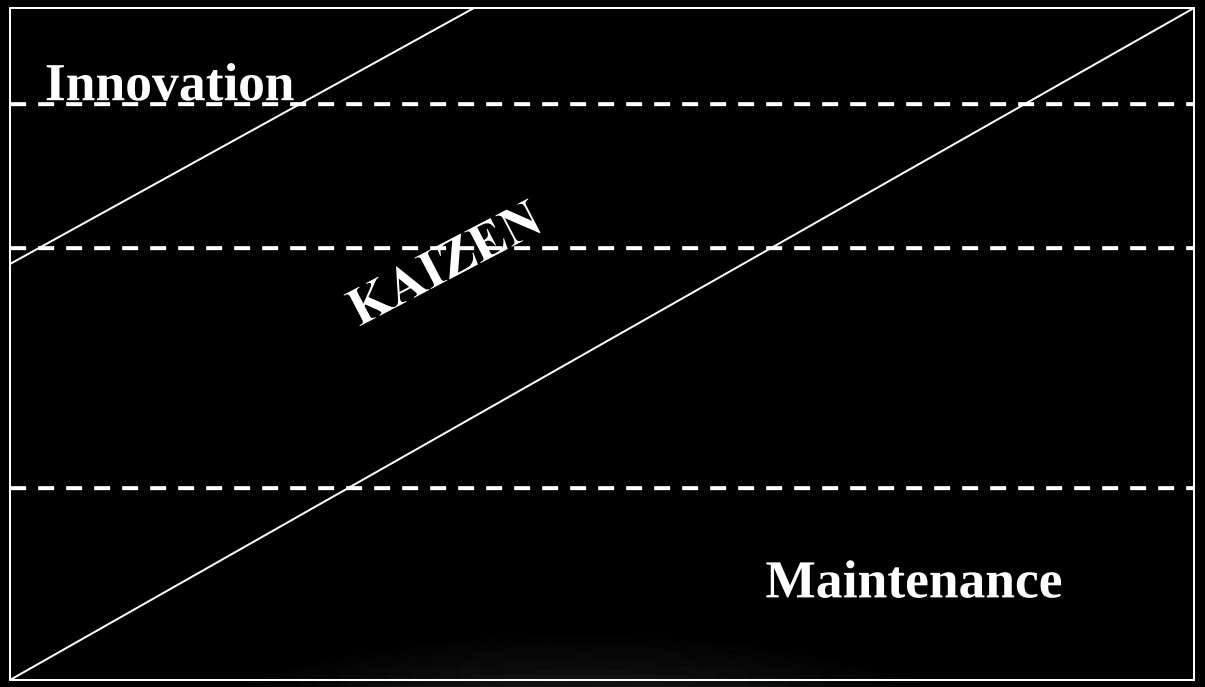
- JIT REQUIRES THE CONSTANT AND PRECISE MONITORING IN DEMAND WHICH COULD BE DONE BY KANBAN
- REDUCING INVENTORY, MINIMIZING WASTE AND RESPONDING TO THE CUSTOMERS

- PRODUCTION — GOALS

- STREAMLINING—— EFFECIENCY ———— IMPROVING QUALITY

- OVER ESTIMATION AND UNDER ESTIMATION

JAPANESE MGT FUNCTIONS AND KAIZEN



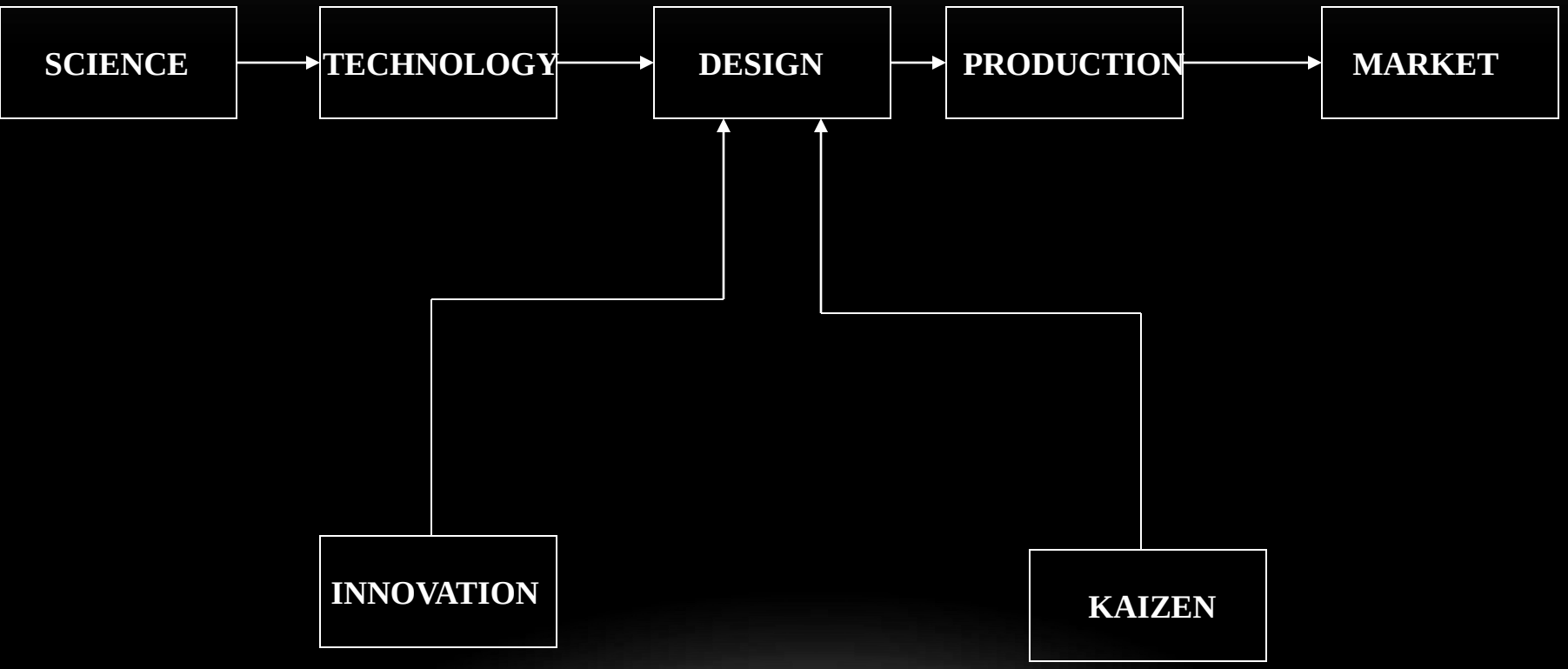
JAPANESE VS WESTERN APPROACH

	KAIZEN	INNOVATION
JAPAN	Strong	Weak
WEST	Weak	Strong

KAIZEN IMPLEMENTATION

- Discard Conventional ideas
- Think in Positive Manner
- Do not make excuses but question Current Practice
- Correct Mistakes at once
- Problem Solving & Find Root Causes
- Team Work To achieve MAXIMUM
- Meeting of Kaizen group once in Month

TOTAL MANUFACTURING CHAIN



COMPARISON OF INNOVATION & KAIZEN

INNOVATION	KAIZEN
Creavitivity	Adaptability
Individualism	Team Work
Technology	People- oriented
Information- Closed	Information-Open
Seeks New Technology	Builds on Existing Technology
Limited Feedback	Comprehensive Feedback

3-MU's Checklist of Kaizen Activities

Muda (Waste)	Muri (Strain)	Mura (Discrepancy)
Man Power	Man Power	Man Power
Technique	Technique	Technique
Method	Method	Method
Time	Time	Time
Materials	Materials	Materials
Inventory	Inventory	Inventory
Way of Thinking	Way of Thinking	Way of Thinking

- **In an Organization, Kaizen *activities will be carried out by asking the Questions-Who, Where, When, Why, and How***
- ***Eg-Who does it?***

  What to do?

  Where to do it?

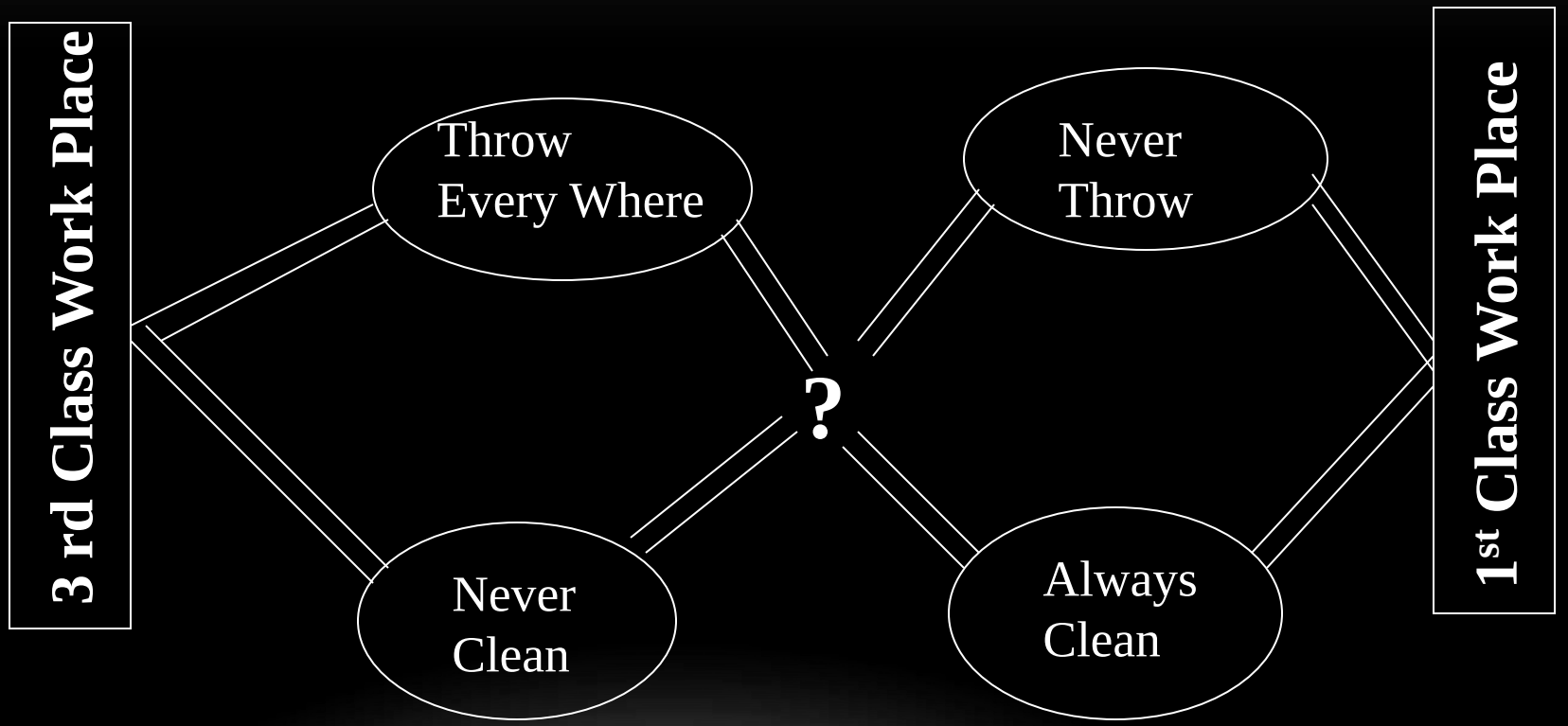
  When to do it?

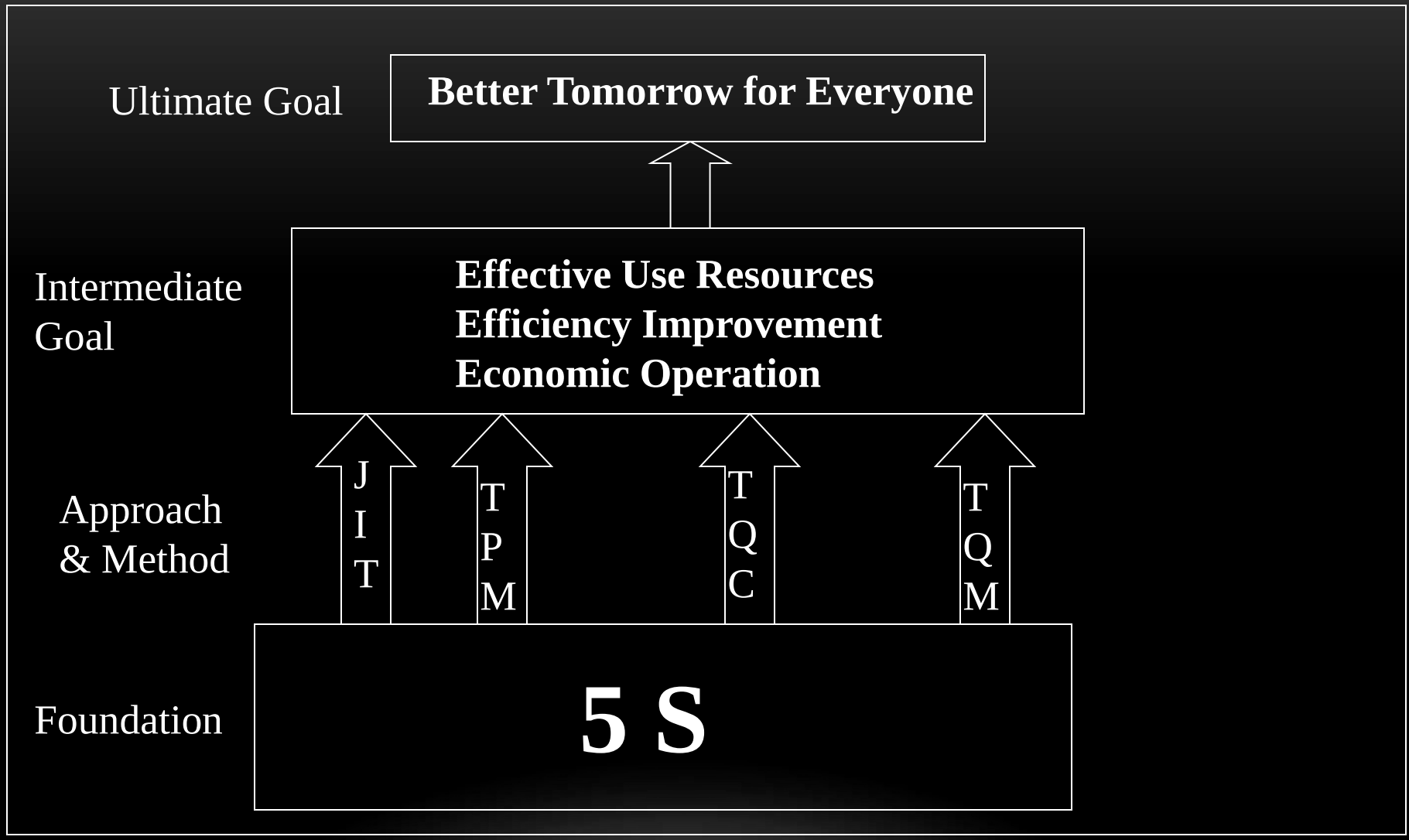
  Why to do it?

  How to do it?

5 S

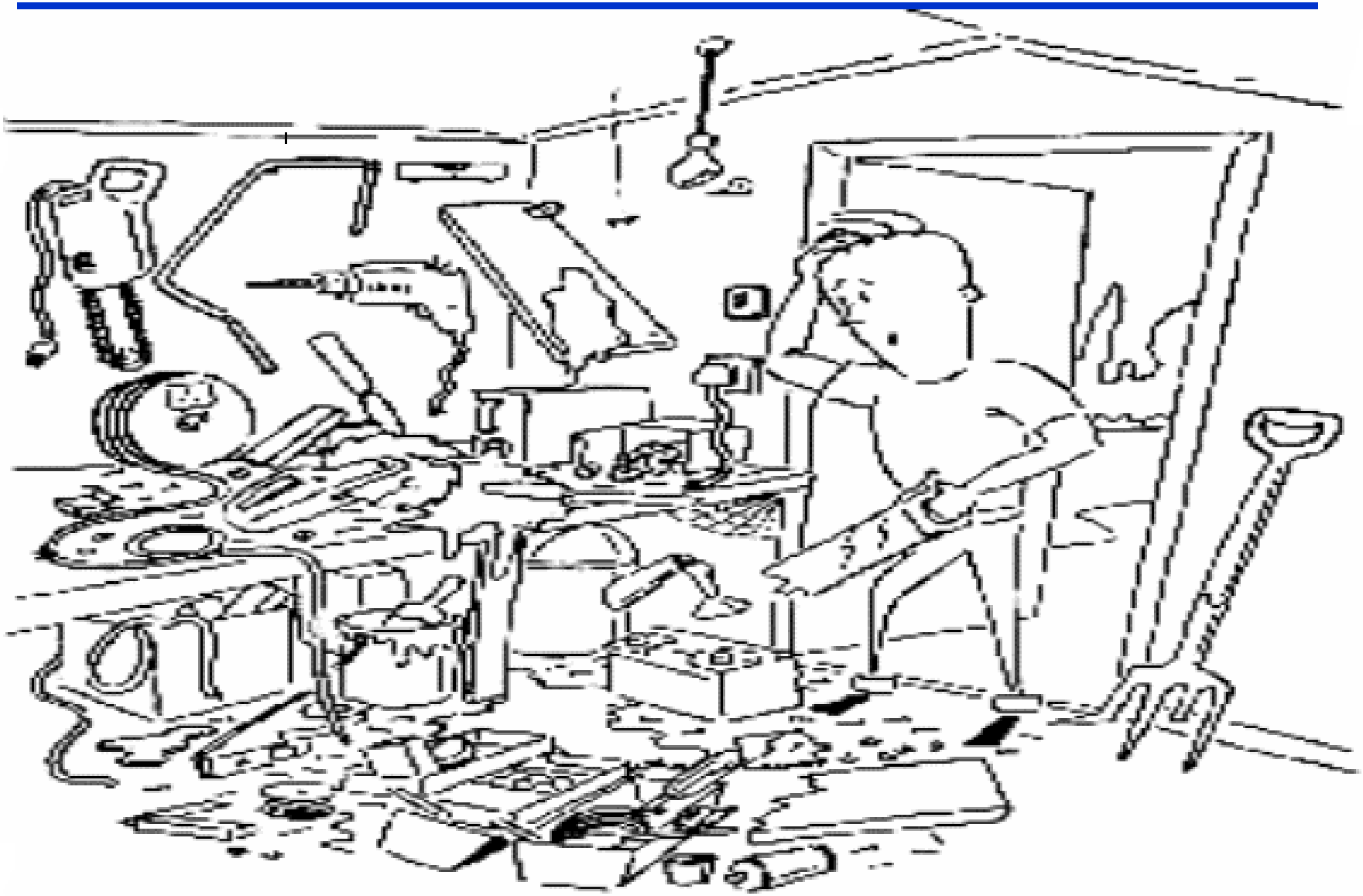
HOUSE KEEPING_5-S MODEL





5 S FOUNDATION FOR PRODUCTIVITY IMPROVEMENT

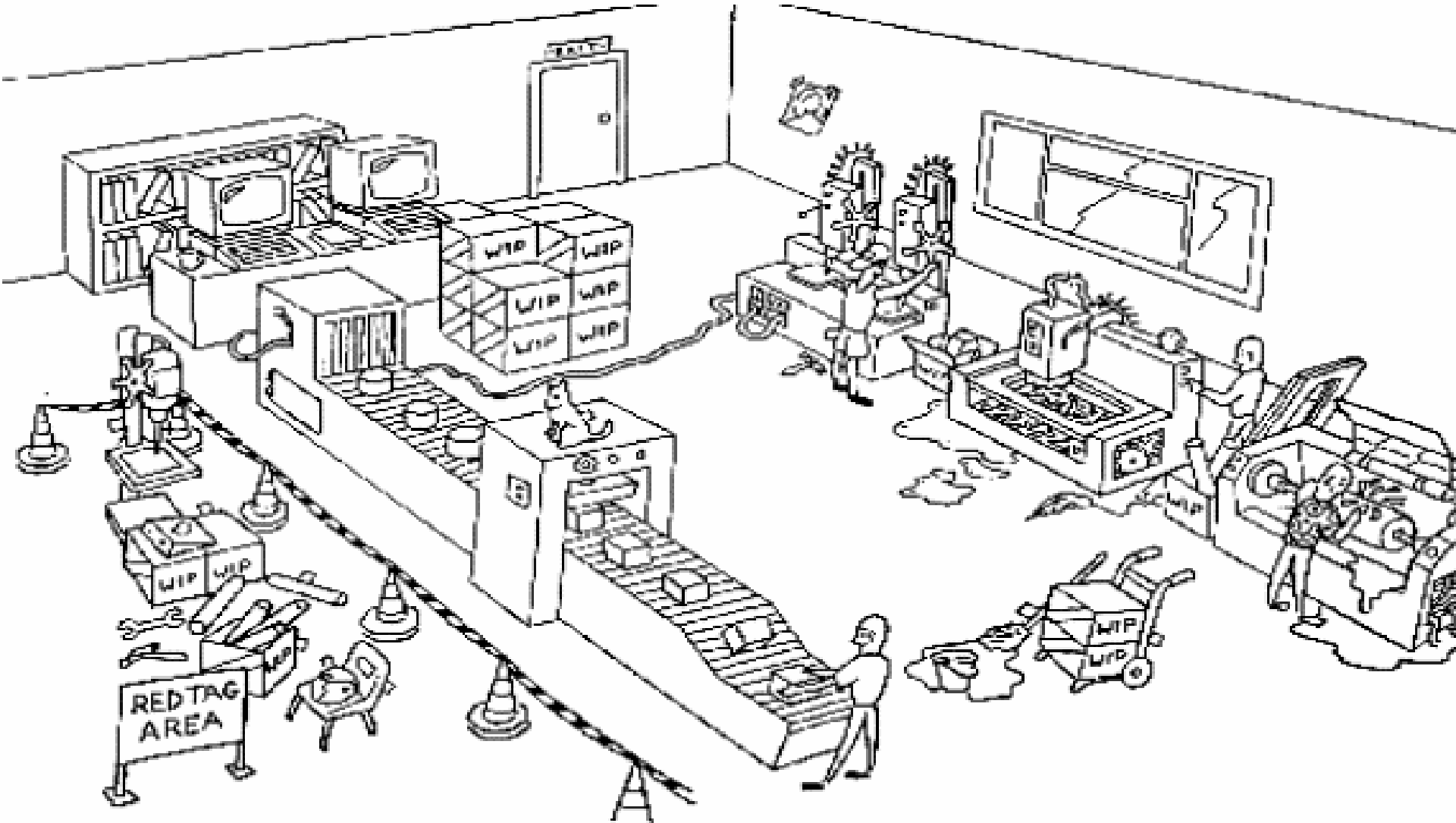
Our Environment (generally)



SEI-RI-CLEARING UP

- **Identification of materials, equipment and tools data which are necessary or not necessary, discarding and make space for the required one’ s.**

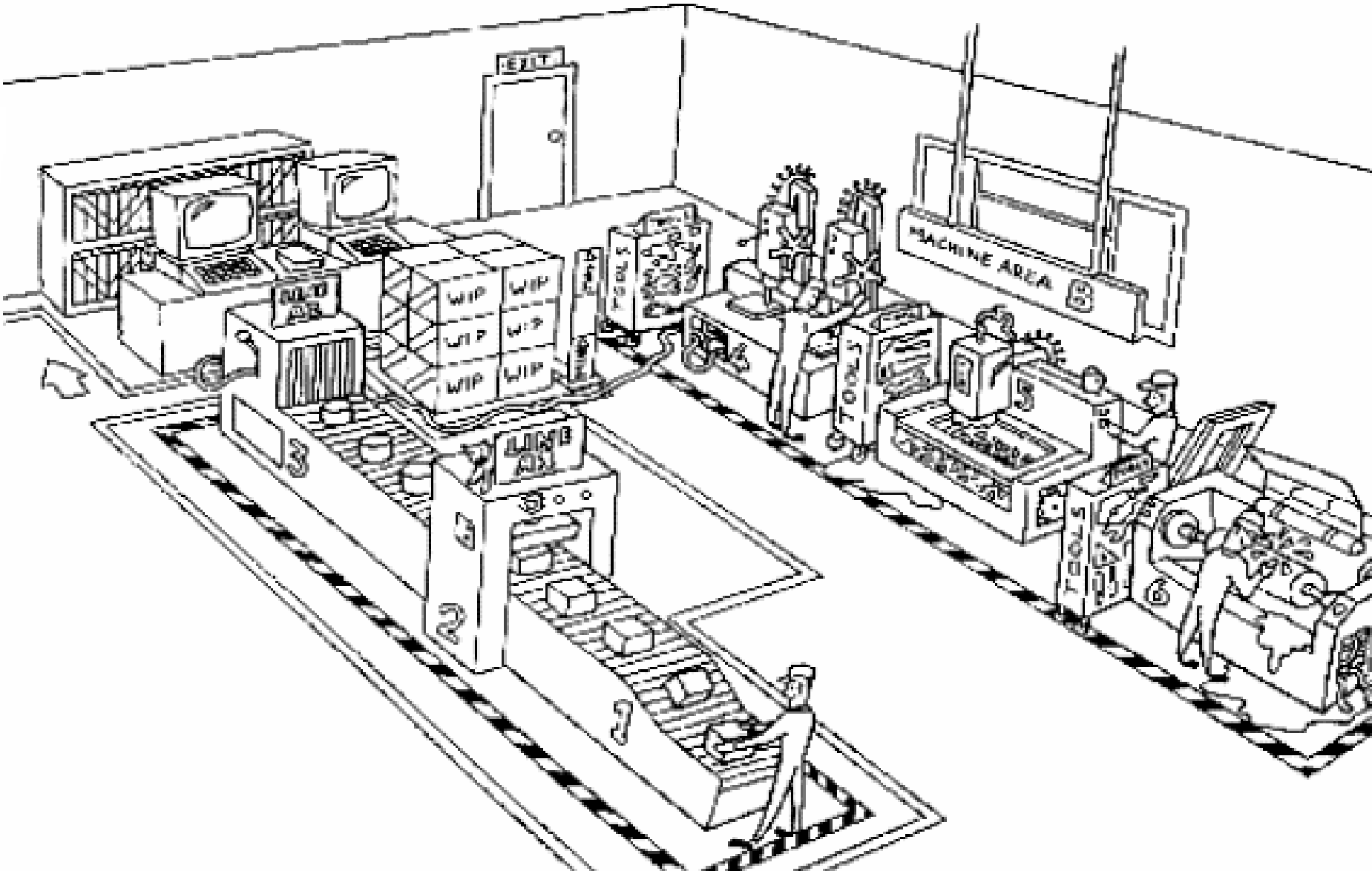
After Clearing…



SEI-TON = ORGANIZING

- **Once Cleaned and then arrange them in orderly manner.**
- **People should cultivate the habit of return the tools to the place from where it was taken.**
- **Easily accessible**
- **Reduces time and confusions**
- **Improves Efficiency**

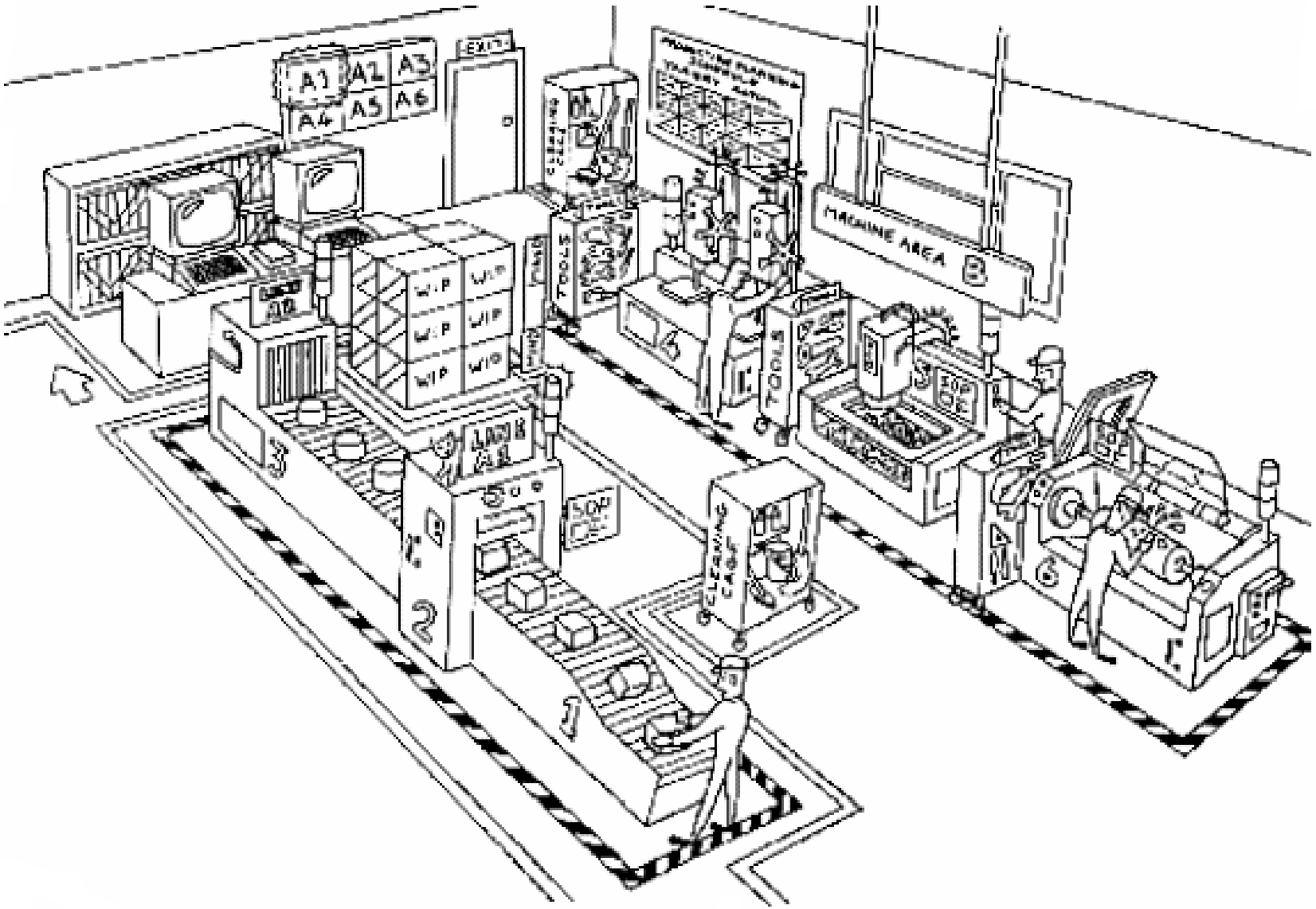
After Organising…



SEI-SO= CLEANING

- After Clearing & Arranging .
- Organization should Identify and Eliminate source of Dirt, Dust, (or) Trash
- Update Constantly

After Standardising...



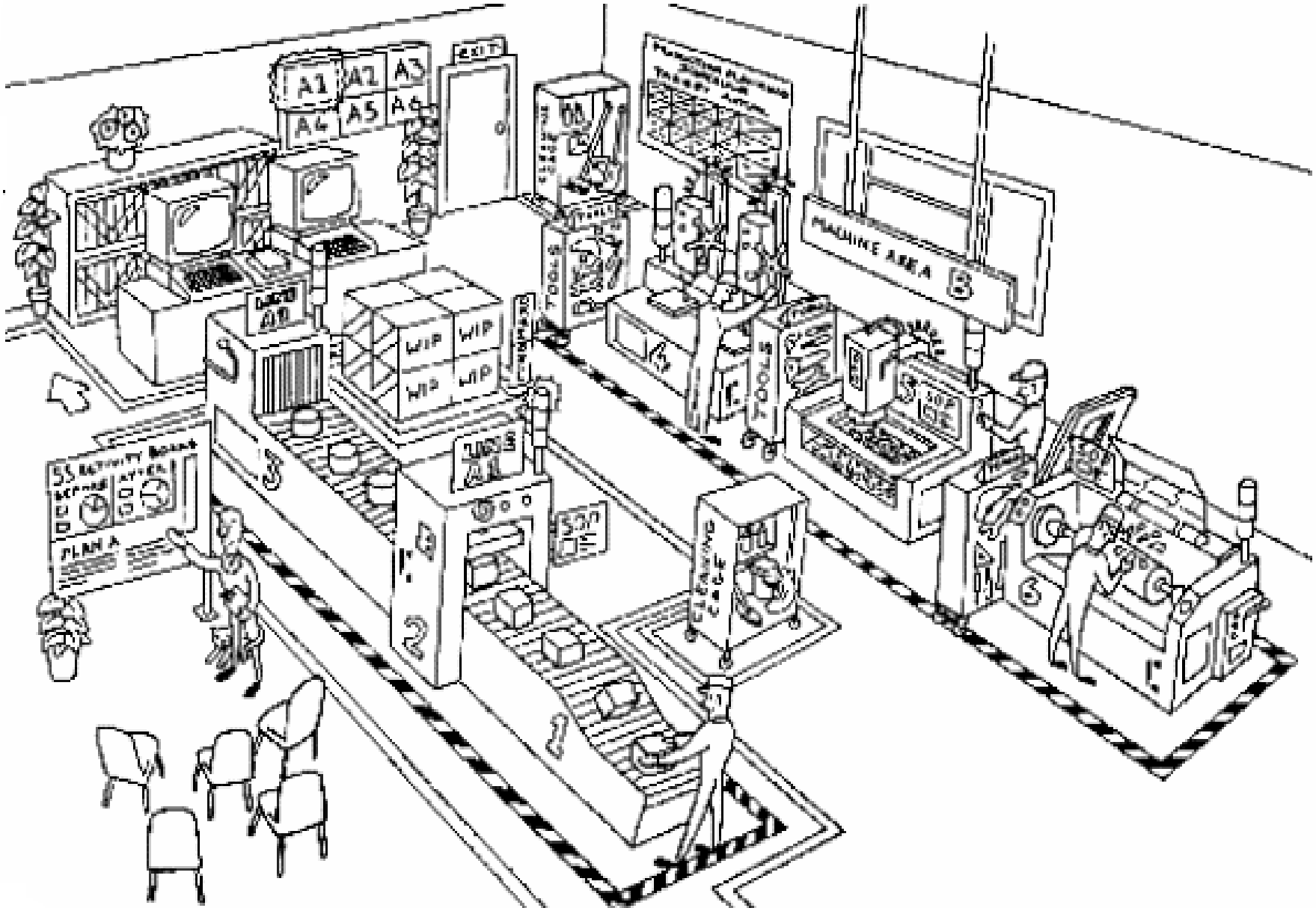
SEI-KE-TSU=PERSONAL CLEANLINESS

- **Good Working Condition and Personal Hygiene**
- **Clean Person is conscious of his Work Place**
- **Good Sanitary Condition**

SHI-TSU-KE =SELF DISCIPLINE

- **Not only Job Related but also Personally it is important.**
- **Job Discipline is the habit of Skill Development to do work as per Standards.**
- **Observe Rules & Policies of the Company**

Building the Discipline



THANK YOU

Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP)

- Founded by Saaty in 1980.
- It is a popular and widely used method for multi-criteria decision making.
- Allows the use of qualitative, as well as quantitative criteria in evaluation.
- Wide range of applications exists:
  - Selecting a car for purchasing
  - Deciding upon a place to visit for vacation
  - Deciding upon an MBA program after graduation.

AHP–General Idea

- Develop an hierarchy of decision criteria and define the alternative courses of actions.

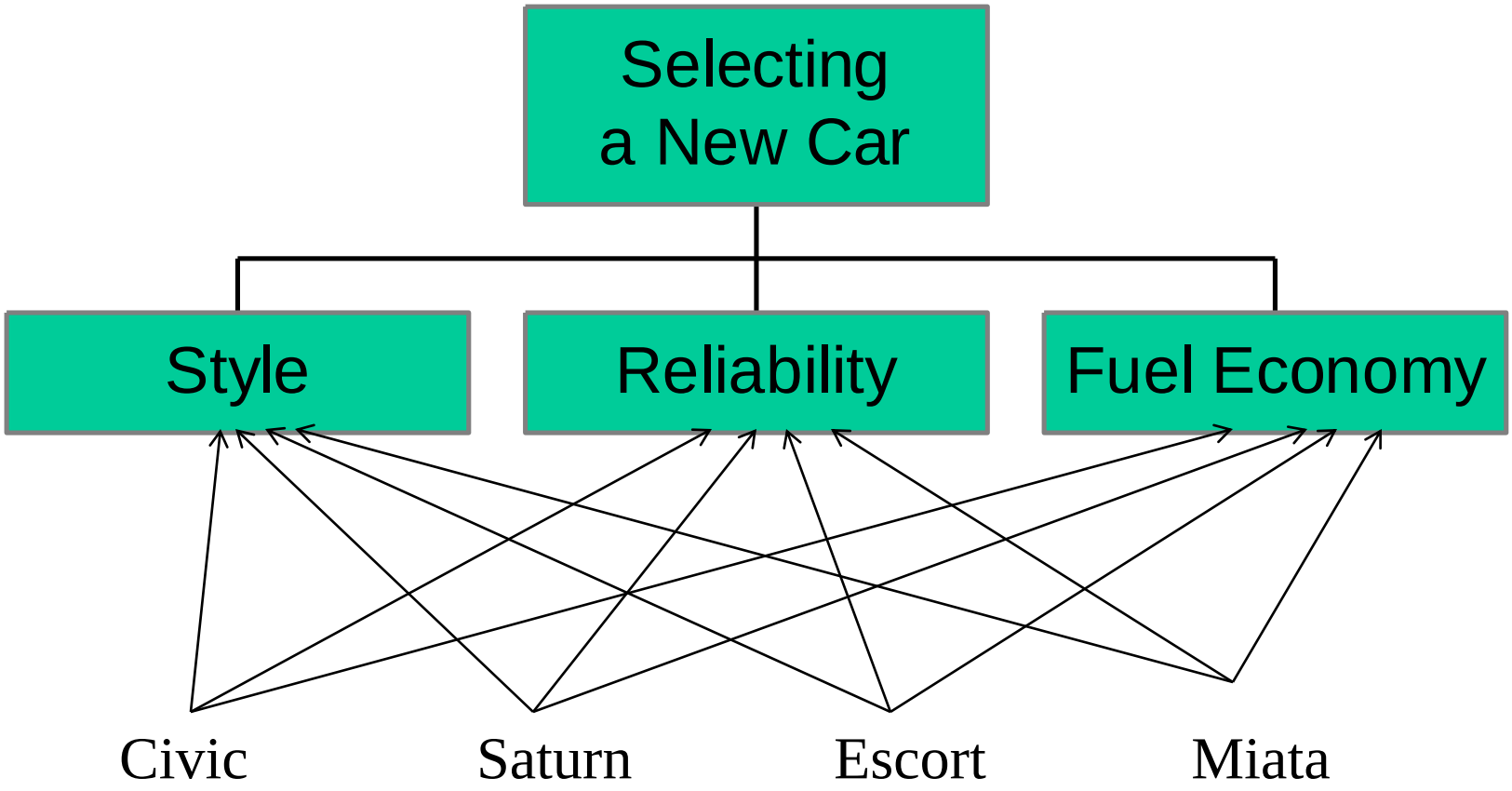
- AHP algorithm is basically composed of two steps:
  1. Determine the relative weights of the decision criteria
  2. Determine the relative rankings (priorities) of alternatives

! Both qualitative and quantitative information can be compared by using informed judgments to derive weights and priorities.

Example: Car Selection

- Objective
  - Selecting a car
- Criteria
  - Style, Reliability, Fuel-economy **Cost?**
- Alternatives
  - Civic Coupe, Saturn Coupe, Ford Escort, Mazda Miata

Hierarchy tree



Alternative courses of action

Ranking of Criteria and Alternatives

- Pairwise comparisons are made with the grades ranging from 1-9.

- A basic, but very reasonable assumption for comparing alternatives:

  If attribute A is absolutely more important than attribute B and is rated at 9, then B must be absolutely less important than A and is graded as 1/9.

- These pairwise comparisons are carried out for all factors to be considered, usually not more than 7, and the matrix is completed.

Ranking Scale for Criteria and Alternatives

Intensity of importance	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective
3	Somewhat more important	Experience and judgement slightly favour one over the other.
5	Much more important	Experience and judgement strongly favour one over the other.
7	Very much more important	Experience and judgement very strongly favour one over the other. Its importance is demonstrated in practice.
9	Absolutely more important.	The evidence favouring one over the other is of the highest possible validity.
2,4,6,8	Intermediate values	When compromise is needed

Ranking of criteria

	Style	Reliability	Fuel Economy
Style	1	1/2	3
Reliability	2	1	4
Fuel Economy	1/3	1/4	1

Ranking of priorities

- Consider [$Ax = \lambda_{max}x$] where
  - A is the comparison matrix of size n×n, for n criteria, also called the priority matrix.
  - x is the Eigenvector of size n×1, also called the priority vector.
  - λ_{max} is the Eigenvalue, $\lambda_{max} \in \Re > n$.

- To find the ranking of priorities, namely the Eigen Vector X:

  1) Normalize the column entries by dividing each entry by the sum of the column.

  2) Take the overall row averages.

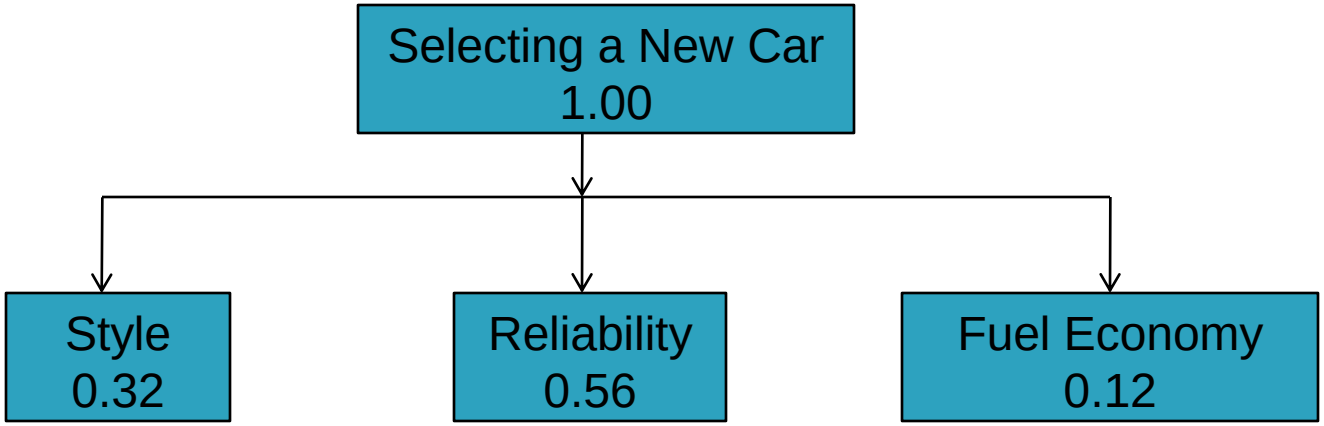
$$A = \begin{bmatrix} 1 & 0.5 & 3 \\ 2 & 1 & 4 \\ 0.33 & 0.25 & 1.0 \end{bmatrix} \xrightarrow{\text{Normalized Column Sums}} \begin{bmatrix} 0.30 & 0.29 & 0.38 \\ 0.60 & 0.57 & 0.50 \\ 0.10 & 0.14 & 0.13 \end{bmatrix} \xrightarrow{\text{Row averages}} X = \begin{bmatrix} 0.32 \\ 0.56 \\ 0.12 \end{bmatrix}$$

Priority vector

Column sums 3.33 1.75 8.00 1.00 1.00 1.00

Criteria weights

- Style .32
- Reliability .56
- Fuel Economy .12



Checking for Consistency

- The next stage is to calculate a Consistency Ratio (CR) to measure how consistent the judgments have been relative to large samples of purely random judgments.

- AHP evaluations are based on the asumption that the decision maker is rational, i.e., if A is preferred to B and B is preferred to C, then A is preferred to C.

- If the CR is greater than 0.1 the judgments are untrustworthy because they are too close for comfort to randomness and the exercise is valueless or must be repeated.

Calculation of Consistency Ratio

- The next stage is to calculate λ_{max} so as to lead to the Consistency Index and the Consistency Ratio.
- Consider [Ax = λ_{max} x] where x is the Eigenvector.

$$\underset{A}{\begin{bmatrix} 1 & 0.5 & 3 \\ 2 & 1 & 4 \\ 0.333 & 0.25 & 1.0 \end{bmatrix}} \underset{x}{\begin{bmatrix} 0.32 \\ 0.56 \\ 0.12 \end{bmatrix}} = \underset{Ax}{\begin{bmatrix} 0.98 \\ 1.68 \\ 0.36 \end{bmatrix}} = \lambda_{max} \underset{x}{\begin{bmatrix} 0.32 \\ 0.56 \\ 0.12 \end{bmatrix}}$$

λmax=average{0.98/0.32, 1.68/0.56, 0.36/0.12}=3.04

- Consistency index , CI is found by

CI=(λmax-n)/(n-1)=(3.04-3)/(3-1)= 0.02

Consistency Ratio

- The final step is to calculate the Consistency Ratio, CR by using the table below, derived from Saaty's book. The upper row is the order of the random matrix, and the lower row is the corresponding index of consistency for random judgments.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

Each of the numbers in this table is the average of CI's derived from a sample of randomly selected reciprocal matrices of AHP method.

An inconsistency of 10% or less implies that the adjustment is small as compared to the actual values of the eigenvector entries.
A CR as high as, say, 90% would mean that the pairwise judgments are just about random and are completely untrustworthy! In this case, comparisons should be repeated.

In the above example: CR=CI/0.58=0.02/0.58=0.03

0.03<0.1, so the evaluations are consistent!

Ranking alternatives

Style	Civic	Saturn	Escort	Miata
Civic	1	1/4	4	1/6
Saturn	4	1	4	1/4
Escort	1/4	1/4	1	1/5
Miata	6	4	5	1

Priority vector

$$\begin{bmatrix} 0.13 \\ 0.24 \\ 0.07 \\ 0.56 \end{bmatrix}$$

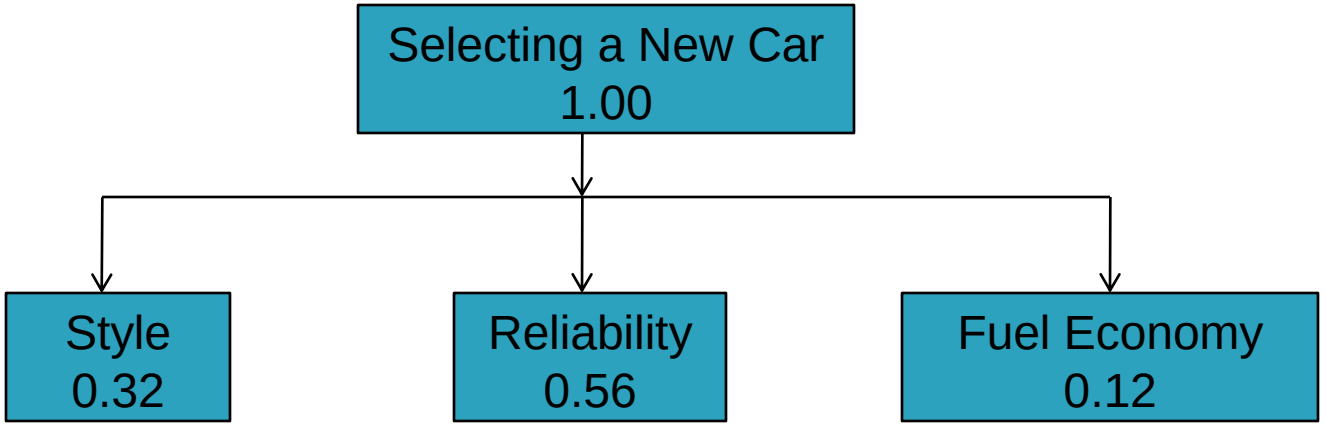
Reliability	Civic	Saturn	Escort	Miata
Civic	1	2	5	1
Saturn	1/2	1	3	2
Escort	1/5	1/3	1	1/4
Miata	1	1/2	4	1

$$\begin{bmatrix} 0.38 \\ 0.29 \\ 0.07 \\ 0.26 \end{bmatrix}$$

Ranking alternatives

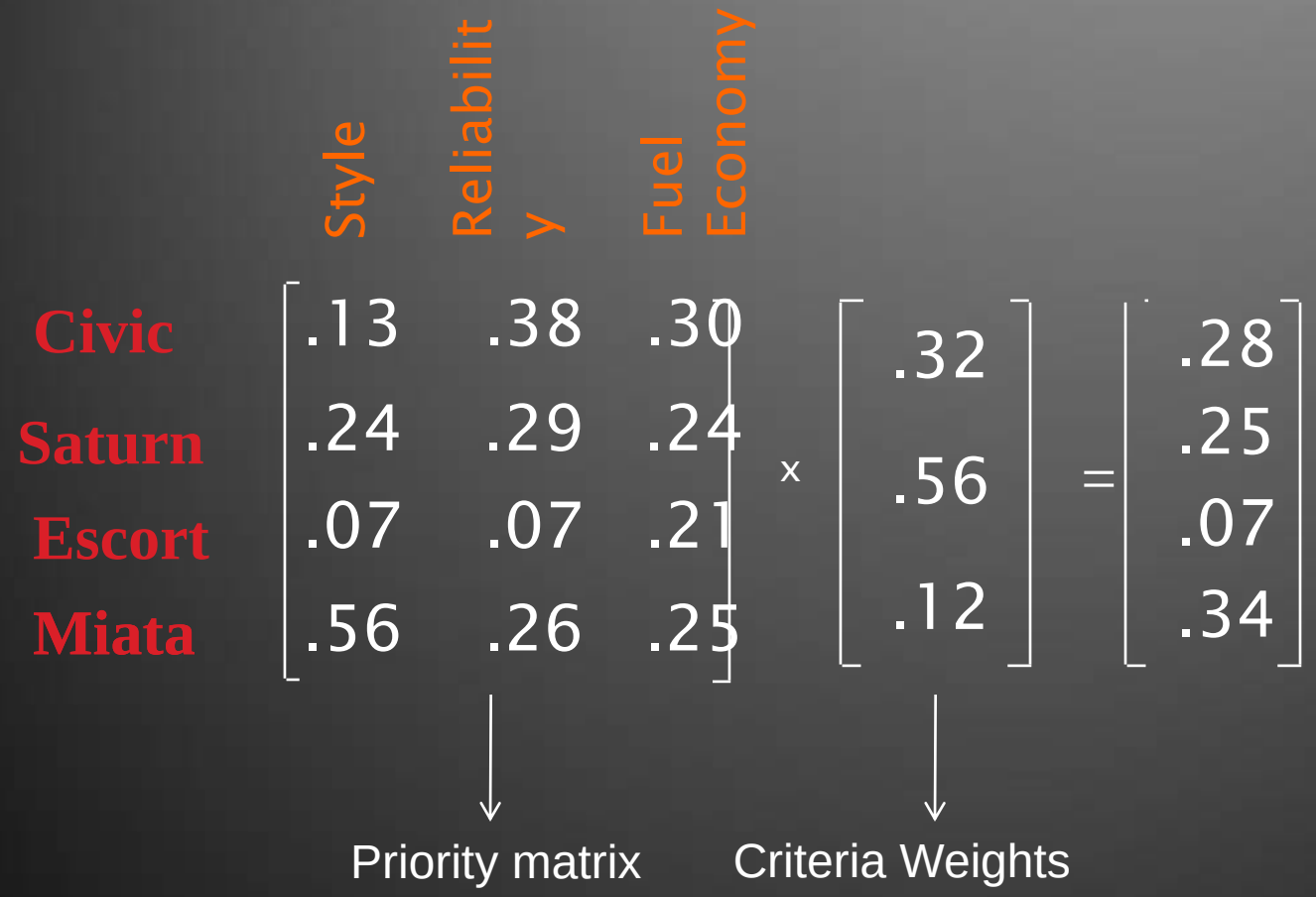
		Miles/gallon	Normalized
Fuel Economy	Civic	34	.30
	Saturn	27	.24
	Escort	24	.21
	Miata	28	.25
		113	1.0

! Since fuel economy is a quantitative measure, fuel consumption ratios can be used to determine the relative ranking of alternatives; however this is not obligatory. Pairwise comparisons may still be used in some cases.



Style		Reliability		Fuel Economy	
Civic	0.13	Civic	0.38	Civic	0.30
Saturn	0.24	Saturn	0.29	Saturn	0.24
Escort	0.07	Escort	0.07	Escort	0.21
Miata	0.56	Miata	0.26	Miata	0.25

Ranking of alternatives



Including Cost as a Decision Criteria

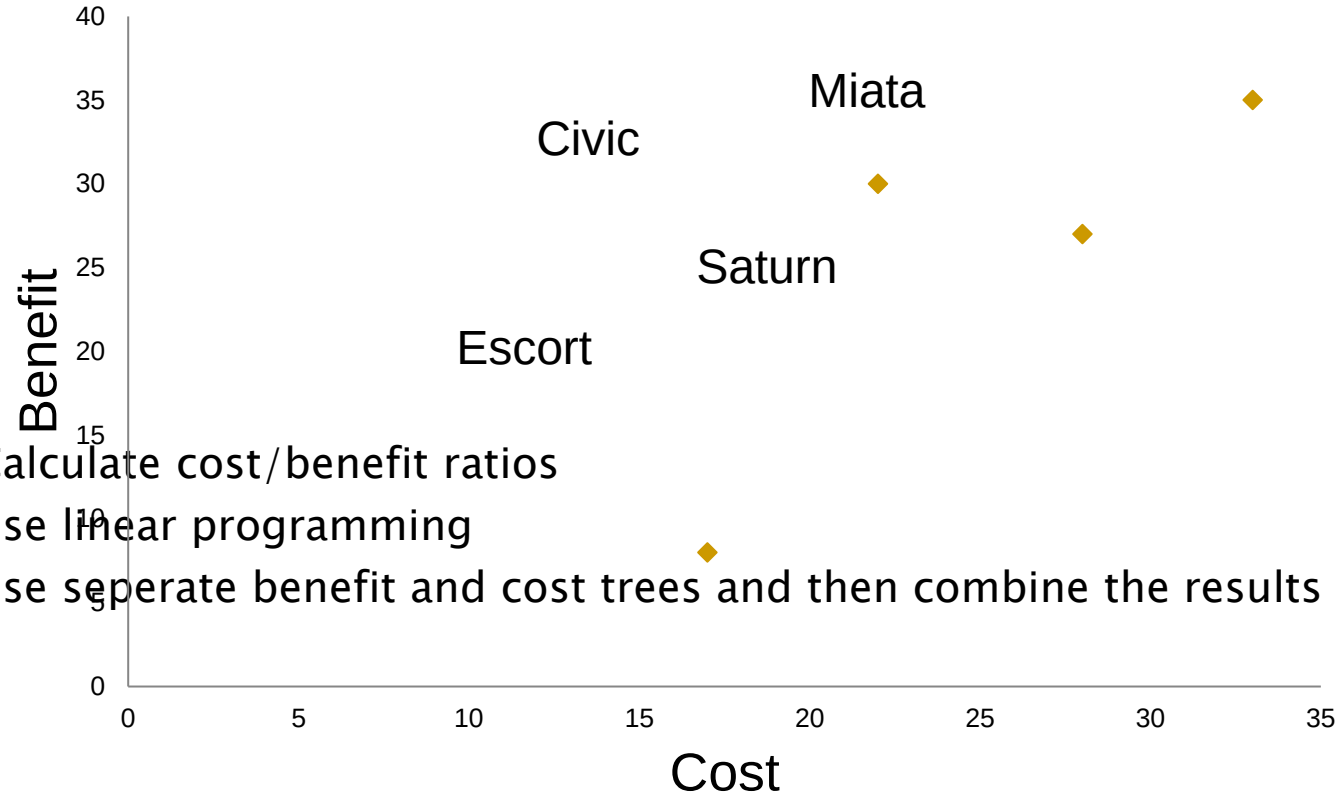
Adding “cost” as a a new criterion is very difficult in AHP. A new column and a new row will be added in the evaluation matrix. However, whole evaluation should be repeated since addition of a new criterion might affect the relative importance of other criteria as well!

Instead one may think of normalizing the costs directly and calculate the cost/benefit ratio for comparing alternatives!

	Cost	Normalized Cost	Benefits	Cost/Benefits Ratio
CIVIC	$12K	.22	.28	0.78
SATURN	$15K	.28	.25	1.12
ESCORT	$9K	.17	.07	2.42
MIATA	$18K	.33	.34	0.97

Methods for including cost criterion

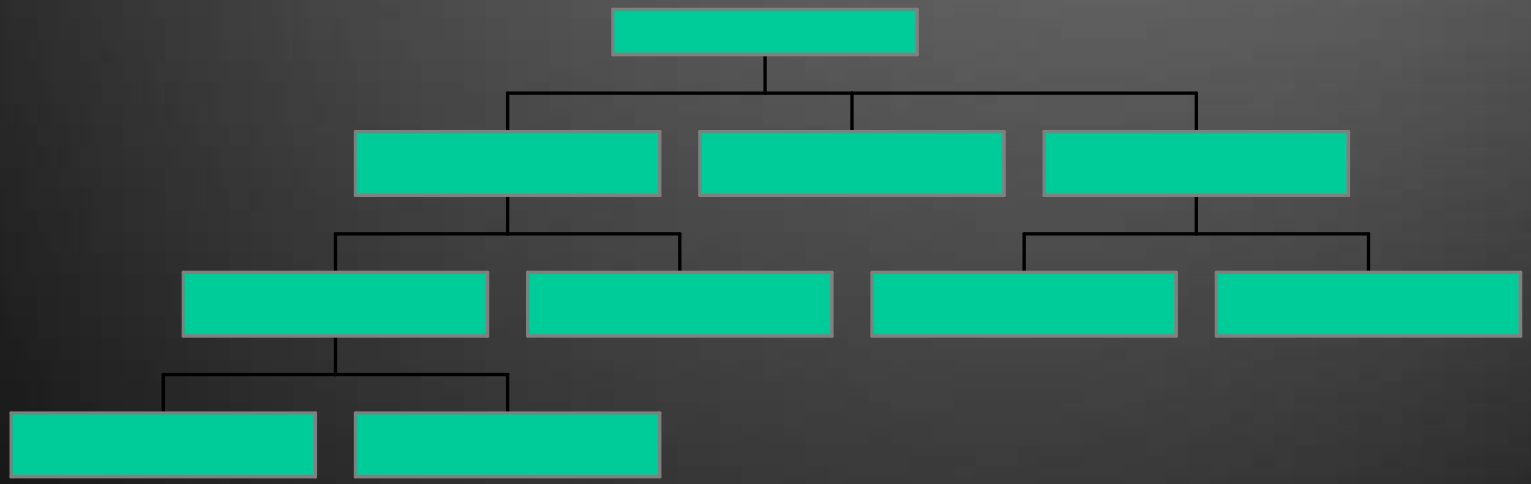
- Use graphical representations to make trade-offs.



- Calculate cost/benefit ratios
- Use linear programming
- Use seperate benefit and cost trees and then combine the results

Complex decisions

•Many levels of criteria and sub-criteria exists for complex problems.



AHP Software:

Professional commercial software Expert Choice developed by Expert Choice Inc. is available which simplifies the implementation of the AHP's steps and automates many of its computations

- computations
- sensitivity analysis
- graphs, tables

Ex 2: Evaluation of Job Offers

Ex: Peter is offered 4 jobs from Acme Manufacturing (A), Bankers Bank (B), Creative Consulting (C), and Dynamic Decision Making (D).
He bases his evaluation on the criteria such as location, salary, job content, and long-term prospects.

Step 1: Decide upon the relative importance of the selection criteria:

	Location	Salary	Content	Long-term
Location	1	1/5	1/3	1/2
Salary	5	1	2	4
Content	3	1/2	1	3
Long-term	2	1/2	1/3	1

Priority Vectors:

1) Normalize the column entries by dividing each entry by the sum of the column.
2) Take the overall row averages

	Location	Salary	Content	Long-term	Average
Location	0.091	0.102	0.091	0.059	0.086
Salary	0.455	0.513	0.545	0.471	0.496
Content	0.273	0.256	0.273	0.353	0.289
Long-term	0.182	0.128	0.091	0.118	0.130
	+				+
	1	1	1	1	1

Example 2: Evaluation of Job Offers

Step 2: Evaluate alternatives w.r.t. each criteria

Location Scores

	A	B	C	D
A	1	1/2	1/3	5
B	2	1	1/2	7
C	3	2	1	9
D	1/5	1/7	1/9	1

Relative Location Scores

	A	B	C	D	Avg.
A	0.161	0.137	0.171	0.227	0.174
B	0.322	0.275	0.257	0.312	
C	0.484	0.549	0.514	0.409	0.293
D	0.032	0.040	0.057	0.045	
					0.489
					0.044

Example 2: Calculation of Relative Scores

	Relative Scores for Each Criteria					Relative weights for each criteria		Relative scores for each alternative
	Location	**Salary**	**Content**	**Long-Term**				
A	0.174	0.050	0.210	0.510		0.086		0.164
B	0.293	0.444	0.038	0.012	x	0.496	=	0.256
C	0.489	0.312	0.354	0.290		0.289		0.335
D	0.044	0.194	0.398	0.188		0.130		0.238

More about AHP: Pros and Cons

Pros

- It allows multi criteria decision making.
- It is applicable when it is difficult to formulate criteria evaluations, i.e., it allows qualitative evaluation as well as quantitative evaluation.
- It is applicable for group decision making environments

Cons

- There are hidden assumptions like consistency. Repeating evaluations is cumbersome. → Users should be trained to use AHP methodology.
- Difficult to use when the number of criteria or alternatives is high, i.e., more than 7. → Use GDSS / Use constraints to eliminate some alternatives
- Difficult to add a new criterion or alternative → Use cost/benefit ratio if applicable
- Difficult to take out an existing criterion or alternative, since the best alternative might differ if the worst one is excluded.

Group Decision Making

The AHP allows group decision making, where group members can use their experience, values and knowledge to break down a problem into a hierarchy and solve. Doing so provides:

- Understand the conflicting ideas in the organization and try to reach a consensus.
- Minimize dominance by a strong member of the group.
- Members of the group may vote for the criteria to form the AHP tree. (Overall priorities are determined by the weighted averages of the priorities obtained from members of the group.)

However;
The GDSS does not replace all the requirements for group decision making. Open meetings with the involvement of all members are still an asset.

Example 3: AHP in project management

Prequalification of contractors aims at the elimination of incompetent contractors from the bidding process.

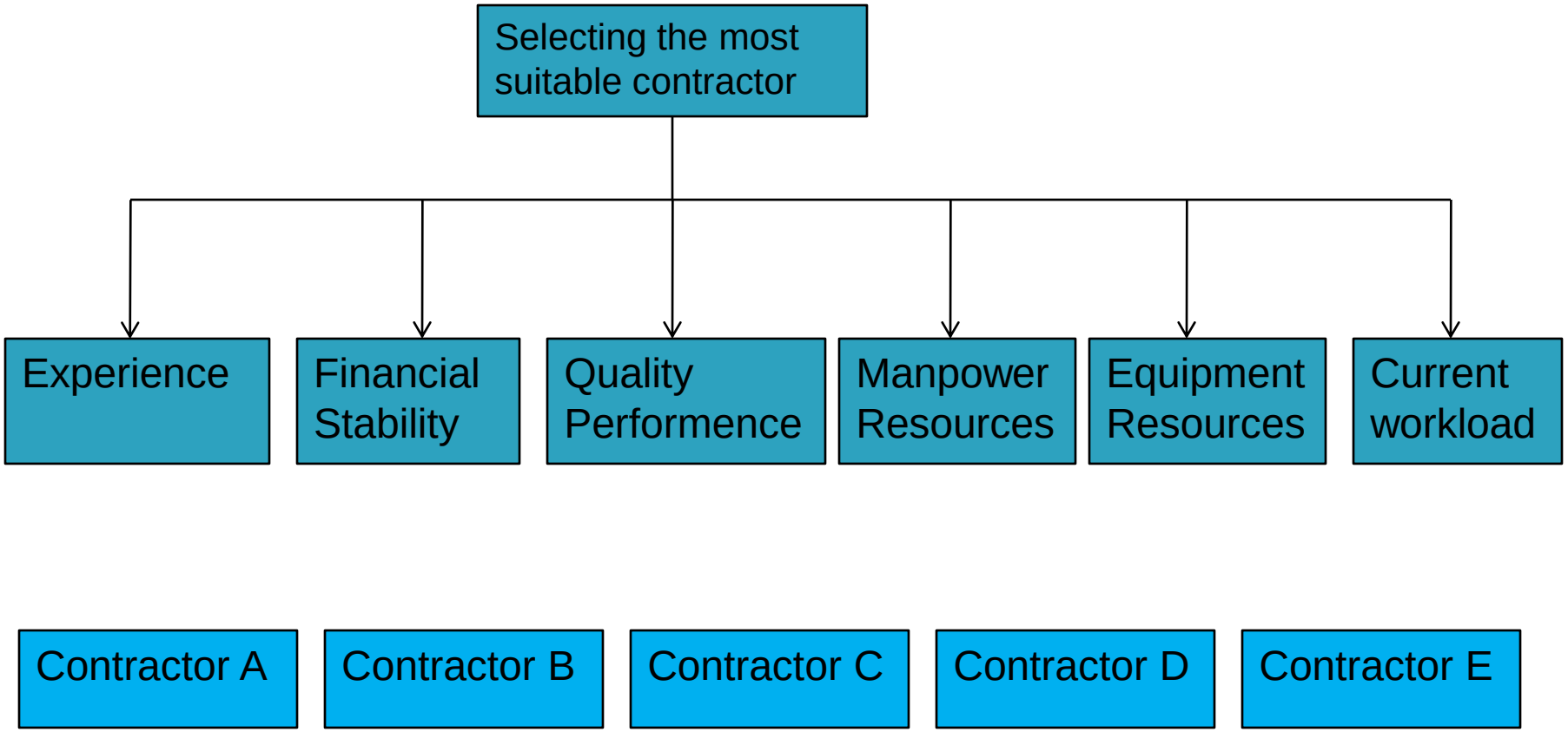
It is the choice of the decision maker to eliminate contractor E from the AHP evalution since it is not “feasible” at all !!

	Contractor A	Contractor B	Contractor C	Contractor D	Contractor E
Experience	5 years experience	7 years experience	8 years experience	10 years experience	15 years experience
	Two similar projects	One similar project	No similar project	Two similar projects	No similar project
		Special procurement experience	1 international project		
Financial stability	$7 M assets	$10 M assets	$14 M assets	$11 M assets	$6 M assets
	High growth rate	$5.5 M liabilities	$6 M liabilities	$4 M liabilities	$1.5 M liabilities
	No liability	Part of a group of companies		Good relation with banks	
Quality performance	Good organization	Average organization	Good organization	Good organization	Bad organization
	C.M. personnel	C.M. personnel	C.M. team	Good reputation	Unethical techniques
	Good reputation	Two delayed projects	Government award	Many certi®cates	One project terminated
	Many certi®cates	Safety program	Good reputation	Cost raised in some projects	Average quality
	Safety program		QA/QC program		
Manpower resources	150 labourers	100 labourers	120 labourers	90 labourers	40 labourers
	10 special skilled labourers	200 by subcontract	Good skilled labors	130 by subcontract	260 by subcontract
		Availability in peaks	25 special skilled labourers		

Example 3 (cont.'d)

	Contractor A	Contractor B	Contractor C	Contractor D	Contractor E
Equipment resources	4 mixer machines	6 mixer machines	1 batching plant	4 mixer machines	2 mixer machines
	1 excavator	1 excavator	2 concrete transferring trucks	1 excavator	10 others
	15 others	1 bulldozer	2 mixer machines	9 others	2000 sf steel formwork
		20 others	1 excavator		6000 sf wooden formwork
		15,000 sf steel formwork	1 bulldozer		
			16 others		
			17,000 sf steel formwork		
Current works load	1 big project ending	2 projects ending (1 big+ 1 medium)	1 medium project started	2 big projects ending	2 small projects started
	2 projects in mid (1 medium +1 small)		2 projects ending (1 big + 1 medium)	1 medium project in mid	3 projects ending (2 small + 1 medium)

Hierarchy Tree



Example 3: AHP in project management

Step 1: Evaluation of the weights of the criteria

Pair-wise comparison matrix for the six criteria[a]

	Exp.	FS	QP	MPR	ER	CWL	Priority vector
Exp.	1	2	3	6	6	5	0.372
FS	1/2	1	3	6	6	5	0.293
QP	1/3	1/3	1	4	4	3	0.156
MPR	1/6	1/6	1/4	1	2	1/2	0.053
ER	1/6	1/6	1/4	1/2	1	1/4	0.039
CWL	1/5	1/5	1/3	2	4	1	0.087
							$\sum = 1.00$

[a] $\lambda_{max} = 6.31$, CI = 0.062, RI = 1.24, CR = 0.05 < 0.1 OK.

Step 2: a) Pairwise comparison matrix for experience

Exp.	A	B	C	D	E
A	1	1/3	1/2	1/6	2
B	3	1	2	1/2	4
C	2	1/2	1	1/3	3
D	6	2	3	1	7
E	1/2	1/4	1/3	1/7	1

Exp.	A	B	C	D	E	Priority vector
A	0.08	0.082	0.073	0.078	0.118	0.086
B	0.24	0.245	0.293	0.233	0.235	0.249
C	0.16	0.122	0.146	0.155	0.176	0.152
D	0.48	0.489	0.439	0.466	0.412	0.457
E	0.04	0.061	0.049	0.066	0.059	0.055
						$\sum = 0.999$

[a] $\lambda_{max} = 5.037$, CI = 0.00925, RI = 1.12, CR = 0.0082 < 0.1 OK.

Example 3: AHP in project management

Calculation of priority vector:

	Exp. (0.372)	FS (02.93)	QP (0.156)	MPR (0.053)	ER (0.039)	CWL (0.087)
A	0.086	0.425	0.269	0.151	0.084	0.144
B	0.249	0.088	0.074	0.273	0.264	0.537
C	0.152	0.178	0.461	0.449	0.556	0.173
D	0.457	0.268	0.163	0.081	0.057	0.084
E	0.055	0.039	0.031	0.045	0.038	0.062

$$\times \begin{bmatrix} 0.372 \\ 0.293 \\ 0.156 \\ 0.053 \\ 0.039 \\ 0.087 \end{bmatrix} = \begin{bmatrix} 0.222 \\ 0.201 \\ 0.241 \\ 0.288 \\ 0.046 \end{bmatrix}$$

Probably Contractor-E should have been eliminated. It appears to be the worst.

Note that a DSS supports the decision maker, it can not replace him/her. Thus, an AHP Based DSS should allow the decision maker to make sensitivity analysis of his judgements on the overall priorities !

Multi Criteria Decision Making Models: PROMETHEE

- One of the most efficient and easiest MCDM methodologies.
- Developed by Jean-Pierre Brans and Bertrand Mareschal at the ULB and VUB universities since 1982
- Considers a set of criteria and alternatives. Criteria weights are determined that indicate the relative importance
- Utilizes a function reflecting the degree of advantage of one alternative over the other, along with the degree of disadvantage that the same alternative has with respect to the other alternative.
- In scaling, there are six options allowing the user to express meaningful differences by minimum gaps between observations. When type I is used, only relative advantage matters; type 6 is based on standardization with respect to normal distribution.

Ex: Media Selection for a Bicycle Co.

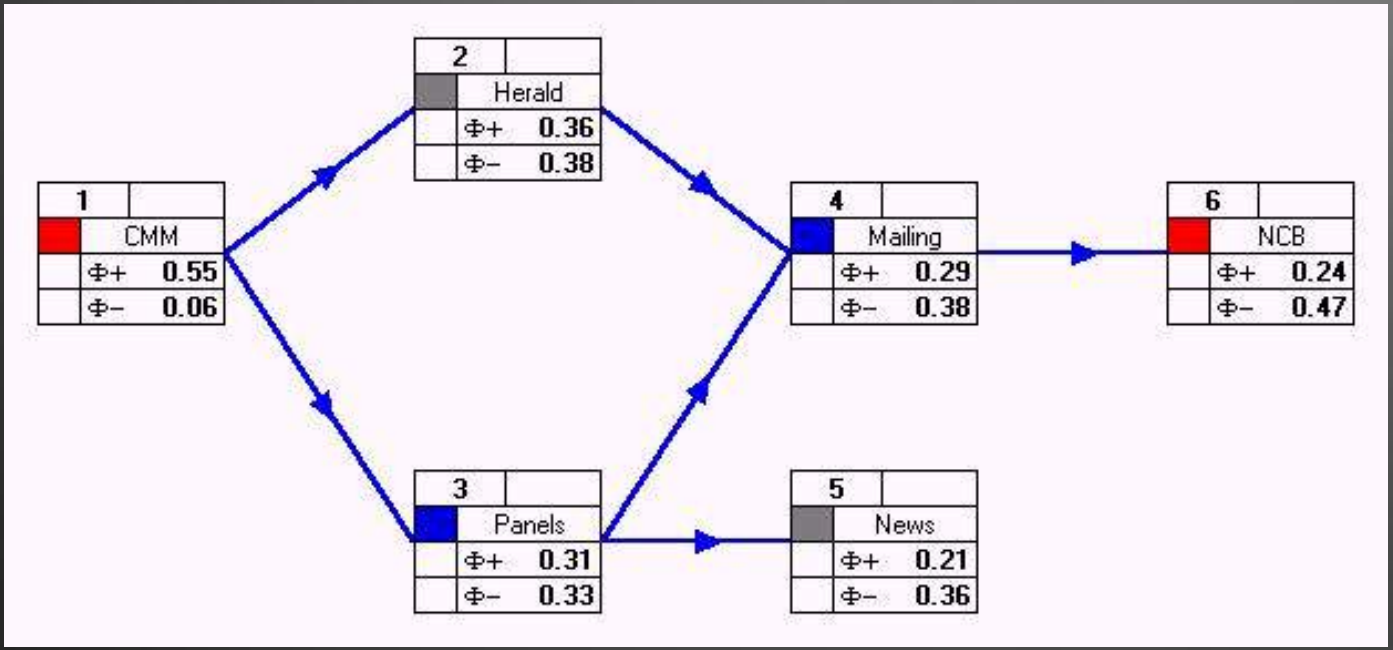
A bicycle manufacturing company is intending to advertise its products.

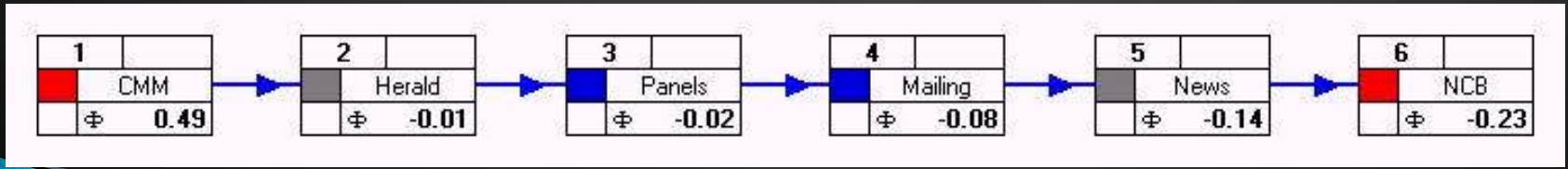
Six marketing actions are considered: Advertising in the international newspaper, *News; in the newspaper Herald; by mean of* advertising boards in large cities; of a personal mailing; by TV spots on channels *CMM or NCB.*

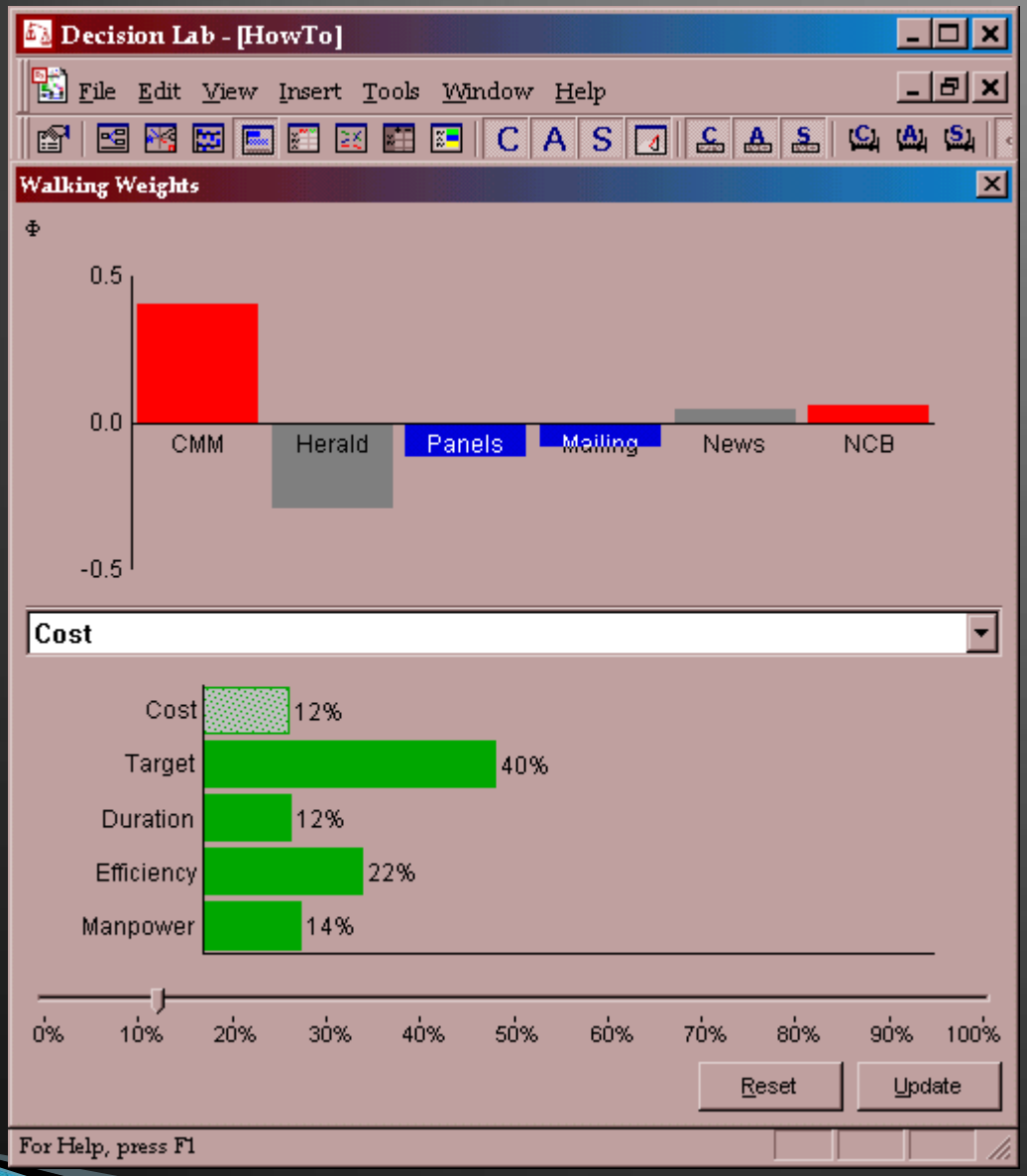
Criteria min/max	C1 cost min	C2 target max	C3 durat. max	C4 effic. max	C5 manp. min
News	60	900	22	51	8
Herald	30	520	31	13	1
Panels	40	650	20	58	2
Mailing	92	750	60	36	3
CMM	52	780	58	90	1
NCB	80	920	4	75	6

Units: Cost ($ 1,000), Target (10,000 people), Duration (days), Efficiency (0-100)
Manpower (# people involved in the company)

Partial anf full rankings with Promethee I and II







Ranking of the alternatives can be obtained for the selected weights

Additional constraints

- It is often necessary that several alternatives have to be selected subject to a set of goals.
- In this case an LP can be constructed with binary decision variables, which gives the selection of *r* actions, among *n* alternatives.

Let xi=1 if media i is selected and 0 otherwise, i=1,2,...,6.

φ(Ai) are the relative weight of media i, i=1,2,...,6.

Max φ(A1) *x1 + … + φ(A6) x6*

Subject to

x1 + x2 + x3 + x4 + x5 + x6 ≥ 2 (at least 2 media should be selected)

x1 + x2 + x3 + x4 + x5 + x6 ≤ 4 (at most 4 media should be selected.)

x1 + x2 = 1 (choose exactly one newspaper)

x5 + x6 = 1 ((choose exactly 1 TV channel)

625 *x1 + 550 x2 + 250 x3 + 150 x4 + 175 x5* + 750 *x6 ≥ 1200 (min. expected return)*

- 60 *x1 - 30 x2 + 40 x3 + 92 x4 + 52 x5* + 80 *x6 ≥ 0 (cost of advertising in newspapers should be less than 50% of total costs)*

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TOTAL
PRODUCTIVE
MAINTENANCE

DEFINITION

- **Maintenance is defined as the management, control, execution and quality assurance of activities which ensure the achievement of optimum availability and performance of a plant in order to meet business objectives.**

TPM - MEANING

- TPM is a partnership between the maintenance and production organization to improve product quality, reduce waste, reduce cost, increase equipment availability and improve maintenance state.

EVOLUTION OF MAINTENANCE

First Generation	Second Generation	Third Generation
❖Fix it when it broke	❖Higher plant availability ❖Longer equipment life ❖Lower Costs	❖Higher plant reliability and availability ❖Greater safety ❖Better quality ❖Longer equipment life ❖Cost Effectiveness

1940 1950 1960 1970 1980 1990 2000

TYPES OF MAINTENANCE

- **Corrective (or) breakdown maintenance**

  It implies that repairs are made after failure of machine or equipment

- **Scheduled (or) Routine maintenance**

  It is a stitch-in-time procedure aimed to avoiding breakdowns

TYPES OF MAINTENANCE

- **Preventive maintenance**

  It is carried out before the failure arises (or) prior to the equipment actually breakdowns. E.g. Overhauling & Periodic upkeep.

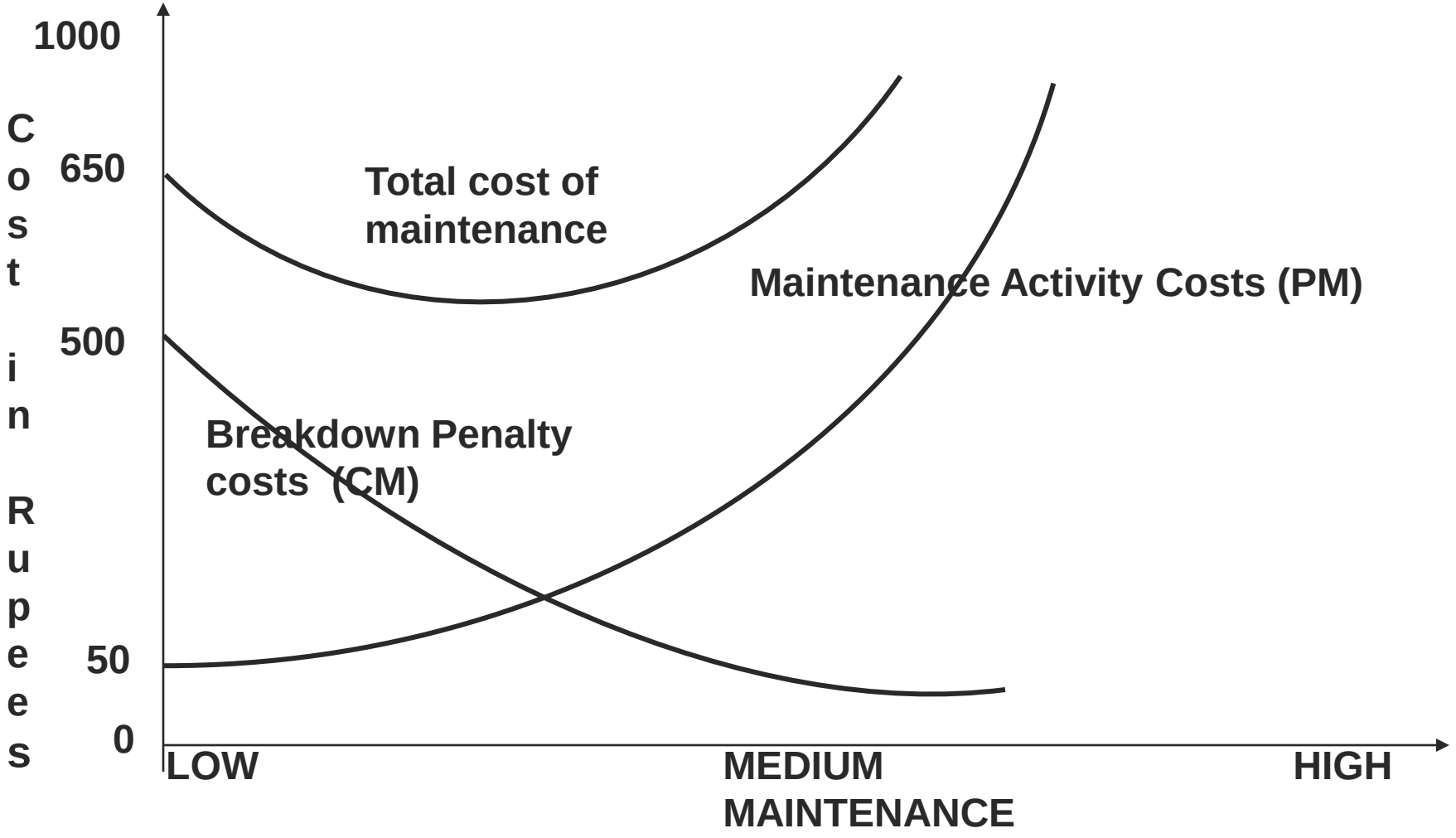
- **Predictive maintenance**

  Equipment Condition evaluated periodically and maintenance carried out.

OBJECTIVES OF TPM

- ☑ Improve Equipment Effectiveness
- ☑ Achieve Autonomous
- ☑ Plan Maintenance
- ☑ To Train all staff in maintenance skills
- ☑ To Zero Breakdowns

COST TRADE-OFF BETWEEN PM & CM



BIG LOSSES

1.	Breakdowns	Long interruptions, Costly Repairs
2.	Setup and changeover	Taking Longer time than needed
3.	Idling time and stoppages	Hard to quantify, add to big losses
4.	Reduced speed	Equipment cycle time reduces
5.	Defects and reworks	Quality losses & Unhappy customer

BENEFITS

- Increased productivity
- Equipment reliability
- Reduced down time
- Increased plant capacity
- Low production maintenance costs
- Team work Between Production & Maintenance People
- Improved safety & Profit

Genichi Taguchi

TAGUCHI'S QUALITY LOSS FUNCTION

INTRODUCTION

- Taguchi Methods is a statistical methods developed largely by GENICHI TAGUCHI to improve quality of manufactured goods.
- The philosophy of off-line quality control.
- Innovations in the design of experiments.

Taguchi Loss Function Definition

- Taguchi defines Quality as “the loss imparted by the product to society from the time the product is shipped.”

- LOSS = Cost to operate, Failure to function, maintenance and repair cost, customer dissatisfaction, poor design.
- Product to be produced “being within specification”

Taguchi's Vs Traditional Approach

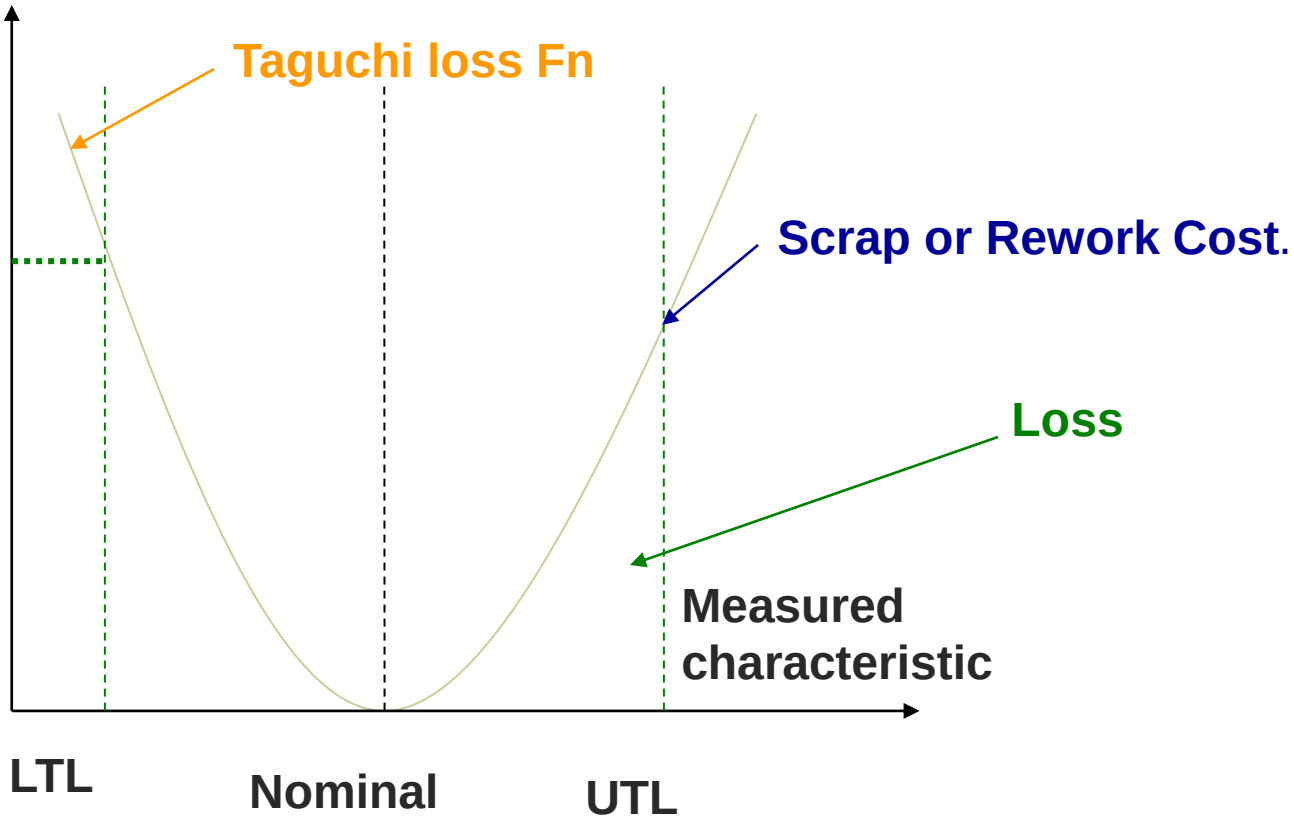
Taguch's	Traditional
When a product moves from its Target will cause the loss even if the product lies or not within Limits	There is Good or Bad Products only as per Limits

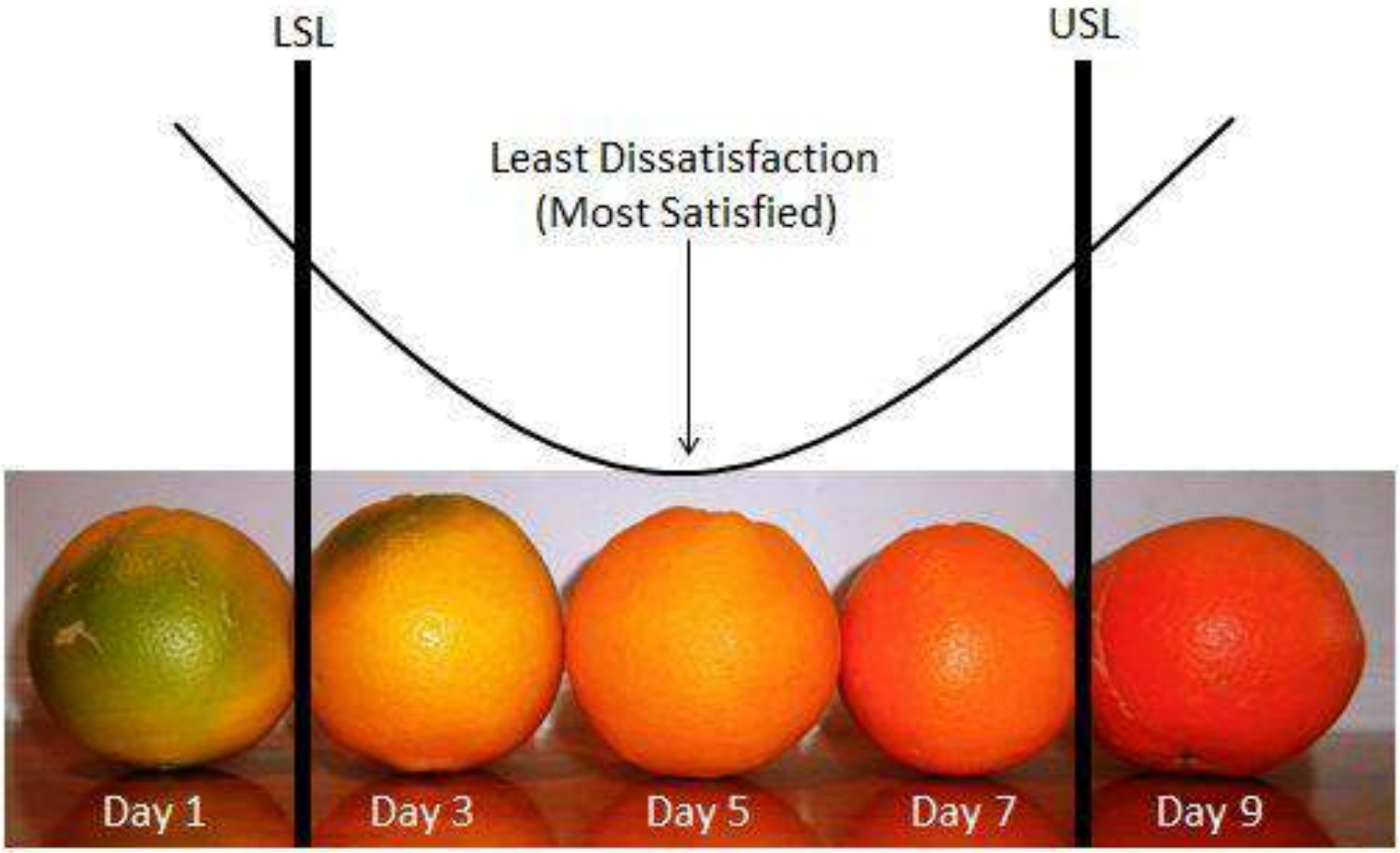
Taguchi's Quadratic Quality Loss Function

- Quality Loss Occurs when a product's deviates from target or nominal value.
- Deviation Grows, then Loss increases.

- Taguchi's U-shaped loss Function Curve.

Taguchi's U-shaped loss Function Curve.



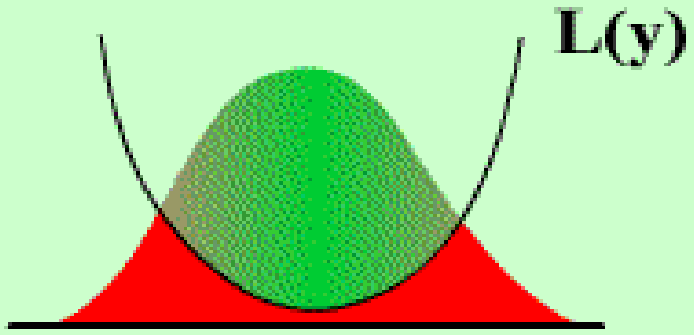

LSL
USL
Least Dissatisfaction
(Most Satisfied)
Day 1
Day 3
Day 5
Day 7
Day 9

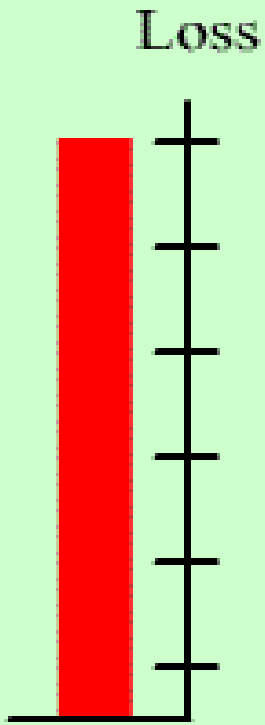
TAGUCHI LOSS FUNCTION

play
stop
step
rew

$$L(y) = k(y-m)^2$$

The loss due to performance variation is proportonial to the square of the deviation of the performance characteristic from its nominal value.





Formula to find Taguchi's Loss Fn

Taguchi uses Quadratic Equation to determine loss Curve

- L(x) = k*(x-t)^2

Where **L (x)** = Loss Function

k = loss coefficient

x = measured value

t = target value

- Avg Loss of a sample set: L = k*(s^2 + (pm - t)^2)
  where,
  s = standard deviation of sample
  pm = process mean
- Total Loss = Avg. Loss * number of samples

QUALITY LOSS FUNCTIONS

(i)Nominal – The Best (ii)Smaller – The Better

(iii) Larger – The Better

When we have a characteristic with bi-lateral tolerance, the nominal value is the target. That is, if all parts are made to this value, the variation will be zero and it is the best.

For example: A component with a specification of 10 ± 0.01 mm has the nominal value of 10 mm. Similarly, if the supply voltage has a specification of 230 ± 10 V. Here the nominal value is 230 V.

PROBLEM

- A medical company produces a part that has a hole measuring 0.5" + 0.050". The tooling used to make the hole is worn and needs replacing, but management doesn't feel it necessary since it still makes "good parts". All parts pass QC, but several parts have been rejected by assembly. Failure costs per part is $45.00 Using the loss function, explain why it may be to the benefit of the company and customer to replace or sharpen the tool more frequently. No of parts produced is 30.Use the data below:

- Measured Value

  0.459 | 0.478 | 0.495 | 0.501 | 0.511 | 0.527
  0.462 | 0.483 | 0.495 | 0.501 | 0.516 | 0.532
  0.467 | 0.489 | 0.495 | 0.502 | 0.521 | 0.532
  0.474 | 0.491 | 0.498 | 0.505 | 0.524 | 0.533
  0.476 | 0.492 | 0.500 | 0.509 | 0.527 | 0.536

- **Solution**

  average of the points is 0.501 and the standard deviation is about 0.022.

- find k,
  using L(x) = k * (x-t)^2
  $45.00 = k * (0.550 - 0.500)^2
  k = 18000

Average loss equation: L=k * (s^2 + (pm - t)^2)

- L = 18000 * (.022^2 + (.501 - .500)^2) = 8.73

  So the average loss per part in this set is $8.73.

  For the loss of the total 30 parts produced,

  L * number of samples
  = $8.73 * 30
  = $261.90

INFERENCE

- Even though all measurements were within specification limits and the average hole size was 0.501", the Taguchi loss shows that the company lost about $261.90 per 30 parts being made. If the batch size was increased to 1000 parts, then the loss would be $8730 per batch. Due to variation being caused by the old tooling, the department is losing a significant amount of money.

Problem

- A part dimension on a power tool is specified as 32.25±0.25.Company records show±0.25 exceeded & 75% of the returned fo replacement. Cost of replacement is Rs.12,500.Determine **k** & QLF.

Solution : Expected Cost of repair

C = 0.75(12500) = Rs 9,375

$k = C/d^2 = 9375/(90.25)^2$ = Rs 1,50,000

QLF =L (x) 1,50,00(x-N)

OEE

- **In NLC power plant the** shift timings are from 8 am to 5 pm. The work of a mechanical engineer is to supervise the plant and take maintain the work that has been alotted. As the mechanical engineer has to much to work on and results in stress, fatigue so the company has decided to give him breaks at regular intevals. (i) 2 short breaks of 10mins (ii) 1 fatigue break of 5 mins (iii) 1 long break of 30 mins long
- Some interupptions and breakdowns are there in the production process which is approximately 45mins.
- The power plant produces 52 kw per/hr , the energy waste that is occuring around here is around 442 kw
- Find the O.E.E overall (performance, availability, rate of quality)

$$Planned\ working\ time = shift\ length - breaks$$
$$= 480 - 20 - 5 - 30\ mins$$
$$= \mathbf{425\ mins}$$

1. $Operating\ time =$
   $planned\ production\ time - downtime\ (interruptions\ or\ break\ down)$
   $$= 425 - 45\ mins$$
   $$= \mathbf{380\ mins}$$

2. Good pieces = Total energy − wastage
   $$= 19749.6 - 442$$
   $$= \mathbf{19307.6}$$

3. $Availability = \frac{Operating\ time}{planned\ production\ time}$
   $$= \frac{380}{425}$$
   $$=$$

4. $$Performance = \frac{\frac{total\ energy}{opeating\ time}}{ideal} run\ rate$$

$$= \frac{19749.6}{380} /60$$

5. $$Quality = \frac{energy\ without\ wastage}{total\ energy}$$

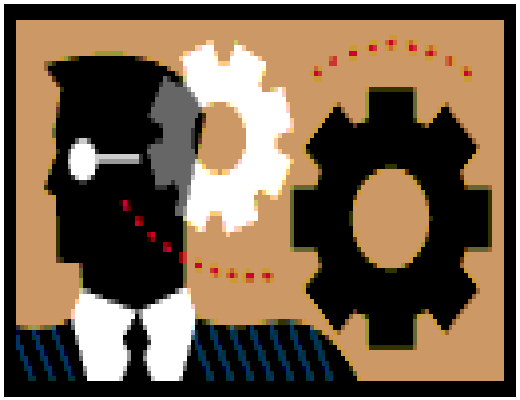
$$= \frac{19307.6}{19749.6}$$


END

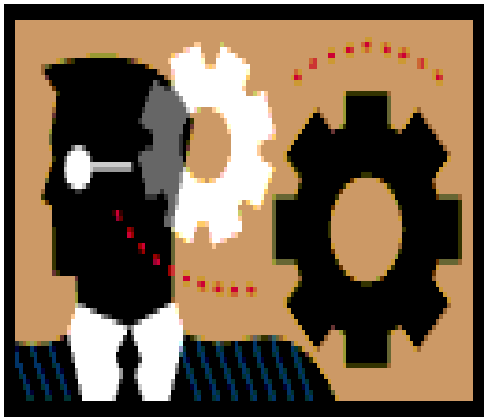

ISO in brief

International Standards for
a sustainable world

- A German company wins a huge contract to sell components to a factory in North Carolina.
- A Swiss firm becomes the leading supplier of power line filters in the U.S.



- A Japanese electronics conglomerate outbids several European manufacturers for a project in South America.
- These are not isolated events, but rather an indication that we have entered a new age in commerce.



INTRODUCTION

- Today, more and more business and industry leaders realize that in order to thrive, or even survive, in the new global economy, their companies must become truly world-class.
- And that means *quality*.
- Quality in your products and services. Quality in your practices and procedures. Quality you maintain and you can prove - because it is documented.

INTRODUCTION

- Quality as a competitive weapon.
- And that is the reason for the growing move to ISO 9000 certification.
- The best companies are starting to insist on it. Your competitors may already be pursuing it. And if you plan to do business in Europe or Japan, it is absolutely essential.

DO YOU KNOW???

- *The race for ISO certification has already started. In the first half of 2003, it is estimated that over **60,000** European companies are registered in compliance with the ISO 9000 standards. In the U.S., over 1000 companies have been certified. (In 2005, the number of certified companies more than doubled.)*

What does the term "ISO" stand for?

- **The term *ISO* stands for the *International Organization for Standardization*. You would reasonably assume that it ought to be *IOS*, but it isn't. Apparently, the term *ISO* was chosen (instead of *IOS*), because *iso* in Greek means *equal*, and ISO wanted to convey the idea of *equality* - the idea that they develop standards to place organizations on an *equal footing*.**

HISTORY OF ISO

- The International Standards Organization (ISO), in Geneva, Switzerland, was founded in 1946 to develop a common set of standards in manufacturing, trade and communications.
- It is composed of the national standards institutes and organizations of 97 countries worldwide, including the American National Standards Institute (ANSI).

HISTORY OF ISO

- The ISO publishes thousands of standards, but the ISO 9000 series is having a major impact on international trade.
- First published in 1987, the standards have been rapidly adopted by organizations in Europe, Asia and North America. In addition, there is a movement by several industries in the EEC where ISO certification is now a prerequisite to product certification. And that trend is growing.

HISTORY OF ISO

- The standards have been endorsed by the American Society of Quality Control, the European Standards Institutes, and by the Japanese Industrial Standards Committee.
- In the U.S., the American Society for Quality Control runs the Registrar Accreditation Board (RAB), which is accountable to ISO when it comes to certification. The RAB has recognized over 40 certification bodies that have trained certified auditors.

FIRST

- Asia's first ISO certified saloon in Chennai

- What is the common strand that runs between giant industrial groups like TVS, Tatas, Birlas and the humbler Ramesh Gents' Hair Stylist on the upmarket Nungambakkam High Road in Chennai?

ISO…

ISO is the world's leading developer of International Standards

ISO standards are designed to be implemented worldwide.

ISO.

ISO standards specify the requirements

- for state-of-the-art products, services,
- processes, materials and systems,
- and for good conformity assessment,
- managerial and organizational practice

ISO standards make a positive contribution to the world we live in. They ensure vital features such as quality, ecology, safety, economy, reliability, compatibility, interoperability, efficiency and effectiveness. They facilitate trade, spread knowledge, and share technological advances and good management practices.

ISO standards avoid having to reinvent the wheel. *They distil the latest in expert knowledge and make it available to all. In this way, they propagate new advances and transfer technology, making them an invaluable source of knowledge.*

ISO standards teach the fisherman. *"Giving fish" is one way. By implementing ISO standards and participating in their development, developing countries "learn how to fish for themselves". ISO standards transfer know-how, avoid wasting resources, safeguard public health and safety, and provide criteria for evaluating imports and for producing exports to compete on markets worldwide.*

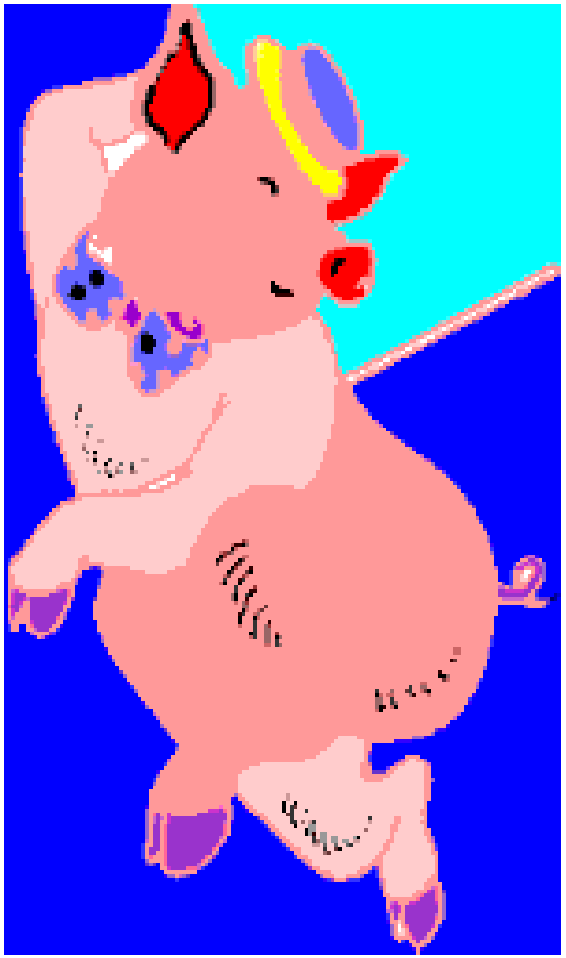
ISO standards level the playing field. They make transparent the requirements that products must meet on world markets, as well as the conformity assessment mechanisms for checking that those products measure up to standards. As a result, suppliers from developed and developing countries alike can compete on an equal basis on markets everywhere.

ISO standards make the cake bigger. When new technologies or business sectors emerge, internationally agreed ISO standards on basic features, such as terminology, compatibility and interoperability, help to disseminate them and increase the size of the market for the derived products and services.

What exactly is ISO 9000?

- **Documentation** is at the core of ISO 9000 conformance. In fact, the standards have been described as this:
- "Say what you do. Do what you say. Write it down."

What's so funny about ISO 9000?



- ***Arguing with an ISO 9000 auditor is like wrestling with a pig in mud . . .***
  Sooner or later you realize the pig enjoys it!

What exactly is ISO 9000?

- ISO 9000 is a set of international standards for both quality management and quality assurance that has been adopted by over 90 countries worldwide.
- The ISO 9000 standards apply to all types of organizations, large and small, and in many industries.

What exactly is ISO 9000?

- The standards require:
- A standard language for documenting quality practices.
- A system to track and manage evidence that these practices are instituted throughout the organization.
- A third-party auditing model to review, certify and maintain certification of organizations.

What exactly is ISO 9000?

- The ISO 9000 series classifies products into generic product categories: hardware, software, processed materials and services.
- ISO 9000 - Explains fundamental quality concepts and provides guidelines for the selection and application of each standard.
- ISO 9001 - Model for quality assurance in design, development, production, installation and servicing.
- ISO 9004 - Guidelines for the applications of standards in quality management and quality systems.

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- ISO 9004 - Guidelines for the applications of standards in quality management and quality systems.

What are the basic functions of the ISO 9000 standards?

- Simply stated, the ISO 9000 standards define "quality" in ways that have been recognized and accepted worldwide.

- The goal is to increase customer confidence in the quality system used by their suppliers. The standards are designed to:
- Establish consistent language and terminology
- Provide baseline quality practices that are accepted internationally
- Reduce the need for costly on-site supplier assessments

- **It doesn't matter what size they are or what they do.**
- **It can help both product and service oriented organizations achieve standards of quality that are recognized and respected throughout the world.**

Documentation

- *ISO 9000 standards don't tell you how to run your business. They only define the critical **documented** elements that must be taken into consideration to produce a quality product.*

A Little Story

- This is a story about four people named **Everybody**, **Somebody**, **Anybody**, **and** Nobody.
- There was an important job to be done and Everybody was sure that **Somebody** would do it.
- **Anybody** could have done it, but Nobody did it.
- **Somebody** got angry about that, because it was Everybody's job.
- Everybody thought **Anybody** could do it, but Nobody realized that Everybody wouldn't do it.
- It ended up that Everybody blamed **Somebody** when Nobody did what **Anybody** could have done!

PURPOSE

- **ISO's purpose is to facilitate international trade by providing a single set of standards that people everywhere would recognize and respect.**

purpose

- **The purpose of ISO 9001 is to assure customers that suppliers can provide quality products and services.**

- **You need to control the quality of your products and services.**
- **You need to reduce the costs associated with poor quality.**
- **Your customers want you to become certified.**
- **Your markets expect you to be certified.**
- **Your competitors are already certified**

Standards and guidelines	Purpose
ISO 9000:2000, *Quality management systems - Fundamentals and vocabulary*	Establishes a starting point for understanding the standards and defines the fundamental terms and definitions used in the ISO 9000 family which you need to avoid misunderstandings in their use.
ISO 9001:2000, *Quality management systems - Requirements*	This is the requirement standard you use to assess your ability to meet customer and applicable regulatory requirements and thereby address customer satisfaction. It is now the only standard in the ISO 9000 family against which third-party certification can be carried.

ISO 9004:2000, *Quality management systems - Guidelines for performance improvements*	This guideline standard provides guidance for continual improvement of your quality management system to benefit all parties through sustained customer satisfaction.
ISO 19011, *Guidelines on Quality and/or Environmental Management Systems Auditing* (currently under development)	Provides you with guidelines for verifying the system's ability to achieve defined quality objectives. You can use this standard internally or for auditing your suppliers.
ISO 10005:1995, *Quality management - Guidelines for quality plans*	Provides guidelines to assist in the preparation, review, acceptance and revision of quality plans.
ISO 10006:1997, *Quality management - Guidelines to quality in project management*	Guidelines to help you ensure the quality of both the project processes and the project products.

ISO 10007:1995, *Quality management - Guidelines for configuration management*	Gives you guidelines to ensure that a complex product continues to function when components are changed individually.
ISO/DIS 10012, *Quality assurance requirements for measuring equipment* - Part 1: *Metrological confirmation system for measuring equipment*	Give you guidelines on the main features of a calibration system to ensure that measurements are made with the intended accuracy.
ISO 10012-2:1997, *Quality assurance for measuring equipment* - Part 2: *Guidelines for control of measurement of processes*	Provides supplementary guidance on the application of statistical process control when this is appropriate for achieving the objectives of Part 1.
ISO 10013:1995, *Guidelines for developing quality manuals*	Provides guidelines for the development, and maintenance of quality manuals, tailored to your specific needs.

ISO/TR 10014:1998, *Guidelines for managing the economics of quality*	Provides guidance on how to achieve economic benefits from the application of quality management.
ISO 10015:1999, *Quality management - Guidelines for training*	Provides guidance on the development, implementation, maintenance and improvement of strategies and systems for training that affects the quality of products.
ISO/TS 16949:1999, *Quality systems - Automotive suppliers - Particular requirements for the application of ISO 9001:1994*	Sector specific guidance to the application of ISO 9001 in the automotive industry.

Why is ISO 9000 Important?

- **ISO 9000 is important because of its *orientation*.**

- **ISO 9000 is important because of its *international* orientation. .**
- **ISO is also important because of its *systemic orientation*.**

- ***if you want to have a* quality *attitude you must have a* quality *system*. This is what ISO recognizes, and this is why ISO 9000 is important.**

Why has ISO 9000 become so important?

- For the first time, there is one internationally accepted standard of quality.
- There is a way to determine and measure that quality.
- There is even a way to prove it..

DID YOU KNOW???

- *In the U.S., the Department of Defense (DoD) is considering replacing its MIL-Q standard with the ISO 9000 series. The U.S. Food and Drug Administration (FDA) has plans to incorporate it into its Good Manufacturing Practices policy*

What about TQM?

- Total Quality Management (TQM) is yet another way of approaching quality processes for your organization and may help support your ISO 9000 certification.
- In fact, many of the practices and policies of TQM are comparable to the ISO 9000 model.

- .

What about TQM?

- Manufacturing experts agree that ISO 9000 certification provides a solid foundation for developing a TQM system. And if undertaken together, relatively little extra effort or expense is needed to achieve both.
- Even two companies who do business with each other may disagree on the standards. ISO 9000 standards are clearly defined and internationally accepted. And that makes ISO 9000 an excellent place to launch your TQM initiative

How can a company determine whether it will benefit from ISO 9000 certification?

- **International**
- Does your company, or the companies you supply, have a global focus?
- Do you, or others in your industry, derive a significant amount of revenue from international business?
- Do you see that as a future growth opportunity for your organization?

How can a company determine whether it will benefit from ISO 9000 certification?

- **New business**
  - Are you getting ISO 9000 inquiries from the companies you sell to?
  - Are there other companies you could do business with, if you gained ISO 9000 certification?
  - Do you do business with any government agencies? Would that represent a new source of business for you in the future?

How can a company determine whether it will benefit from ISO 9000 certification?

- Quality
- Is quality an integral part of your entire organization, across all functions?
- Is your company's reputation based on quality? Is that one of the important selling points in the industry in which you compete?
- Do you want to give your existing quality assurance program a platform to improve quality?
- Most importantly, do you see quality as a competitive edge that could help you accomplish your organization's goals in the 90s?

- *If you answered "yes" to several of these questions, your organization may benefit from ISO 9000 certification.*

FACTS

- ITC Hotel Maurya Sheraton was the **first** hotel in India to **get ISO** 14001. **...**
- **IndiaMART becomes the first ISO Certified Dotcom Company**

Can I quantify exactly what it will be worth?

- Unlike many TQM initiatives or general quality improvements, the benefits of ISO 9000 certification have been studied and quantified.
- In a September 1991 study for the British government, *Survey of Quality Consultancy Scheme Clients 1988-90,* researchers (Pera International and Salford University Business Service Ltd.) contacted over 2300 firms. The survey of registered companies found that:

o 89% reported greater operational efficiency

o 48% reported increased profitability

o 76% reported improvement in marketing

o 26% reported increased export sales

Can it give a competitive edge?

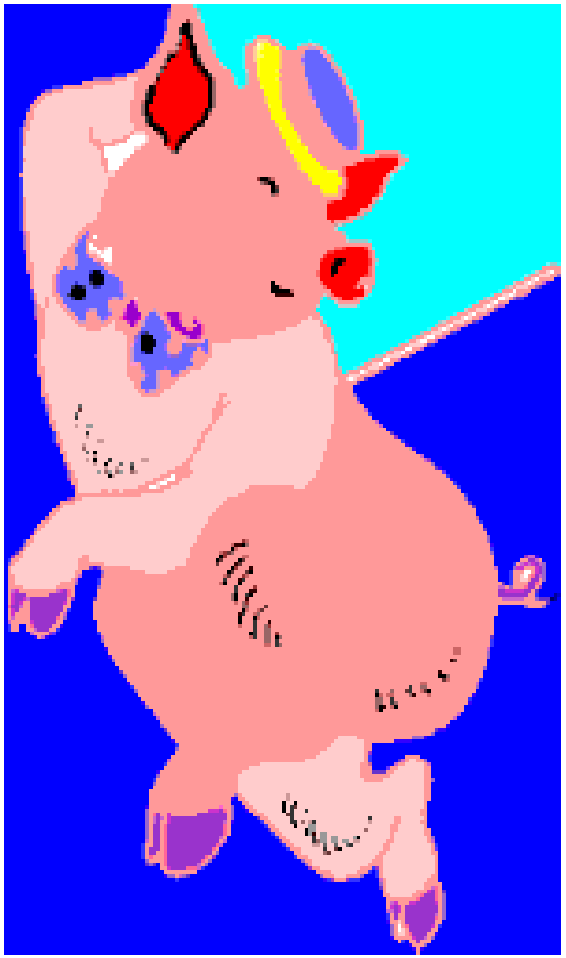
- You can use ISO 9000 certification to gain or maintain approved vendor status, even when companies reduce the number of their suppliers.
- You can enter new and lucrative markets that were previously closed to you.

Can it give a competitive edge?

- You can successfully compete with virtually any other company in your industry.
- In fact, small and medium-sized companies are using ISO 9000 to win business away from much larger organizations.

- **Documentation is at the core**
- *"Documentation sounds simple, but it's one of the principal things that must happen with ISO 9000."*
  - Mark Morrow, Sr. Editor, Quality Systems Update

What's so funny about ISO 9000?



- ***Arguing with an ISO 9000 auditor is like wrestling with a pig in mud . . .***
  Sooner or later you realize the pig enjoys it!

How True Is The Story ?

- This is one of those stories that get circulated via fax from time to time. Could the aerospace company described below get ISO certified? What are your thoughts?
- Once upon time, an aerospace company in Maryland and a Japanese automobile company decided to have a competitive boat race on the Potomac river. Both teams practiced hard and long to reach their peak performance. On the big day they both felt as ready as they could be.
- The Japanese won by a mile.
- Afterwards, the American team became very discouraged by the loss and morale sagged. Corporate Management decided that the reason for the crushing defeat had to be found. A "Continuous Measurable Improvement" team was set up to investigate the problem and to recommended appropriate corrective action. Their conclusion:
- The problem was that the Japanese team had eight people rowing and one person steering, whereby the American team had one person rowing and eight people steering. The American Company Steering Committee immediately hired a consulting firm to do a study on the management structure. After some time and millions of dollars, the consulting firm concluded that "Too many people were steering and not enough rowing!"

- To prevent losing to the Japanese again next year, the team's management structure was totally reorganized to four Steering Managers, three Area Steering Managers, one Staff Steering Manager and a new performance system for the person rowing the boat to give him more incentive to work harder. "We must give him empowerment and enrichment. That should accomplish our Total Quality Management goals!!"
- The next year the Japanese won by two miles.
- Humiliated, the aerospace company laid off the rower for poor performance, sold the paddles, canceled all capital investment for new equipment, halted development of a new boat, gave a "High Performance" award to the consulting firm, then distributed the money saved as bonuses to the senior executives

NEED

- Many manufacturers even have to undergo customer-driven "quality audits," which can be expensive and time-consuming.
- ISO 9000 practically eliminates the need for many customer-driven quality programs.
- ISO 9000 certification is a uniform standard, accepted and recognized internationally. So you save money.

NEED

- *you begin to accrue benefits even before you achieve ISO 9000 certification*.
- The preparation for ISO 9000 registration involves a close analysis of your existing quality systems.
- ISO 9000 can improve overall business efficiency

NEED

- ISO 9000 can ensure timely, accurate, accessible information
- ISO 9000 can help you develop "best practices" and eliminate costly surprises
- ISO 9000 improves the quality of your information

NEED FOR ISO

- Companies who have achieved ISO 9000 certification enjoy a significant advantage in satisfying their customers and gaining new ones. It also helps maintain approved vendor status, as the trend is to reduce the number of suppliers.
- In fact, a recent study of certified companies revealed that ISO 9000 certification had also brought unexpected benefits, such as **greater operational efficiency, increased profitability, savings in administrative costs, and improvements in marketing and sales activity.**

NEED

- Standards make an enormous contribution to most aspects of our lives - although very often, that contribution is invisible.
- We are usually unaware of the role played by standards in raising levels of quality, safety, reliability, efficiency and interchangeability - as well as in providing such benefits at an economical cost.

NEED

- ISO standards also have important economic and social repercussions. ISO standards make a positive difference, not just to engineers and manufacturers for whom they solve basic problems in production and distribution, but to society as a whole.

NEED

. They are useful to

- industrial and business organizations of all types,
- to governments and other regulatory bodies,
- to trade officials,
- to conformity assessment professionals,
- to suppliers and customers of products and services in both public and private sectors,
- and, ultimately, to people in general in their roles as consumers and end users

NEED

- ISO standards contribute to making the development, manufacturing and supply of products and services more efficient, safer and cleaner.
- They make trade between countries easier and fairer.
- They provide governments with a technical base for health, safety and environmental legislation.
- They aid in transferring technology to developing countries.
- ISO standards also serve to safeguard consumers, and users in general, of products and services - as well as to make their lives simpler.

NEED FOR ISO

- **ISO 9000 is sweeping the world. It is rapidly becoming *the* most important quality standard.**
- **Thousands of companies in over 100 countries have already adopted it, and many more are in the process of doing so. Why?**
- **Because it controls quality.**
- **It saves money.**
- **Customers expect it.**
- **And competitors use it.**

NEED FOR ISO

- In a word, ***customers*****.**
- More than just a quality standard, ISO 9000 has become a competitive advantage.
- In many countries, ISO 9000 compliance is a **must** for organizations that sell to buyers of industrial products. In the U.S. and Canada, it is becoming increasing important to manufacturers across all industries.

NEED

- A simple but comprehensive set of instructions (procedures, work instructions, etc) that enable consistency of work practices and ease training of new staff.
- Accurate reporting mechanisms that enable the identification of adverse trends and the implementation of effective corrective action.
- Achievement of specific goals.
- Improved worker confidence and participation.

NEED

- Achievement of world’s best practice.
- Improved efficiency and productivity.
- Effective management of risk.
- Improved marketability of products locally and internationally
- Reduction in paperwork
- Automation of document flows
- Improvement in morale
- Effective record management

FACTS

- ISO Quality Standard Provides Corporations With Substantial Financial Rewards
- U.S. publicly held companies traded on the New York Stock Exchange that receive certification under the International Standards Organization's 9000 quality standard show significant improvement in financial performance compared to those companies that have not pursued the standard, according to researchers. In analyzing the impact of ISO 9000 certification on publicly traded firms, researchers from UCLA, the University of Maryland and the Universidad Carlos III in Madrid, found that there is a direct correlation with a firm's return on assets.

How ISO standards benefit society

- *For businesses*, suppliers can base the development of their products and services on specifications that have wide acceptance in their sectors. This, in turn, means that businesses using International Standards are increasingly free to compete on many more markets around the world.

BENEFITS

- According to leading experts, the ISO 9000 standards result in greater operational efficiency, increased productivity, reduced overtime payments, reduced administrative costs and the elimination of unnecessary procedures.
- And while some people think that ISO 9000 benefits are mainly for large organizations, studies have shown that they also produce **significant savings** for smaller companies, such as sub-contractors.

BENEFITS

- ***For customers***, products and services are based on International Standards brings them an increasingly wide choice of offers, and they also benefit from the effects of competition among suppliers.
- ***For governments***, International Standards provide the technological and scientific bases underpinning health, safety and environmental legislation.

BENEFITS

- ***For trade officials*** International Standards create "a level playing field" for all competitors. International Standards are the technical means by which political trade agreements can be put into practice

BENEFITS

- ***For developing countries***, important source of technological know-how. By defining the characteristics that products and services will be expected to meet on export markets, International Standards give developing countries a basis for making the right decisions when investing their scarce resources and thus avoid squandering them.

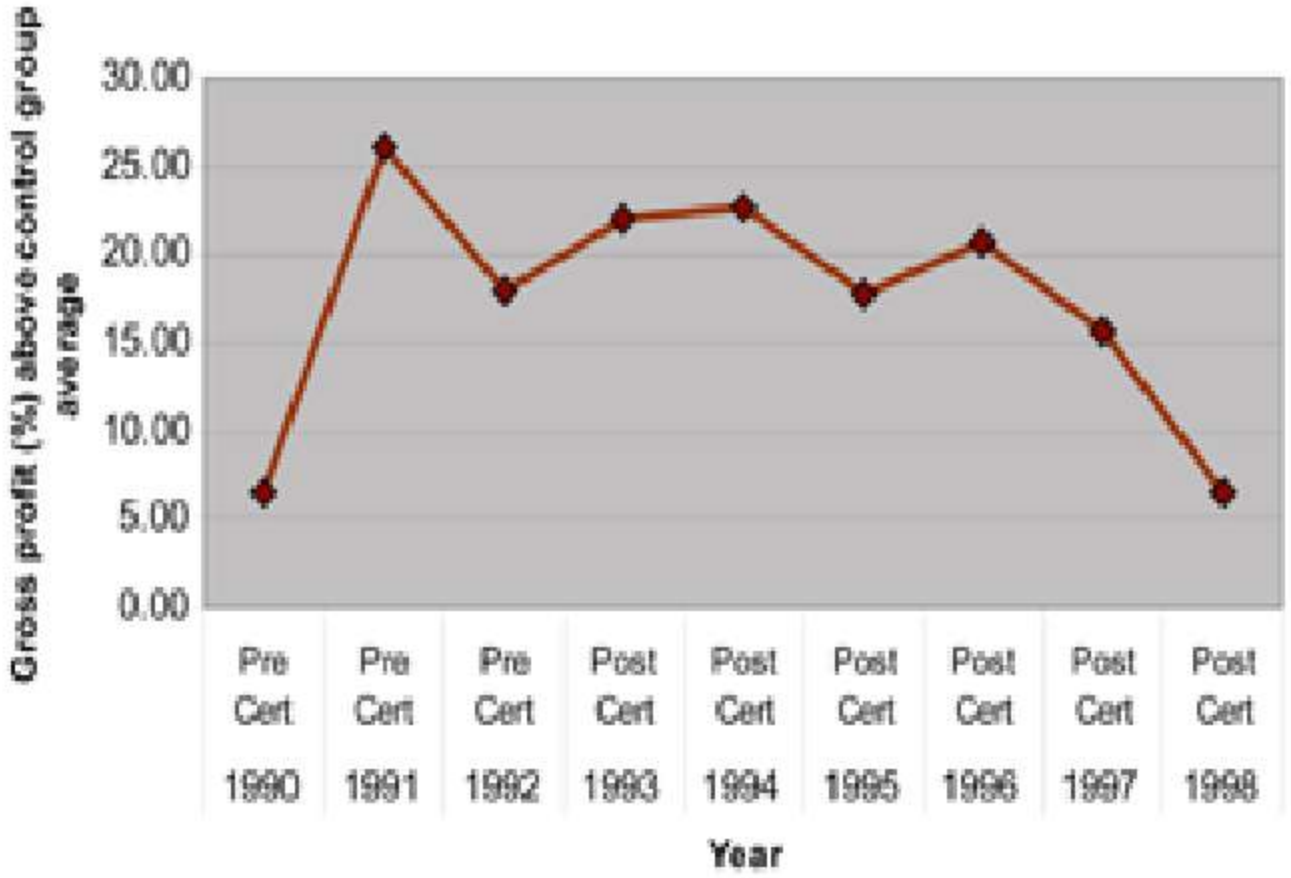
BENEFITS

- ***For consumers***, conformity of products and services to International Standards provides assurance about their quality, safety and reliability.
- ***For everyone***, International Standards can contribute to the quality of life in general by ensuring that the transport, machinery and tools we use are safe.
- ***For the planet*** we inhabit, International Standards on air, water and soil quality, and on emissions of gases and radiation, can contribute to efforts to preserve the environment.

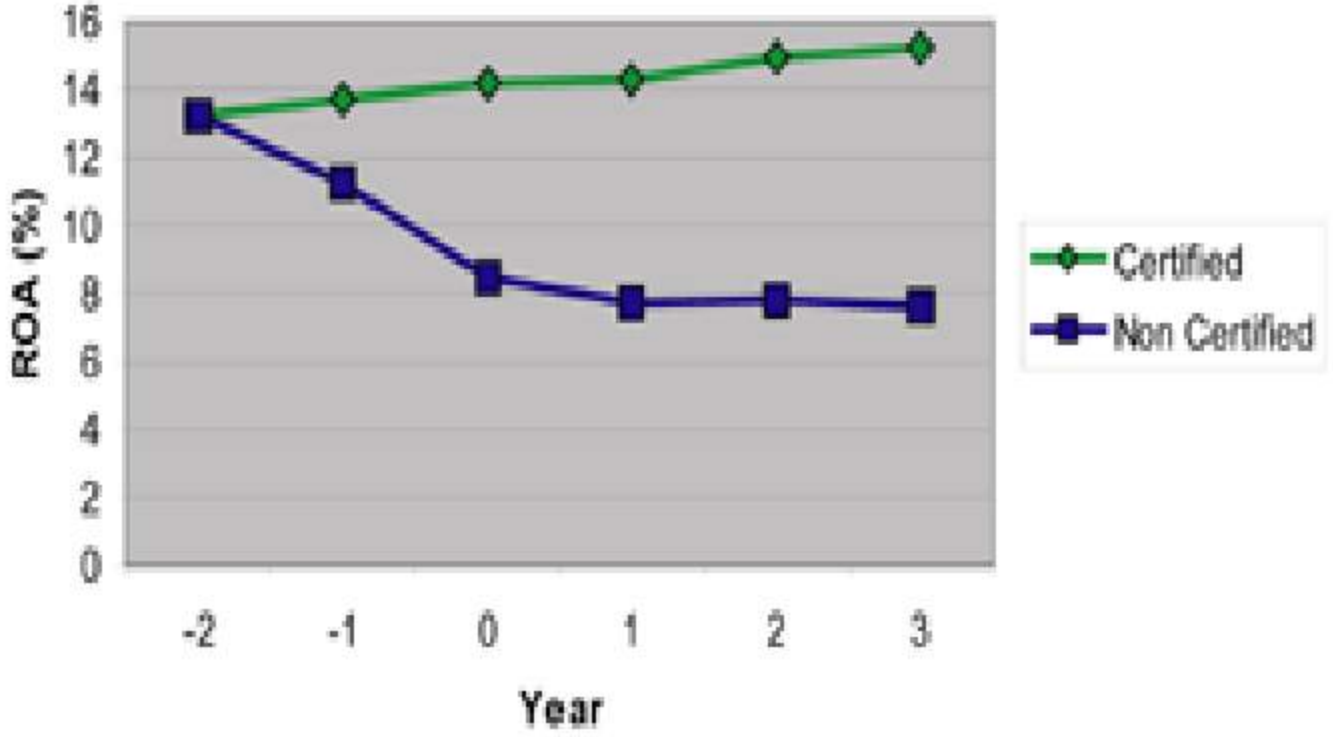
FACTS

- DAV Centenary Public School has attained international standards of quality by being recommended for ISO 9001:2000. This is perhaps the first school in the Rohtak, Jhajjar, Sonepat, Bhiwani, Mohindergarh, Panipat, Karnal, Rewari, Hisar and Sirsa region which has been recommended for this certification.

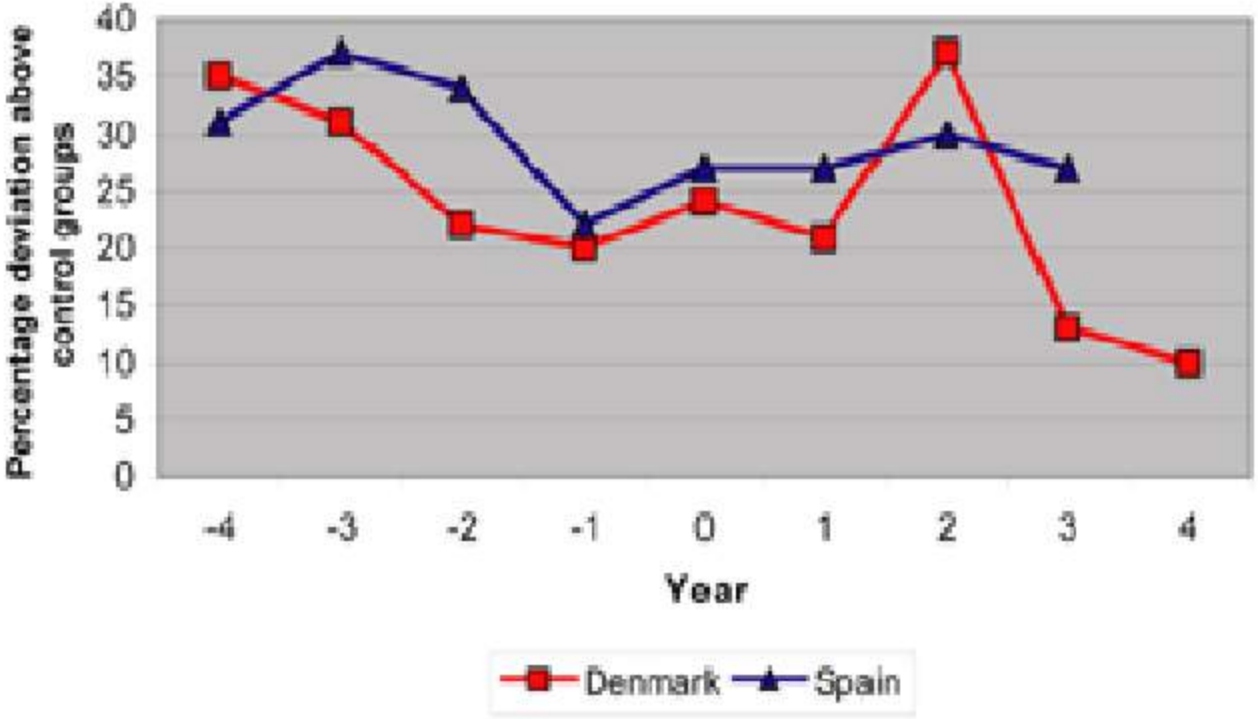
The change in percentage gross profit of ISO 9000 registered companies above a control of non-registered companies.



Performance of certified and non-certified companies in the industrial machinery and computer industry



The ISO 9000 sample's average percentage deviation before and after certification compared to non-certified organizations



FACTS

- CINCINNATI, OH, January 1, 2005 — First Vehicle Services, a leader in the fleet management and maintenance industry, announced today that it has become the first and only company in the fleet management market to receive ISO9001:2000 certification.

CASE STUDY

BACKGROUND

'Tech. Co.' is a sales and distribution organisation based in the UK.
All products sold by the company are manufactured by its parent company overseas. The products are high-technology products, they are sold to business and government customers.

Originally the company had seven divisions (organised by product) and each division had its own sales order function. It had recently centralised the sales order functions - in a structural sense - but the people who worked within product divisions still processed orders for the same products. The primary change with centralisation was standardisation of working procedures.

Tech. Co. decided to register to ISO 9000 three years ago

•**REASONS**

•Government customers were insisting on it.

•It was also felt that the company might achieve some benefits from clarity of working procedures.

•Registration to ISO 9000 meant the creation of nine manuals of procedures. One for each type of product, one called quality and one for the warehouse. The manuals documented what should be done at each stage of an order, nothing had been left out.

•The standard procedures meant that people wouldn't get things wrong. The organisation viewed salespeople as needing to be controlled - "They won't be able to get away with giving administrators inadequate information and what they provide has to be written down".

•It also saw advantages in controlling customers: "Because we have controlled procedures we can prove to them what they have ordered if there is any dispute".

Has ISO 9000 contributed to performance?

- **SALES**

There had been a cultural tradition of sales being 'heroes', they had treated 'back office' staff work as drudgery, they were always seeking last-minute changes and rarely were accurate with their form-filling.

When asked whether the new procedures had improved performance, no-one could say. There had been no collection of data on the performance of the administrative practices prior to the new procedures and hence it was not possible to determine whether things were better or worse.

'GOODS RETURNED'

• Goods returned stayed at the same level as prior to registration (suggesting no change to the performance of the system). What did change was the way returned goods were handled?
• ISO 9000 has a requirement to control product which is returned by customers ('control of non-conforming product'). All goods returned by customers were now held in 'quarantine', pending authorisation for release into the warehouse (for re-use).

• After a considerable debate about what to do with returned product as Tech. Co.'s products are sensitive to excesses of temperature and light a compromise was developed.

• It was argued that product returned within fifteen days would be likely not to have been subjected to adverse conditions. The procedure for returned product required the warehouse supervisor to check date of receipt against date of despatch and, where it fitted the new rule, to send a list of returned product to a director for signature. Signatories were hard to find. When they were available, they were not inclined to think of signing forms from the warehouse as their top priority.

•But no-one asked: Why do we have product being returned? - with a view to eradicating it.

•Have we ever had a problem with product being returned and then sent out as another order? The answer, when asked, was no.

•If they had viewed their organisation as a system, they would have known that returned product had not shown signs of fault and would have taken the view that customers' receiving faulty goods would have been an unlikely occurrence. In the unlikely event of a customer receiving faulty goods, the organisation could respond by engaging in excellent 'repair'. A good way to show customers what matters to you.

•Their view now, is that ISO 9000 is the foundation for other things to happen. They felt that without it, they would have been unable to get a company-wide focus for the quality effort.

•The managers argued that ISO 9000 registration produced benefits. Processes were more clearly defined and that resulted in less waste or more efficiency. They had recognised and sought to avoid unnecessary bureaucracy, and even went a further step away from the norm by getting rid of procedures, using flow-charts to provide clarity of focus.

•The extent to which ISO 9000 can or will improve economic performance will depend on features of the Standard (and their interpretation) and features of the company's current culture

CONCLUSION

The three most important benefits of ISO 9000 were seen as better management control, greater awareness of procedural problems and promotional value.

- **Those most satisfied with the impact of ISO 9000 on their organisations had sought the Standard for better management control and improved customer service.**

- **Companies with ISO 9000 certification showed a significantly higher rate of sales growth than the national average and were four times more likely to have survived the recent recession.**

- **Company certificationÖhas grown by 10,000 certificates a year since 1992Öcertification in Europe has doubled every nine months since 1993 and there are now 95,000 certificates world-wide.**