

## Turning Defects into Dollars: Using the Cost of Quality to Drive Improvement

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## You must demonstrate the value of your quality efforts to Management

- ☐ Demonstrate ROI for every effort
- ☐ Track impact of every effort
- ☐ Use objective and subjective measures
- ☐ Speak the language of management:
  - ☐ Savings
  - ☐ Cost Avoidance
  - ☐ Revenue/Time to Market
  - ☐ Return on Investment



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## The Beta Company Case Study Situational Analysis -- 2006

- ☐ Beta is a big player in its industry
- ☐ Been around a long time, bureaucratic, slow to change – stuffy
- ☐ New, vigorous competition, markets shifting and changing
- ☐ Many long-term employees who are dedicated to improvement & quality
- ☐ Weak IT organization, diffuse reporting structure at beginning of study



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## Gap Analysis DIY or Consultant

- ☐ QA and Testing Survey
- ☐ Measurement Readiness Survey
- ☐ Interviews
- ☐ Document Review
- ☐ Defect Analysis
- ☐ Observation



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## Use Surveys to Demonstrate Need and Results of Efforts

- Keep it simple, short, and focused
- Use a consistent format: positive statement, 5 choices (1 = Strongly Disagree; 5 = Strongly Agree)
- Ask for specific comments – adds depth
- Supplement with interviews, doc review
- Be as concerned with range of responses as calculating the average

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## Report Content

- Context for report and recommendations =
- Cost of Quality Model
  - Definitions of Quality, Quality Assurance, Quality Control, Quality Improvement
  - International standards: CMM(I), TMM
  - Strategic approach to improving results of testing and development

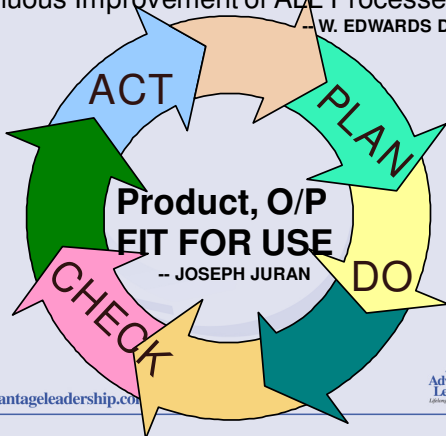
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## Continuous Improvement of ALL Processes

W. EDWARDS DEMING

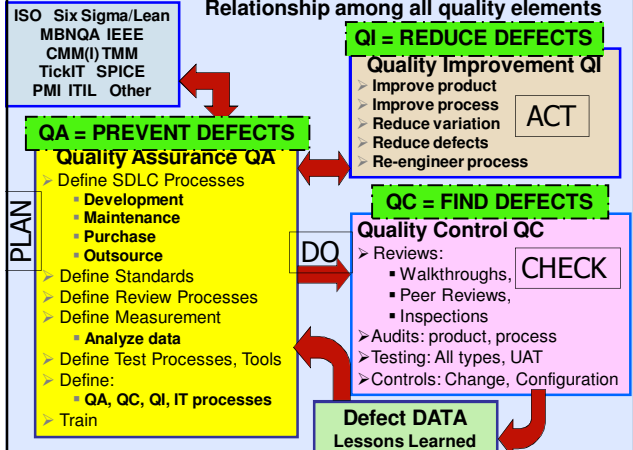
QUALITY IS...

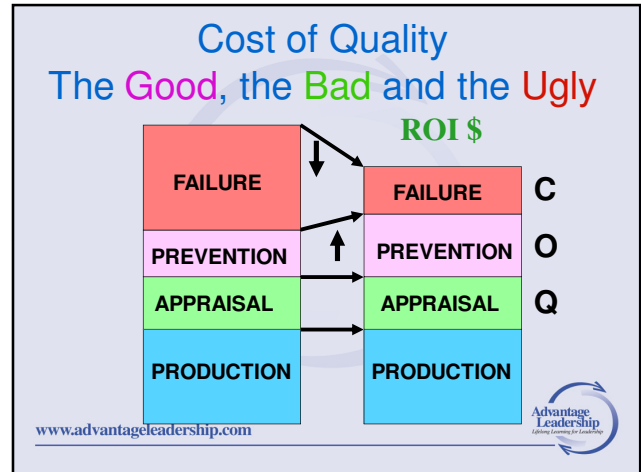
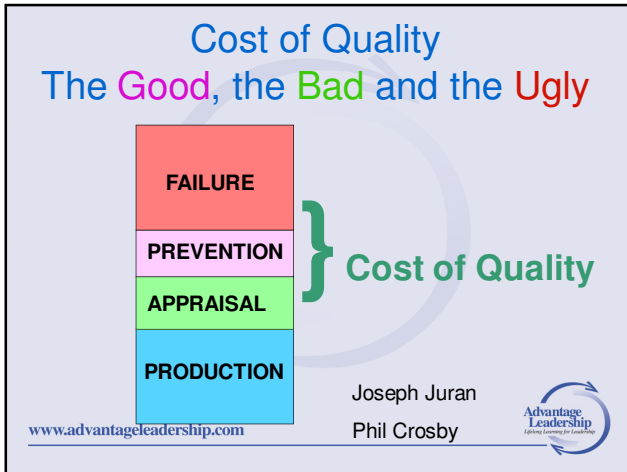


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## Relationship among all quality elements





- ### Strategies to Reduce COQ
- Increase the Cost of Prevention
  - Shift Appraisal emphasis to beginning of Life Cycle, more static testing
  - Use test tools more effectively, efficiently
- Why should BETA do this?
- Appraisal: Find defects early, save time, \$
  - Prevention: Reduce defects, reduce costs;
  - Use defect data to improve processes
  - Improve time to market
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BETA had Quality Policy but ignored it

QT used existing policy as starting point

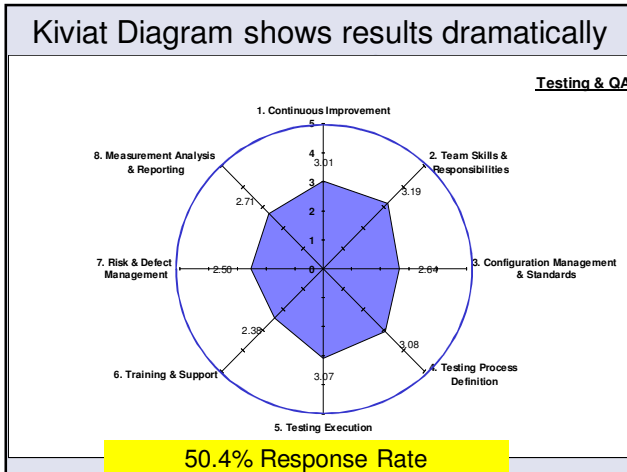
Surveyed all IT employees, managers

Questions based on TMM, CMM, specific conditions at BETA

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## Kiviat Diagram shows results dramatically



## QA & Testing Survey: Quality Process Conclusions

- ☐ Islands of Good SW Engineering Practice
  - ☐ “We have pockets of order”
- ☐ “It’s too late... ship it’ is the rule”
- ☐ “We need a quality group that can’t be circumvented”
- ☐ Lack of fully deployed Quality Policy
- ☐ Variable processes are defect generators

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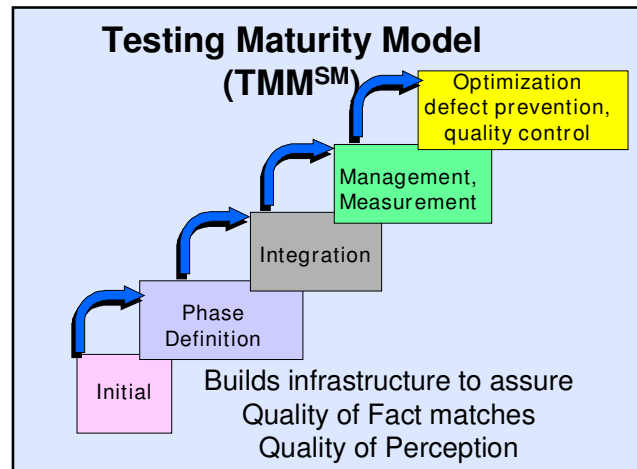
Conclusions compared BETA practices to CMM KPAs to demonstrate maturity level

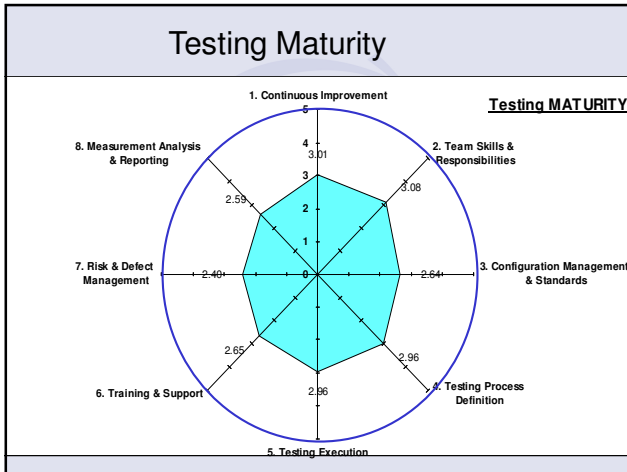
- ☐ BETA believed it was CMM Level 2 – it was Level 1
- ☐ Highlighted good practices, teams
- ☐ Place conclusions in relation to GSEP – Good Software Engineering Practice
- ☐ Made recommendations specific for company

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## Testing Maturity Model






Conclusions compared BETA practices to TMM Goals to demonstrate maturity level

- ☐ BETA was at TMM Level 1
- ☐ Highlighted good practices, teams
- ☐ Place conclusions in relation to GSEP – Good Software Engineering Practice
- ☐ Made recommendations specific for company

  
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### Testing Center of Excellence (recommendations)

- ☐ Define, deploy testing methodology
- ☐ Train testers on tool use
- ☐ Matrix manage all testers
- ☐ Manage technical testers
- ☐ Audit use of testing methodology
- ☐ Select, train new testers
- ☐ Consult to projects on testing, UAT

  
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### Implementation Considerations

- ☐ Establishing Mission Critical Processes for Testing
- ☐ Cost/Benefit Analysis: 10:1 ROI – **could** avoid \$5 million first year of implementation
- ☐ Funded through defect elimination and prevention

  
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## The Defect Study

- Analyze defect data for one year from test tool defect tracker
- All defects reported and closed prior to production and in production cycle
- Analyze defect data by phase found; ignore 'cause' data
- Analyze data using industry studies

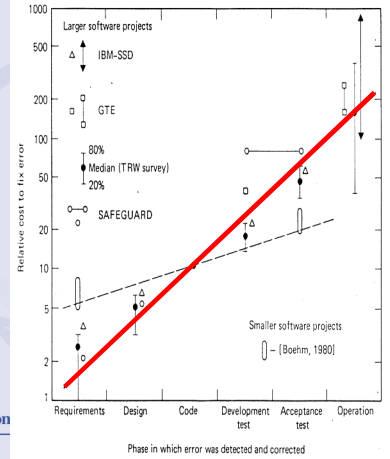


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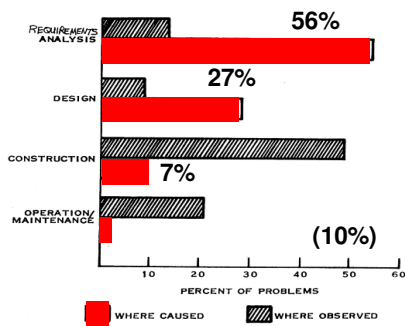


**Software Engineering Economics**  
Barry Boehm  
Prentice Hall,  
1981

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## Where Defects Caused/Found



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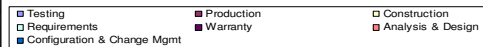
James Martin



## Defects by Stage FOUND

PRODUCTION

TESTING



## Calculating Defect Cost

Life Cycle Stage	Relative Cost/Defect	Example: Actual Cost/Defect
Requirements	\$2	\$100
Design	\$5	\$250
Code	\$10	\$500
Testing	\$20	\$1000
Configuration Mgt	\$50	\$2500
Warranty	\$100	\$5000
Production	\$200	\$10,000

Cost to Repair = (Defects) X (Relative Cost) X (Hourly Rate) X (Time)  
 (Based on Boehm) **Example: \$50/hour**

## What defects cost BETA in 2007

Life Cycle Phase	Number of Defects Found	Percent of Defects Found	Cost to Find/Fix Defects
Requirements	46	1%	\$ 4,600
Design	27	0.6%	\$ 6,750
Code/Unit Test	89	2%	\$ 44,500
Test	3954	86%	\$ 3,954,000
Configuration	14	0.3%	\$ 35,000
Warranty	37	0.8%	\$ 185,000
Production	437	9.5%	\$ 4,370,000
<b>TOTAL</b>	<b>4604</b>	<b>100%</b>	<b>\$ 8,599,850</b>

Based on hourly rate of \$50 – note actual rate for BETA was higher

### BETA Costs to Find 85% of Defects Where They Are Caused in 2007

Life Cycle Stage	Actual Cost of Found Defects	% of Defects Found	Expected % of Defects	Expected Number of Defects	85% of Defects in Stage	Cost to find/fix 85% of Defects
Requirements	\$ 4,600	1%	56%	2578	2191	\$ 219,100
Design	\$ 6,750	0.60%	27%	1243	1057	\$ 264,000
Code/Unit Test	\$ 44,500	2%	7%	322	274	\$ 137,000
Test	\$ 3,954,000	86%	10%	461	*931	\$ 931,000
Configuration	\$ 35,000	0.30%	0	0	0	---
Warranty	\$ 185,000	0.80%	0	0	0	\$ ---
Production	\$ 4,370,000	9.50%	0	0	**151	\$ 1,510,000
<b>TOTAL</b>	<b>\$8,599,850</b>	<b>100%</b>	<b>100%</b>	<b>4604</b>	<b>4604</b>	<b>\$ 3,061,000</b>

\*Test estimated to find 86% of remaining 1082 defects  
 \*\*Remaining defects = 3% of total

## Defect Study Conclusions

### Conclusions:

- The current estimated cost of defects for 100% of projects is **\$14,000,000 out of a budget of \$30,000,000 annually.**
- QT is not charged with providing vital data to management,
- Management cannot make effective decisions on Quality.
- If ALL defects found in stage where they were created, cost to find and fix defects would be reduced to **\$1,400,000!**

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## BETA established IT Plan Quality Framework

- Quality Management Definitions
- Defined Principles
- IT Steering Committee; COO, VPs
- IT Policies: SDLC, Quality, Testing, Requirements
- Overall goal: reduce number of defects being introduced, identifying/resolving defects closer to their point of origin

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## Initiative to Improve Testing 2006 - 2008

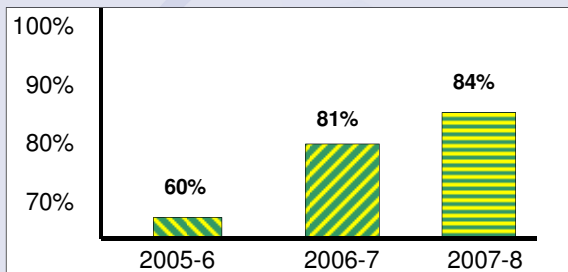
- Testing Resource Center
- Automation and Performance Testing
- Stage Gate Assessments
- Business Acceptance Testing
- Testing and Quality Policy
- Use of XYZ Test Tools
- Definitions of Testing Roles, Responsibilities
- Improved Templates for Testing
- Early Involvement Project Control Boards
- IT Plan Deployment

IT Quality Plan Framework embraced by management

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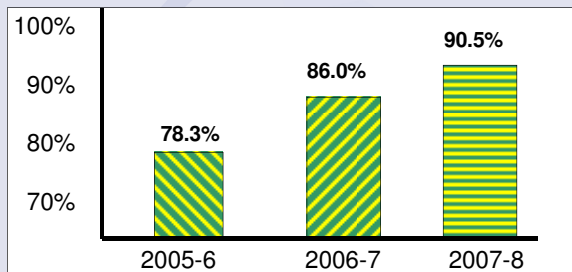
## Increased use of ZYZ Test Tool to track Defects



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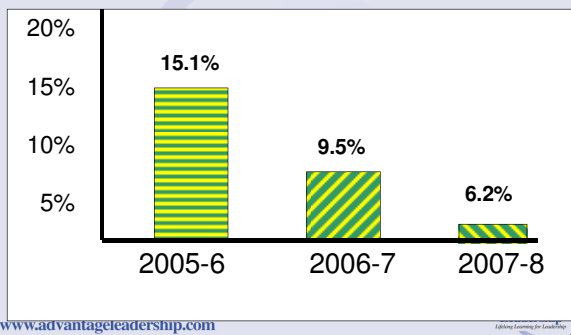
## Improved defect detection from improved testing processes



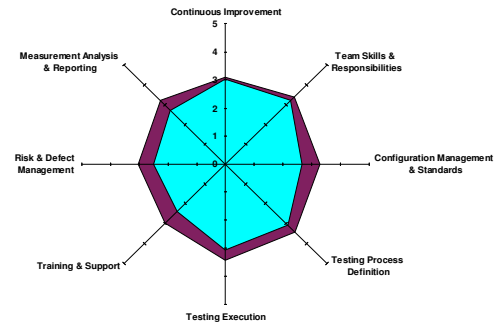
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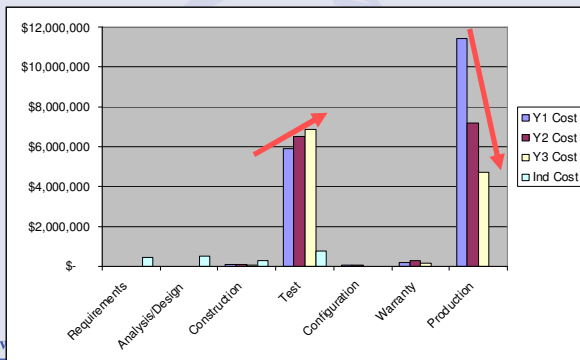
## Fewer defects enter production due to improve testing processes



Baseline = Blue vs. Year 3 Change = Purple



## Defect Costs Comparison



BETA began implementing Fagan Inspections in 2008

- Trained Inspectors and Moderators
- Established Defect Analysis and Reporting
- Compared similar projects with and without Inspections

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Project A With Inspections vs. Project B Without Inspections						
Stage Found	# Defects		% of Defects		Cost of Defects	
	Project A	Project B	Project A	Project B	Project A	Project B
REQ	220	-0-	94.00%	-0-	\$22,000	-0-
DES	2	1	0.85%	1.00%	\$500	\$250
CODE	-0-	-0-	-0-	-0-	-0-	-0-
TEST	12	83	5.13%	83%	\$12,000	\$83,000
Config	-0-	-0-	-0-	-0-	-0-	-0-
Warranty	-0-	-0-	-0-	-0-	-0-	-0-
PROD	-0-	16	-0-	16%	-0-	\$160,000
Inspection/ Train Cost					\$11,346	
<b>TOTAL</b>	<b>234</b>	<b>100</b>			<b>\$45,846</b>	<b>\$243,250</b>
<b>Cost Avoid</b>					<b>\$518,404</b>	<b>-0-</b>

## Other Results

- In first year, Requirements Inspections resulted in over \$6 million in cost avoidance
- QT preserved after major reorganization; value recognized by new executives
- Inspections established as part of required methodology
- Continued defect studies and comparisons of projects with and without inspections published; dramatic results

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## What can you do?

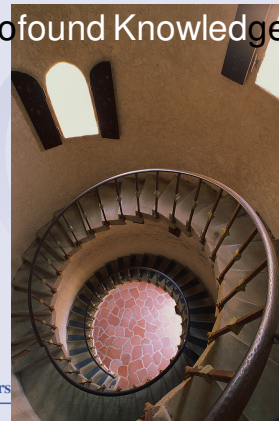
- Conduct gap analysis with/without outside help
- Compare to CMM, TMM
- Extract defects from test tool defect tracker, analyze, demonstrate unnecessary costs
- Use GSEP - Good Software Engineering Practice
- Educate management, testers, PMs, others – show relevance
- Conduct follow-up analyses; show progress
- SHOW ROI
- BE A LEADER



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## Evolution of Profound Knowledge



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Good Judgment  
comes from  
Experience

Experience  
comes from  
Bad Judgment

-- Anon



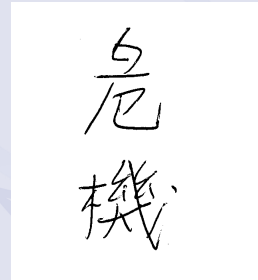
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## CRISIS

Danger

Opportunity



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Knowledge  
must come  
through  
Action

-- Sophocles

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