



ISO 9001:2000 and Measuring the Cost of Quality

Presented to

Orange Empire ASQ 701

by

Roger E Olson, Partner

SYSTEMS Quality Consulting



Agenda

- ISO 9000:2000, ISO 9001:2000 and ISO 9004:2000 references to measurement and Cost of Quality
- History of Cost of Quality
- Understanding Cost of Quality
- Implementing a Cost of Quality System
- Questions

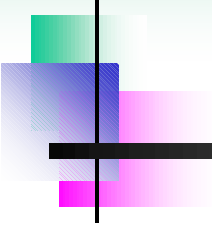


ISO 9000:2000

ISO 9001:2000

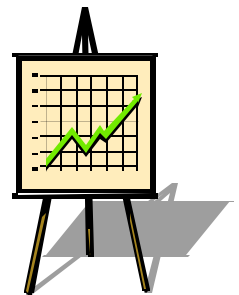
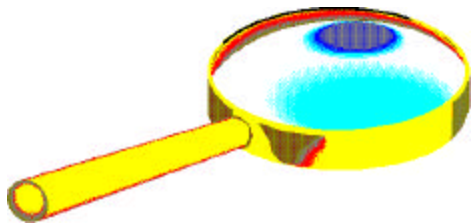
ISO 9004:2000

references to measurement and
Cost of Quality



The words “measure” or
“measurement” can be found twenty
times in ISO 9001:2000

What does this say about “measuring”?



ISO 9000:2000

Quality Management Systems - Fundamentals and Vocabulary

- Section 2.3 - Quality Management Systems Approach

e establish means to measure effectiveness/efficiency of each process 

f determine effectiveness/efficiency of each process 

- Section 2.9 - Continual Improvement

a analyze/evaluate current situation for opportunities

b establish objectives

c seek solutions to achieve objectives

d evaluate solutions, make choice

e implement chosen solution

f *measure, analyze, evaluate results.* (Were objectives met?) 

ISO 9001:2000

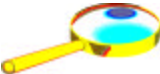
References to Measurement

- 4.1e
- 5.4.1
- 8.1
- 8.2.1
- 8.2.3
- 8.2.4
- 8.4

ISO 9001:2000

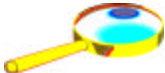
4.1 General requirements

The organization shall

- a) identify the processes needed for the quality management system and their application throughout the organization (see 1.2),
- c) determine criteria and methods needed to ensure that both the operation and control of these processes are effective,
- d) ensure the availability of resources and information necessary to support the operation and monitoring of these processes,
- e) **monitor, measure and analyze these processes** 

ISO 9001:2000


5.4.1 Quality objectives

Top management must ensure that quality objectives, including those needed to meet requirements for product are established at relevant levels and functions within the organization. **The quality objectives must be measurable and consistent with the quality policy.** 

ISO 9001:2000

8 Measurement, analysis and improvement

8.1 General

....plan and implement the **monitoring, measurement,** analysis and improvement processes needed 

- a) to demonstrate conformity of the product,
- b) to ensure conformity of the quality management system, and
- c) to continually improve the effectiveness of the quality management system.

Examples

- Customer satisfaction surveys
- internal audits
- **financial measurements**
- self-assessments

ISO 9001:2000

8.2.1 Customer satisfaction

As one of the **measurements of the performance** of the quality management system, the organization must **monitor information relating to customer perception** as to whether the organization has met customer requirements.

Examples

- customer/user surveys
- feedback on product
- customer requirements
- contract information
- service delivery data
- information on the competition
- customer complaints

ISO 9001:2000

8.2.3 Monitoring and measurement of processes

..... apply suitable methods for monitoring and where applicable, **measurement of the quality management system processes**. These methods shall demonstrate the ability of the processes to achieve planned results.

Examples

Process capability, capability at capacity

cycle time, lead time, reaction time

yield

waste reduction

cost reductions (cost of quality)

ISO 9001:2000

8.2.4 Monitoring and measurements of product

..... **monitor and measure** the characteristics of the product to verify that product requirements have been met.

Examples from ISO 9004:2000

- In-process inspection/testing
- Product verification/validation/qualification
- Qualification of people/materials/product/processes
- Final inspection

ISO 9001:2000

8.4 Analysis of data

..... determine, collect and analyze appropriate data to demonstrate the suitability and effectiveness of the quality management system and to evaluate where continual improvement of the effectiveness of the quality management system can be made. include data generated as a result of **monitoring and measurement** and from other relevant sources.

The analysis of data shall provide information relating to

- a) customer satisfaction (8.2.1),
- b) conformity to product requirements (7.2.1),
- c) characteristics and trends of processes and products including opportunities for preventive action, and
- d) suppliers.

ISO 9001:2000

Implied References to Measurement

- 5.6.2 b,c
- 6.1b
- 6.2.2 c
- 6.4
- 7.2.2 c
- 7.2.3 c
- 7.3.3 a
- 7.3.4 a
- 7.3.5
- 7.3.6
- 7.4.1
- 7.4.3
- 7.5.1
- 8.2.2
- 8.5.1
- 8.5.2



ISO 9004:2000 and COQ

- ISO 9004:2000 is “Guidelines for Performance Improvements”
- ISO 9004:2000 and ISO 9001:2000 were developed as a “consistent pair”, designed to complement each other, but can be used independently
- Think of ISO 9004:2000 as the “how to” for ISO 9001:2000



ISO 9004:2000 and COQ

- ISO 9004:2000 8.2.1.1 - top management should ensure that effective and efficient methods are used to identify area for improvement of QMS performance. Methods include:
 - customer satisfaction surveys
 - internal audits
 - **financial measurements**, and
 - self assessments



ISO 9004:2000 and COQ

- ISO 9004:2000 8.2.1.3 Internal audits
- Examples of subjects for consideration of internal audits include
 - effective/efficient implementation of processes
 - opportunities for continual improvement
 - **analysis of quality cost data**
 - effective/efficient use of resources
 - improvement activities

ISO 9004:2000 and COQ



ISO 9004:2000 8.2.1.4 Financial Measures

- Management should consider the conversion of data from processes to financial information in order to provide comparable measures across processes and to facilitate improvement of the effectiveness and efficiency of the organization. Examples of financial measures include:
 - **prevention and appraisal costs**
 - **nonconformity costs analysis**
 - **internal and external failure cost analysis, and**
 - life-cycle cost analysis

ISO 9004:2000 and COQ



ISO 9004:2000 8.2.2 Measurement and monitoring of processes

Measurement of process performance should cover the needs and expectations of interested parties. Examples include:

- waste reduction
- **cost allocation and reduction**
- effectiveness/efficiency of the organization's people
- capability
- cycle time and throughput



Cost of Quality Systems

History of COQ

- Early 1940's, Armand Feigenbaum, while Director of Quality at G.E.'s Schenectady Works, recognized the value of converting “percent defective”, “defects per unit”, “scrap” and “return rates” into dollars
- 1943, Feigenbaum and his team developed “quality costs”, a dollar based reporting system
- 1961, ASQ forms the Quality Costs Committee
- 1963, MIL-Q-9858A issued, makes “Costs Related to Quality” a requirement for many government contractors

History of COQ



- Original “quality costs” included
 - prevention
 - appraisal
 - internal failures
 - external failures
- In retrospect, it ignored the costs of failures incurred by the customer after delivery of defective product, and the loss of reputation and loss of business



Basic Finances

$$\text{Income} - \text{Expenses} = \text{Profit}$$

“Good” quality affect on Income and Expenses

- good quality increases customers, increases income
- good quality increases repeat business, increases income
- good quality lowers production costs, lowers expenses
- good quality lowers inspection costs, lowers expenses
- good quality allows reduced inventories, which lowers expenses

Basic Finances

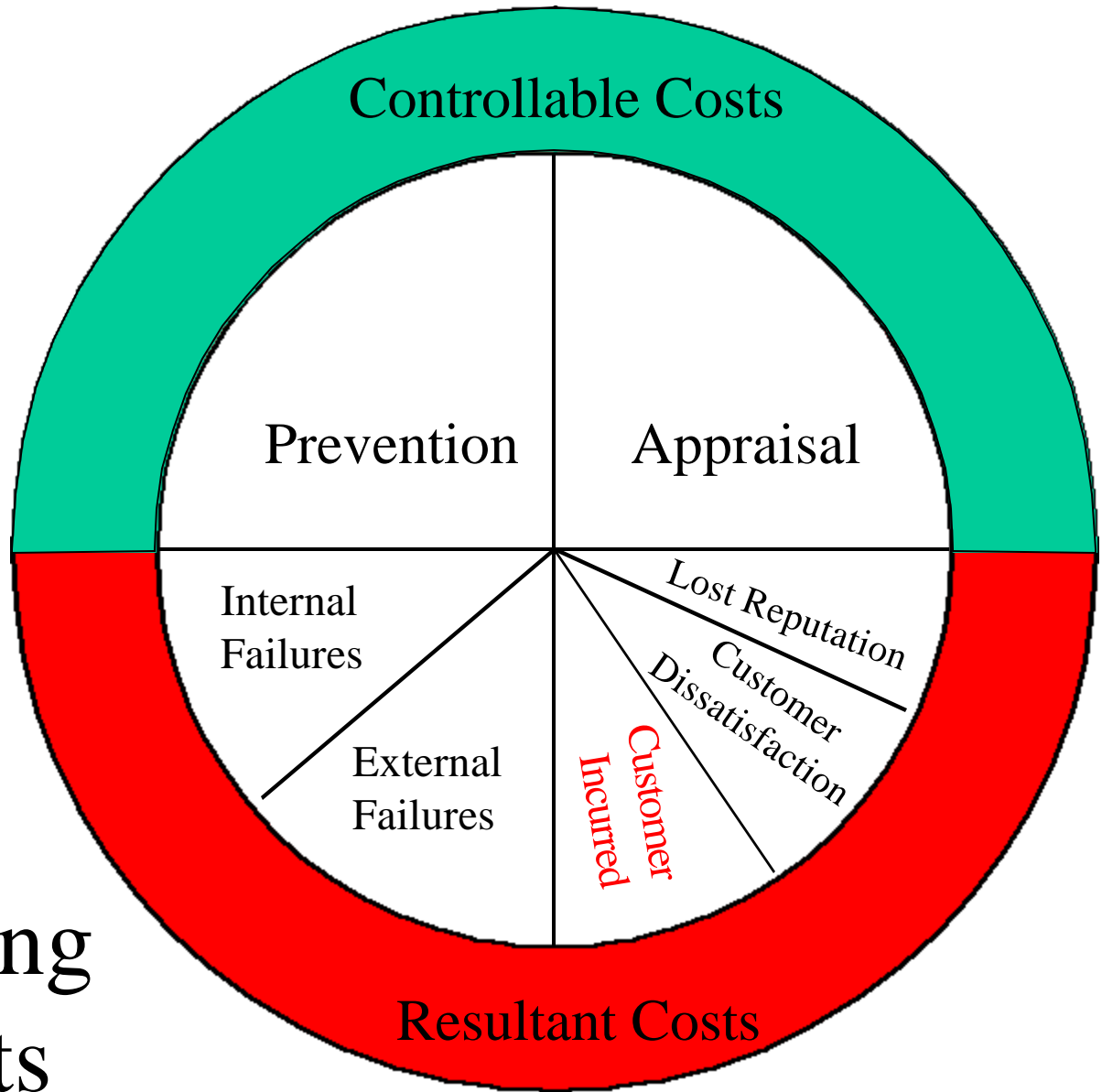
$$\text{Income} - \text{Expenses} = \text{Profit}$$

“poor” quality affect on Income and Expenses

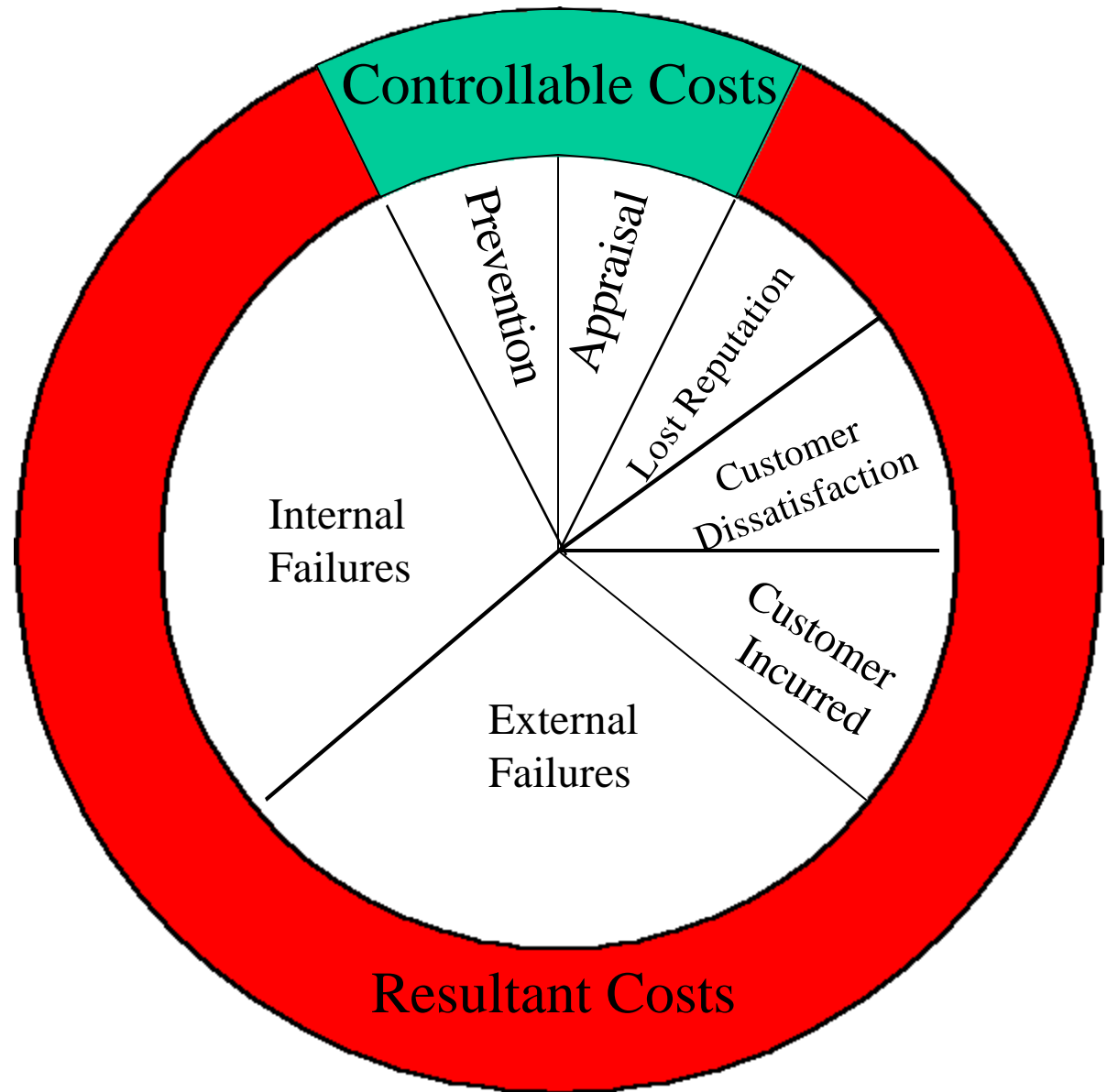
- poor quality decreases customers, decreases income
- poor quality increases warranty costs, increases expenses
- poor quality increases express shipping, increases expenses
- poor quality increases scrap, increases expenses
- poor quality increases rework, increases expenses



The
Starting
Point:
Understanding
Quality Costs

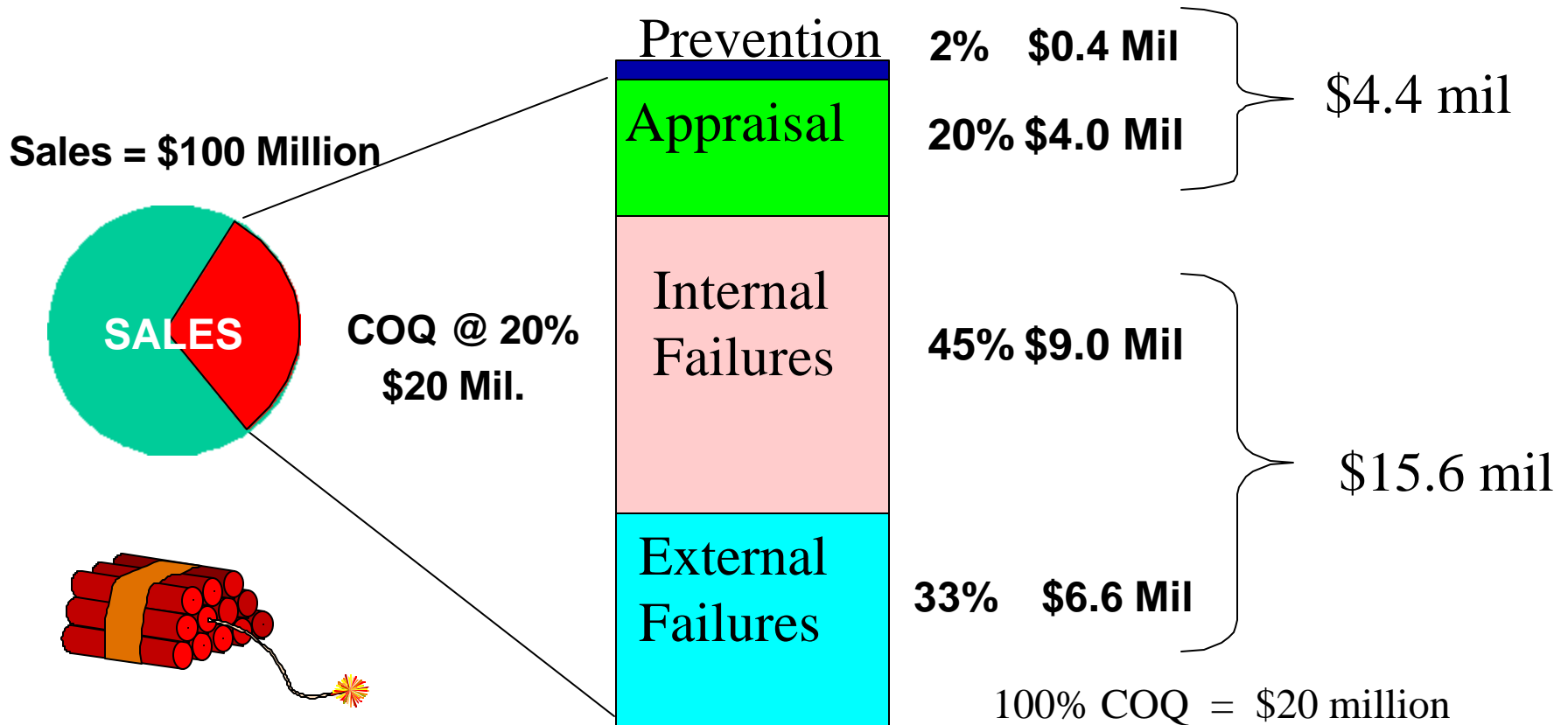


**Typical
Starting
Point:**
Resultant
Costs are
Much Larger
Than
Controllable
Costs



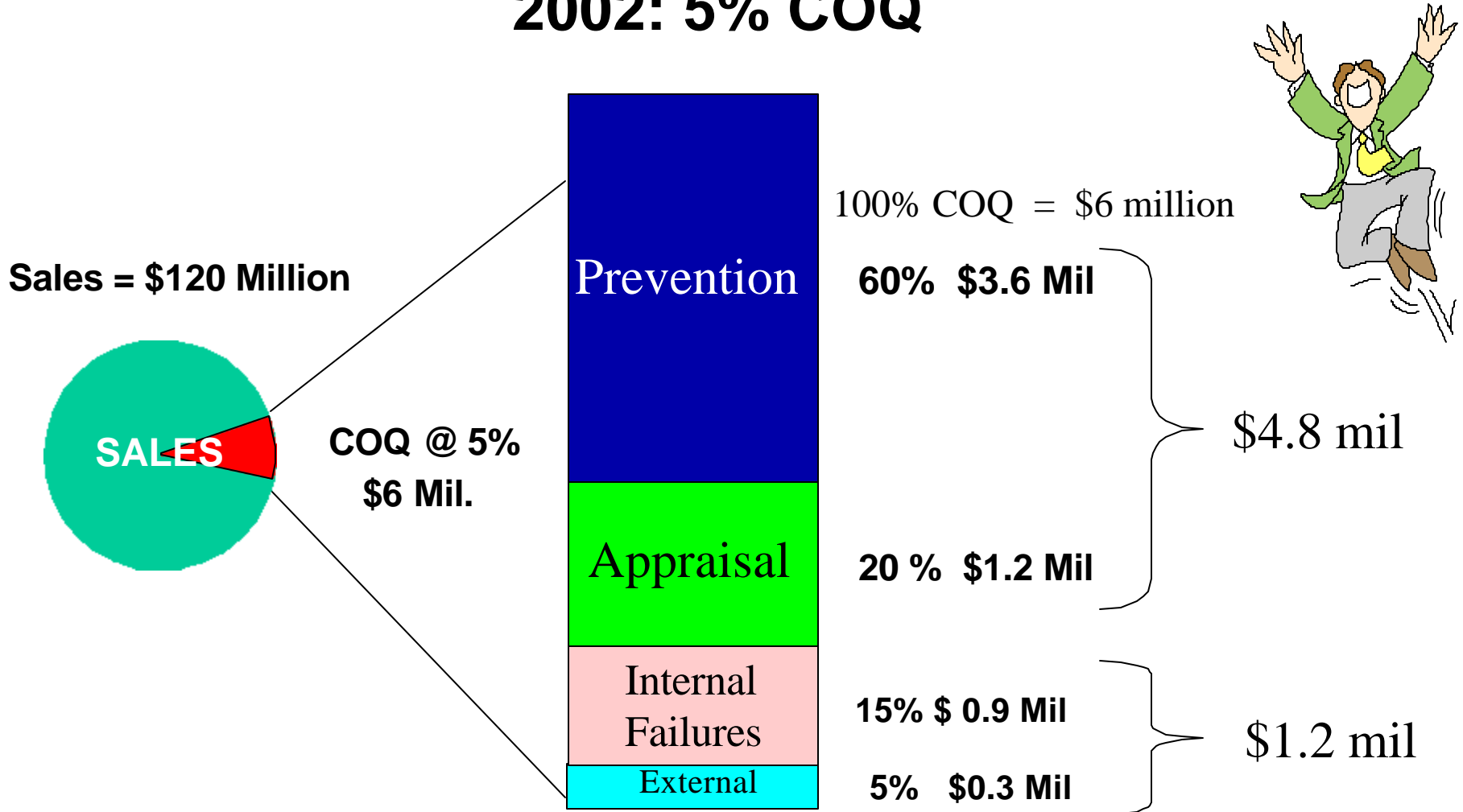
Cost of Quality

Company A: 1997, 20% COQ



Cost of Quality

2002: 5% COQ



What could you do with an extra \$14 million?

Prevention Costs - Examples

All activities specifically designed to *prevent* poor quality in product or services

- Quality planning
- Supplier quality planning
- Process control planning
- Design review
- Quality training
- Gage design
- Supplier reviews/surveys
- Customer surveys
- Marketing research
- Purchase order reviews
- Process validation
- Quality improvement activities

These are all planned, proactive activities

Appraisal Costs - Examples

All costs associated with measuring, evaluating or auditing product to *assure conformance* to standards/requirements

- Receiving inspection
- Source inspection
- Laboratory inspection testing
- In-process inspection
- Quality audits
- Calibration costs
- Process control measurements (SPC)
- Inspection, test, and measurement equip
- Product quality audit
- Outside certifications

These are all planned, proactive activities



Internal Failures - Examples

All costs resulting from failures found **before** product or service reaches the customer

- Scrap
- Rework
- Process trouble-shooting
- Vendor caused scrap or rework
- MRB
- Meetings to reschedule
- Overtime - poor quality related
- Supplier corrective action
- Design corrective action
- Rework of supplier rejects
- Corrective action activities
- Down-graded product
- Internal failure labor losses
- Shortages meetings

These are non-value added and reactive



External Failures - Examples

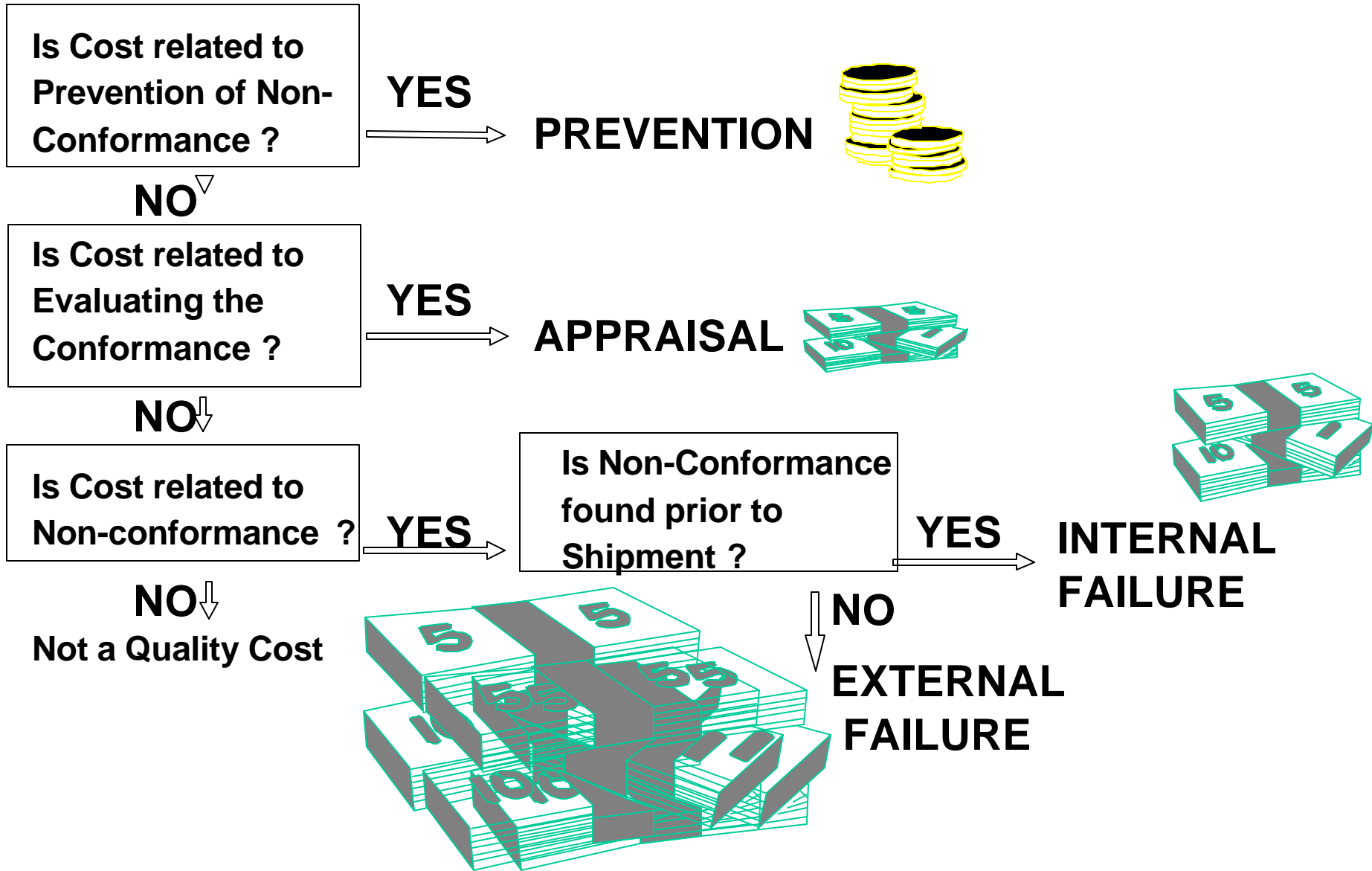
The costs incurred when the customer finds the failure

- Processing customer complaints
- Field repairs
- Recall costs
- Returned goods
- Processing returned materials
- Warranty costs
- Loss of reputation
- Penalties
- *Customer incurred costs*



These are non-value added

Cost of Quality Decision Flow



3-7%
of
Sales

Recalls
Customer returns Rejects Rework

Expediting costs

Billing errors

Customer allowances

Premium freight

5-20%
of
Sales

Retooling due to poor design

Meetings to reschedule

Handling complaints

Shortages meetings

Correcting paperwork errors

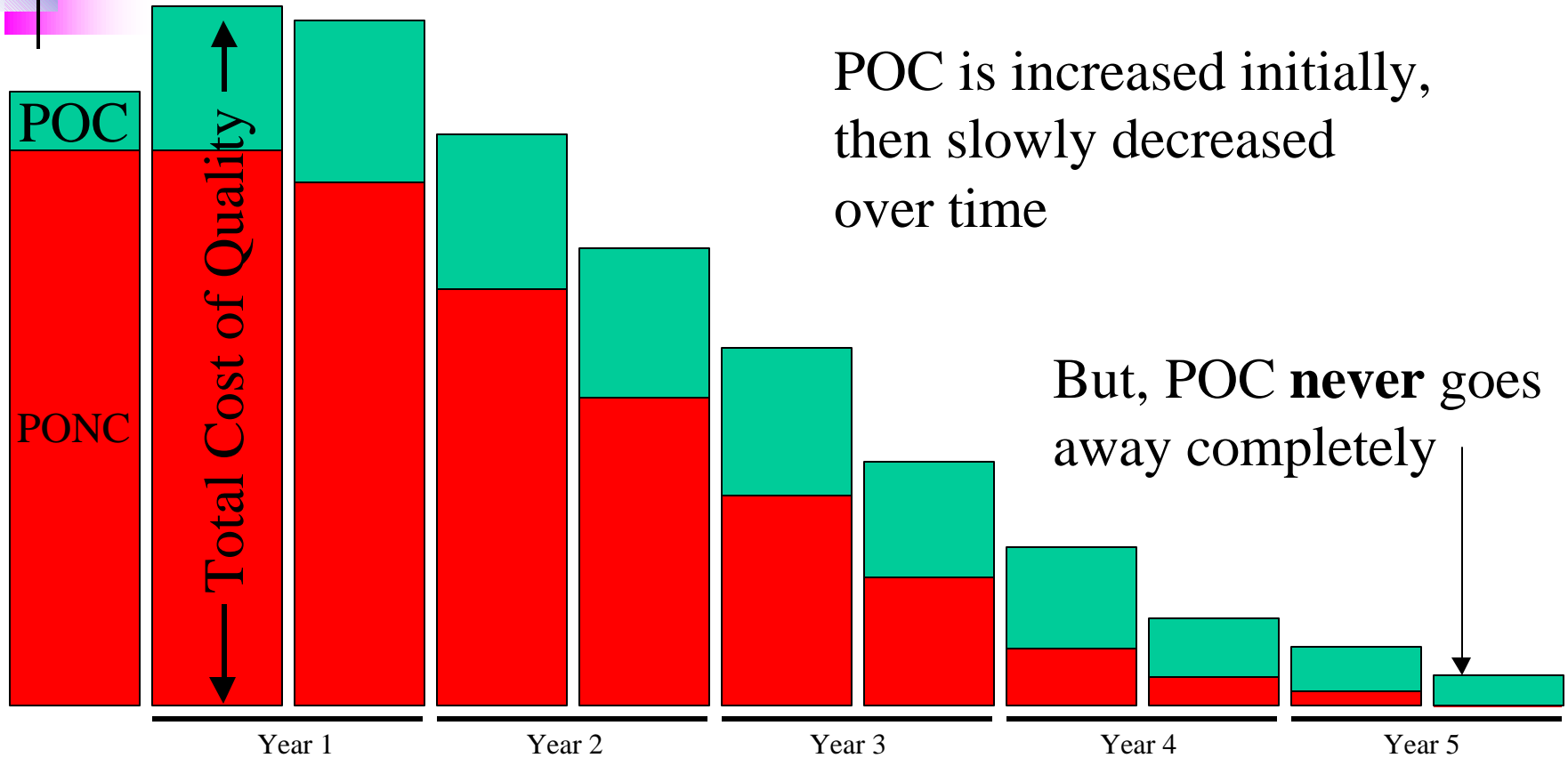
Excessive overtime

The cost of poor quality can be as much as 25% of sales



Where
We
Want
To Be:
No
Unplanned
Costs!

Price of Conformance and Price of Nonconformance Over Time



Over time, PONC is reduced to 1/10 - 1/20 of its original level

Before Starting a COQ System....



“Data is a lot like garbage,
You need to know what you
Are going to do with it
Before you start collecting it”

Mark Twain



Getting Started

1. Categorizing costs
2. **Focus on problem prevention**
3. Establishing and tracking measurements

The underlying beliefs:

- For each failure there is a *root cause*
- Causes are *preventable*
- Prevention is *always* cheaper

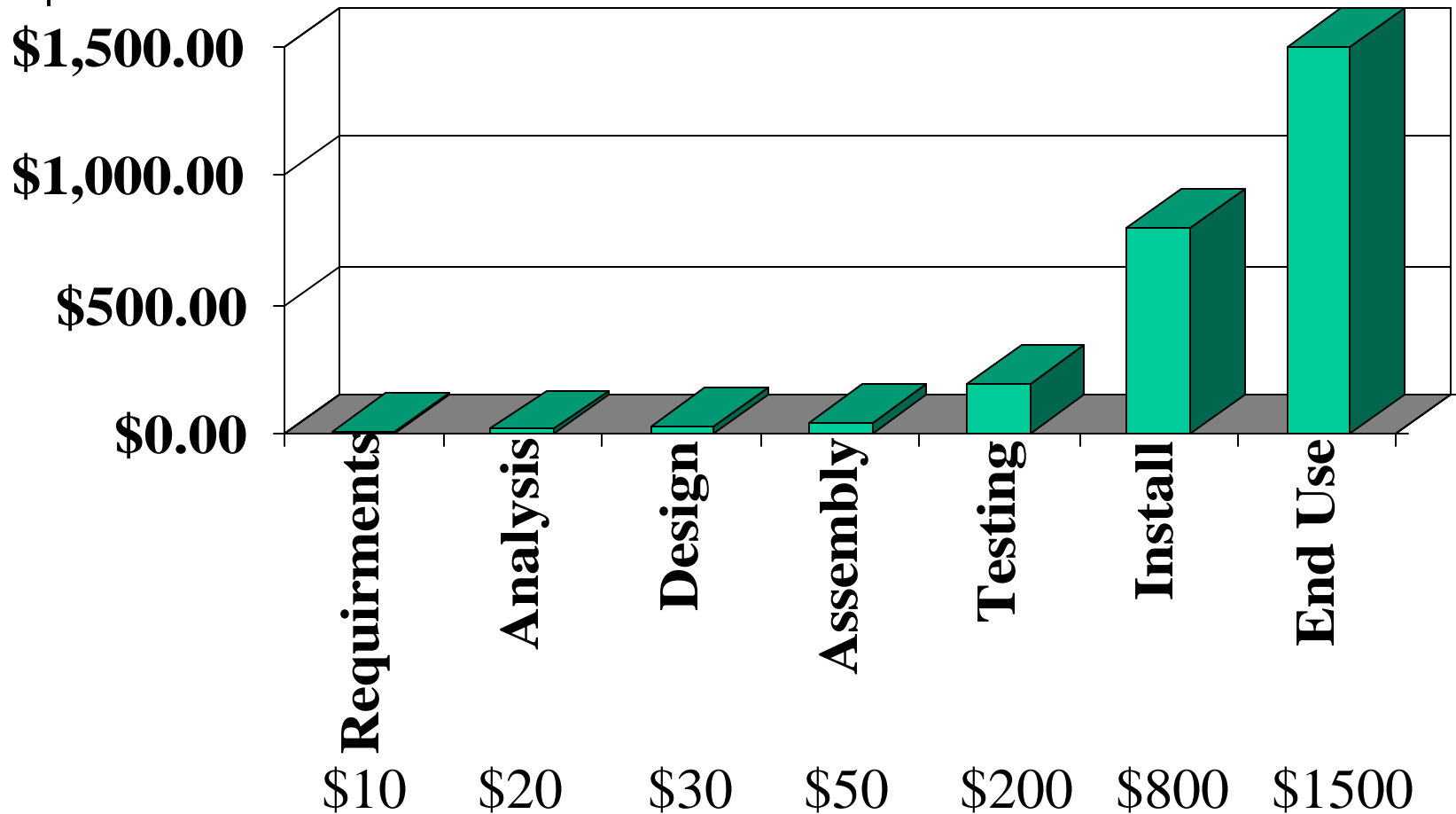
Comparative Cost of Quality

- Least costly - QMS is designed and oriented for defect prevention \$\$\$
- More costly - defects found and corrected internally \$\$\$
- Most costly - customer finds defects in delivered goods \$\$\$\$

Warranty costs are the #1 reason for computer manufacturer bankruptcies

Cost of Quality

Cost to Fix a Defect at Various Stages

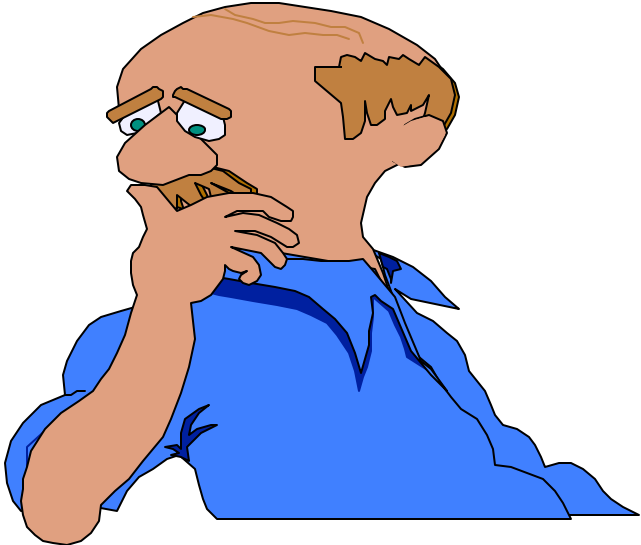


Getting Started



- One representative from each departments plus one from accounting will need ~20-30 hours of meetings
- On going, about 20-40 hours per year for a company with 150-200 employees
- Reducing cost of quality, as a percentage of sales, by as much as 5% a year are possible
- Don't forget to involve suppliers!

Traditional accounting categories mask most quality costs.



New Thinking Is Required

Income Statement	
Income	
Sales	\$4,100,000
Returns	(\$105,000)
Income	\$3,995,000
Cost of Goods Sold	
Labor	\$960,600
Materials	\$1,118,000
COGS	\$2,078,600
Expenses	
Salaries	\$483,800
Services	\$98,400
Depreciation	\$194,340
Training	\$3,300
Supplies	\$36,900
Interest	\$61,500
Rent	\$287,000
Accounting	\$24,600
Legal	\$28,200
Office Supplies	\$16,400
Travel	\$28,700
Licenses/Certification	\$12,300
Meals and Ent.	\$15,300
Advertising	\$82,000
Sales Shows	\$41,000
Repairs	\$44,600
Telephone	\$20,500
Utilities	\$36,900
Expenses	\$1,515,740
Profit	\$400,660

Hidden Quality Costs

Prevention Costs

\$20,000

- Quality Planning \$4,000
 - Engineering design \$10,000
 - Quality Training \$2,000
 - Preventive maint. \$4,000
- \$20,000**

Income Statement		
Income		
Sales	\$4,100,000	
Returns	(\$105,000)	
Income	\$3,995,000	
Cost of Goods Sold		
Labor	\$960,600	
Materials	\$1,118,000	
COGS	\$2,078,600	
Expenses		
Salaries	\$483,800	
Services	\$98,400	
Depreciation	\$194,340	
Training	\$3,300	
Supplies	\$36,900	
Interest	\$61,500	
Rent	\$287,000	
Accounting	\$24,600	
Legal	\$28,200	
Office Supplies	\$16,400	
Travel	\$28,700	
Licenses/Certification	\$12,300	
Meals and Ent.	\$15,300	
Advertising	\$82,000	
Sales Shows	\$41,000	
Repairs	\$44,600	
Telephone	\$20,500	
Utilities	\$36,900	
Expenses	\$1,515,740	
Profit	\$400,660	

Hidden Quality Costs

Appraisal Costs

\$250,000

Income Statement		
Income		
Sales	\$4,100,000	
Returns	(\$105,000)	
Income	\$3,995,000	
Cost of Goods Sold		
Labor	\$960,600	
Materials	\$1,118,000	
COGS	\$2,078,600	
Expenses		
Salaries	\$483,800	
Services	\$98,400	
Depreciation	\$194,340	
Training	\$3,300	
Supplies	\$36,900	
Interest	\$61,500	
Rent	\$287,000	
Accounting	\$24,600	
Legal	\$28,200	
Office Supplies	\$16,400	
Travel	\$28,700	
Licenses/Certification	\$12,300	
Meals and Ent.	\$15,300	
Advertising	\$82,000	
Sales Shows	\$41,000	
Repairs	\$44,600	
Telephone	\$20,500	
Utilities	\$36,900	
Expenses	\$1,515,740	
Profit	\$400,660	

- Inspector wages \$40,000
 - In-process inspect \$75,000
 - Quality audits \$20,000
 - Calibration services \$40,000
 - Supplies \$15,000
 - QC floorspace \$50,000
 - Regulatory approval \$10,000
- \$250,000**

Hidden Quality Costs

Internal Failure Costs

\$400,000

- Labor (rework) \$110,000
 - Materials \$95,000
 - Eng. redesign \$30,000
 - Failure analysis \$20,000
 - Software fix \$40,000
 - Fire loss – equip. \$70,000
 - Rework space \$35,000
- \$400,000**

Income Statement		
Income		
Sales	\$4,100,000	
Returns	(\$105,000)	
Income	\$3,995,000	
Cost of Goods Sold		
Labor	\$960,600	
Materials	\$1,118,000	
COGS	\$2,078,600	
Expenses		
Salaries	\$483,800	
Services	\$98,400	
Depreciation	\$194,340	
Training	\$3,300	
Supplies	\$36,900	
Interest	\$61,500	
Rent	\$287,000	
Accounting	\$24,600	
Legal	\$28,200	
Office Supplies	\$16,400	
Travel	\$28,700	
Licenses/Certification	\$12,300	
Meals and Ent.	\$15,300	
Advertising	\$82,000	
Sales Shows	\$41,000	
Repairs	\$44,600	
Telephone	\$20,500	
Utilities	\$36,900	
Expenses	\$1,515,740	
Profit	\$400,660	

Hidden Quality Costs

External Failure Costs

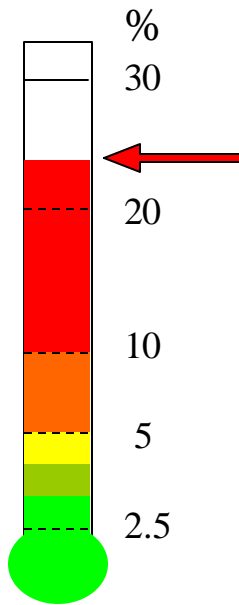
\$330,000

- Returns \$105,000
 - Labor \$60,000
 - Materials \$40,000
 - Consulting Services \$37,000
 - Legal \$25,000
 - Travel \$15,400
 - Meals & Entertain \$3,000
 - Repairs \$44,600
- \$330,000**

Income Statement		
Income		
Sales		\$4,100,000
Returns		(\$105,000)
Income		\$3,995,000
Cost of Goods Sold		
Labor		\$960,600
Materials		\$1,118,000
COGS		\$2,078,600
Expenses		
Salaries		\$483,800
Services		\$98,400
Depreciation		\$194,340
Training		\$3,300
Supplies		\$36,900
Interest		\$61,500
Rent		\$287,000
Accounting		\$24,600
Legal		\$28,200
Office Supplies		\$16,400
Travel		\$28,700
Licenses/Certification		\$12,300
Meals and Ent.		\$15,300
Advertising		\$82,000
Sales Shows		\$41,000
Repairs		\$44,600
Telephone		\$20,500
Utilities		\$36,900
Expenses		\$1,515,740
Profit		\$400,660

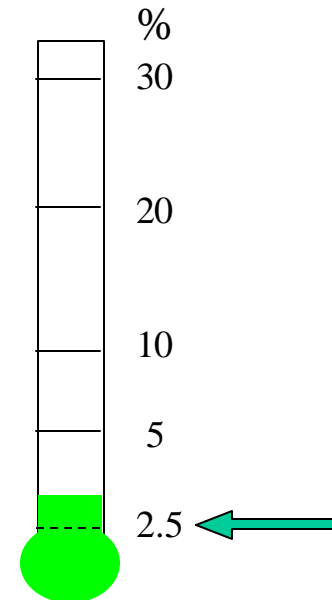
Cost of Quality

Measurement of a Company's Health



Where we are

Percentage
of Sales
Dollar



Where we want to be



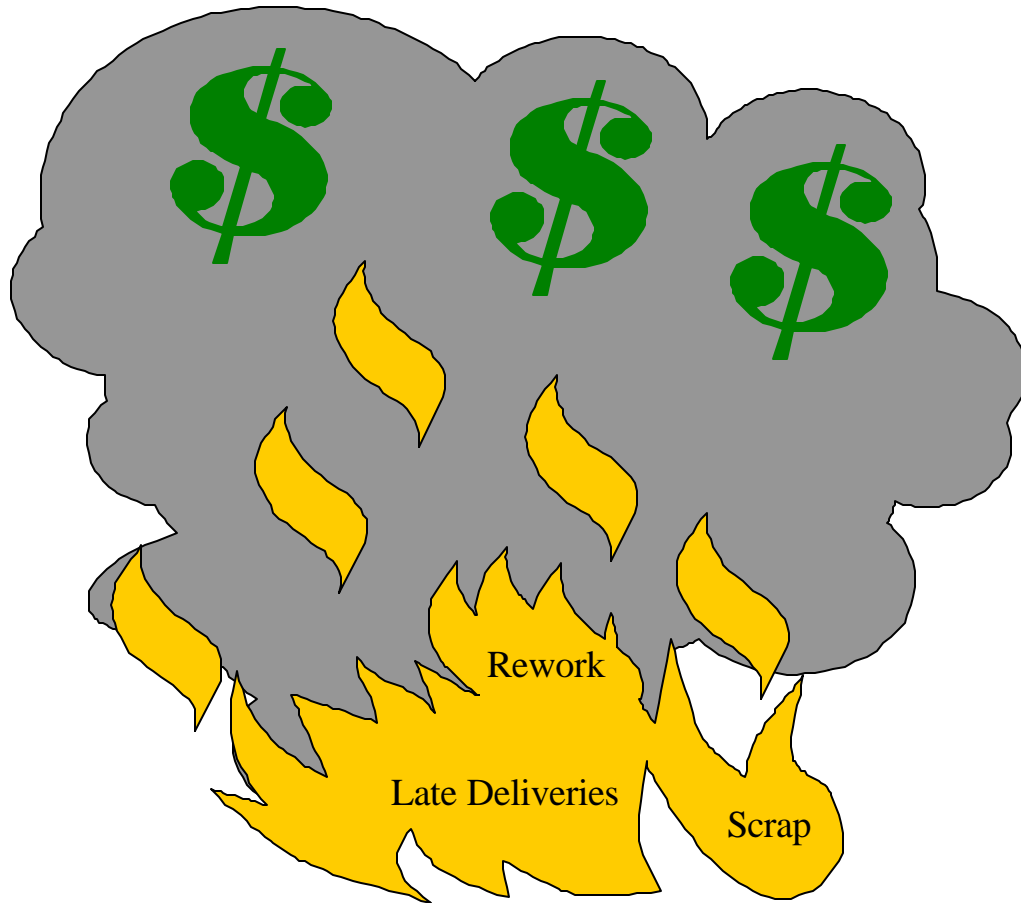
How long can you afford to ignore your costs of poor quality?



Barriers

- Lack of management buy-in/support
 - Some changes to systems and processes may be needed
 - May be viewed as another fad
- Fear of finger-pointing/punishment
- Because loss of reputation and customer dissatisfaction can be hard to convert to dollars, they tend to be ignored

Which does your company culture support and reward: **Fire fighters, or problem preventers?**



Conclusion



**KNOW
YOUR
QUALITY
COSTS**



QUESTIONS



Resources

- Principles of Quality Costs, Jack Campanella, editor, ASQ Press
- Quality Planning and Analysis, Juran and Gryna, McGraw-Hill
- Juran's Quality Control Handbook, Juran and Gryna, McGraw-Hill
- Total Quality Control, Armand Feigenbaum, McGraw-Hill



SYSTEMS Quality Consulting

www.systemsquality.com

909-484-7545

Lean Enterprise, Six Sigma

ISO 9001, ISO 14001

Training and Consulting