A Cost Model and Tool to Support Quality Economic Trade-off Decisions

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From the Boehm and Basili Top 10 List

Software Defect Recduction Top 10 List, IEEE Software,January 2001

Finding and fixing a software problem after delivery is often 100 times more expensive than finding and fixing it during the requirements and design phase.

About 80 percent of avoidable rework comes from 20 percent of the defects.

Peer reviews catch 60 percent of the defects.

Disciplined personal practices can reduce defect introduction rates by up to 75 percent.

All other things being equal, it costs 50 percent more per source instruction to develop high-dependability software products than to develop low-depend-ability software products. However, the investment is more than worth it if the project involves significant operations and maintenance costs.

What Have We Learned?

We still hear

"We had to release yesterday. We'll take the shortcut and polish it later."

What do you rush?

- Completing test cases? Reduced test coverage?
- Designs? Design inspections?
- Coding? Code inspections?

Peer review might improve quality, but will delay release, right?

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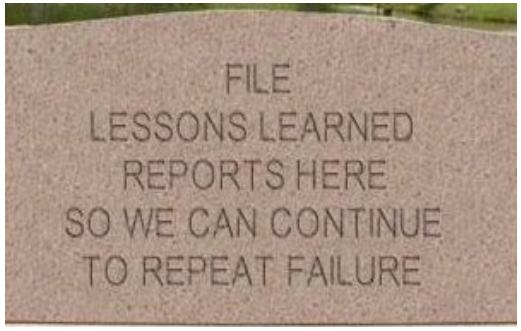


???

Can you really buy time in the short run by trading-off the long run?

Debt or Liability?

We've all heard "Quality is free." Do you believe it?

How do you make the right trade-off for the short term and long term?

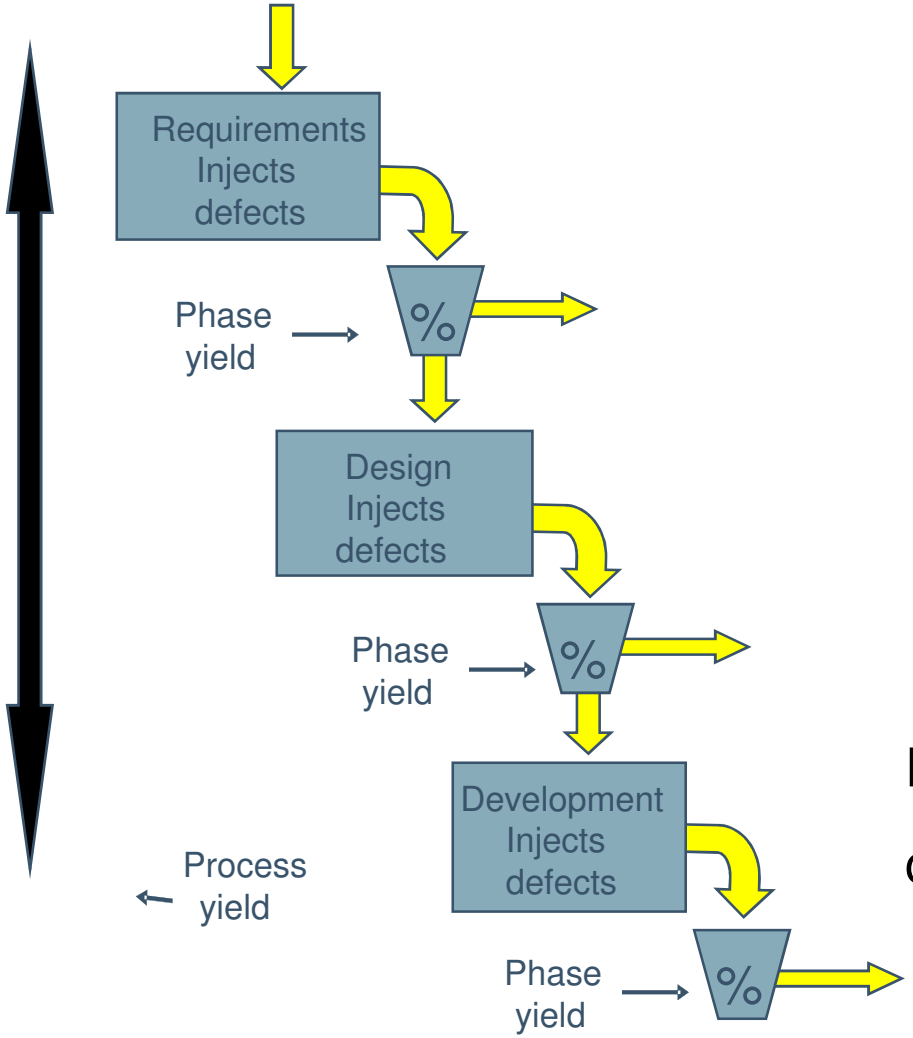
How do you know and how do you convince others?

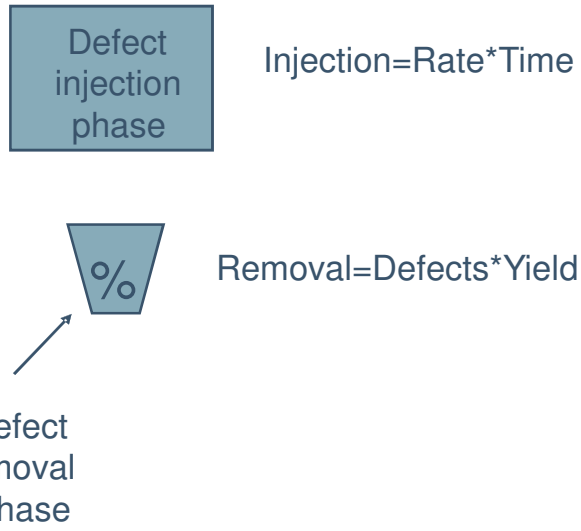
Start with "What does **done** look like?"

- Does it have to be unit tested?
- Does it have to get through an integration and system test?
- Does it have to pass a user acceptance test?
- How long will test take? What is the model?

How long it takes and what it costs to get through these activities depends the quality of the product going into test.

Defect Injection-Filter Model

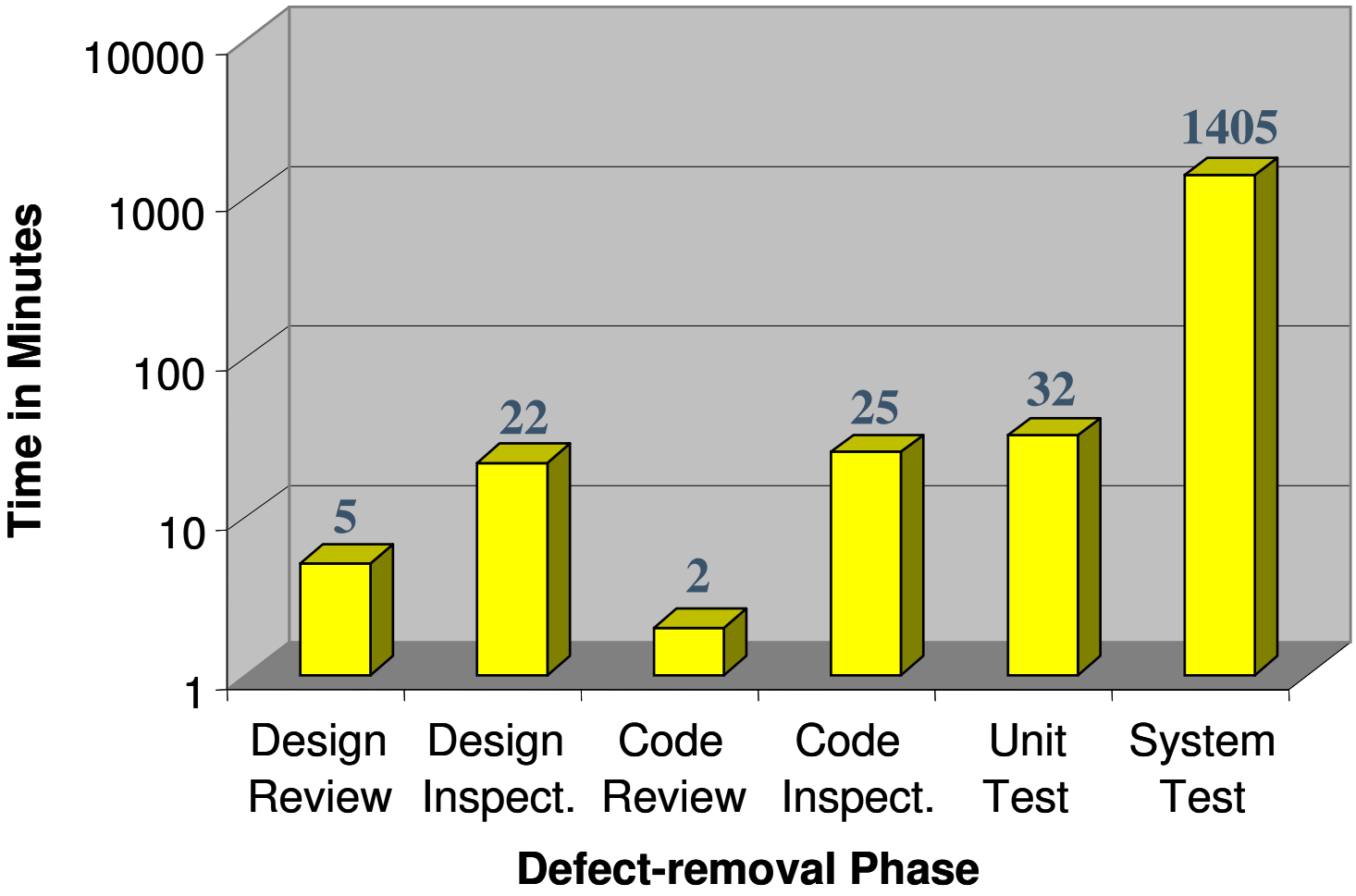




For personal and team plans, calibrate directly with real data.

Similar to Jones “Tank and Pipe.” Simplifies assumptions found in Boehm/Chulani COQUALMO.

Defects Require Time to Find and Fix

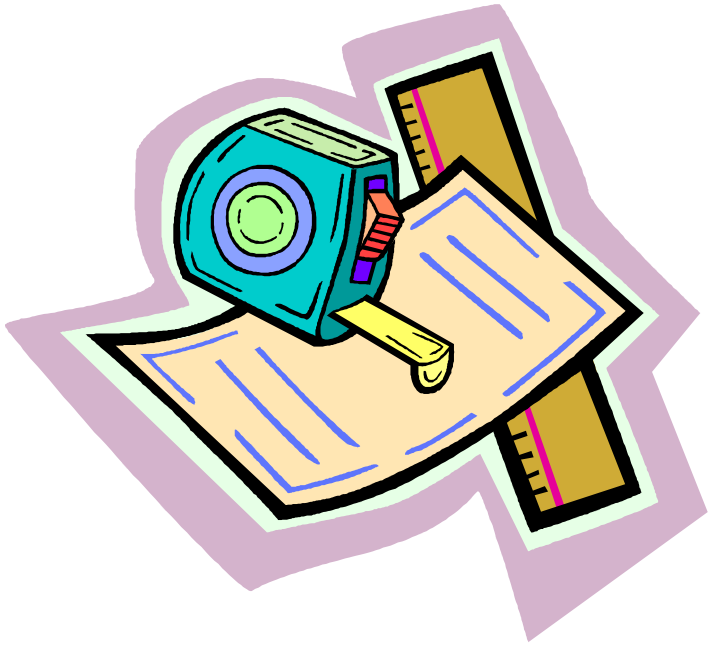


Source: Xerox

Quality Process Measures

The TSP uses quality measures for planning and tracking.

1. Defect injection rates [Def/hr/ and removal yields [% removed]
2. Defect density (defects found and present at various stages and size)
3. Review/inspection rates [LOC/hr]



Parameters

Phase Injection Rate [defects/hr]

Phase Effort Distribution [%] total time

Size [LOC]

Production Rate (construction phase) [LOC/hr]

Phase Removal Yield [% removed]

Zero Defect Test time [hr]

Phase “Find and Fix” time [hr/defect]

Review/Inspection Rate [LOC/hr]

Make the Theoretical Concrete

Do you achieve your goals?

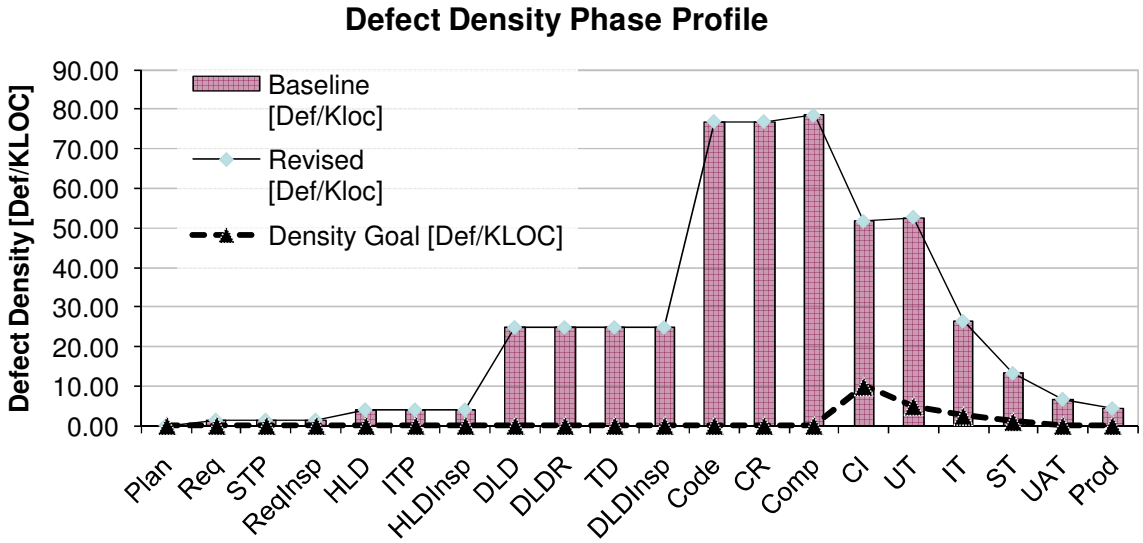
- How much functionality do you want to deliver?
- What are the non-functional targets? (performance, security…)
- What is your desired schedule?
- How many defects do you expect the user to find?

Build the model.

Use real data.

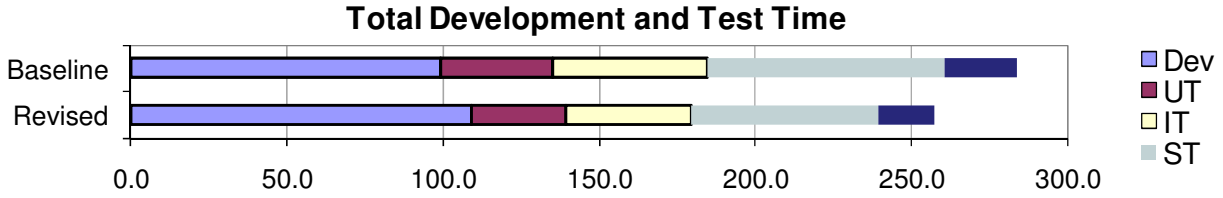
Visualize the result.

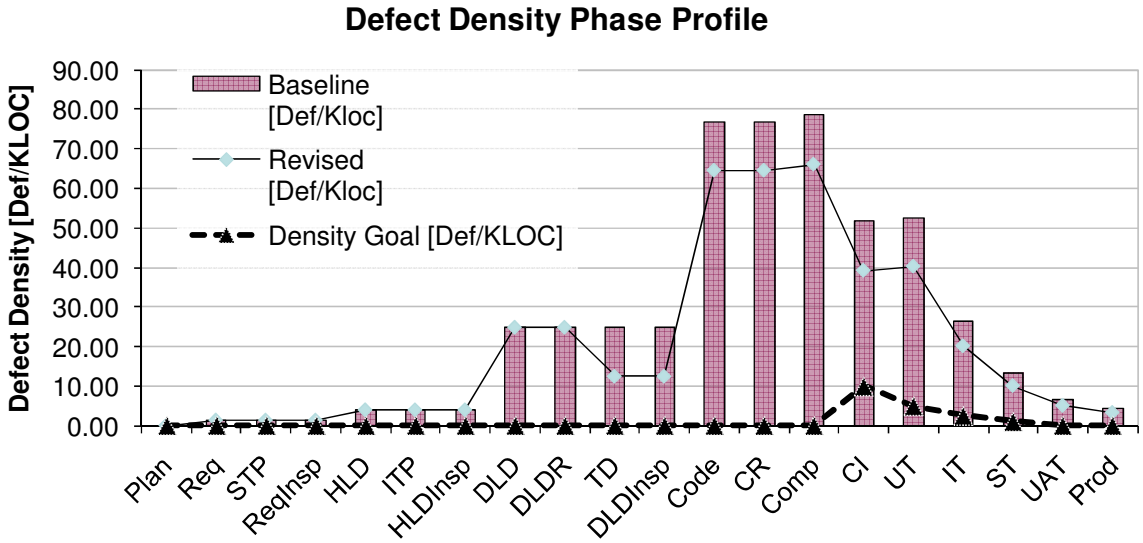
Control Panel	Rate [LOC/hr]	Yield (per insp)	Yield (total)	# Insp	Effort [hr]
Design Review	200	50.0%	0.0%	0	0.0
Design Inspection	200	50.0%	0.0%	0	0.0
Code Review	200	50.0%	0.0%	0	0.0
Code Inspection	200	50.0%	0.0%	0	0.0



Compare your performance to a baseline.

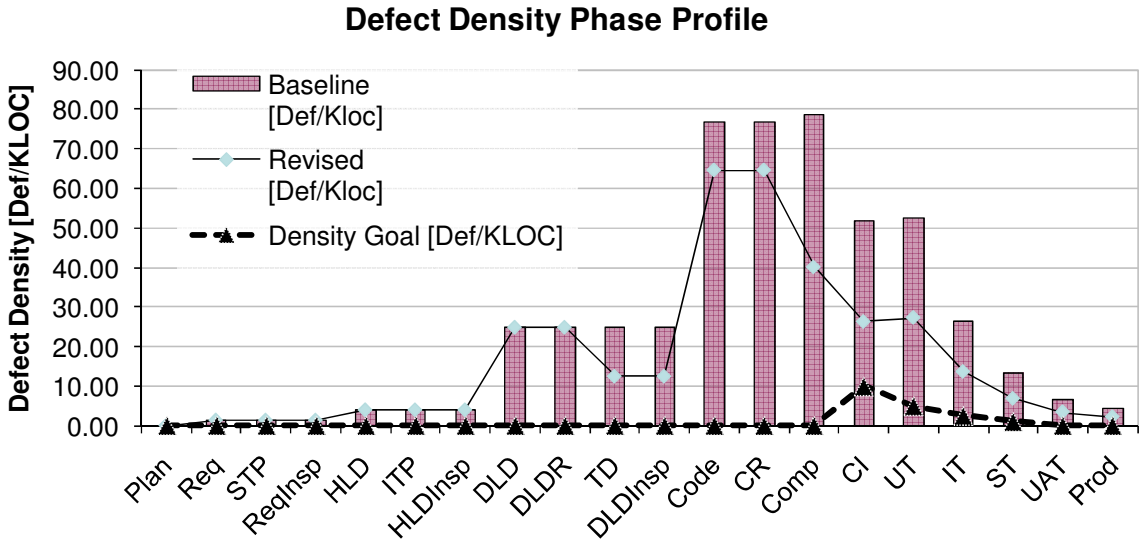
Control Panel	Rate [LOC/hr]	Yield (per insp)	Yield (total)	# Insp	Effort [hr]
Design Review	200	50.0%	0.0%	1	0.0
Design Inspection	200	50.0%	0.0%	0	0.0
Code Review	200	50.0%	0.0%	0	0.0
Code Inspection	200	50.0%	0.0%	0	0.0





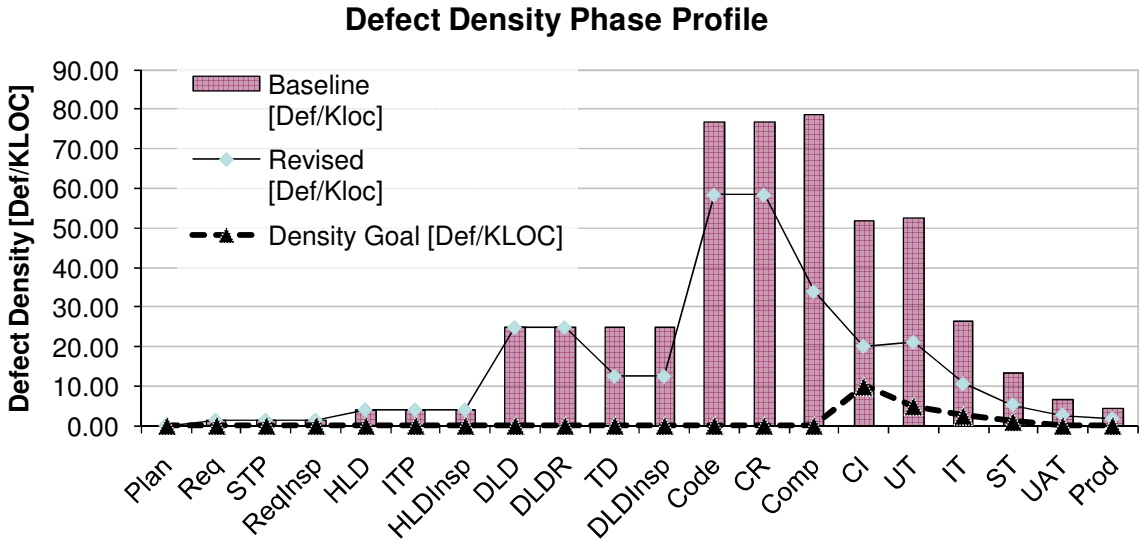
Perform a personal design review.

Control Panel	Rate [LOC/hr]	Yield (per insp)	Yield (total)	# Insp	Effort [hr]
Design Review	200	50.0%	0.0%	1	0.0
Design Inspection	200	50.0%	0.0%	0	0.0
Code Review	200	50.0%	0.0%	1	0.0
Code Inspection	200	50.0%	0.0%	0	0.0



Include a peer design review.

Control Panel	Rate [LOC/hr]	Yield (per insp)	Yield (total)	# Insp	Effort [hr]
Design Review	200	50.0%	0.0%	1	0.0
Design Inspection	200	50.0%	0.0%	1	0.0
Code Review	200	50.0%	0.0%	1	0.0
Code Inspection	200	50.0%	0.0%	0	0.0



Have a peer inspect the code.

Control Panel	Rate [LOC/hr]	Yield (per insp)	Yield (total)	# Insp	Effort [hr]
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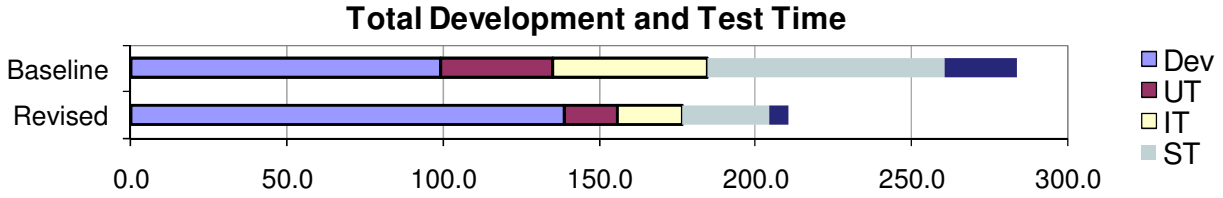

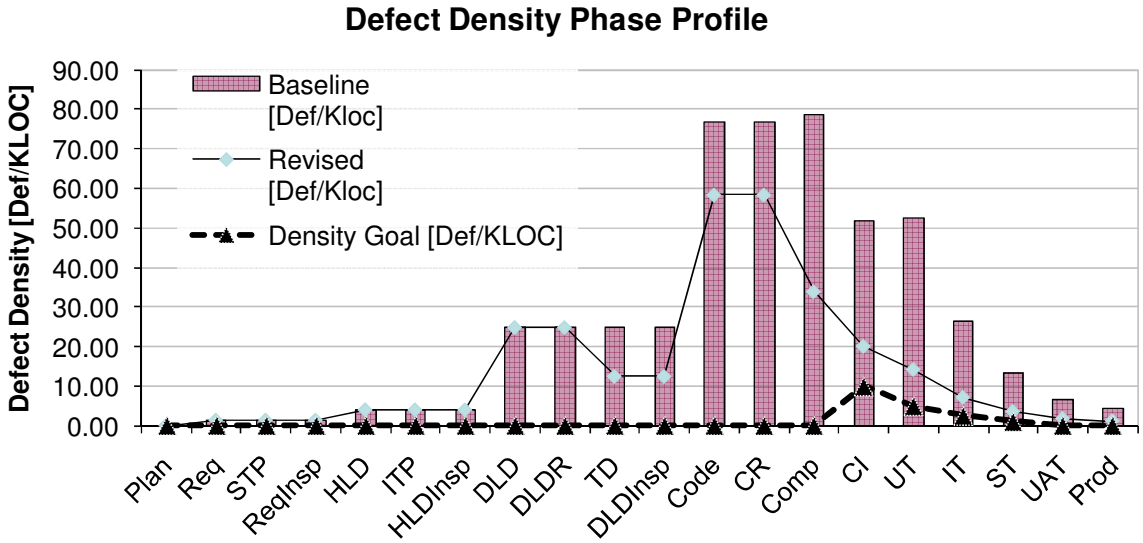

At some point we cross the “quality is free” point.

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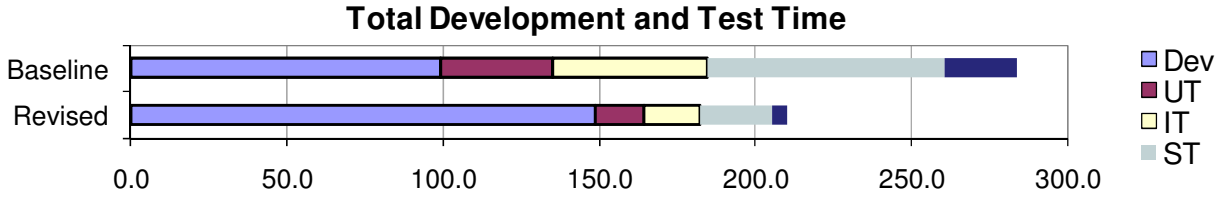
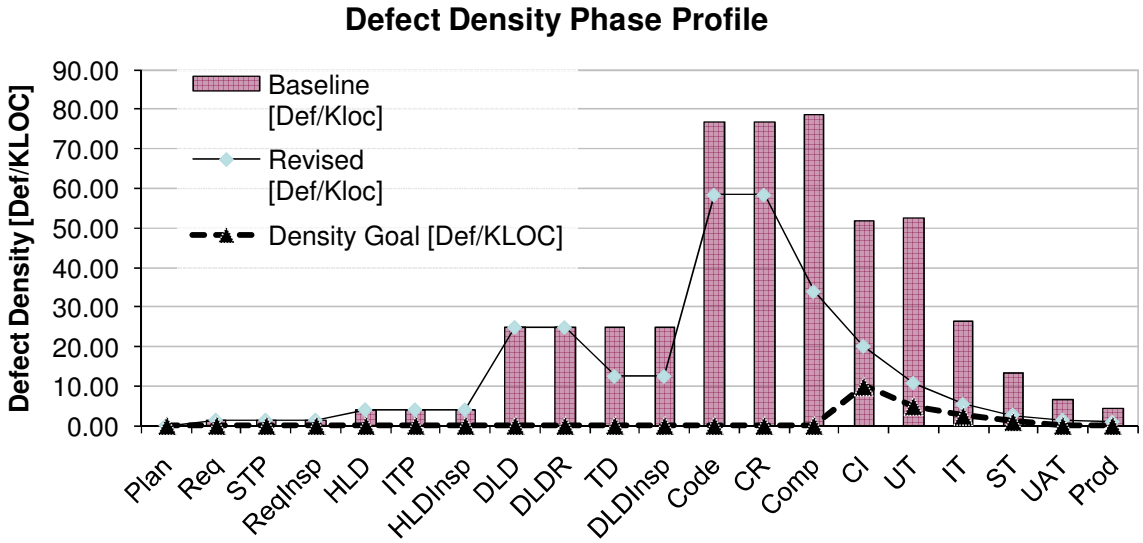
Design Inspection	200	50.0%	0.0%	1	0.0
Code Review	200	50.0%	0.0%	1	0.0
Code Inspection	200	50.0%	0.0%	2	0.0





Here's where you reach the "quality is free" point!

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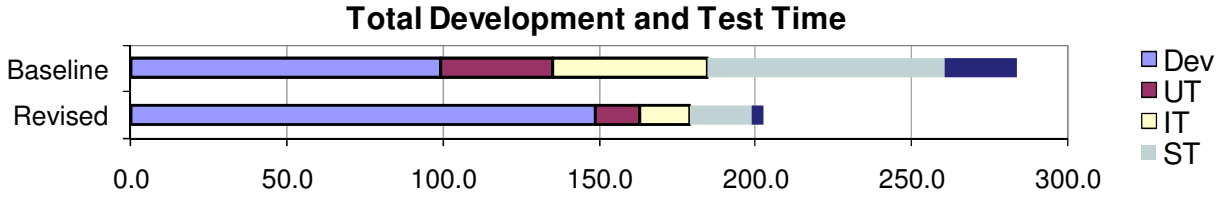
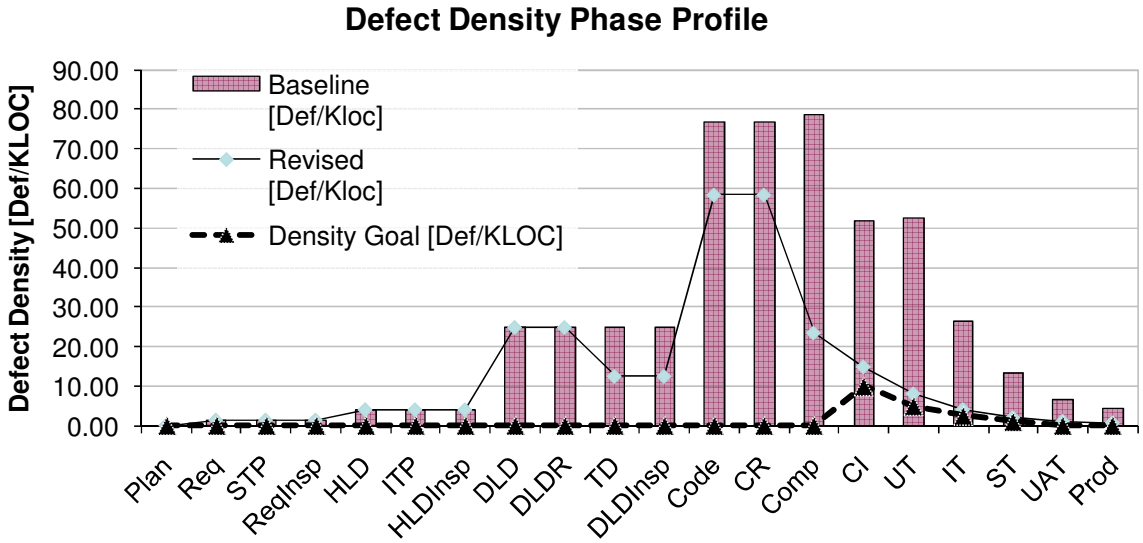
Design Review	200	50.0%	0.0%	1	0.0
Design Inspection	200	50.0%	0.0%	1	0.0
Code Review	200	70.0%	0.0%	1	0.0
Code Inspection	200	70.0%	0.0%	2	0.0





The “quality is free” point depends on your personal parameters.

In Construction Through Test

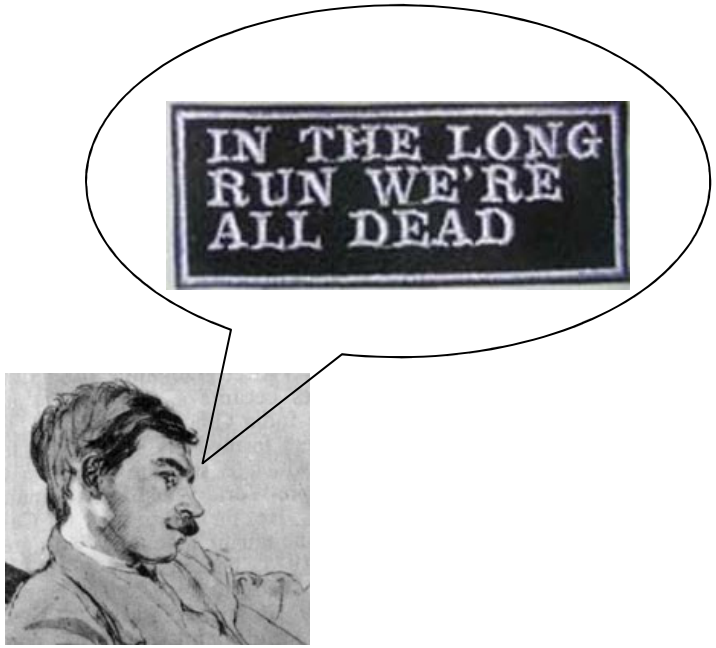
When you hear the claim,

we have to take a short cut to save time

"*we'll deal with consequences later…*"

…Respond with, "*Build code, not liability. Doing it right is faster and cheaper.*"

The "Long Run" is already here! Deal with it!



Contact Information

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TSP Symposium 2011

September 20-22, 2011

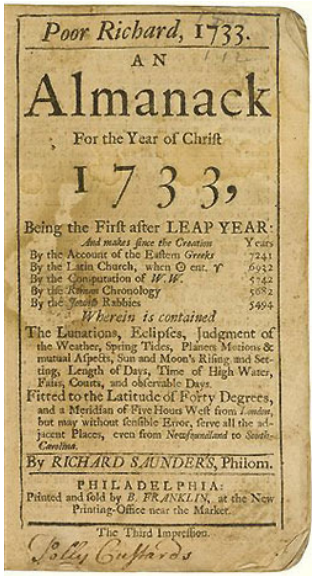
Atlanta, GA

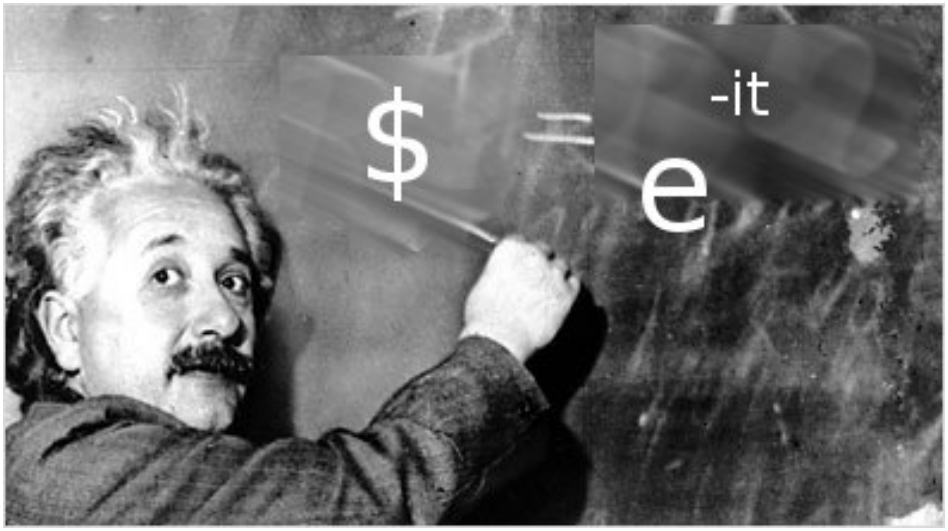
http://www.sei.cmu.edu/tsp/symposium/

Software Engineering Institute | Carnegie Mellon

Additional Material

Implicitly Use
Intertemporal equity exchang theorem


Poor Richard, 1733.
AN
Almanack
For the Year of Christ
1733,
Being the First after LEAP YEAR:
And makes since the Creation Years
By the Account of the Eastern Greeks 7241
By the Latin Church, when ⊙ ent. ♈ 6932
By the Computation of W. W. 5742
By the Roman Chronology 5682
By the Jewish Rabbies 5494
Wherein is contained
The Lunations, Eclipses, Judgment of the Weather, Spring Tides, Planets Motions & mutual Aspects, Sun and Moon's Rising and Setting, Length of Days, Time of High Water, Fairs, Courts, and observable Days.
Fitted to the Latitude of Forty Degrees, and a Meridian of Five Hours West from London, but may without sensible Error, serve all the adjacent Places, even from Newfoundland to South-Carolina.
By RICHARD SAUNDERS, Philom.
PHILADELPHIA:
Printed and sold by B. FRANKLIN, at the New Printing-Office near the Market.
The Third Impression.



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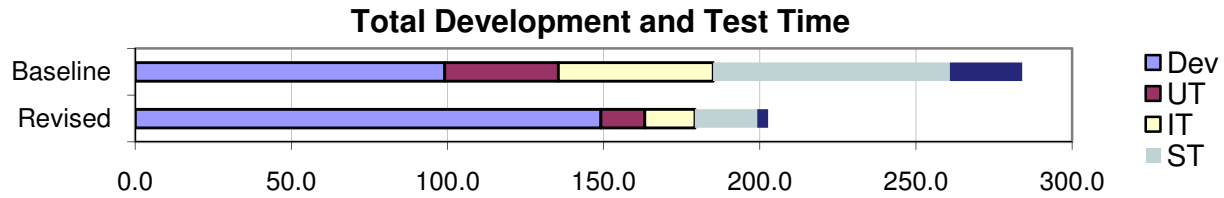
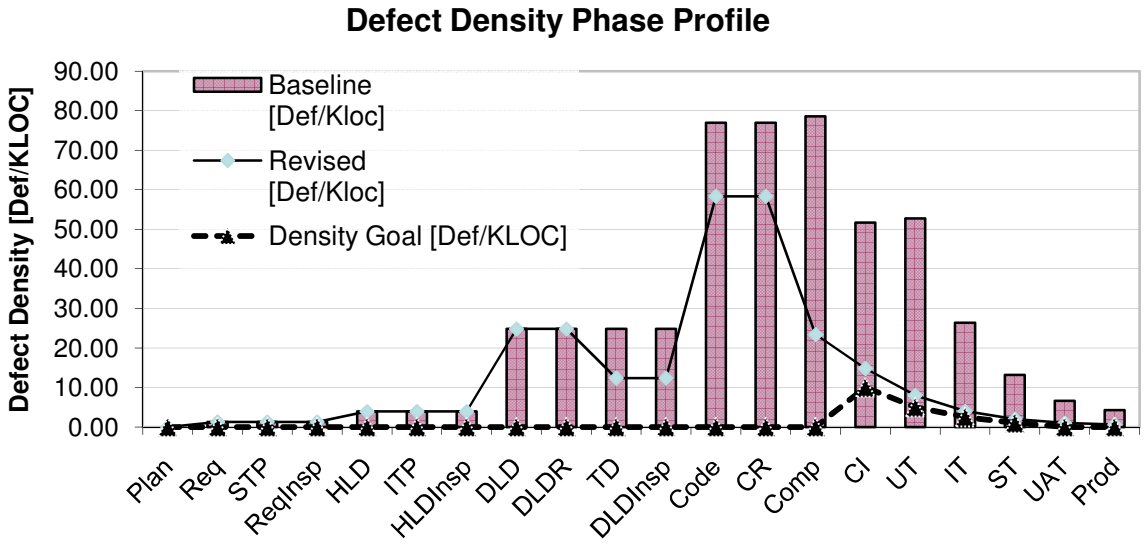
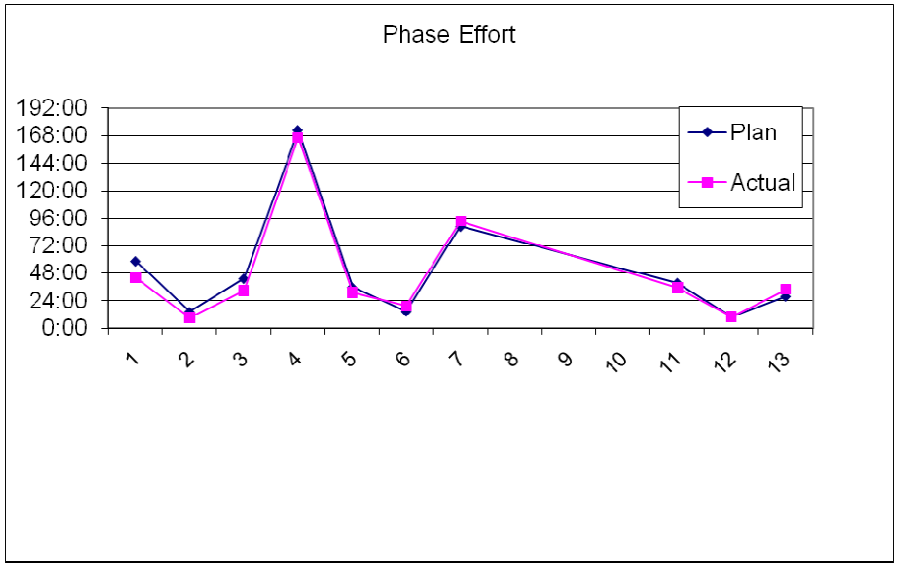
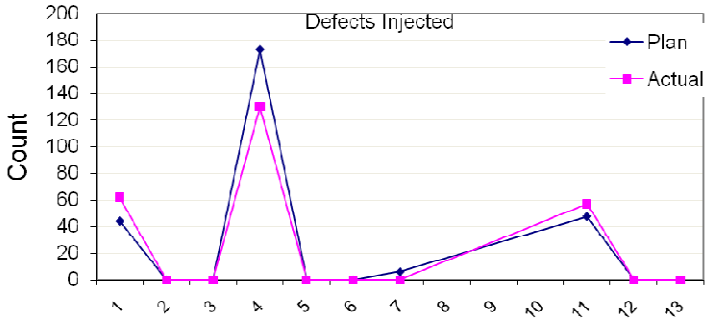




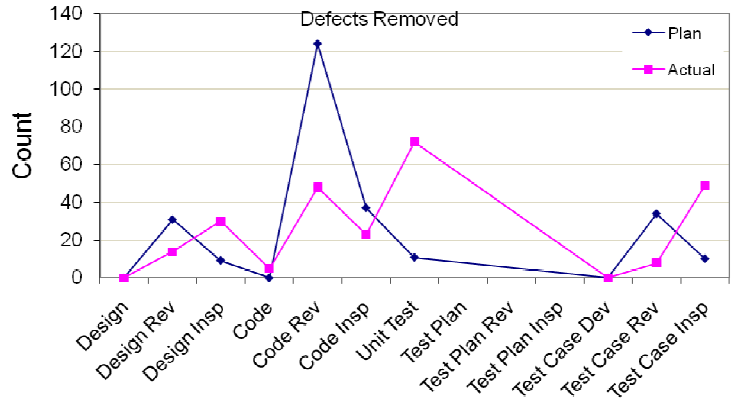
Planning Effort and Defects



Phase Effort

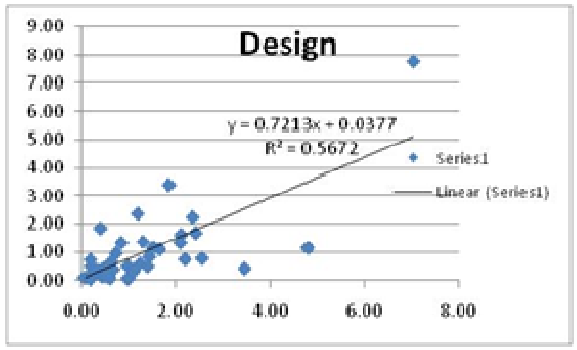


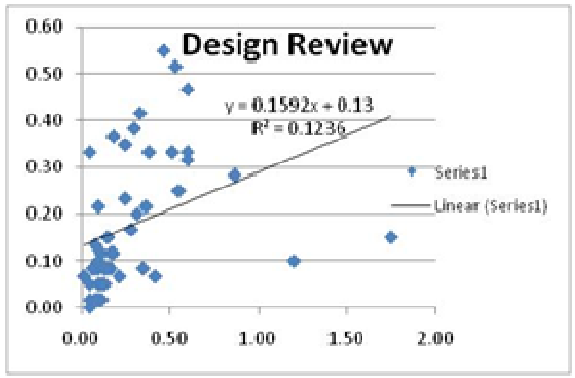
Defects Injected

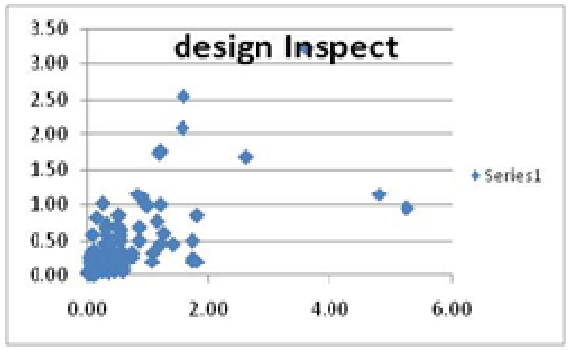


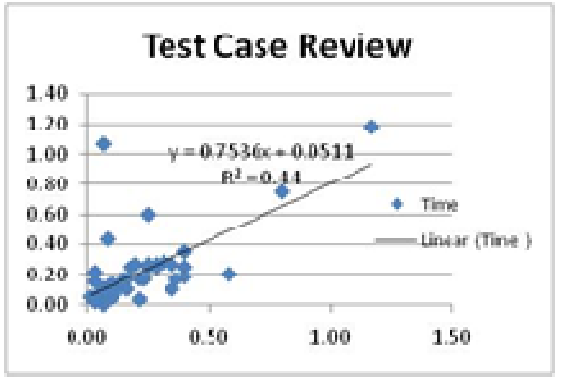
Defects Removed

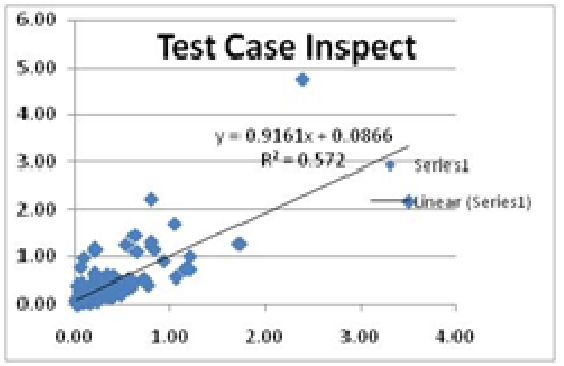
Plan and Actual Effort for Components

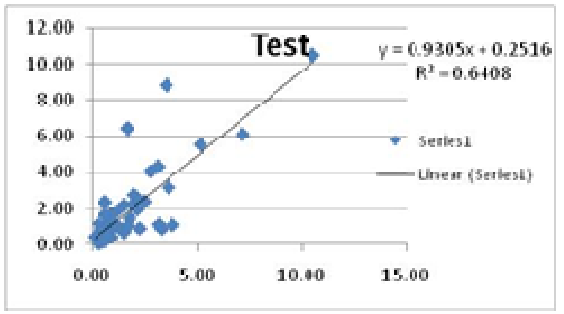




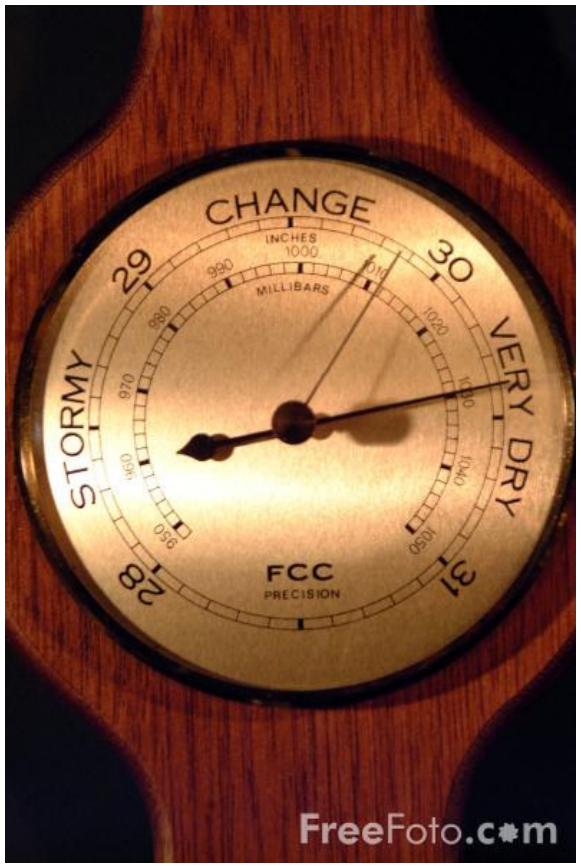


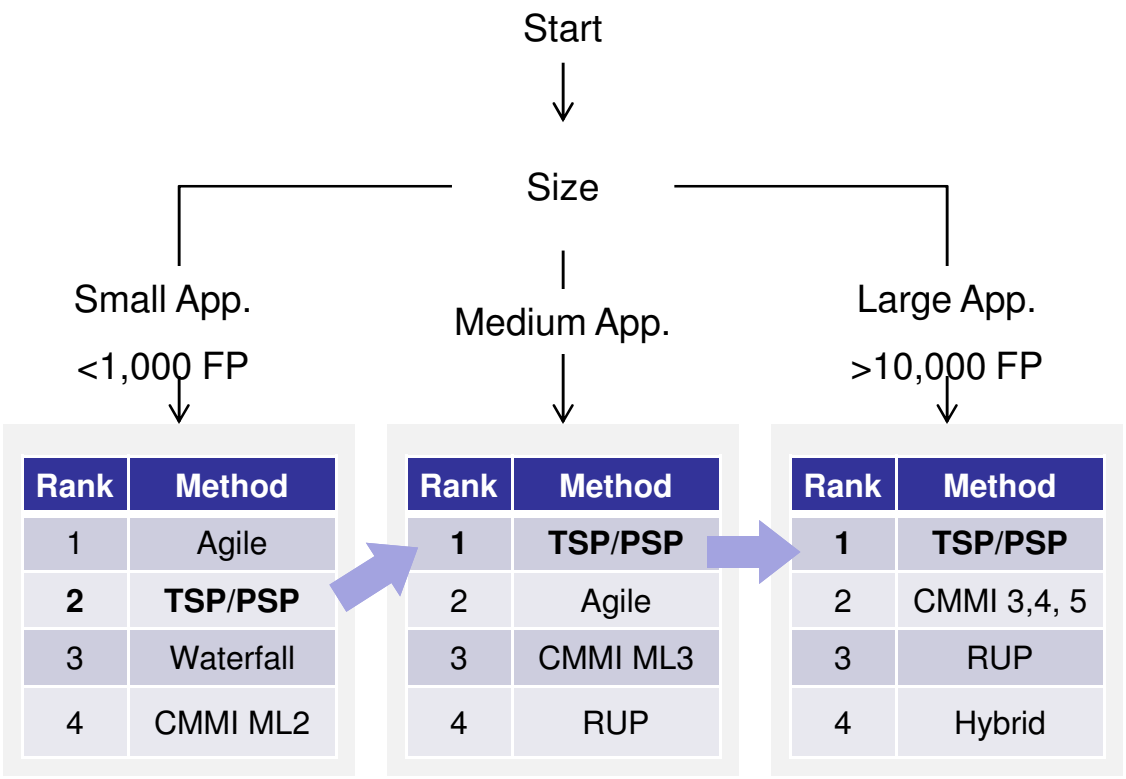






Leading vs. Lagging Indicators

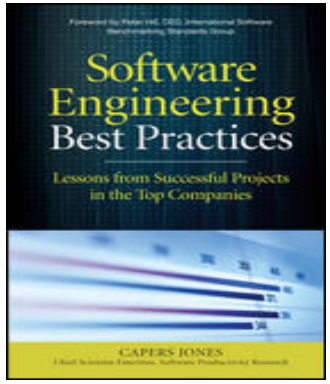




Rank	Method
1	Agile
2	**TSP/PSP**
3	Waterfall
4	CMMI ML2

Rank	Method
1	**TSP/PSP**
2	Agile
3	CMMI ML3
4	RUP

Rank	Method
1	**TSP/PSP**
2	CMMI 3,4, 5
3	RUP
4	Hybrid



Software Engineering Best Practices,

C. Jones, 2010

You Don’t Want to Be This Person