# Cost of Quality Prediction Tool

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Agenda

- **Process Performance Model (PPM):**
  - What is it?
  - What is it used for?
- **Why Cost of Quality indicator was selected as PPM?**
- **COQ Prediction Tool**
- **COQ prediction on organization level**
- **Conclusion**

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How Do We Manage Trade-offs?
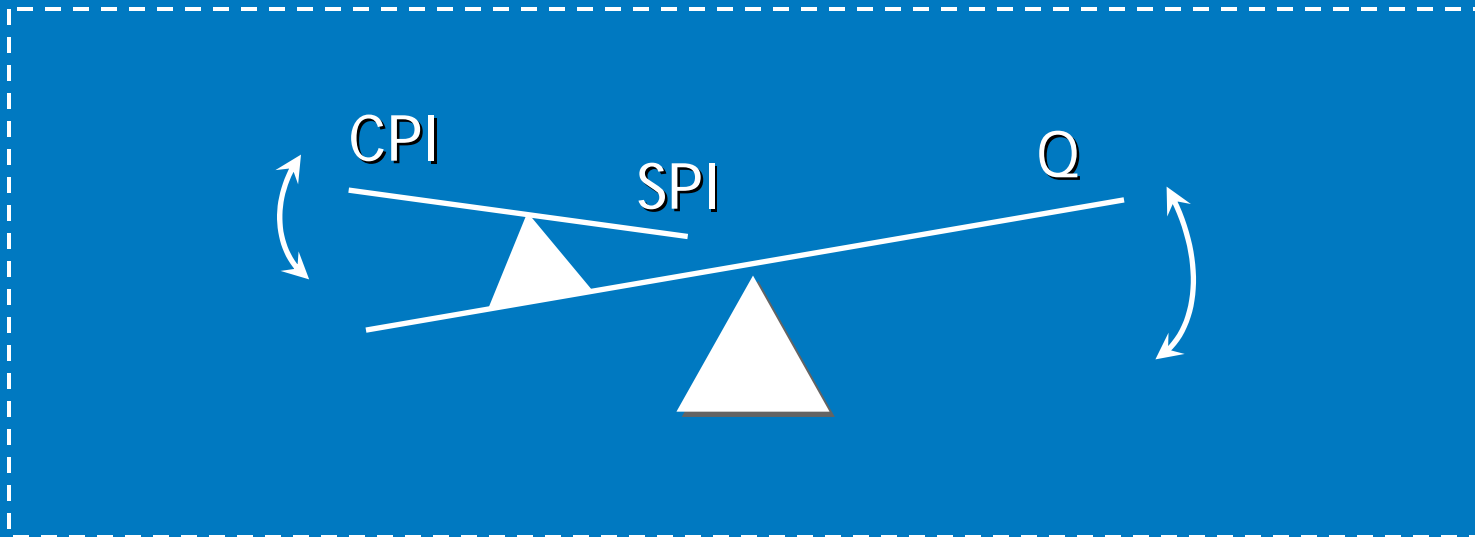
CPI – Cost Performance Index

SPI - Schedule Performance Index

Q - Quality (e.g. # of latent defects)

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How Can CMMI Help?

Specific Goal of Organizational Process Performance Process Area (Maturity Level 4) :

"Baselines and models that characterize the expected process performance of the organization's set of standard processes are established and maintained"
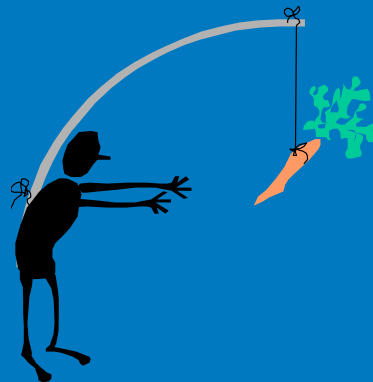
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What is Process Performance Model?

Process performance models (PPM) are used:

✓ **To estimate or predict the value of a process performance measure from the values of other process and product measurements.**

$$Y = f(x_1, x_2 \ldots x_n)$$

✓ **To estimate progress toward achieving objectives that cannot be measured until the end in the project's life.**

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PPM General Use

✓ **The organization uses them:**

 ✓ for estimating, analyzing, and predicting the process performance associated with the organization's standard processes.

  ✓ to assess the (potential) return on investment for process-improvement activities.
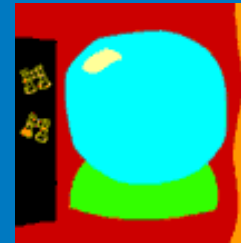
✓ **Projects use them:**

  ✓ for estimating, analyzing, and predicting the process performance for their defined processes.

  ✓ for selecting their particular processes.

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Why Predict Cost Of Quality Indicator?
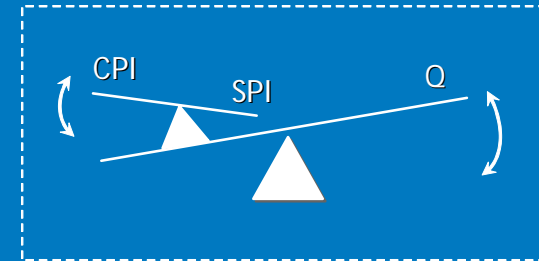

✓ **Cost of Quality Reduction Goal is one of the Business Goals in the organization:**

   ✓ Make appraisal and prevention mechanisms effective that they allow paying less for adding quality to the software

   ✓ Optimize relevant processes to reduce COQ value not compromising a quality of software

   ✓ Do more with less

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Cost of Quality Prediction

✓ **Is done at the initial project phase (e.g. planning)**

✓ **Is used during tailoring to optimize the project specific processes**

✓ **Uses organization historical database and Process Capability Baselines**

✓ **Follows component-based approach**

✓ **Is automated through MS Excel-based tool**

COQ Prediction Tool

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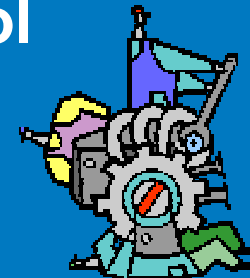
COQ components

✓ **Agreed within the organization**
✓ **Each component has a calculation definition:**
  ✓ Appraisal Part:
    ✓ **APR-TST: Testing Efforts**
    ✓ **APR-QA : Quality Assurance Efforts**
    ✓ **APR-REV: Review Efforts**
    ✓ **APR-INS : Inspection Efforts**
  ✓ Prevention Part:
    ✓ **PREV-DP: Efforts spent on DP activities**
    ✓ **PREV-TR: Prevention Related Training**
  ✓ Internal Failure Part:
    ✓ **INT-RETST: Efforts spent on retesting due to poor quality**
    ✓ **INT-BUG   : Fault Resolution Time**
    ✓ **INT-REREV: Review Rework Efforts**
    ✓ **INT-AUD   : Audit Findings Closure/Verification Effort**
  ✓ External Failure Part:
    ✓ **EXT-PRD: Efforts spent on post-release defect fixing**

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COQ Prediction Tool (example)

Criteria for more specific data retrieve

Update Historical Database

Selection Criteria	
Domain	DOMAIN1
Release Type	
Project Type	
Testing Done	Yes
Project Type	
CT Bucket	
Lifecycle Type	
Project Status	Completed
Start Year	2003
End Year	2004
Number of projects in query:	19

Manual entry
Manual entry [List]

Refresh Data from Org. DB
Help for Refresh Button

VIEW HELP

Process Process Performance Model Usage Guideline

COQ Components	% of Project Efforts	Total Efforts [Staff*Month]	COQ Components Estimates			Auto [Historical DB]		
			[Staff Week]	[Staff Week]	%	AVG	MIN	MAX
Appraisal Efforts	21.94%	21.9						
APR-TST	20.00%	20.		0	20.00%	21.32%	12.24%	45.16%
APR-QA	0.64%	0.6		3.6		0.64%	0.00%	26.10%
APR-REV	1.30%	1.3		2.5		1.30%	0.16%	17.03%
APR-INS	0.00%	0.0				0.00%	0.00%	0.00%
Prevention Efforts	0.45%	0.5						
PREV-DP	0.40%	0.4		0.7		0.40%	0.00%	10.30%
PREV-TR	0.06%	0.1				0.06%	0.00%	1.09%
Internal Failure	1.33%	1.3						
INT-RETST	0.25%	0.3	0.3	1.0		0.17%	0.00%	4.80%
INT-BUG	0.53%			2.1	2.1	0.42%	0.00%	2.08%
INT-REREV	0.43%	0.4	0.4	1.7	1.7	0.29%	0.05%	3.44%
INT-AUD	0.13%	0.1	0.1	0.5	0.5	0.06%	0.00%	1.15%
External Failure	0.25%	0.3						
EXT-PRD	0.25%	0.3	0.3	1.0		0.03%	0.00%	2.21%
	23.72%	23.7				24.64%	15.86%	68.35%
Total Efforts		100.0	100.0	400.0		216.0		

by default

COQ value

Total efforts

General Business Use, COQ_PT_SECR2005.ppt, v. 1.0

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COQ Prediction Tool
(INT_BUG component example)

PCB mode:	CL	
Baseline tag:	2004h2	

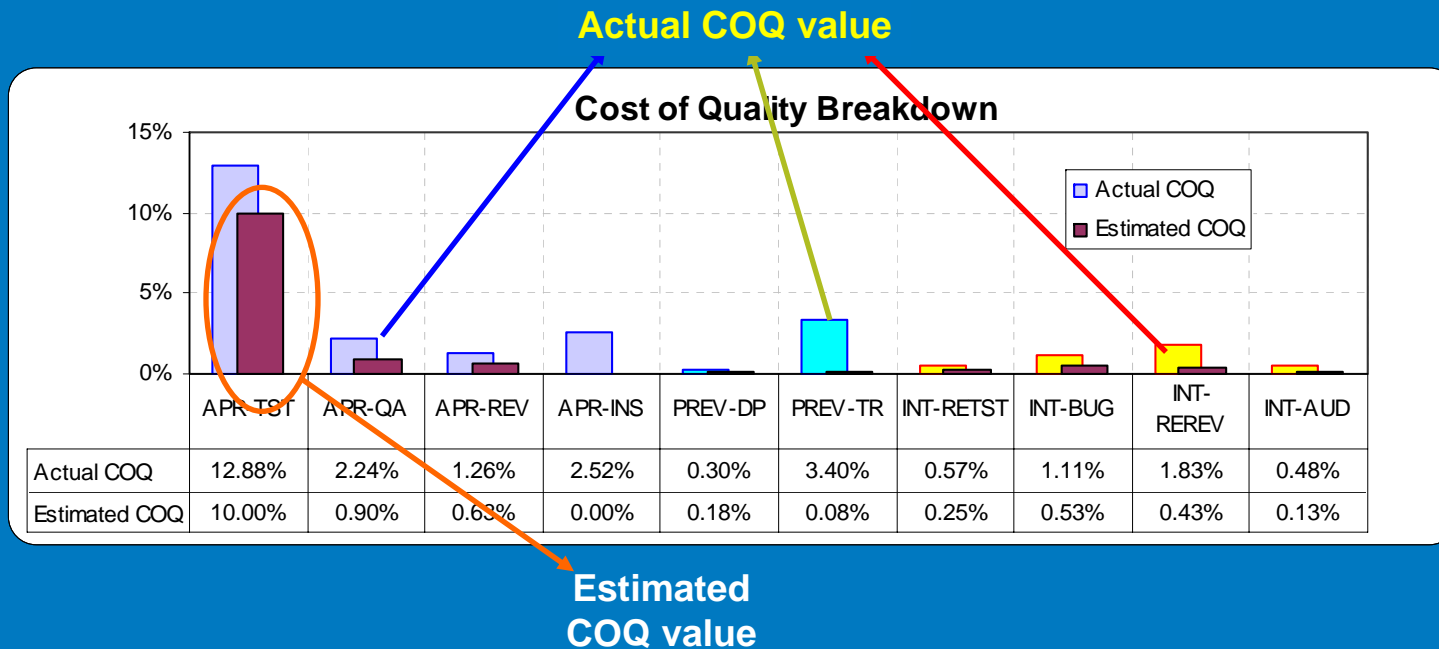| Severity	Time to fix fault, [person*hours]	Planned # of faults	Time to fix faults, [person*hours]
1	1.08	30	32.40
2	1.69	20	33.80
3	1.78	10	17.81

Time to fix faults for CL (average value)

Time to fix faults for UCL (maximum value)

Choose Process Capability Baseline: CL (Center Line) or UCL (Upper Control Limit)

PCB mode:	UCL	
Baseline tag:	2004h2	

Severity	Time to fix fault, [person*hours]	Planned # of faults	Time to fix faults, [person*hours]
1	2.02	30	60.60
2	3.26	20	65.20
3	5.63	10	56.33

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COQ Prediction Value Tracking (example)

✓ Predicted COQ value is:
  ✓ tracked in Project Metrics
  ✓ roll-uped to the organization database

Actual COQ value

Cost of Quality Breakdown

	APR-TST	APR-QA	APR-REV	APR-INS	PREV-DP	PREV-TR	INT-RETST	INT-BUG	INT-REREV	INT-AUD
Actual COQ	12.88%	2.24%	1.26%	2.52%	0.30%	3.40%	0.57%	1.11%	1.83%	0.48%
Estimated COQ	10.00%	0.90%	0.63%	0.00%	0.18%	0.08%	0.25%	0.53%	0.43%	0.13%

Legend:
- □ Actual COQ
- ■ Estimated COQ

Estimated COQ value

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COQ Prediction on Organization Level (example)

Actual COQ values from completed projects

Actual COQ

Domains	1Q2005	2Q2005	3Q2005	4Q2005	YTD Value
DOMAIN1	N/A	N/A	N/A	N/A	N/A
DOMAIN2	27.55%	N/A	N/A	N/A	27.55%
DOMAIN3	29.92%	N/A	N/A	N/A	29.92%
DOMAIN4	15.11%	N/A	N/A	N/A	15.11%
DOMAIN5	N/A	N/A	N/A	N/A	N/A
DOMAIN6	11.19%	N/A	N/A	N/A	11.19%
DOMAIN7	21.39%	N/A	N/A	N/A	21.39%
Organization	**21.66%**	**N/A**	**N/A**	**N/A**	**21.66%**

Predicted COQ

Domains	1Q2005	2Q2005	3Q2005	4Q2005	YTD Value
DOMAIN1	N/A	N/A	N/A	14.22%	14.22%
DOMAIN2	27.55%	13.11%	N/A	N/A	17.29%
DOMAIN3	29.92%	N/A	N/A	N/A	29.92%
DOMAIN4	15.11%	24.40%	N/A	N/A	19.98%
DOMAIN5	N/A	N/A	N/A	27.30%	27.30%
DOMAIN6	11.19%	N/A	N/A	N/A	11.19%
DOMAIN7	21.39%	N/A	22.50%	N/A	22.08%
	66%	22.68%	22.50%	16.16%	**20.26%**

Predicted COQ values from active projects that are going to be completed in the current year

Predicted COQ value by the end of the year

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Conclusion

✓ **COQ prediction is implemented on both project and organization levels:**

   ✓ COQ Prediction Tool is used in all projects

   ✓ Integration with Common Data Warehouse helps to get up-to-date estimated/actual COQ values

✓ **Focus on COQ goal reduction**

✓ **Think on other Process Performance Models (e.g. Fault Prediction, COCOMO)**

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Q&A