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Innovation. In all domains.

How Peer Reviews Actually Work

Pilot Results from a Peer Review Performance Model

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Raytheon

The Problem...

The Slippery Slope of Managing Software (SW) Peer Reviews:

- We believe Peer Reviews increase SW quality & decrease SW cost**
- Yet... SW Project Managers can't assess their impact on quality/cost**
- So... Peer Reviews are underutilized**

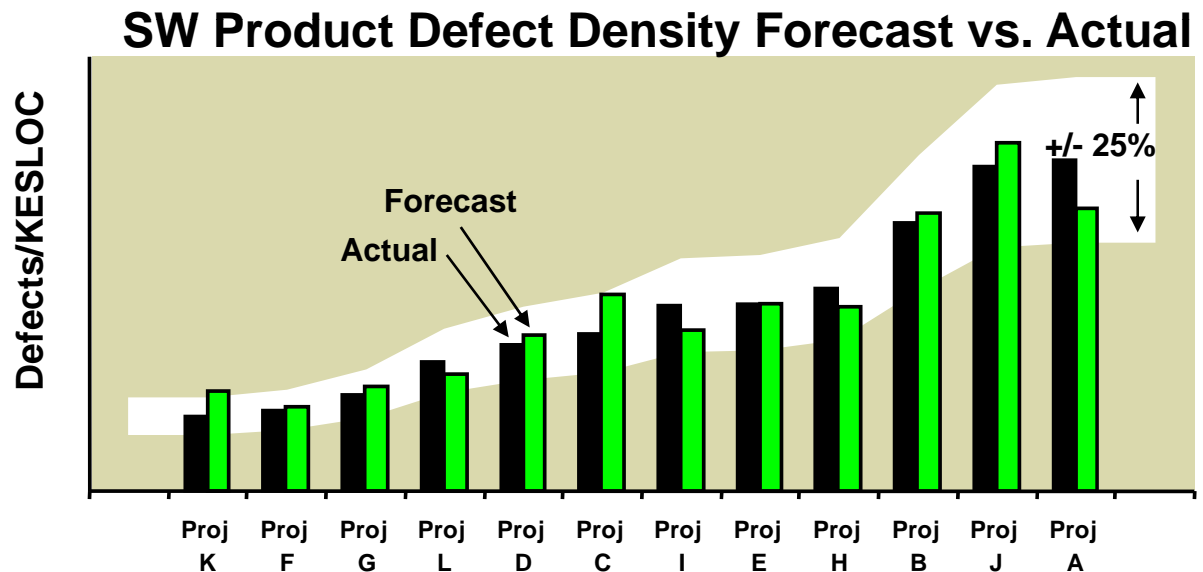
... and the Solution

The Peer Review Exploitation Tool (PRET) [Patent Pending] resolved this... by using a Performance Model to forecast:

- Defect Density (quality)
- Related cost impacts of performing Peer Reviews

(Empirical)
Performance Model
($R^2 = 0.92$)

Density: Defects
per Thousand
Equivalent Source
Lines of Code



Peer Review Exploitation Tool

Agenda

- Performance Model Derivation
- Performance Model Application
- Performance Impacts of:
 - Peer Review Investment
 - Process Improvements
- Conclusion

Performance Model Overview

Peer Review Defect Removal

(Explicit)

PEP (Process, Environment, & People)

(Implicit)



Forecast

If we conduct X Peer Reviews...
We should detect Y software defects per
KESLOC during formal test.

Requirements

Design

Code/Unit Test

Product Integration

Formal Systems Integration/Test

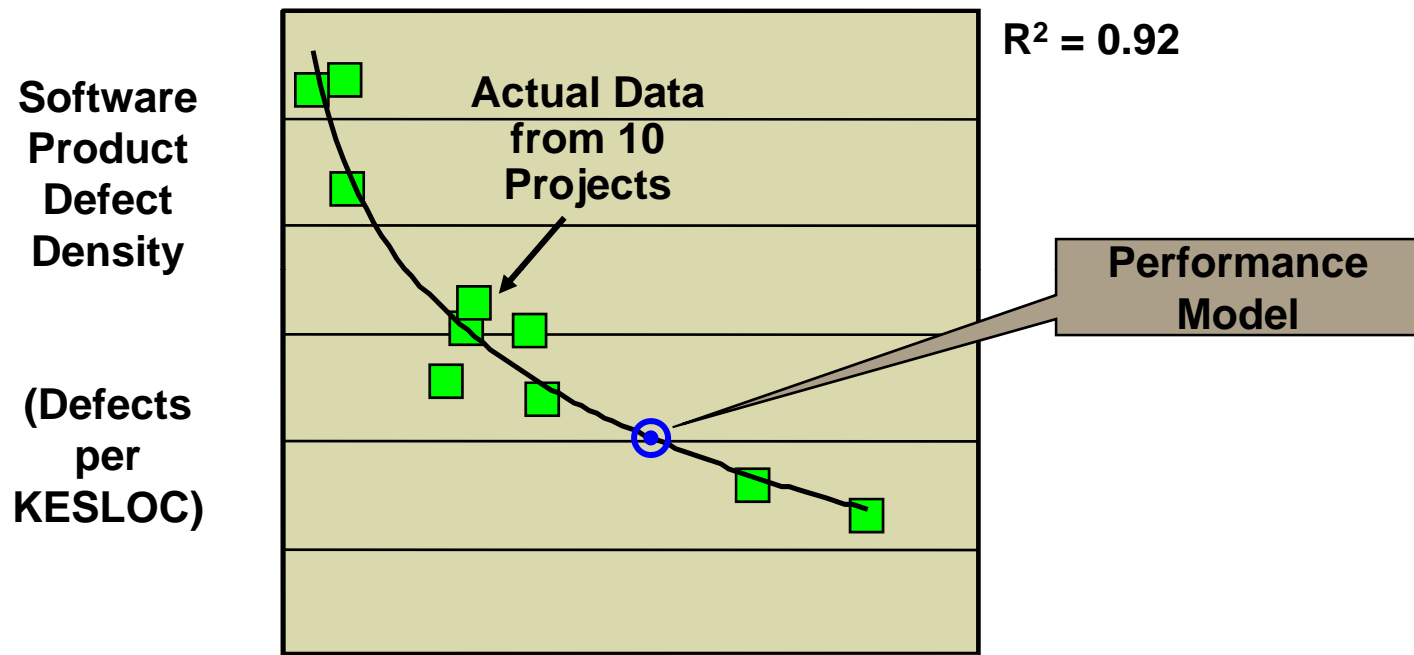
Software Development
Cycle

Software
Product
Defect
Density

Prediction is based on both explicit and implicit defect reduction

Performance Model Equations

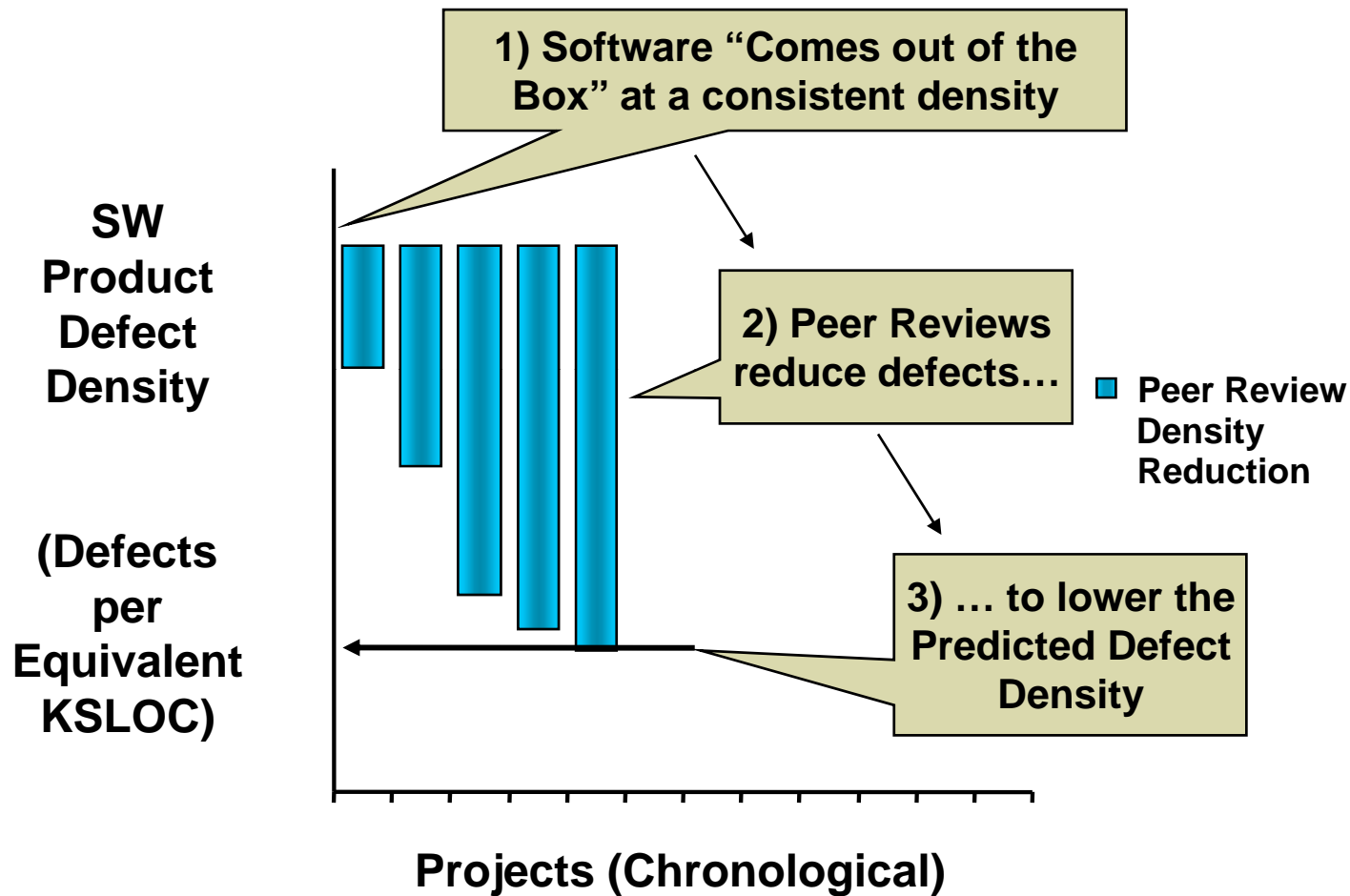
Defect Density vs. Predictive “Score”



“Score” is calculated from Peer Review Defect Removal and PEP (Process, Environment, & People)

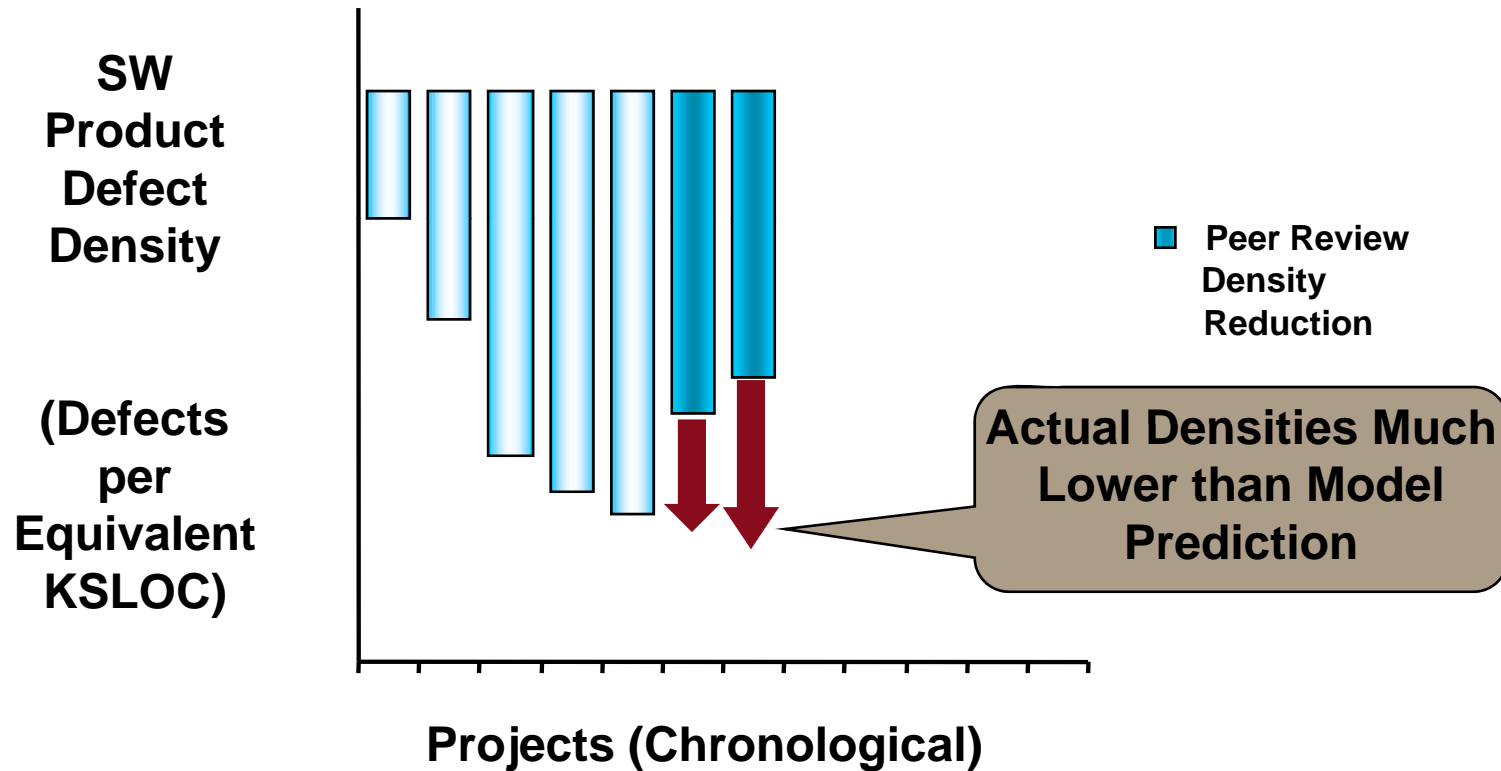
Defect Density is reduced as more defects are removed and PEP is more favorable

Early Calibration



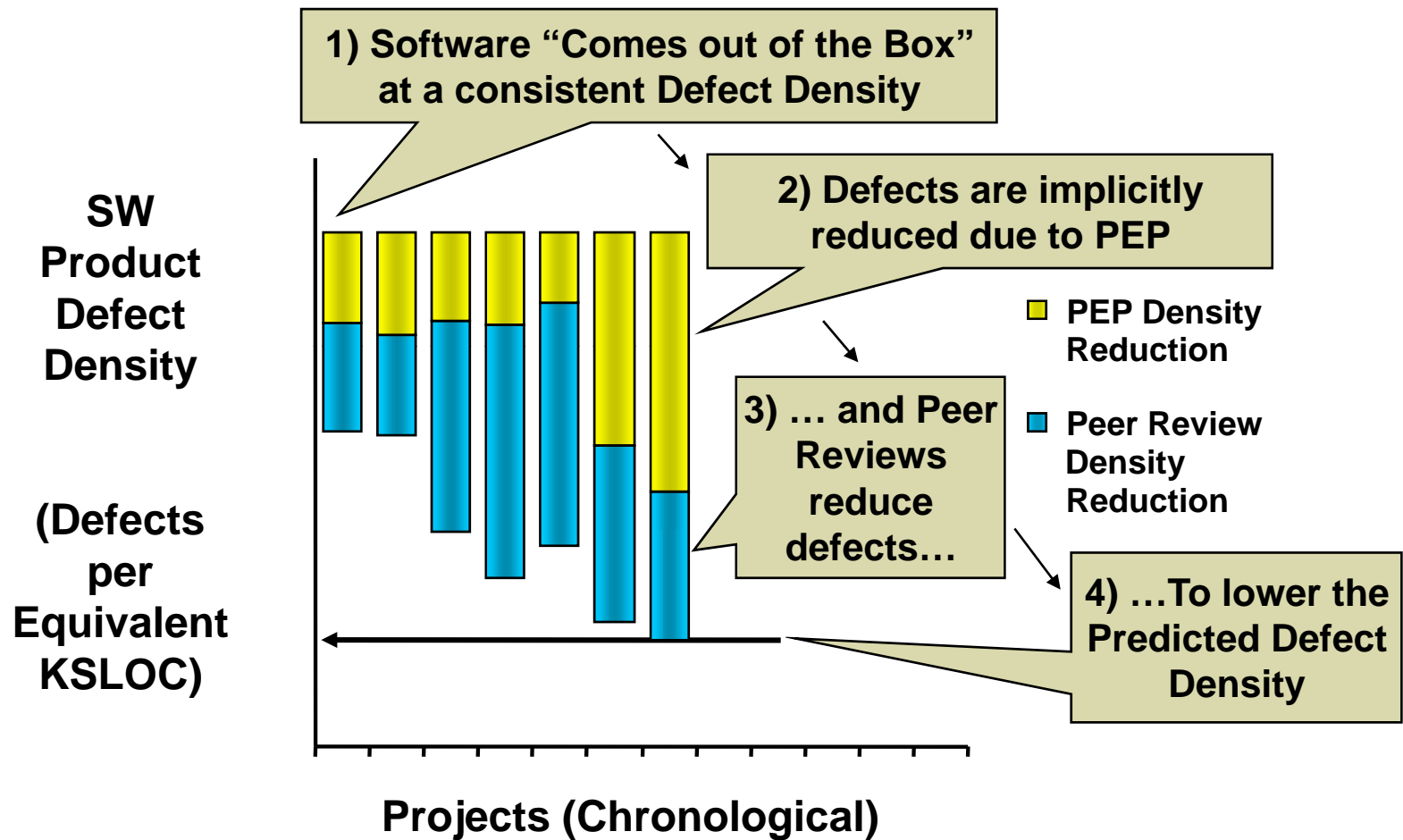
The initial model was based on the impact of Peer Reviews alone

Calibration Issues



The next 2 projects “broke” the model, revealing the need for a new factor

Revised Calibration



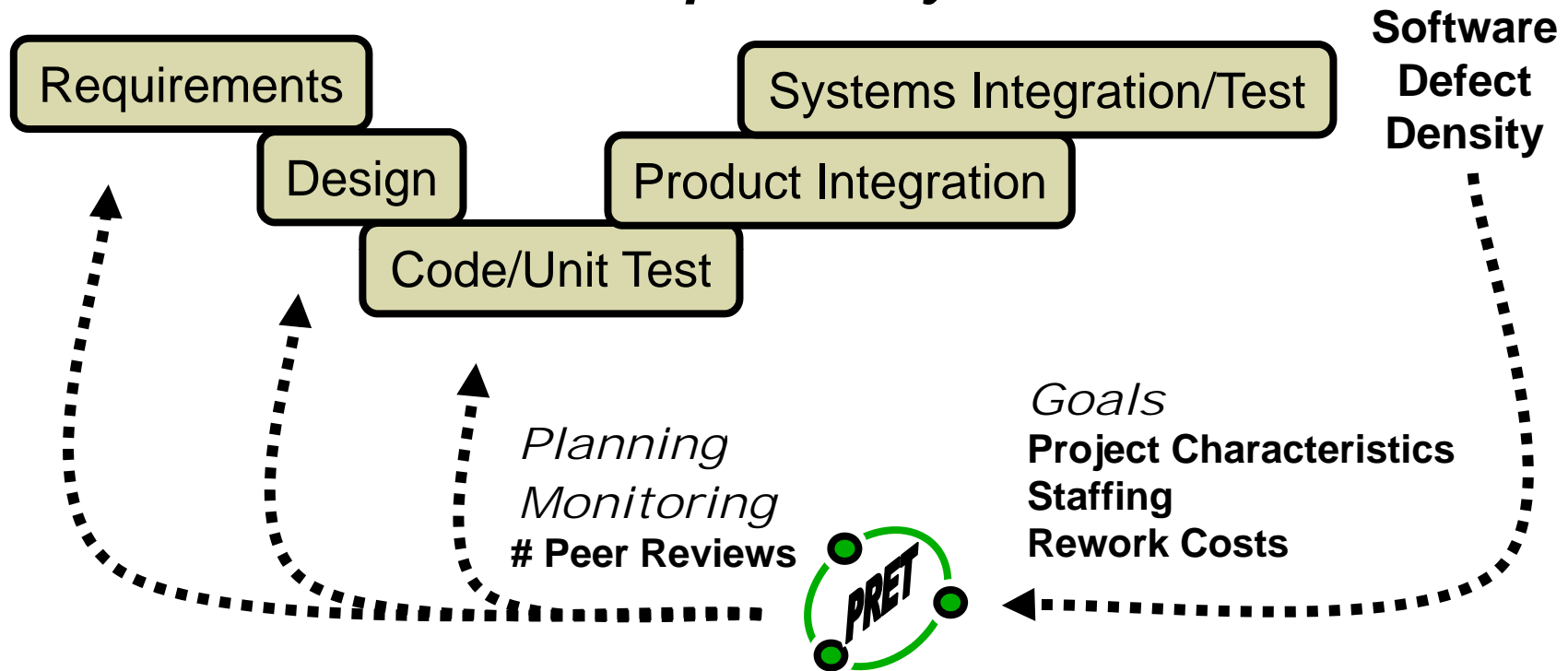
The model was revised to include PEP (characterization for Process, Environment and People)

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Peer Review Performance Management

Software Development Cycle



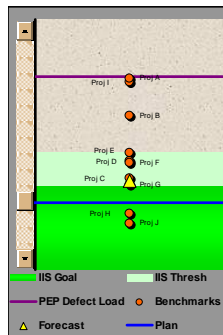
SW Projects use PRET during proposals and monthly to budget, plan, and monitor Peer Reviews



Graphical User Interface

User Sets the Goal or the Effort

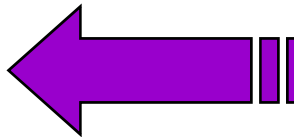
SW Product Defect
Density Goal



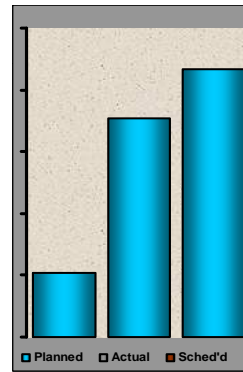
Goal Drives Effort



Effort Drives Goal



Peer Review
Effort



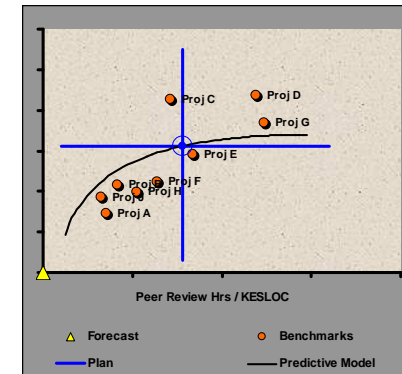
Requirements Design Code

Nominal Cost Comparison

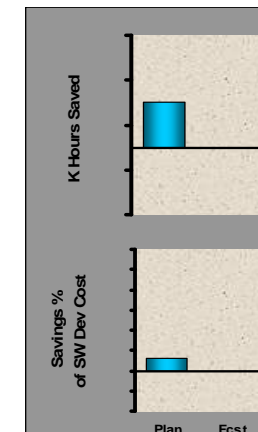
Hours Invested vs Net Savings	Peer Review Hours Invested			Net Hours Saved
	Req	Design	Code	SI Rework Saved - Peer Review Hours
Budget re. Plan	XX	y,yyy	Z,ZZZ	XX,XXX
Budget re. Nominal Peer Review Plan & Performance	xxx	y,yyy	Z,ZZZ	XX,XXX
Budget Delta (Plan - Nominal)	-xx	y,yyy	Z,ZZZ	X,XXX

Cost Data

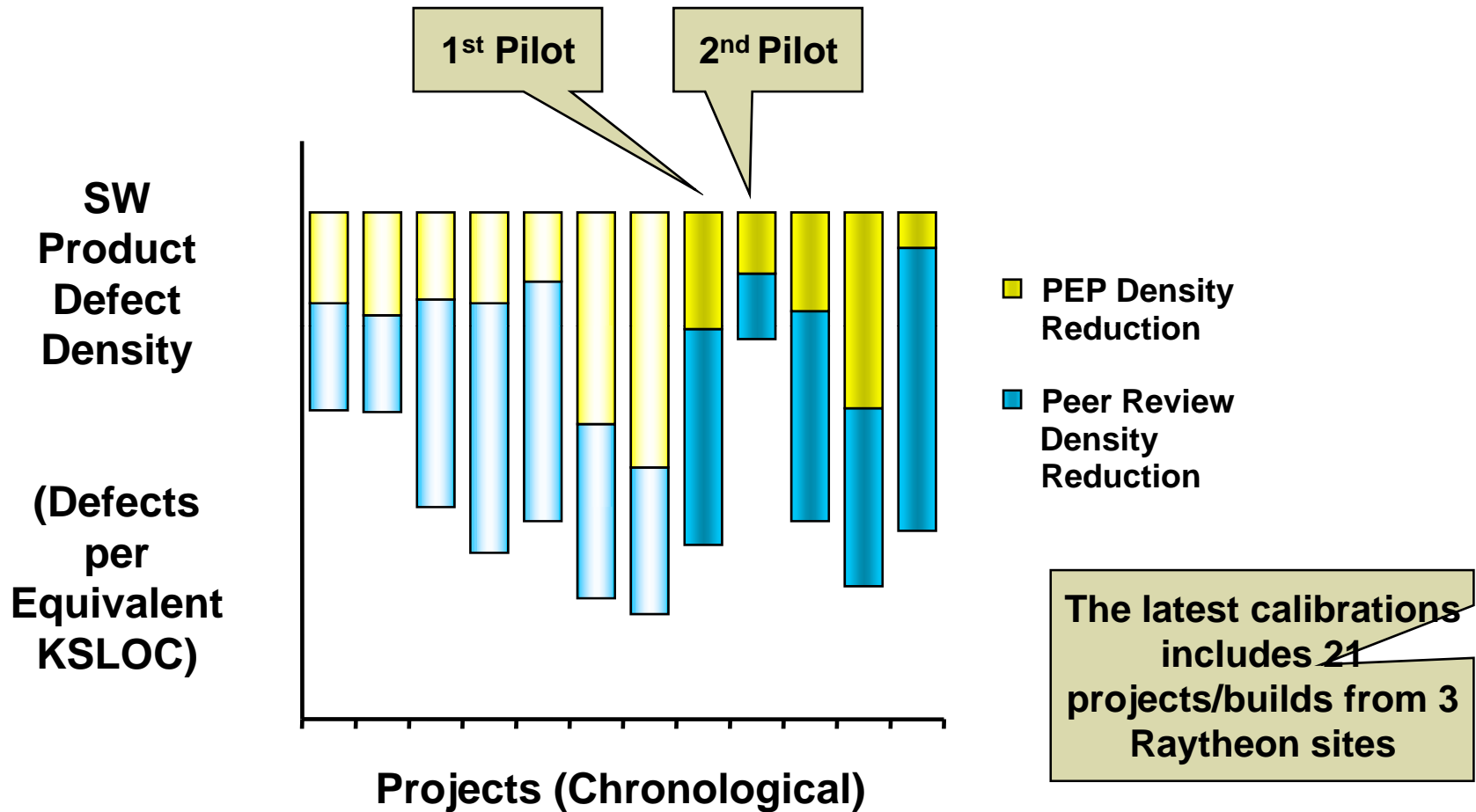
Net Savings vs. Cost



Project Savings



Piloting and Calibration

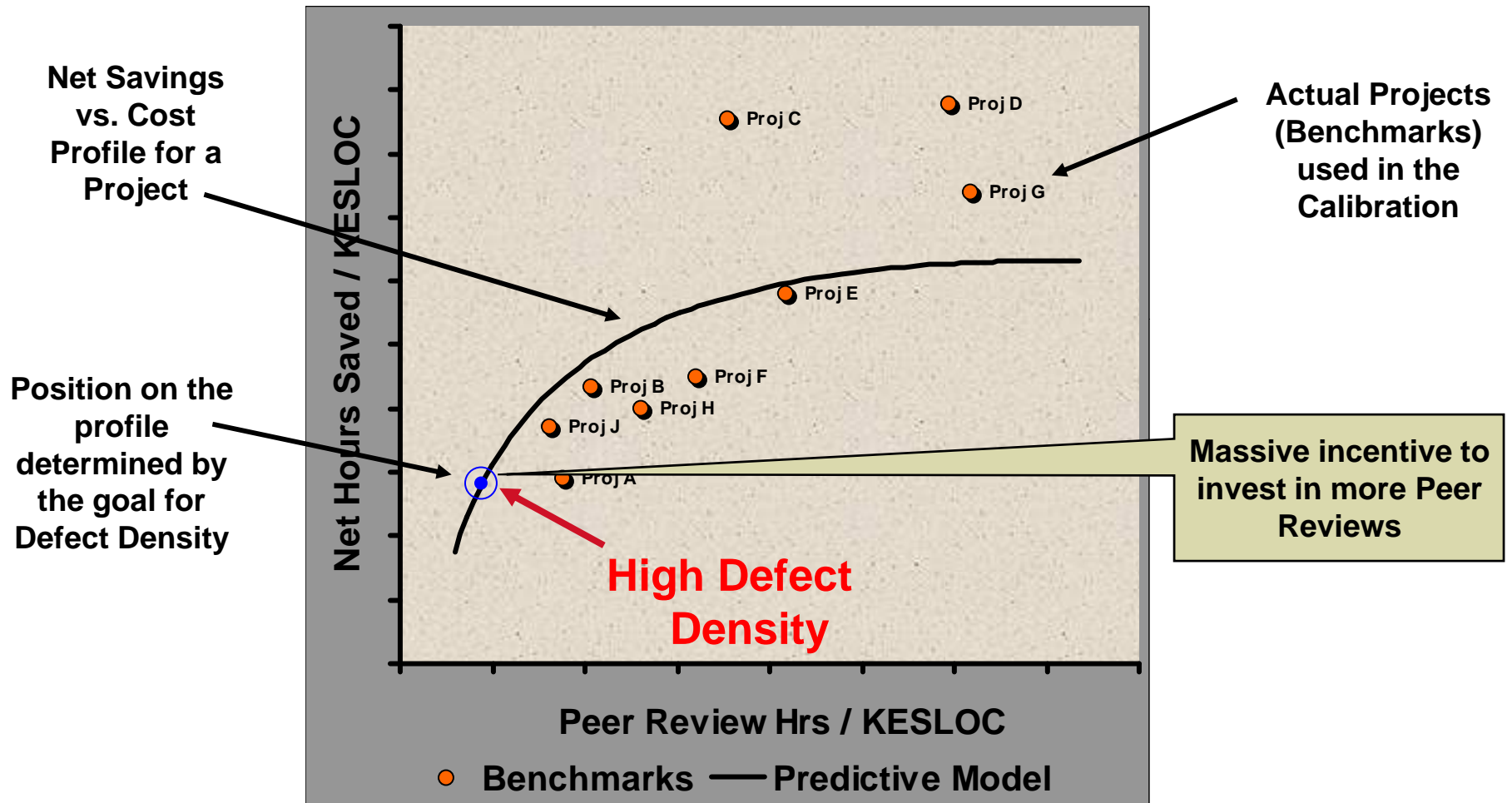


Projects were regularly added to the calibration, and where possible used as Pilots for the PRET user interface and features

Agenda

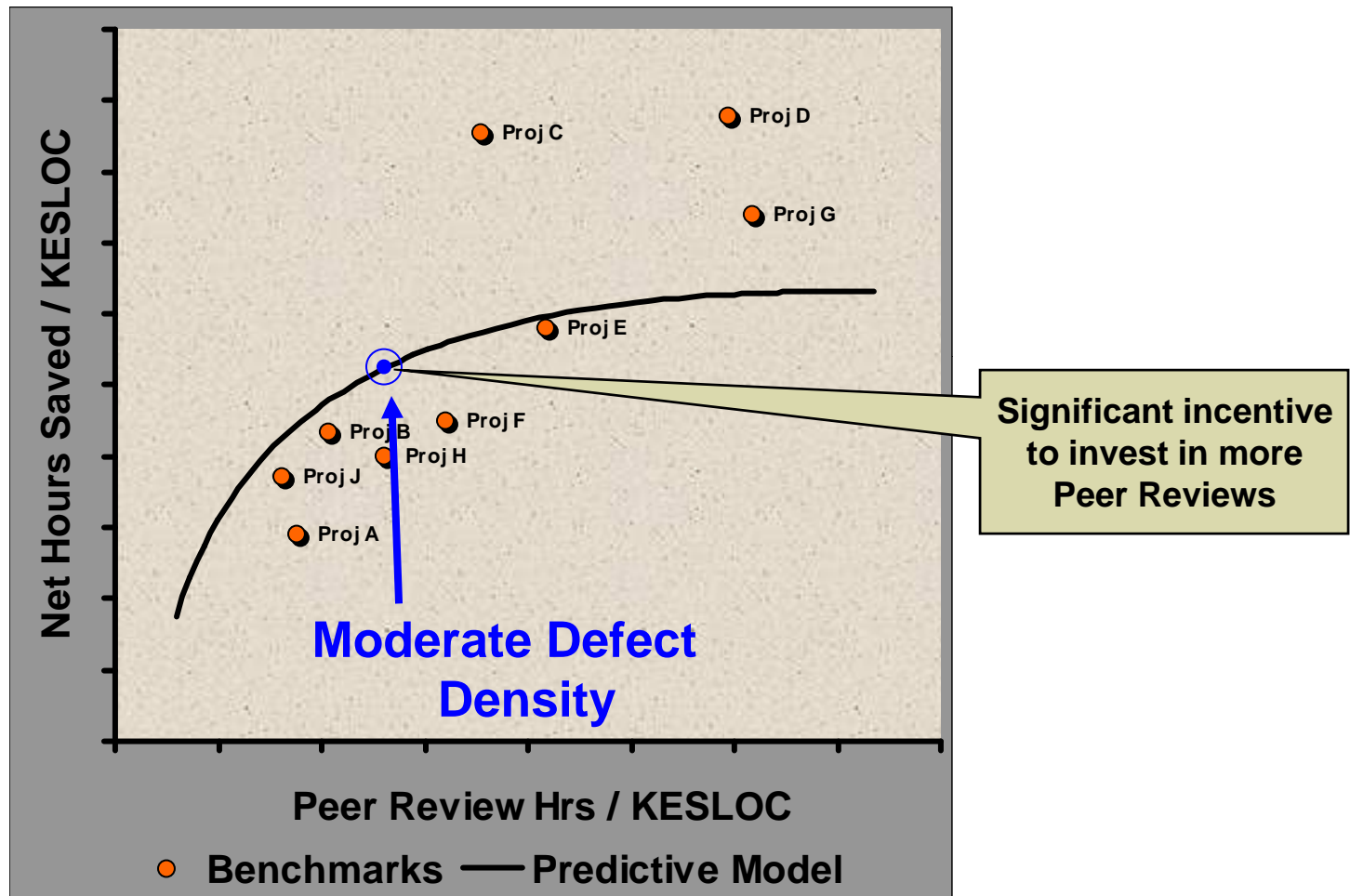
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Small Investment in Peer Reviews



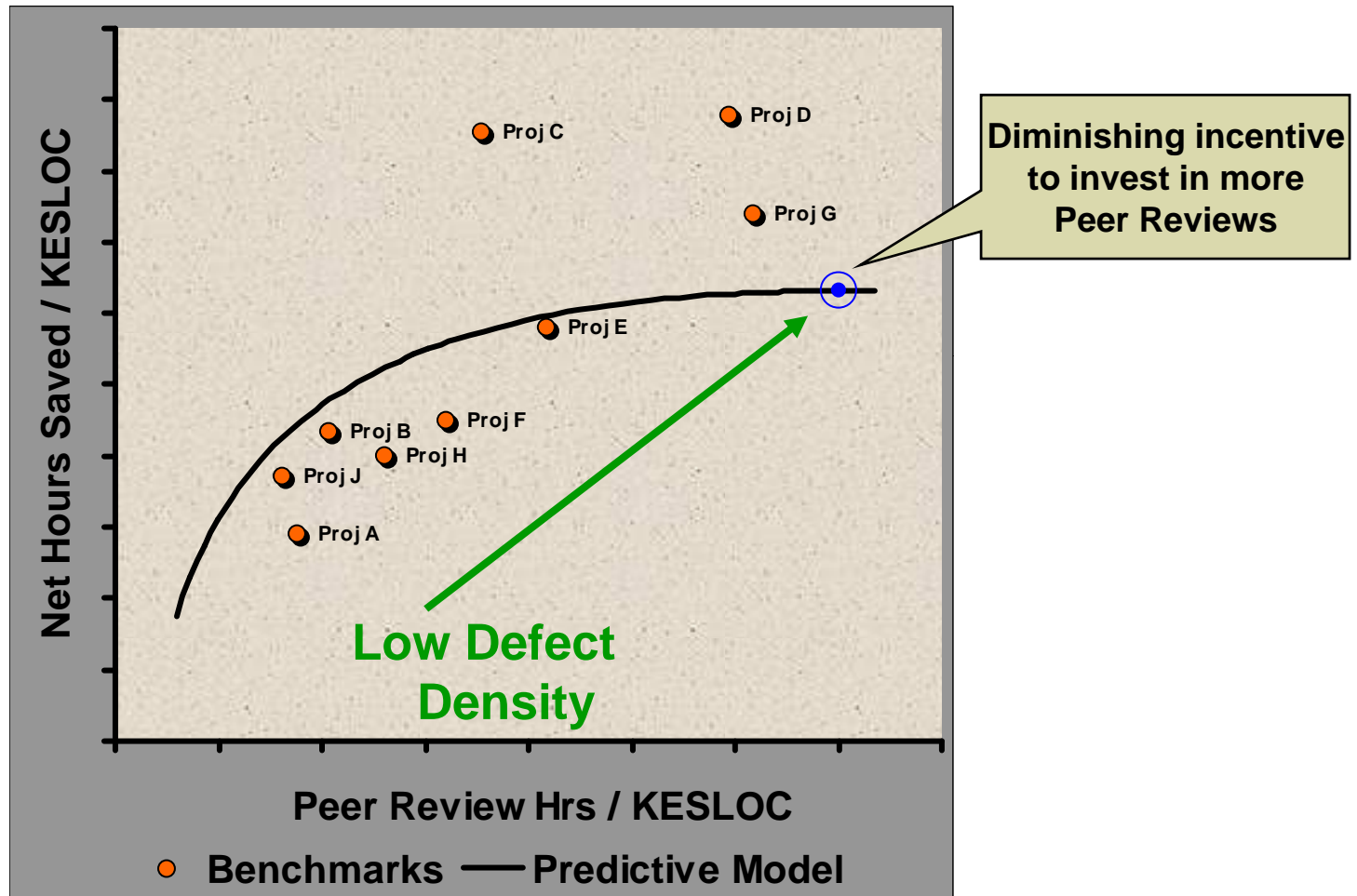
A small investment isn't enough to prevent high defect densities but does offer a very high Return on Investment

Moderate Investment in Peer Reviews



As investment increases, Return on Investment decreases but is still significant. Density decreases as the investment grows.

Large Investment in Peer Reviews



At some point, a diminishing return may be reached. Product quality requirements may nevertheless force investment above this level.

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Efficiency Improvement

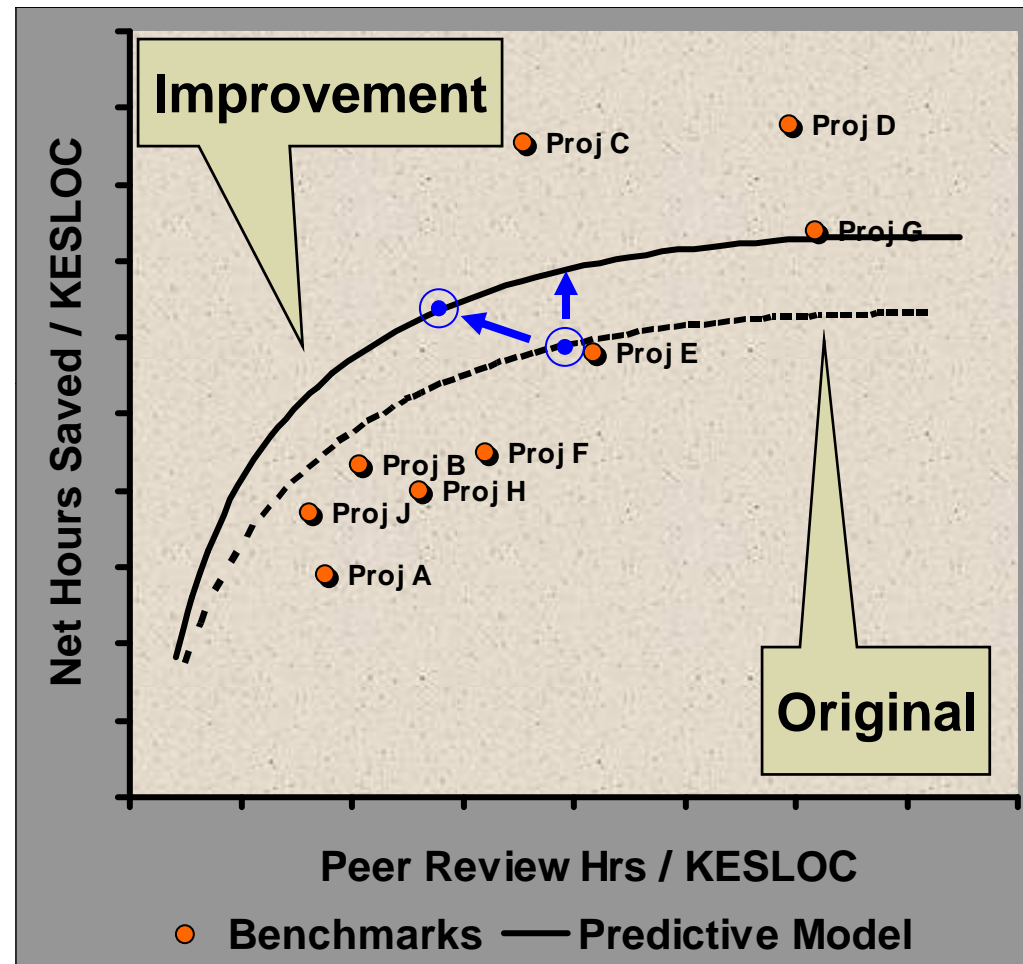
Fewer average Peer Review hours per defect:

- Increases savings

- Offers an option:

Decrease Investment ←

or
Reduce Defect Density ↑

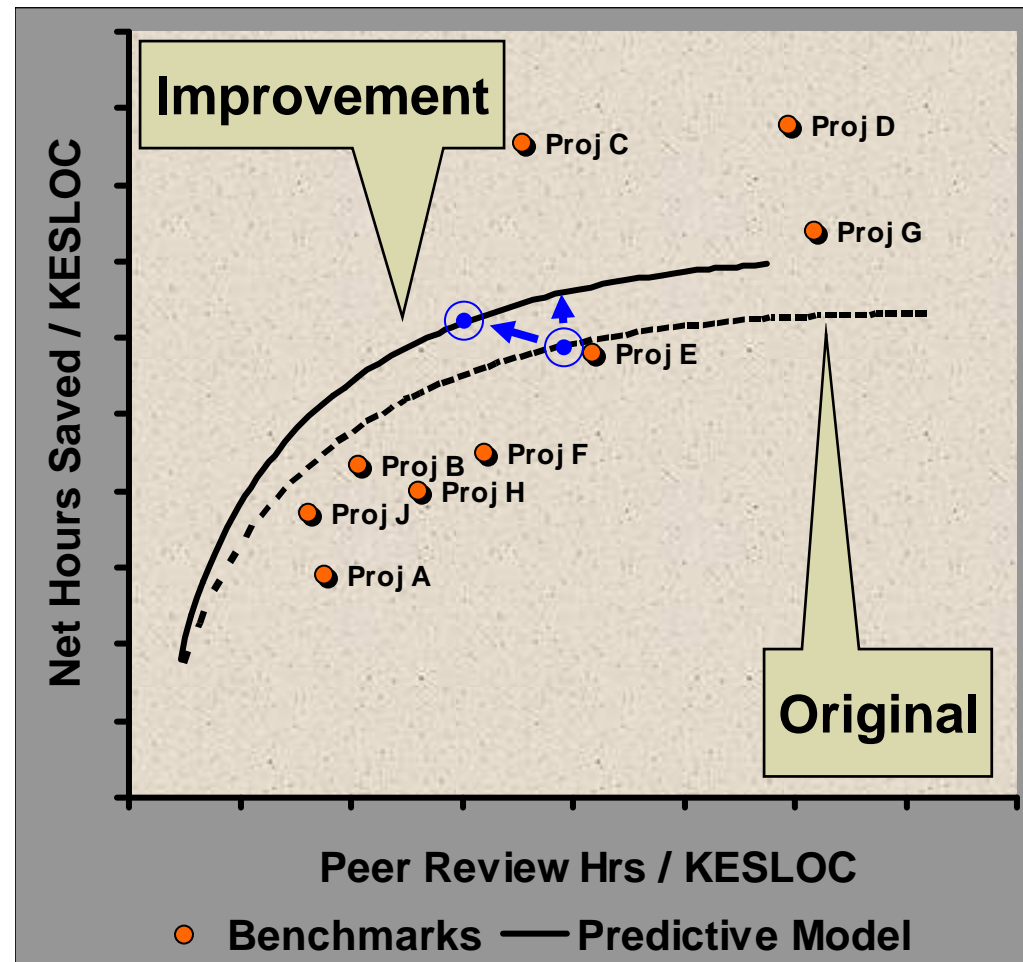


Efficiency improvement impacts on performance can be confirmed as project development proceeds

Early Defect Detection Improvement

Conducting
relatively more
Requirements and
Design Peer
Reviews:

Has similar impact
as Efficiency

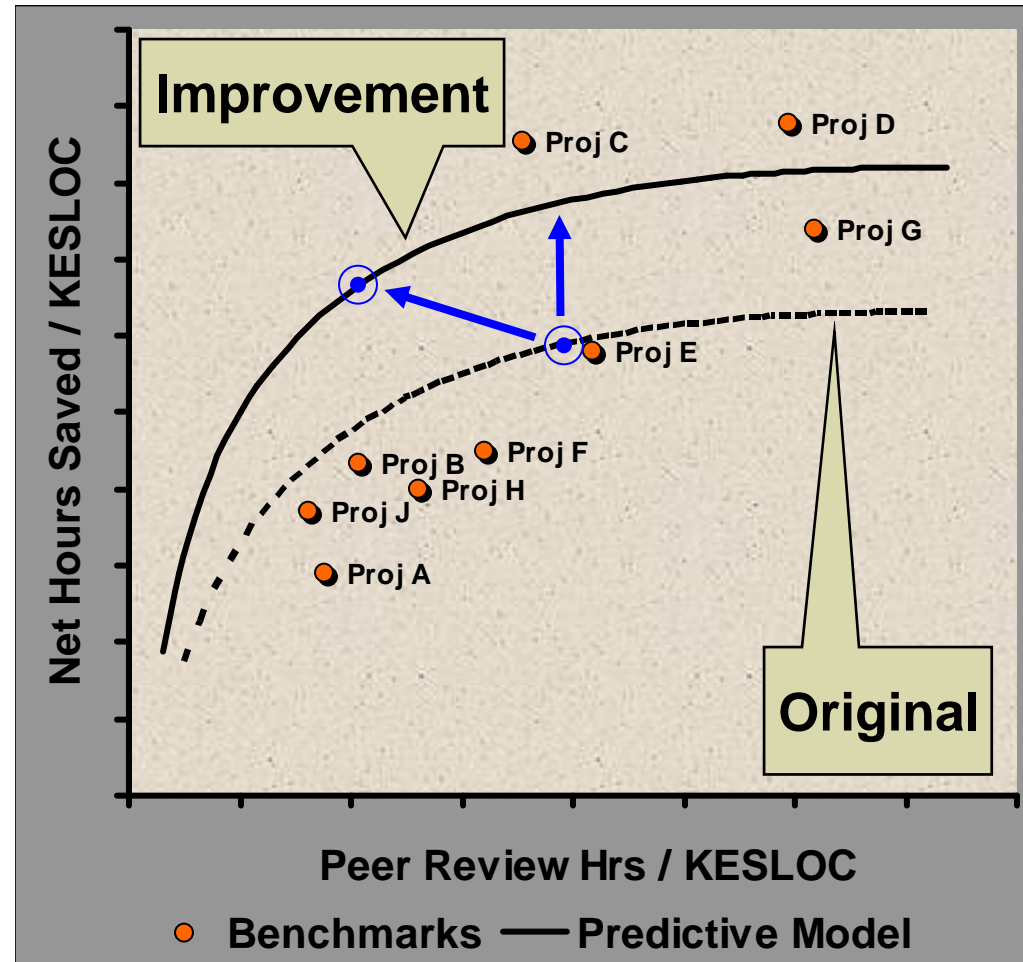


Early detection impacts on performance can be confirmed as development proceeds

PEP Improvement

Improving Process,
Environment, or
People:

Has similar impact
as Efficiency



PEP improvements occur over the long term and are worth considering due to their impact on performance

Conclusion

Peer Reviews:

- actually perform very well
- have a predictable impact on cost and quality
- offer improvement options that are also predictable

Therefore:

**Managing SW Peer Reviews with a
Performance Model is a low risk
opportunity to significantly improve
quality and reduce cost**

Acronyms

- KESLOC Thousand Equivalent Source Lines of Code
- PEP characterization of Process, Environment and People
- PRET Peer Review Exploitation Tool
- SW Software