



Chapter 20

Quality Management

Quality

- ❖ *What is quality?*
 - *Useful life?*
 - *Guarantee?*
 - *Meeting the standards?*
 - *Cost-expected quality relationship?*
- ❖ *Customer expectations define the quality level*



Quality Drivers

- ❖ Higher performance requirements
- ❖ Faster product development
- ❖ Higher technology levels
- ❖ Materials and processes pushed to the limit
- ❖ Lower contractor profit margins
- ❖ Fewer defects/rejects



Market Expectations

- ❖ **Salability:** the balance between quality and costs
- ❖ **Produceability:** the ability to produce the product with available technology and workers, and at an acceptable cost
- ❖ **Social acceptability:** the degree of conflict between the product or process and the values of society (i.e., safety, environment)
- ❖ **Operability:** the degree to which a product can be operated safely



Market Expectations *(Continued)*

- ❖ **Availability:** the probability that the product, when used under given conditions, will perform satisfactorily when called upon
- ❖ **Reliability:** the probability of the product performing without failure under given conditions and for a set period of time
- ❖ **Maintainability:** the ability of the product to be retained in or restored to a performance level when prescribed maintenance is performed



Past

- Quality is the responsibility of blue-collar workers and direct labor employees working on the floor
- Quality defects should be hidden from the customers (and possibly management)
- Quality problems lead to blame, faulty justification, and excuses
- Corrections-to-quality problems should be accomplished with minimum documentation
- Increased quality will increase project costs
- Quality is internally focused
- Quality will not occur without close supervision of people
- Quality occurs during project execution

Present

- Quality is everyone's responsibility, including white-collar workers, the indirect labor force, and the overhead staff
- Defects should be high-lighted and brought to the surface for corrective action
- Quality problems lead to cooperative solutions
- Documentation is essential for "lessons learned" so that mistakes are not repeated
- Improved quality saves money and increases business
- Quality is customer focused
- People want to produce quality products
- Quality occurs at project initiation and must be planned for within the project

Strategic Quality Management

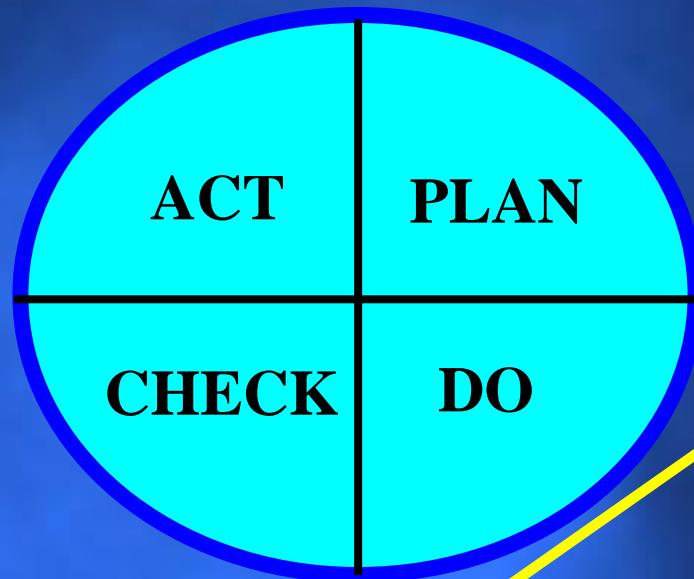
- ❖ **Quality is defined by the customer.**
- ❖ **Quality is linked with profitability on both the market and cost sides.**
- ❖ **Quality has become a competitive weapon.**
- ❖ **Quality is now an integral part of the strategic planning process.**
- ❖ **Quality requires an organization-wide commitment.**



The Deming Cycle For Continuous Improvement

(Also Known as The Shewhart Cycle)

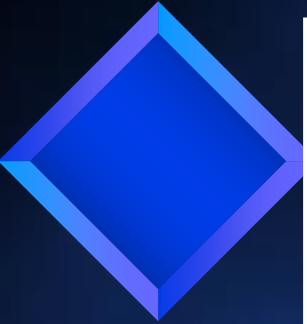
- Immediate Remedies
- Future Actions



- Against Objectives
- How Methods are Executed

- Objectives
- Methods

- Train
- Execute



Deming's 14 Points for Management

1. Create constancy of purpose for improvement of product and service.
2. Adopt the new philosophy.
3. Cease dependence on inspection to achieve quality.
4. End the practice of awarding business on the basis of price tag alone. Instead, minimize total cost by working with a single supplier.
5. Improve constantly and forever every process for planning, production, and service.
6. Institute training on the job.
7. Adopt and institute leadership.
8. Drive out fear.
9. Break down barriers between staff areas.
10. Eliminate slogans, exhortations, and targets for the work force.
11. Eliminate numerical quotas for the workforce and numerical goals for management.
12. Remove barriers that rob people of workmanship. Eliminate the annual rating or merit system.
13. Institute a vigorous program of education and self-improvement for everyone.
14. Put everybody in the company to work to accomplish the transformation.



Degrees of Quality

- ❖ Structural (length, frequency)
- ❖ Sensory (taste, beauty, appeal)
- ❖ Time-oriented (reliability, maintainability)
- ❖ Commercial (warranty)
- ❖ Ethical (courtesy, honesty)



Juran's 10 Steps to Quality Improvement

1. Build awareness of the need and opportunity for improvement.
2. Set goals for improvement.
3. Organize to reach the goals (establish a quality council, identify problems, select projects, appoint teams, designate facilitators).
4. Provide training.
5. Carry out projects to solve problems.
6. Report progress.
7. Give recognition.
8. Communicate results.
9. Keep score.
10. Maintain momentum by making annual improvement part of the regular systems and processes of the company.



Absolutes of quality

- ❖ Quality means conformance to requirements.
 - ❖ ● Quality comes from prevention.
 - ❖ ● Quality means that the performance standard is “zero defects.”
 - ❖ ● Quality is measured by the cost of nonconformance.



Crosby's 14 Steps to Quality Improvement

1. Make it clear that management is committed to quality.
2. Form quality improvement teams with representatives from each department.
3. Determine where current and potential quality problems lie.
4. Evaluate the cost of quality and explain its use as a management tool.
5. Raise the quality awareness and personal concern of all employees.
6. Take actions to correct problems identified through previous steps.
7. Establish a committee for the zero-defects program.
8. Train supervisors to actively carry out their part of the quality improvement program.
9. Hold a "zero-defects day" to let all employees realize that there has been a change.
10. Encourage individuals to establish improvement goals for themselves and their groups.
11. Encourage employees to communicate to management the obstacles they face in attaining their improvement goals.
12. Recognize and appreciate those who participate.
13. Establish quality councils to communicate on a regular basis.
14. Do it all over again to emphasize that the quality improvement program never ends.



	Deming	Juran	Crosby
Definition of quality	Continuous improvement	Fitness for use	Conformance to requirements
Application	Manufacturing-driven companies	Technology-driven companies	People-driven companies
Target audience	Workers	Management	Workers
Emphasis on	Tools/system	Measurement	Motivation (behavioral)
Type of tools	Statistical process control	Analytical, decision-making and cost-of-quality	Minimal use
Use of goals and targets	Not used	Used for breakthrough projects	Posted goals for workers



Quality Expectations

- ❖ Quality policy
- ❖ Quality objectives
- ❖ Quality assurance
- ❖ Quality control
- ❖ Quality audit
- ❖ Quality program plan



Quality Policy

- ❖ Be a statement of principles, stating what, not how
- ❖ Promote consistency throughout the organization and across projects
- ❖ Provide and explanation to outsiders of how the organization views quality
- ❖ Provide specific guidelines for important quality matters
- ❖ Provide provisions for changing/updating the policy



Quality Objectives

- ❖ Be obtainable
- ❖ Define specific goals
- ❖ Be understandable
- ❖ State specific deadlines



Quality Assurance

- ❖ Identify objectives and standards
- ❖ Be multifunctional and prevention oriented
- ❖ Plan for collection and use data in a cycle of continuous improvement
- ❖ Plan for the establishment and maintenance of performance measures
- ❖ Include quality audits



Quality Control

- ❖ **Select what to control**
- ❖ **Set standards that provide the basis for decisions regarding possible corrective action**
- ❖ **Establish the measurement methods used**
- ❖ **Compare the actual results to the quality standards**
- ❖ **Act to bring nonconforming processes and material back to the standard based on the information collected**



Quality Control (Continued)

- ❖ Monitor and calibrate measuring devices
- ❖ Include detailed documentation for all processes



Quality Audit

- ❖ The planned quality for the project will be met.
- ❖ The products are safe and fit for use.
- ❖ All pertinent laws and regulations are followed.
- ❖ Data collection and distribution systems are accurate and adequate.
- ❖ Proper corrective action is taken when required.
- ❖ Improvement opportunities are identified.



Quality Plan

- ❖ Identify all of the organization's external and internal customers
- ❖ Cause the design of a process that produces the features desired by the customer
- ❖ Bring in suppliers early in the process
- ❖ Cause the organization to be responsive to changing customer needs
- ❖ Prove that the process is working and that quality goals are being met

Cost of Quality (COQ)

Definitions & Examples

Prevention: cost associated with design and planning of a quality control (QC) program	Appraisal: costs involved in the direct appraisal of quality both in the plant and in the field	Internal failure: costs directly related to the occurrence of defective production within the plant	External failure: costs associated with the failure of a product or service in the field
<ul style="list-style-type: none">• QC administration and systems planning• Quality training• Quality planning (QC engineering work)<ul style="list-style-type: none">• Incoming, in-process, final inspection, and test planning• Special processes planning• Quality data analysis and feedback• Procurement planning• Vendor surveys, audit and surveillance planning• Reliability studies• Design and development of quality measurement and control equipment• Qualification of material	<ul style="list-style-type: none">• Testing• Inspection• Quality audits• Incoming test and inspection and laboratory acceptance• Checking labor• Laboratory or other measurement service• Setup for test and inspection• Test and inspection material• Outside endorsements• Maintenance and calibration• Product engineering review and shipping release• Field Testing	<ul style="list-style-type: none">• Scrap, at full shop cost• Rework, at full shop cost• Scrap and rework, fault of vendor• Material procurement• Factory contact engineering• QC investigations (of failures)• Material review activity• Repair and troubleshooting	<ul style="list-style-type: none">• Complaints and loss of customer good will• Warranty cost• Field maintenance and product service• Returned material processing and repair• Replacement inventories• Strained distributor relations





THE SEVEN QUALITY CONTROL TOOLS

- ❖ Data Tables (check sheets)
- ❖ Cause and Effect Analysis
- ❖ Histogram
- ❖ Pareto Analysis
- ❖ Scatter Diagrams
- ❖ Trend Analysis
- ❖ Control Charts

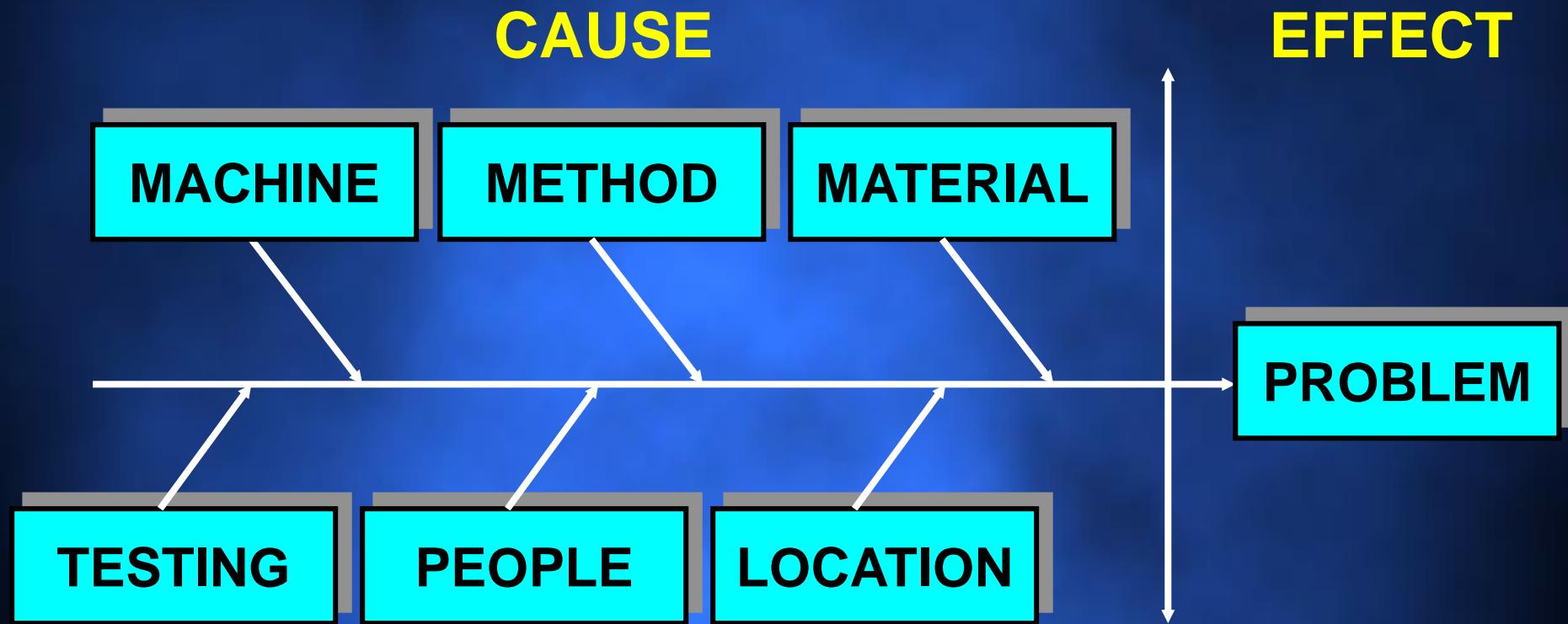


Check Sheets

- ❖ Agree on what is being observed
- ❖ Decide on time period
- ❖ Design form
- ❖ Collect data

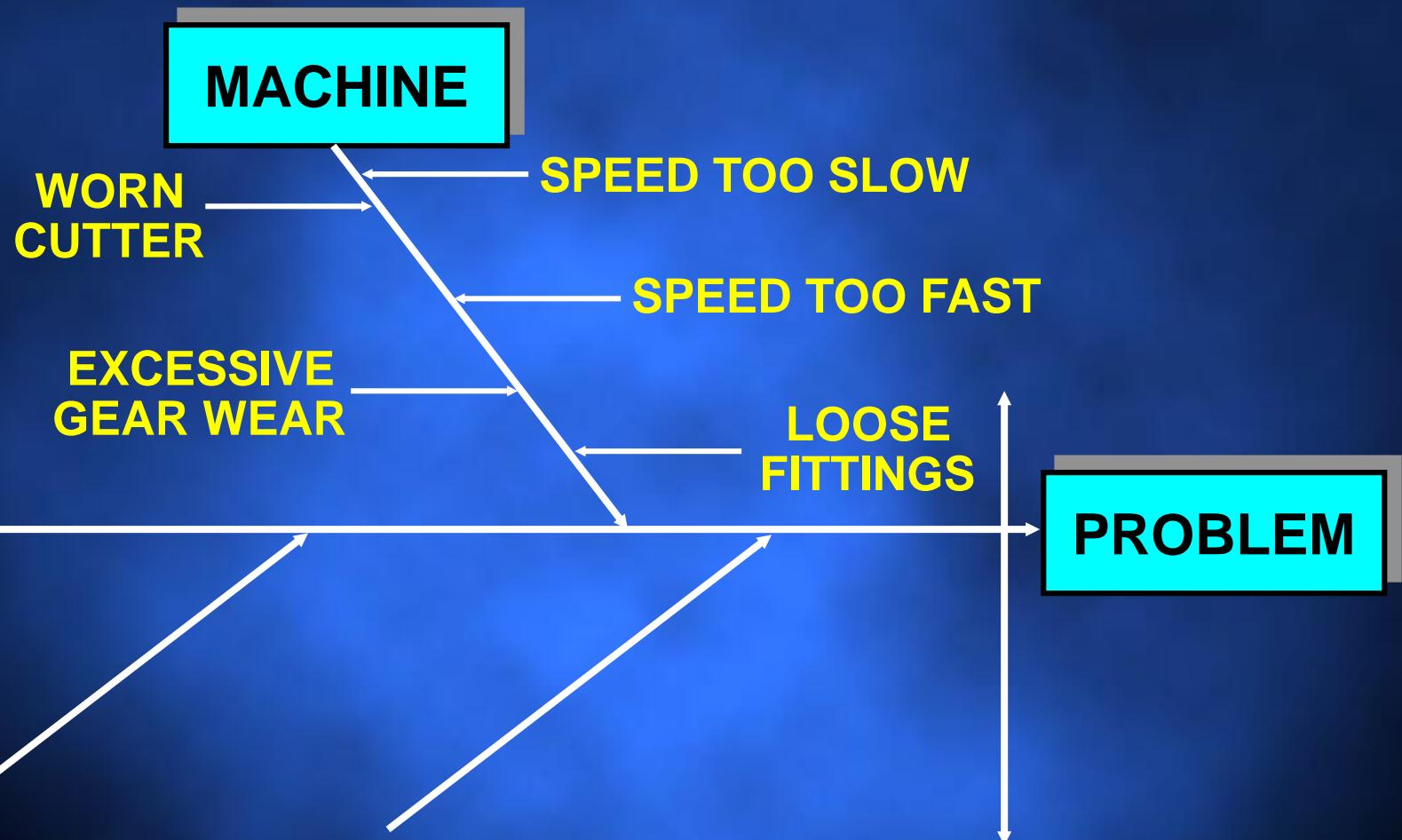
<u>Problem</u>	<u>Month</u>			<u>Total</u>
	1	2	3	
A				5
B				3
C				12
TOTAL	8	5	7	20

Cause-And-Effect Analysis



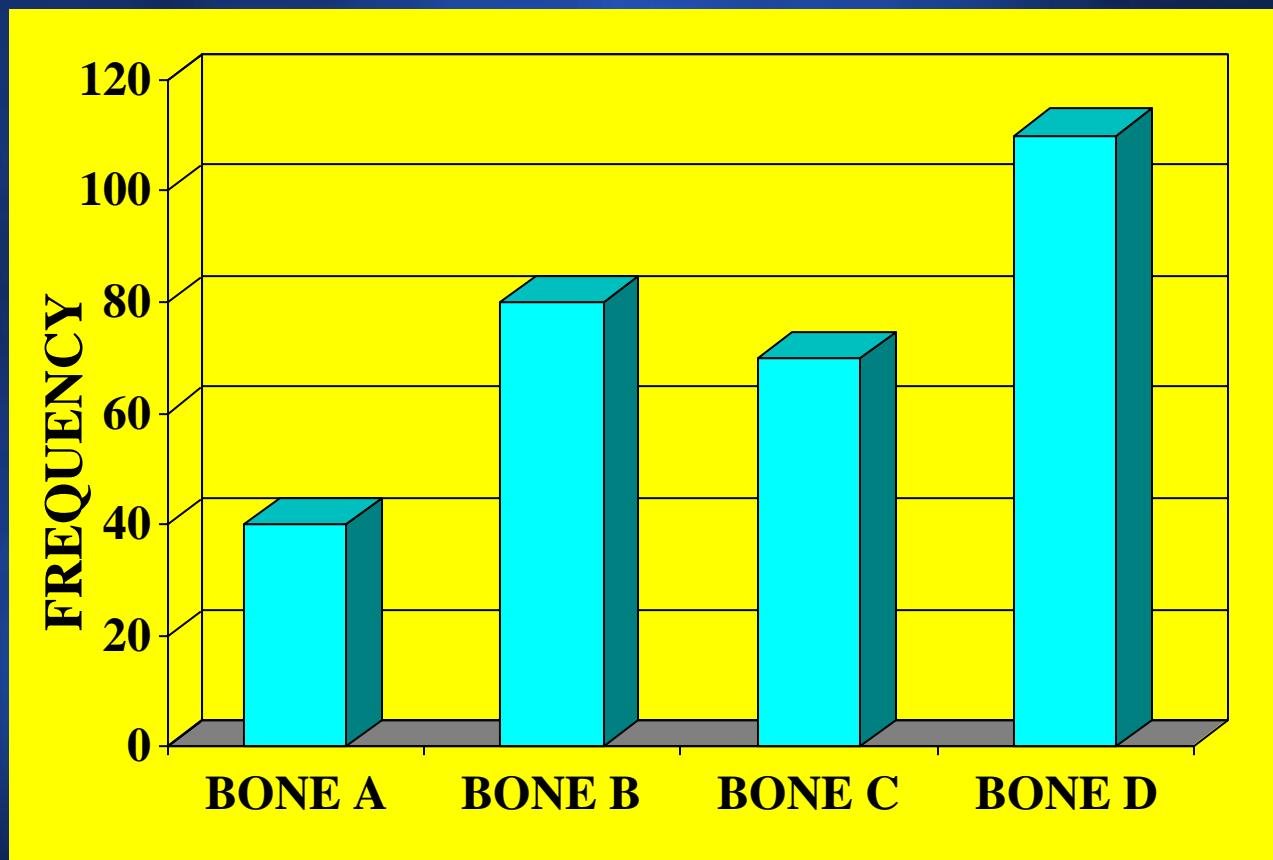
Cause-And-Effect Analysis

(With “Bones” Inserted)





Histogram

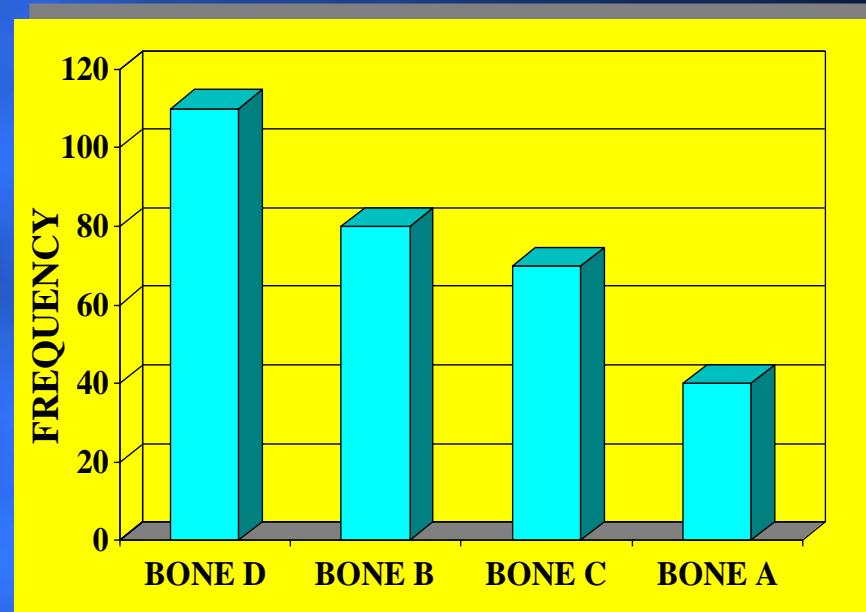
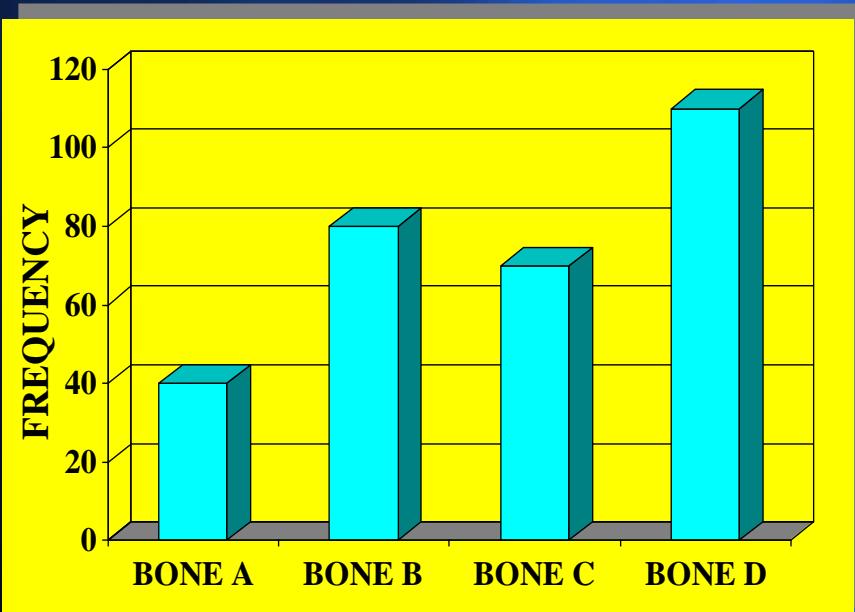


From Histogram To Pareto

Histogram



Pareto (Chosen Few)



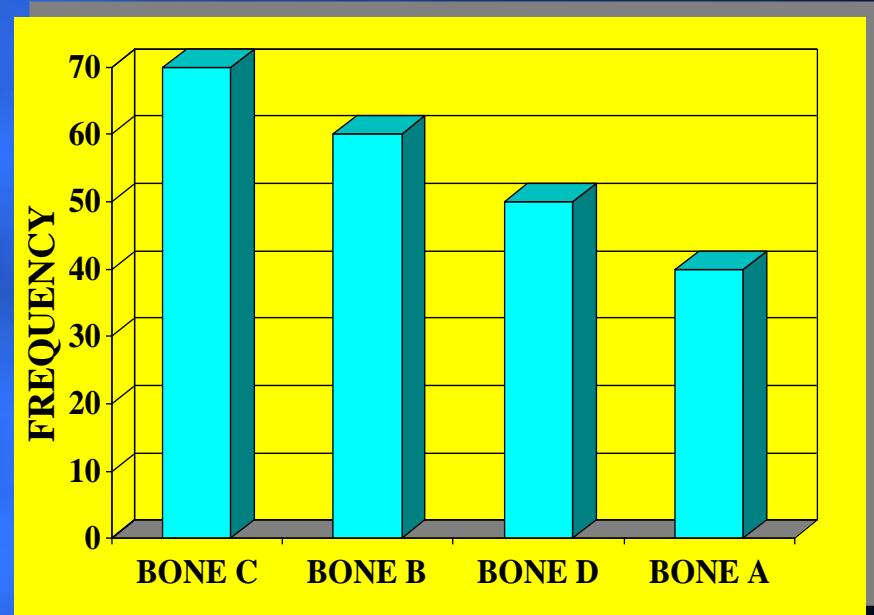
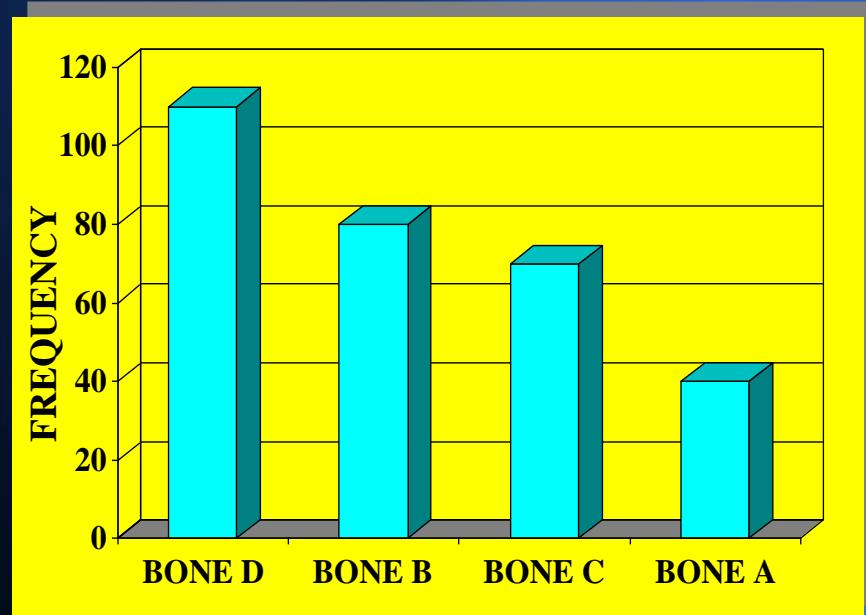


Pareto Analysis

BEFORE

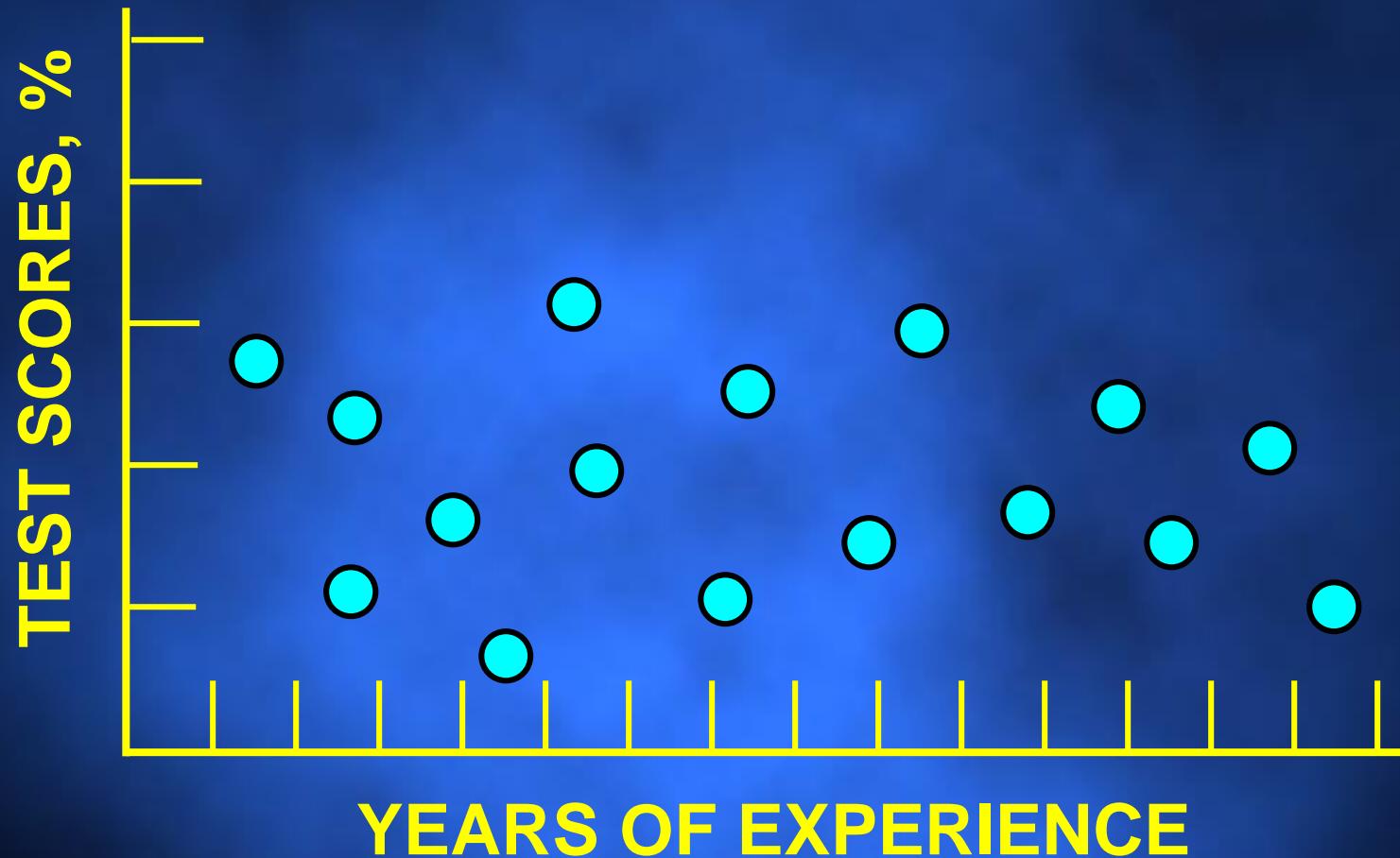


AFTER

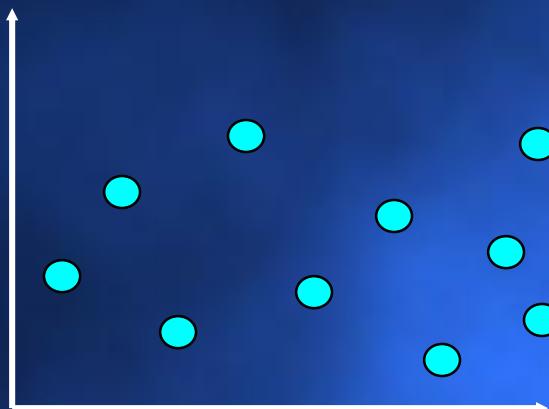




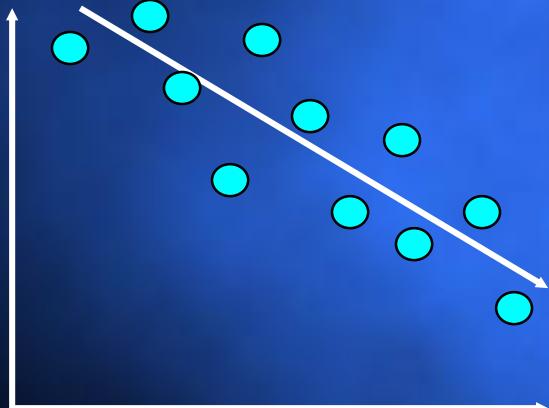
Scatter Diagram



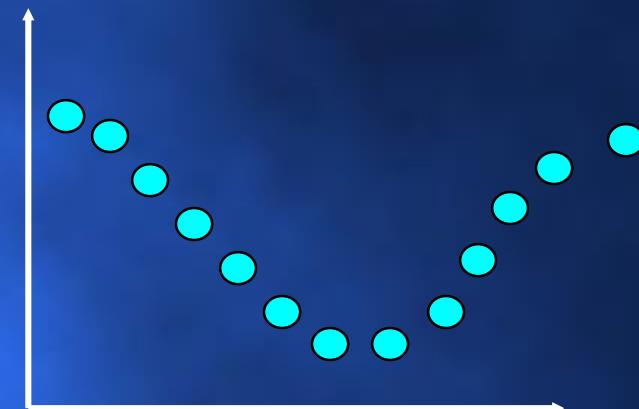
Scatter Plot Correlation



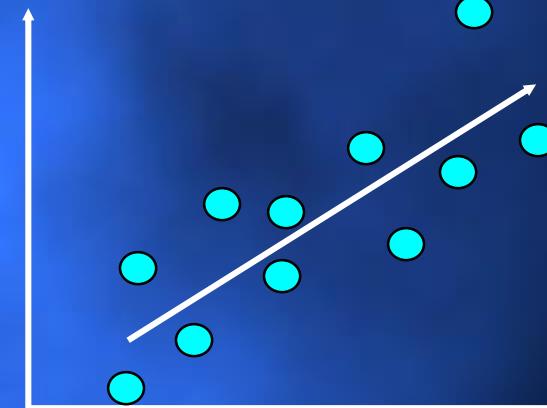
NO CORRELATION



NEGATIVE CORRELATION



CURVILINEAR CORRELATION



POSITIVE CORRELATION

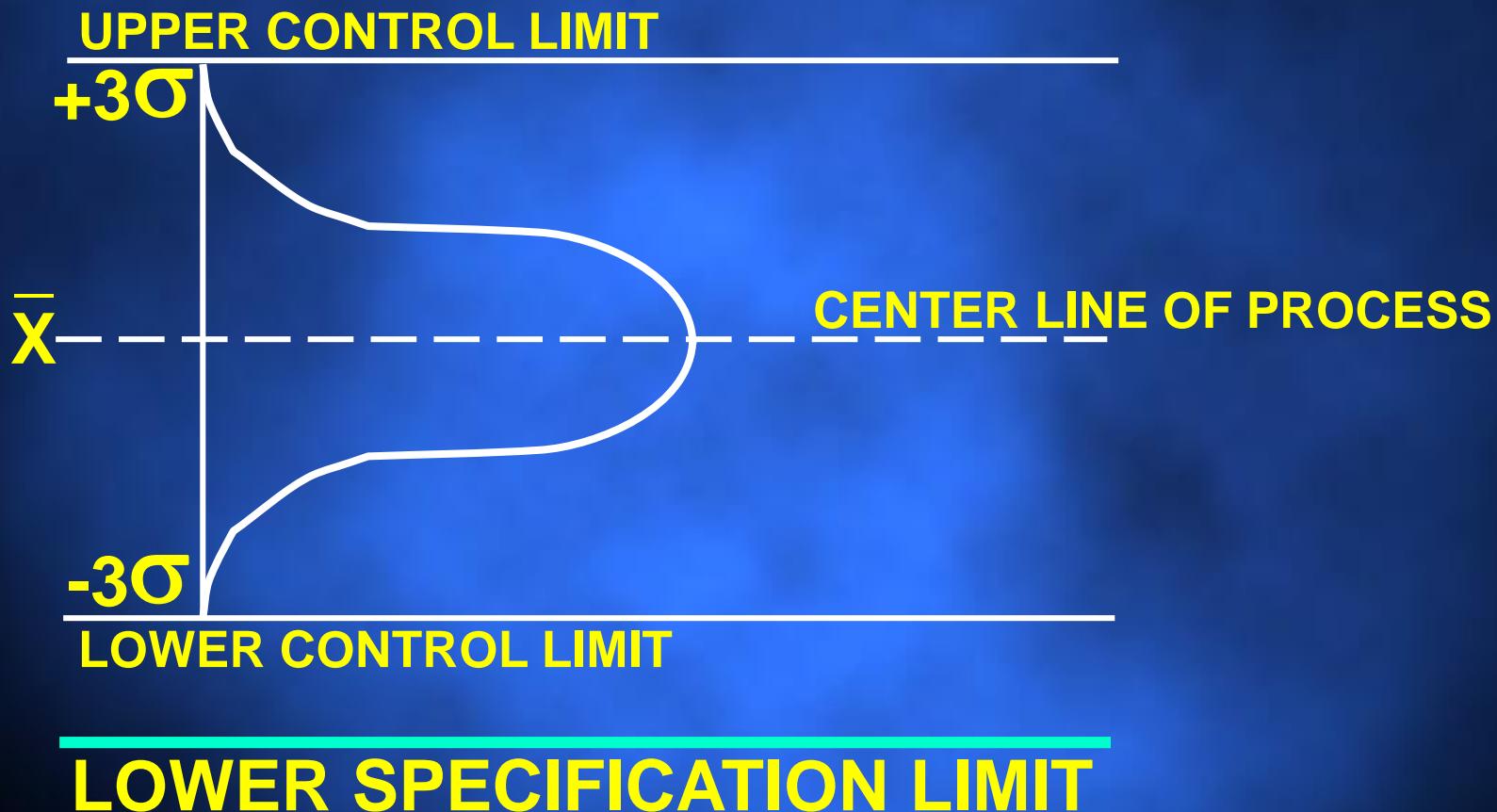


*Scatter Charts That
Correlate Well Are Also
Referred To As Trend
Charts.*



Control Chart

UPPER SPECIFICATION LIMIT



Normal Distribution Attributes

SPECIFICATION RANGE (+/- σ)	PERCENT WITHIN RANGE	DEFECTS PER BILLION PARTS
1	68.27	317,300,000
2	95.45	45,400,000
3	99.73	2,700,000
4	99.9937	63,000
5	99.999943	57
6	99.999998	2



Common Cause Variability

- ❖ **Common cause variability or variation:** This source of random variation is always present in any process. It is that part of the variability inherent in the process itself. The cause of this variation can be corrected only by a management decision to change the basic process.



Common Cause Variability

(Continued)

- ❖ **Special cause variability or variation:** This variation can be controlled at the local or operational level. Special causes are indicated by a point on the control chart that is beyond the control limit or by a persistent trend approaching the control limit.



Process Capability

$$C_p = \frac{USL - LSL}{6\sigma}$$



Capability Index

$$C_{pk} = \frac{|CL - NEAREST\ SPEC\ LIMIT|}{3\sigma}$$



Acceptance Sampling

- ❖ **Single sampling:** This is the acceptance or rejection of a lot based upon one sampling run.
- ❖ **Double sampling:** A small sample size is tested. If the results are not conclusive, then a second sample is tested.
- ❖ **Multiple sampling:** This process requires the sampling of several small lots.



Sampling Risks

- ❖ **Producer's risk:** This is called the α (alpha) risk or type I error. This is the risk to the producer that a good lot will be rejected.
- ❖ **Consumer's risk:** This is called the β (beta) risk or type II error. This is the consumer's risk of accepting a bad lot.



Quality Circles

- ❖ They give a team effort.
- ❖ They are completely voluntary.
- ❖ Employees are trained in group dynamics, motivation, communications, and problem solving.
- ❖ Members rely upon each other for help.
- ❖ Management support is active but as needed.
- ❖ Creativity is encouraged.
- ❖ Management listens to recommendations.



Quality Circles _ Benefits

- ❖ Improved quality of products and services
- ❖ Better organizational communications
- ❖ Improved worker performance
- ❖ Improved morale



Chapter 21

*Modern Developments
In Project
Management*

Project Management Maturity Model

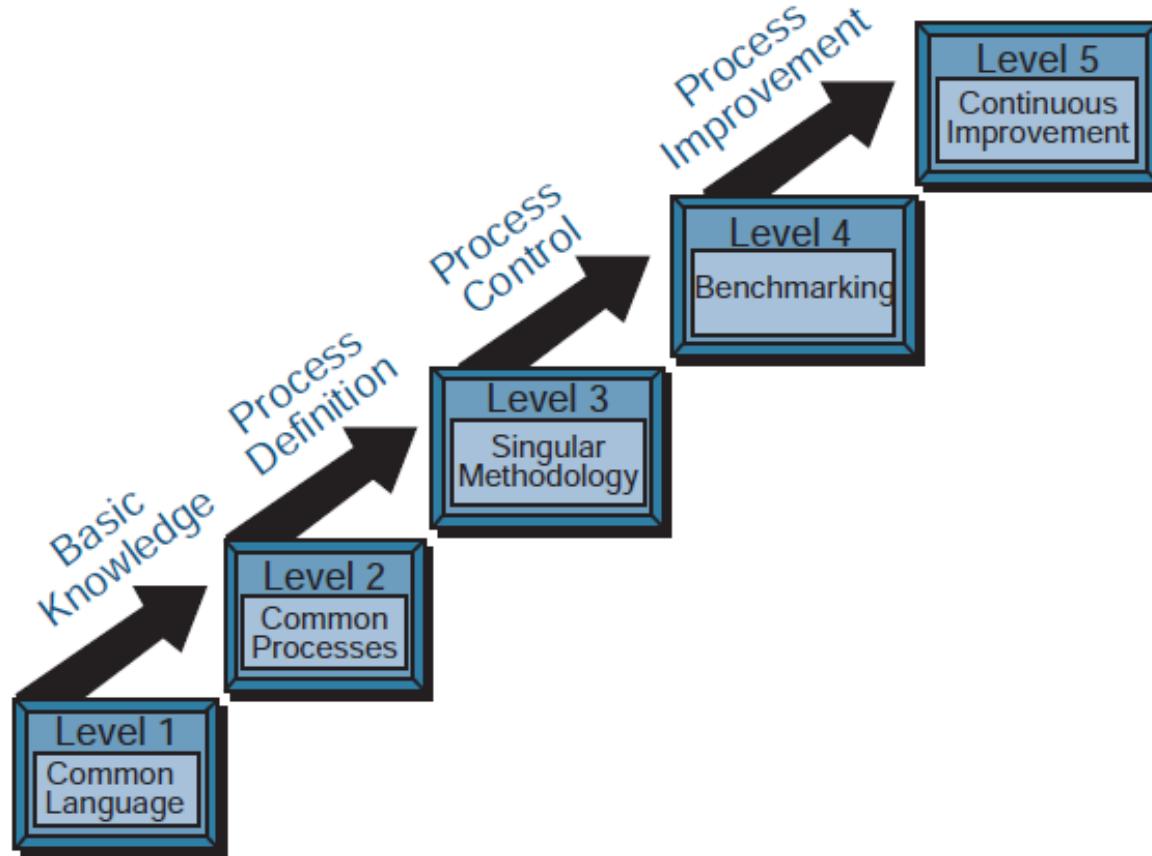
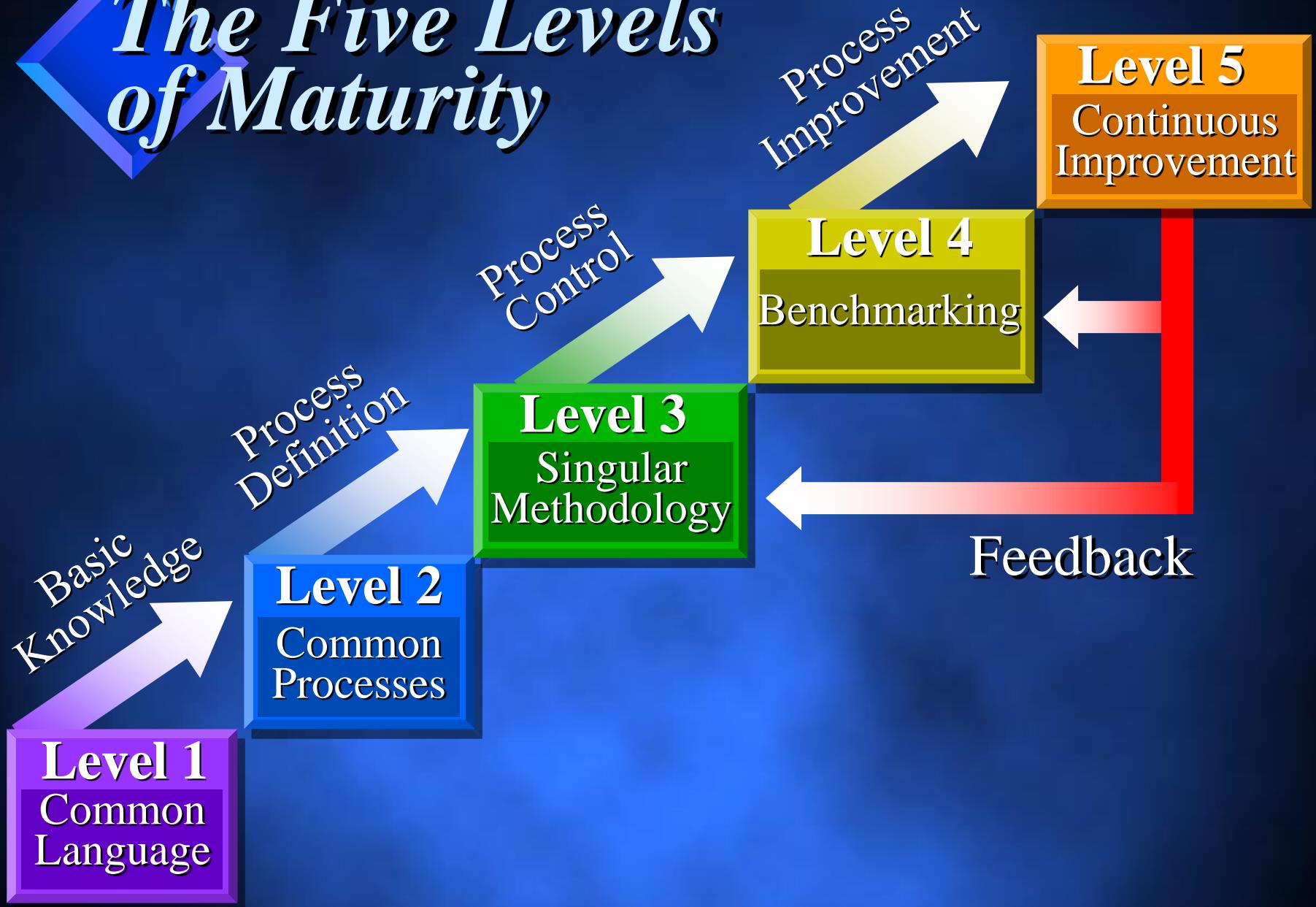


FIGURE 21-1. The five levels of maturity.

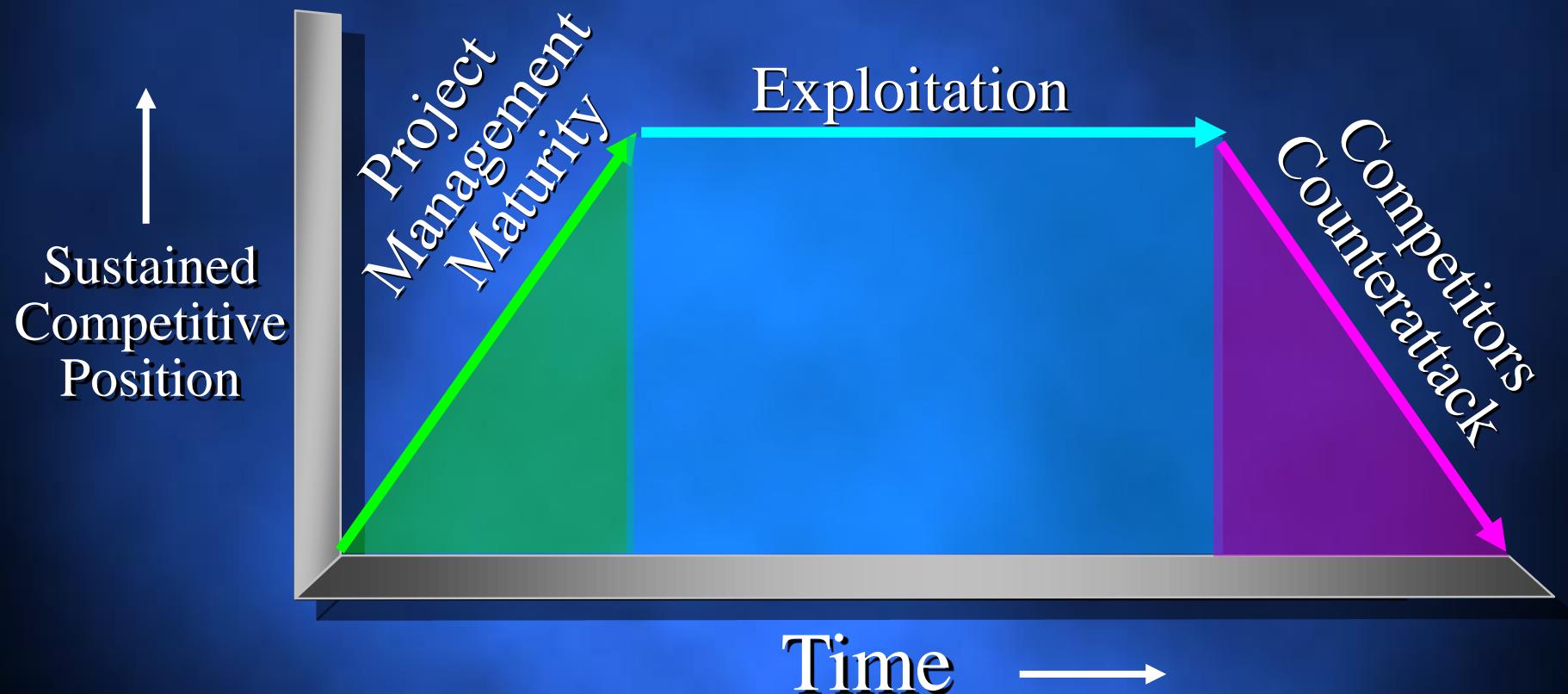
Degree of Difficulty

Level	Description	Degree of Difficulty
1	Common Language	Medium
2	Common Processes	Medium
3	Singular Methodology	High
4	Benchmarking	Low
5	Continuous Improvement	Low

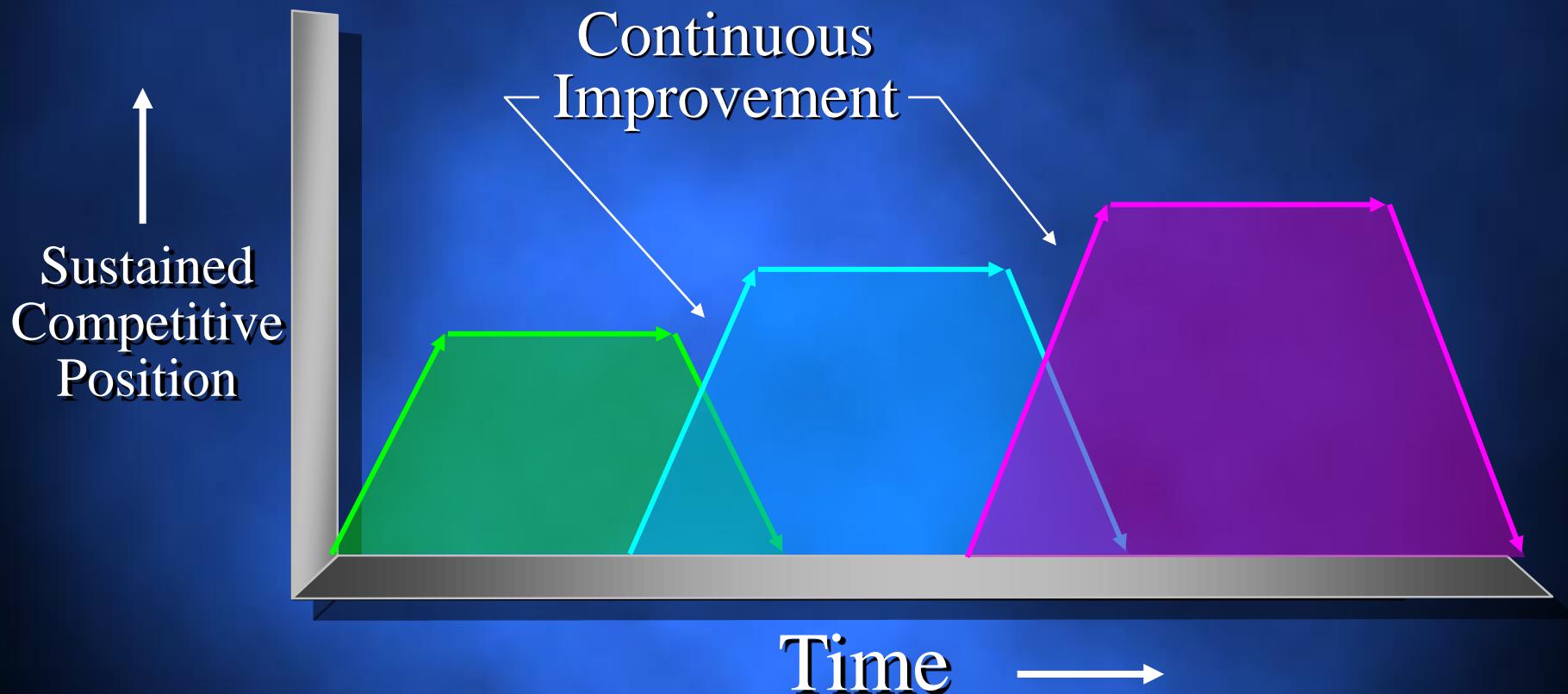
The Five Levels of Maturity



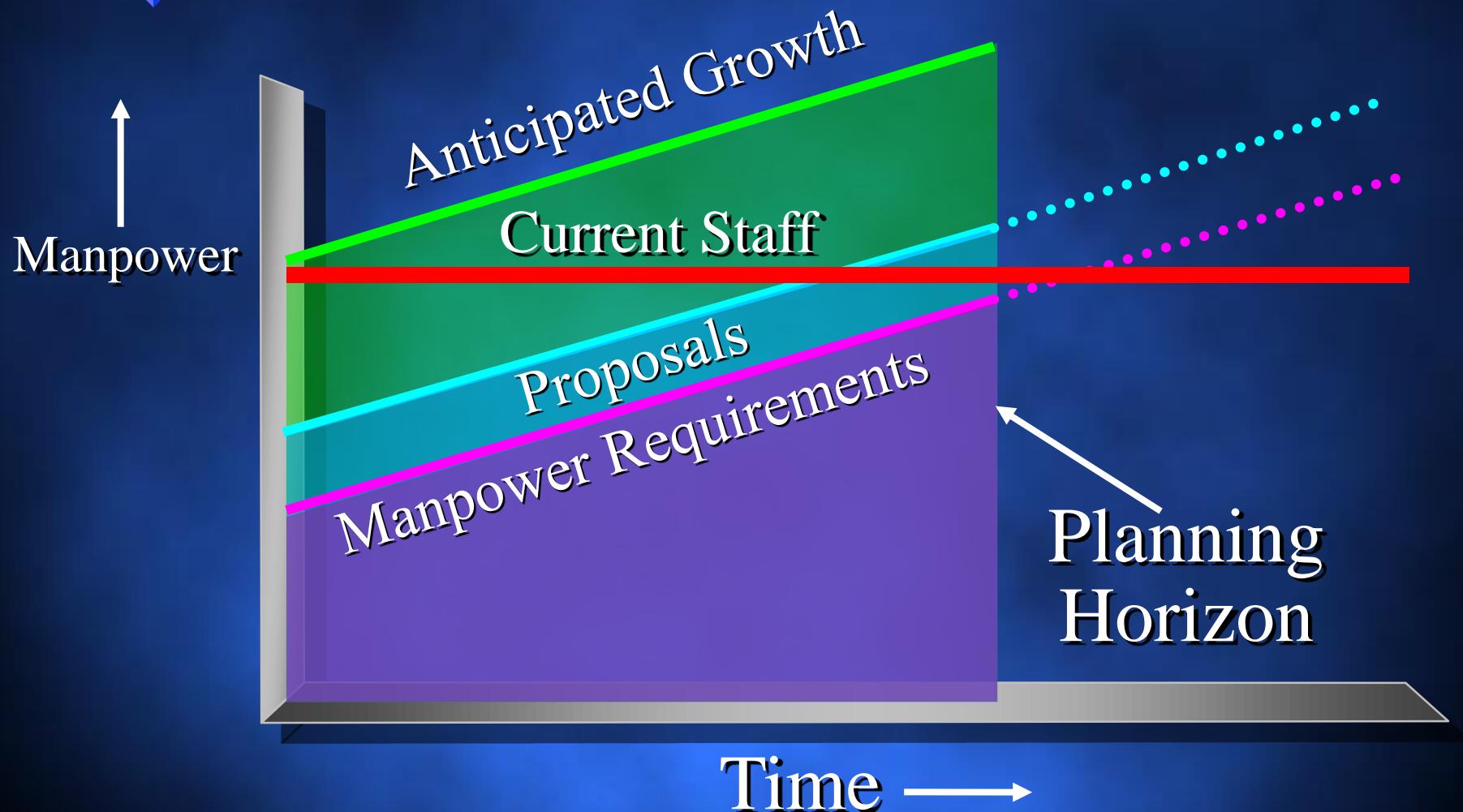
The Need for Continuous Improvement



The Need for Continuous Improvement



Capacity Planning

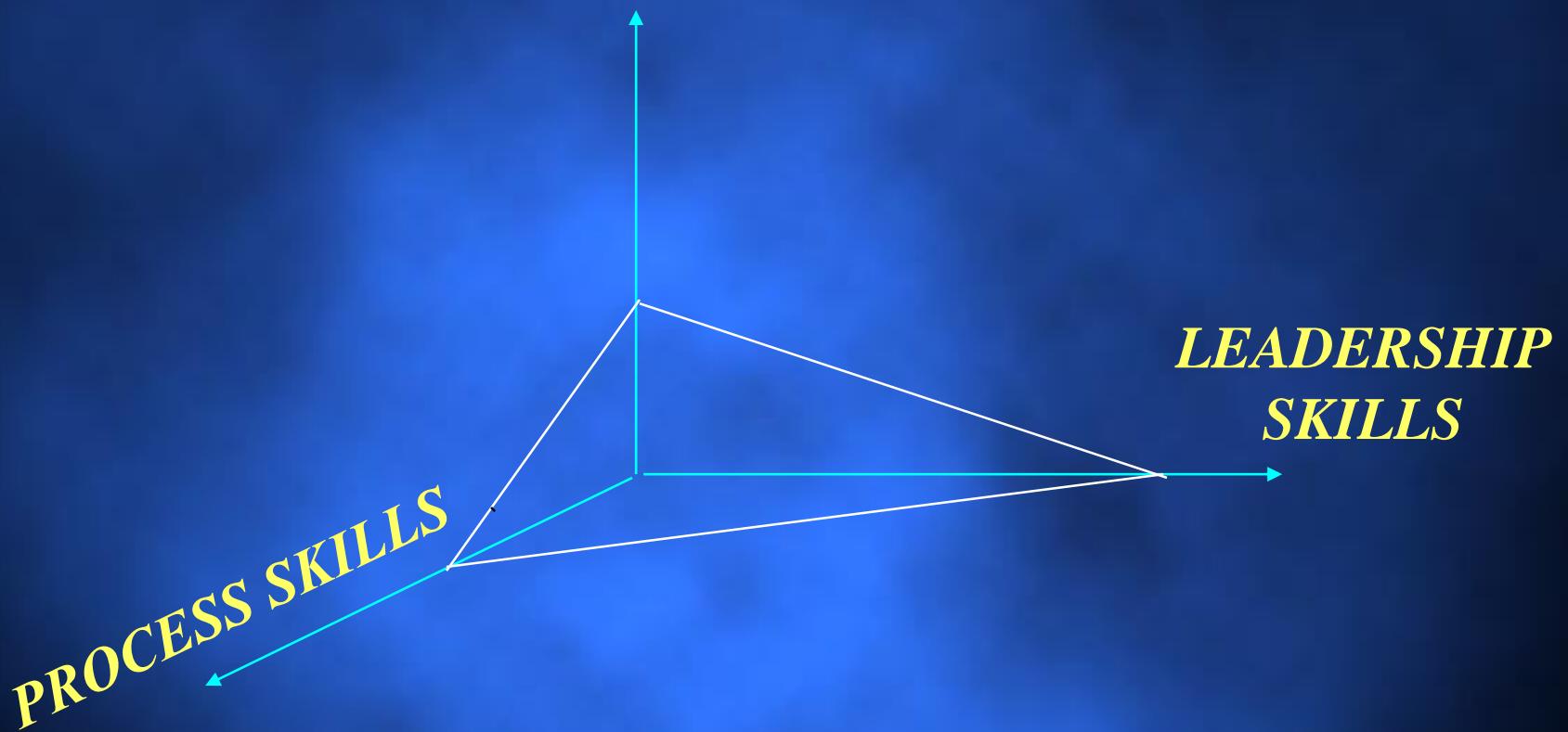


Capacity Planning

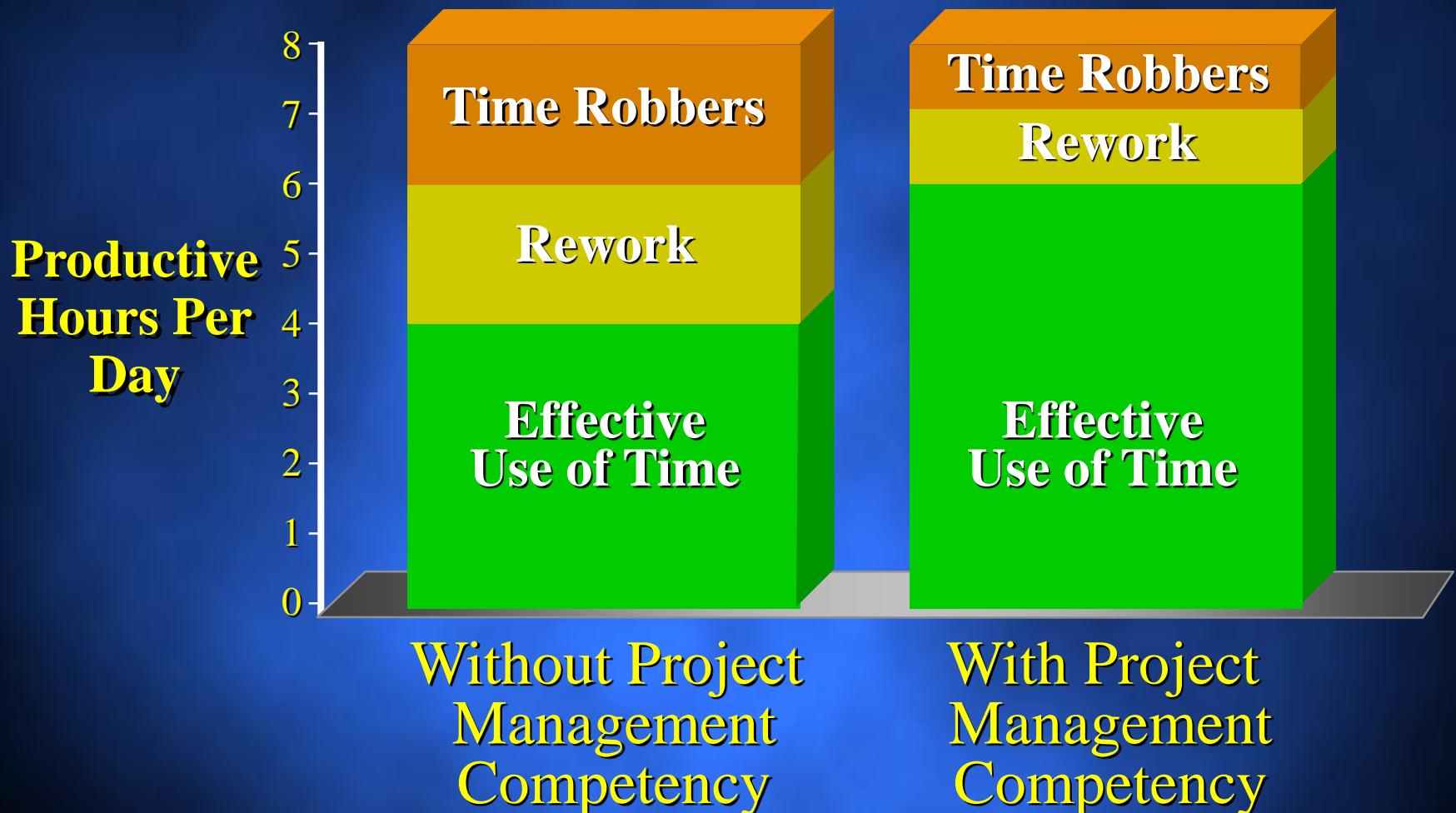


COMPETENCY MODEL

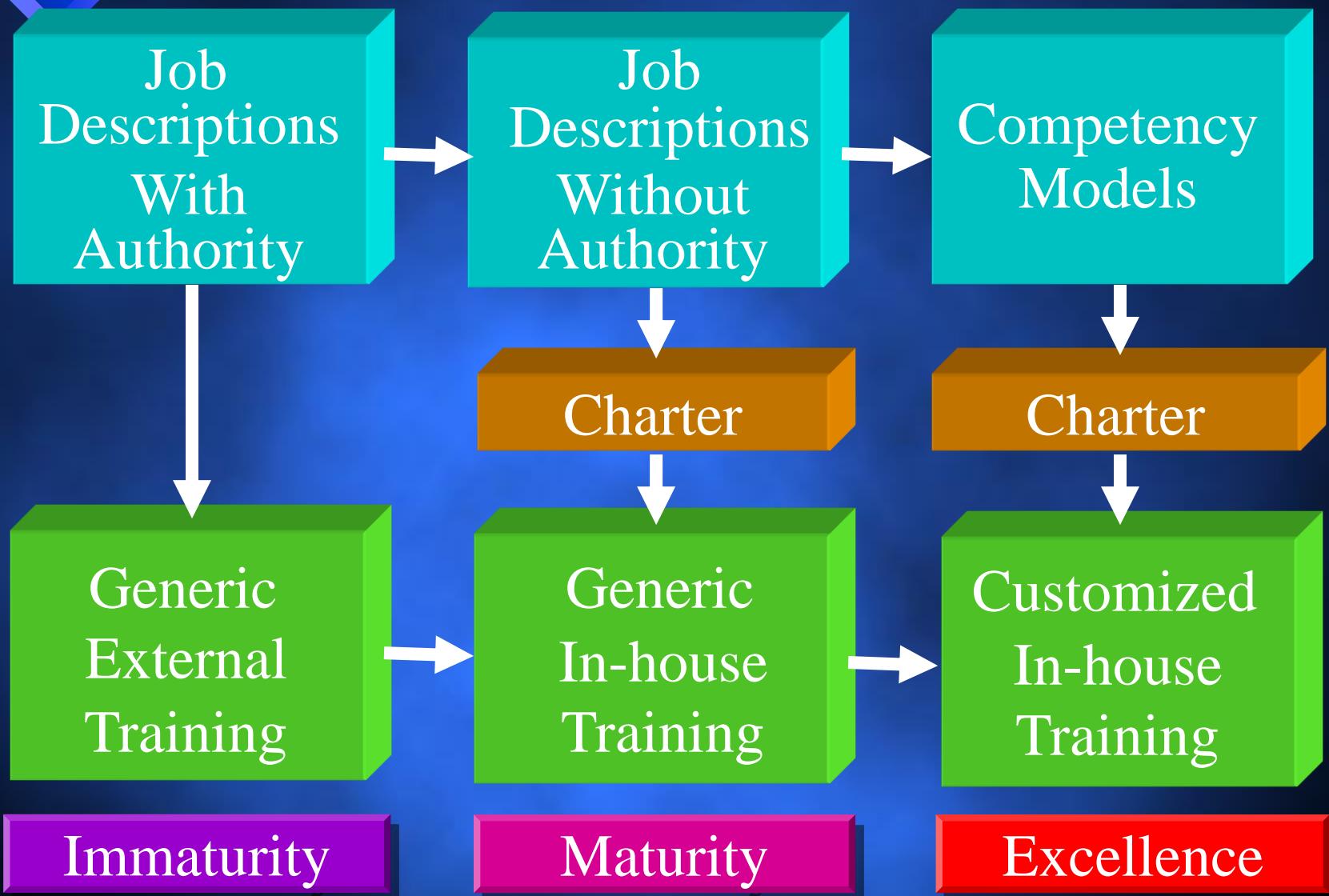
***SCIENTIFIC / TECHNICAL
SKILLS***



Core Competency Analysis



Competency Models and Training





Chapter 22

*The Business of
Scope Changes*



Understanding Scope Changes

- ❖ **Regardless of what people think, scope changes, if approved, will result in:**
 - Elongation of the schedule
 - An increase in the cost baseline
 - Possibly unhappy stakeholders



Understanding Scope Changes

- ❖ The early view of scope changes, as seen by the Department of Defense contractors, was a source of significant profitability.
- ❖ This was the result of gaps in the statement of work provided by the department of Defense
- ❖ Contractors refused to identify these omissions until after contract award



Understanding Scope Changes

- ❖ Many scope changes were not necessary, but were approved because of often erroneous judgment by some project managers that possessed a command of technology and had to put their personal identification on the project's deliverables.



Scope Changes Disasters

- ❖ Many scope changes ended in disasters because the project manager did not understand the downstream impact on other contractors as a result of upstream scope changes.



Figure 1 *Sequential Contractors*

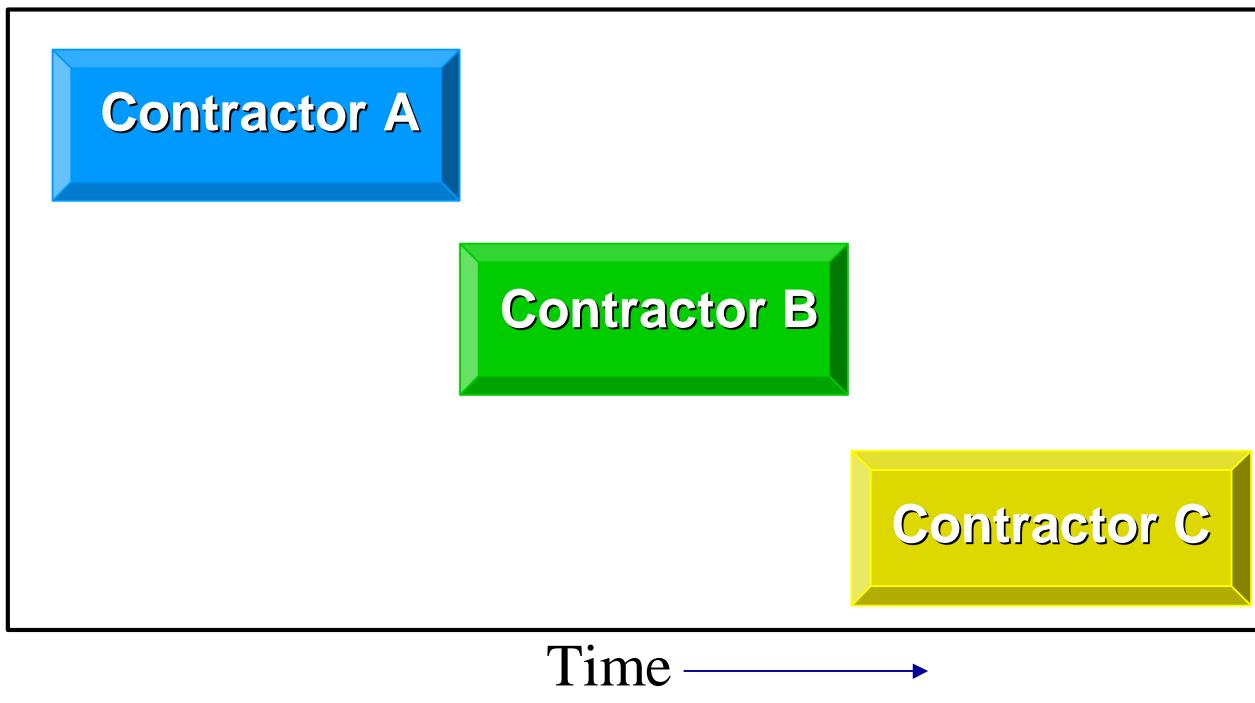
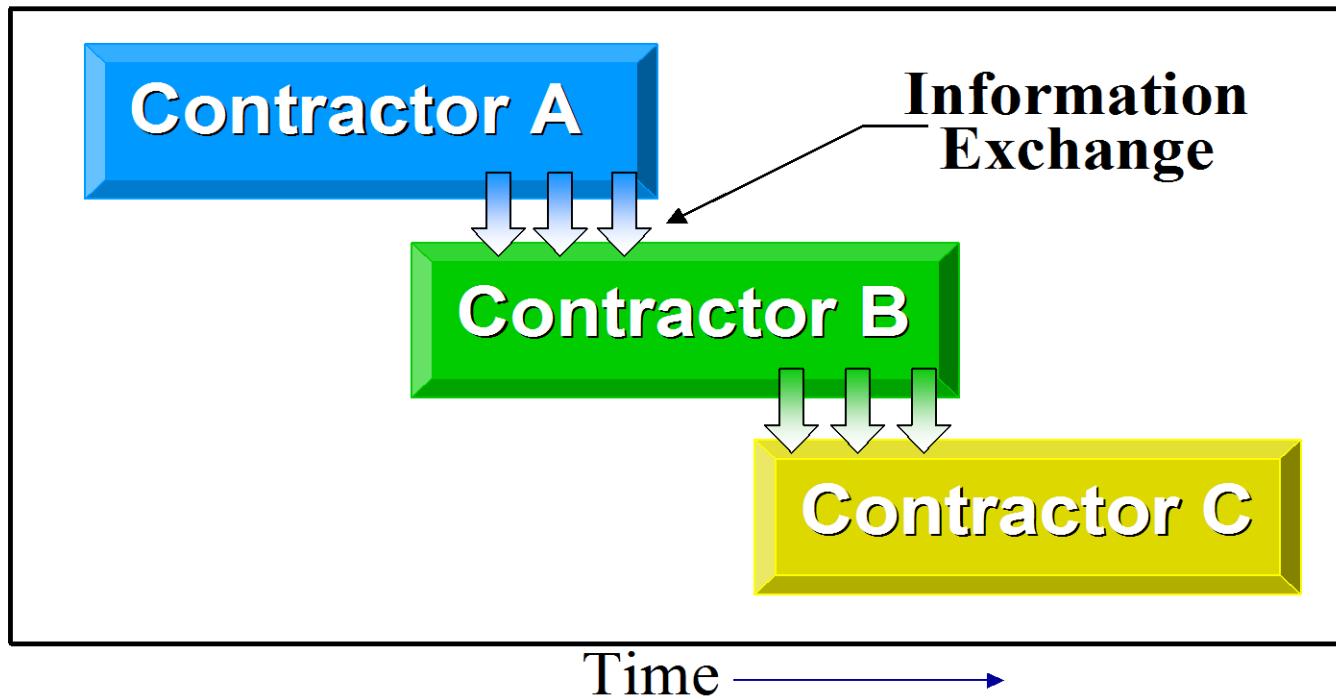


Figure 2
Overlapping Contractors



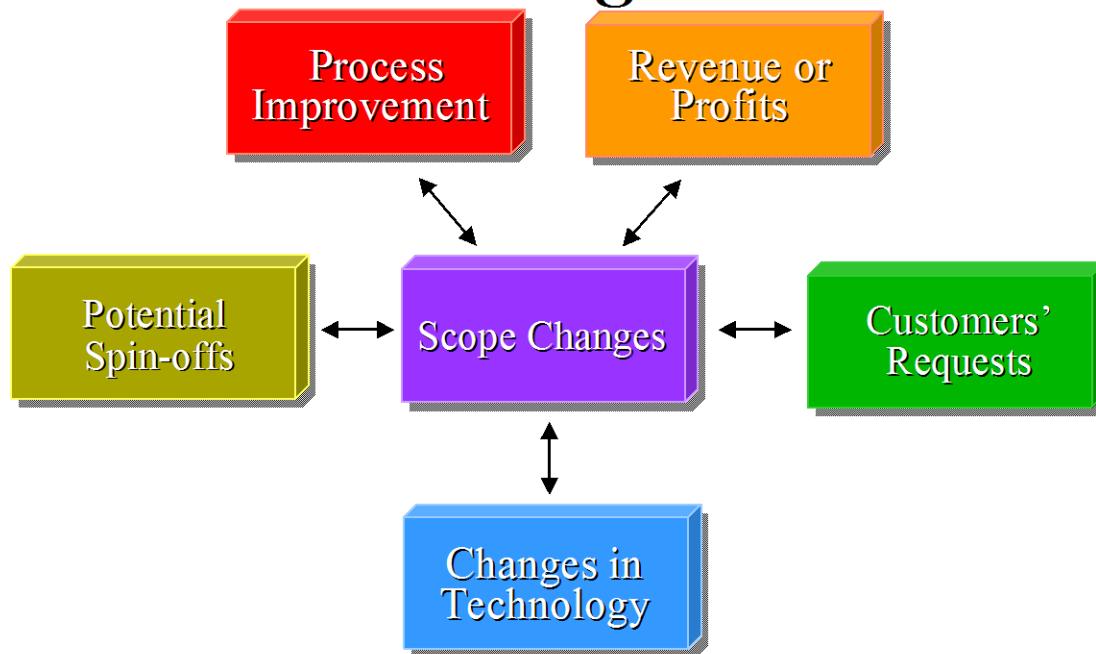


Scope Changes

- ❖ **Many scope changes should be avoided if they have an unfavorable impact on:**
 - Product liability
 - Safety
 - Reputation
 - Image
 - Market share
 - Other factors



Figure 3 *Factors to Consider for Scope Changes*





Scope Change and a Business Need

- ❖ There must exist a valid business purpose for a scope change. This includes the following factors at a minimum:
 - An assessment of the customers' needs and the added value that the scope change will provide
 - An assessment of the market needs including the time required to make the scope change, the payback period, return on investment, and whether the final product selling price will be overpriced for the market.
 - An assessment on the impact on the length of the product life cycle
 - An assessment on the competition's ability to imitate the scope change
 - Is there a product liability associated with the scope change and can it impact our image?



Rationale for Not Approving a Scope Change

- ❖ Typical rationalization for termination or not approving a scope change includes:
 - The cost of the scope change is excessive and the final cost of the deliverable may make us noncompetitive
 - The return on investment may occur too late
 - The competition is too stiff and not worth the risks
 - There are insurmountable obstacles and technical complexity
 - There are legal and regulatory uncertainties
 - The scope change may violate the company's policy on nondisclosure, secrecy and confidentiality agreements