

# Process Improvement Journey (From level 1 to Level 5)



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## Questions

**Is process improvement a good investment ?**

**Are Capability Maturity Models (SW-CMM, P-CMM, etc. )  
the right frameworks for process improvement ?**

**As an organization moves to higher levels of the SW-CMM,  
are software quality, cost, time and performance getting  
better ?**

**Should we stop after achieved CMM Level 3 ?**

**Do PSP and TSP help accelerate process improvement ?**

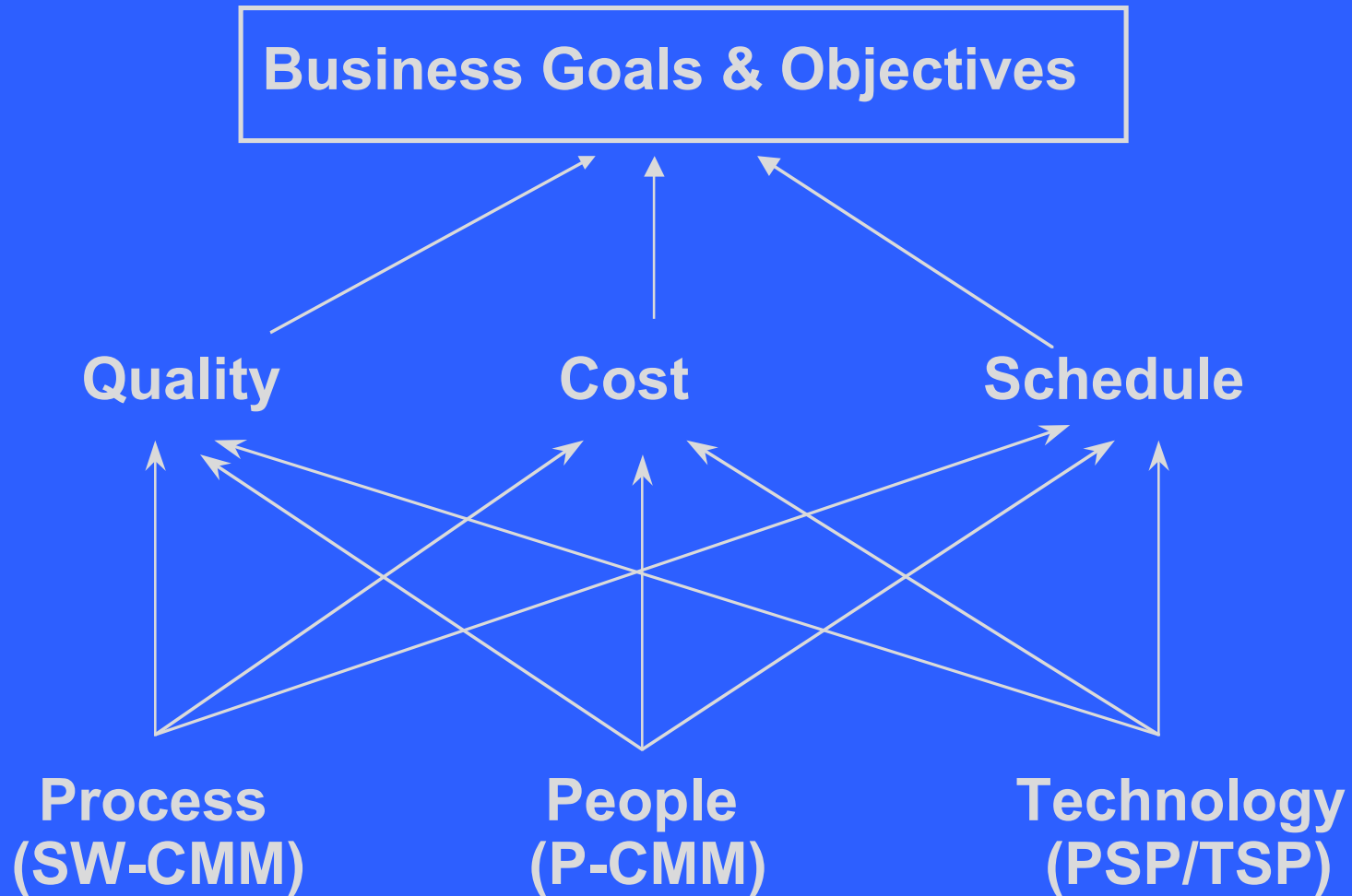
## Software Process Improvement (SPI)

- The Boeing Company has used the SW-CMM as the framework for software process improvement since 1991.
- Over 200 organizations have been assessed.
- Over 11,000 people trained in SW-CMM.
- Several higher levels of maturity organizations (Level 3, 4 & 5).
- Well-established SEPG infrastructure.
- P-CMM is used as the framework to improve workforce practices since 1997.
- PSP/TSP techniques are used to accelerate the rate of improvement since 1998.

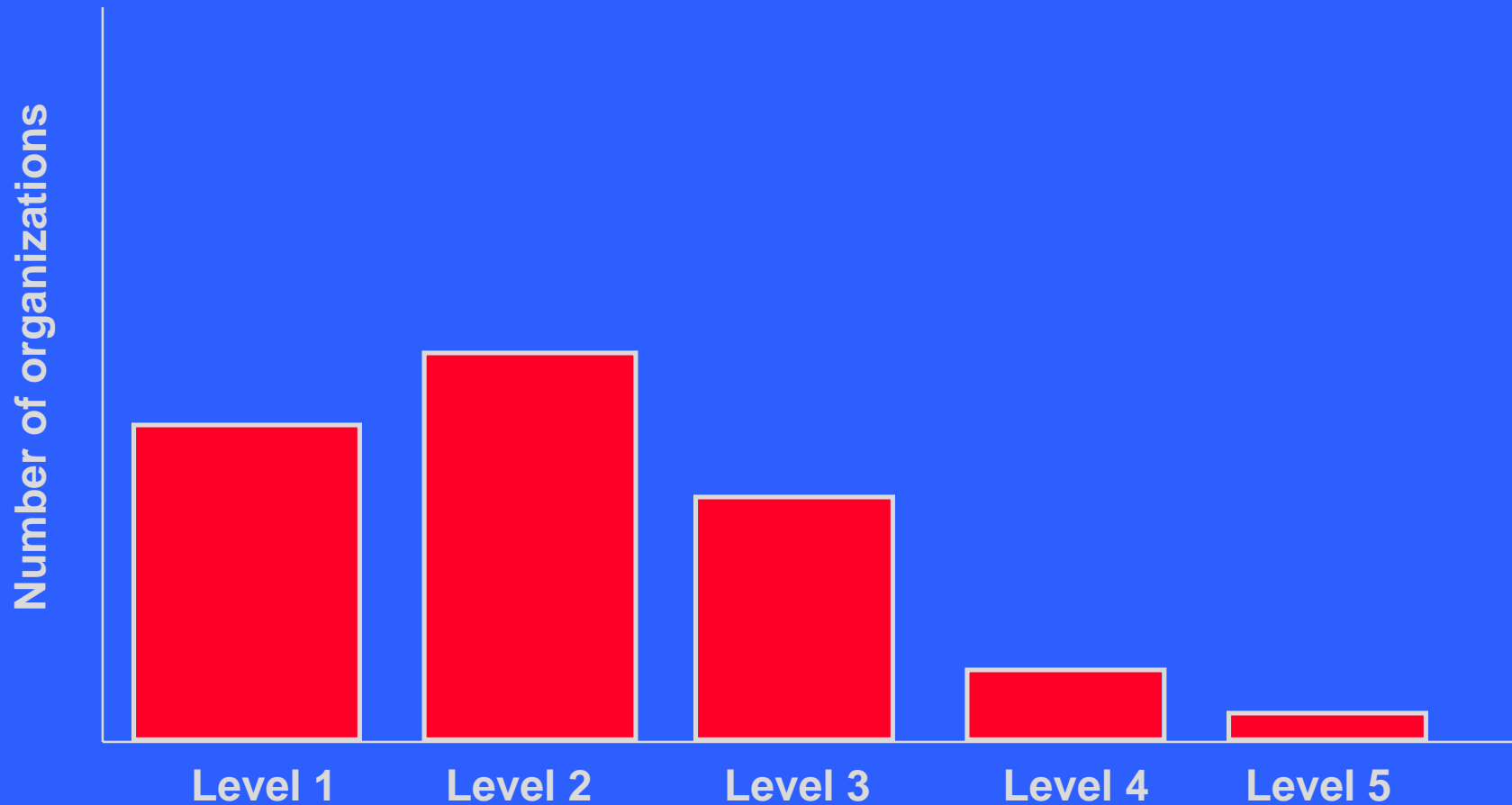
## Company-Wide Approach Benefits

- **Process Improvement is a company-wide activity.**
- **A well-defined infrastructure of SEPG helps ensure implementation success.**
- **Management commitment is at all levels.**
- **Process improvement strategy is part of company strategy.**
- **Process improvement goals align with business goals.**
- **Redundant activities are avoided or reduced.**
- **Standardization of software process is accelerated.**

# Improvement Strategy



# Maturity Levels In Boeing



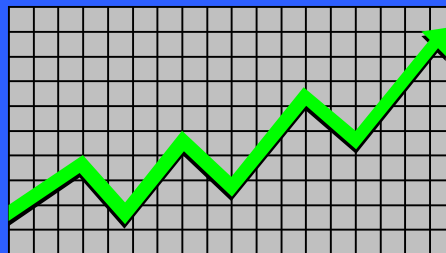
Based on 216 assessments in Boeing between 1991 to 2000

## Process Improvement Results

120 projects in Boeing Information Systems participated in the validation study of the SW-CMM.

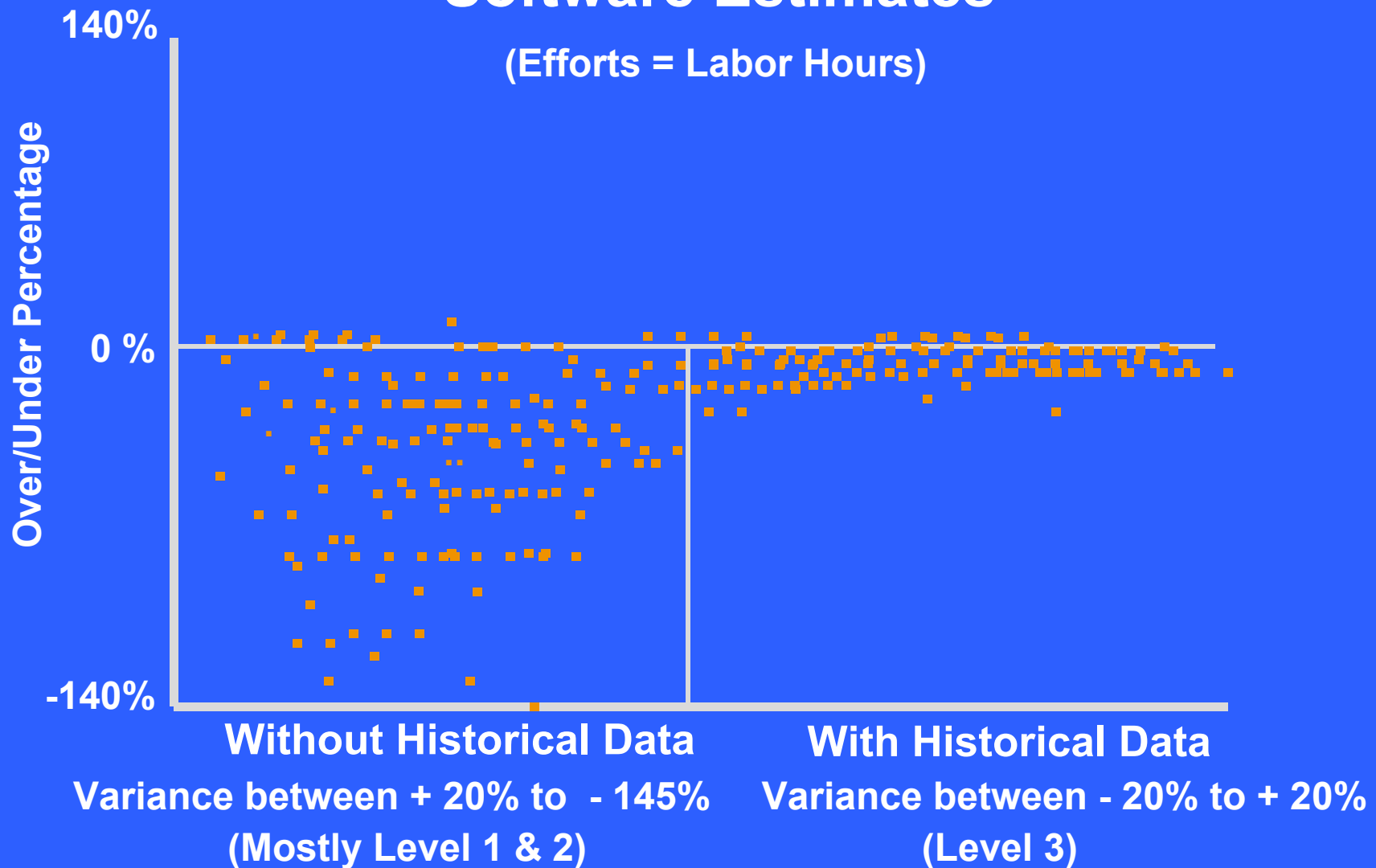
Measurements baseline established in 1991.

Data collected and analyzed independently by Dr. Kay Nelson of University of Kansas.



# Software Estimates

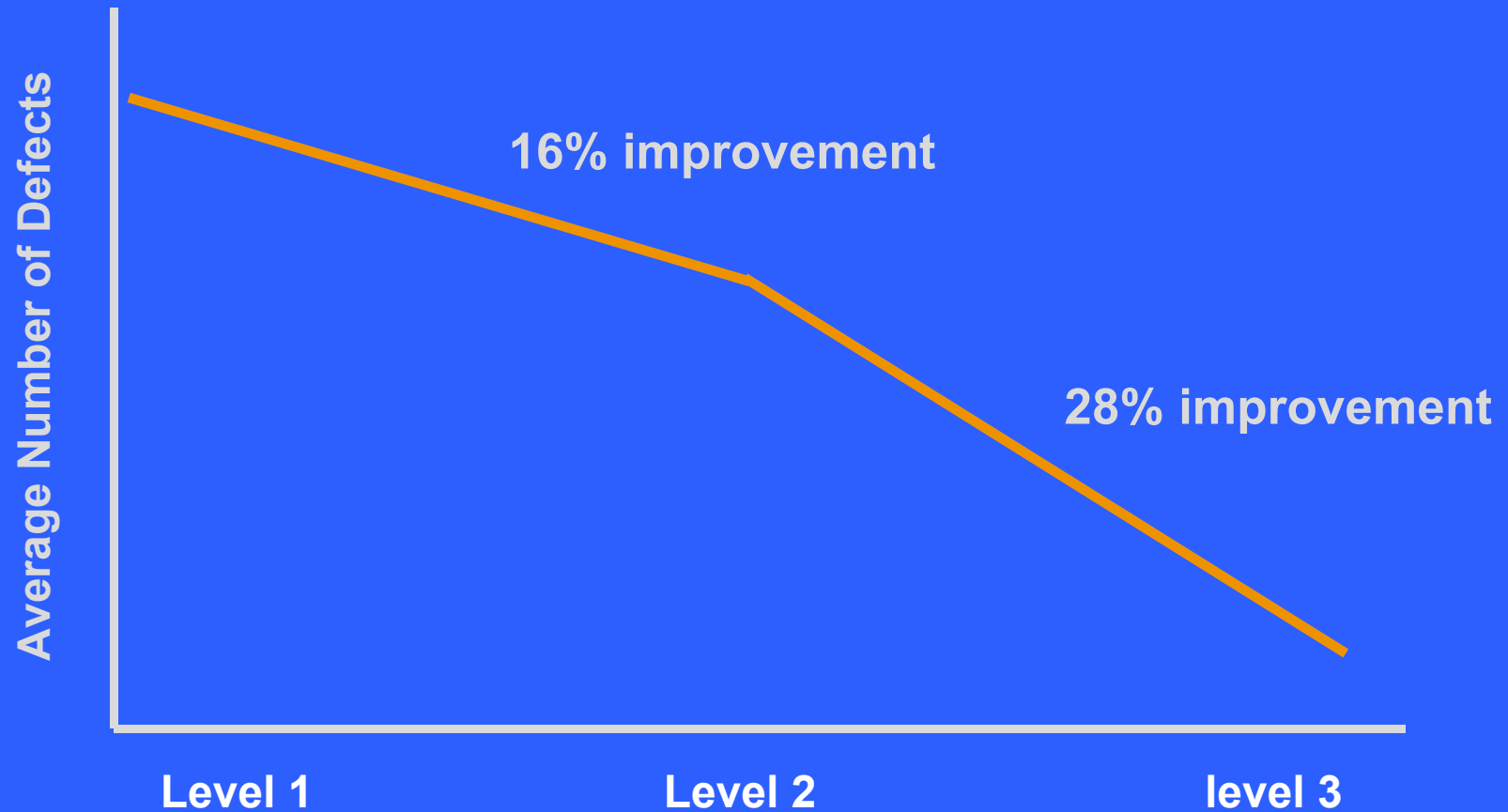
(Efforts = Labor Hours)



(Based on 120 projects in Boeing Information Systems)



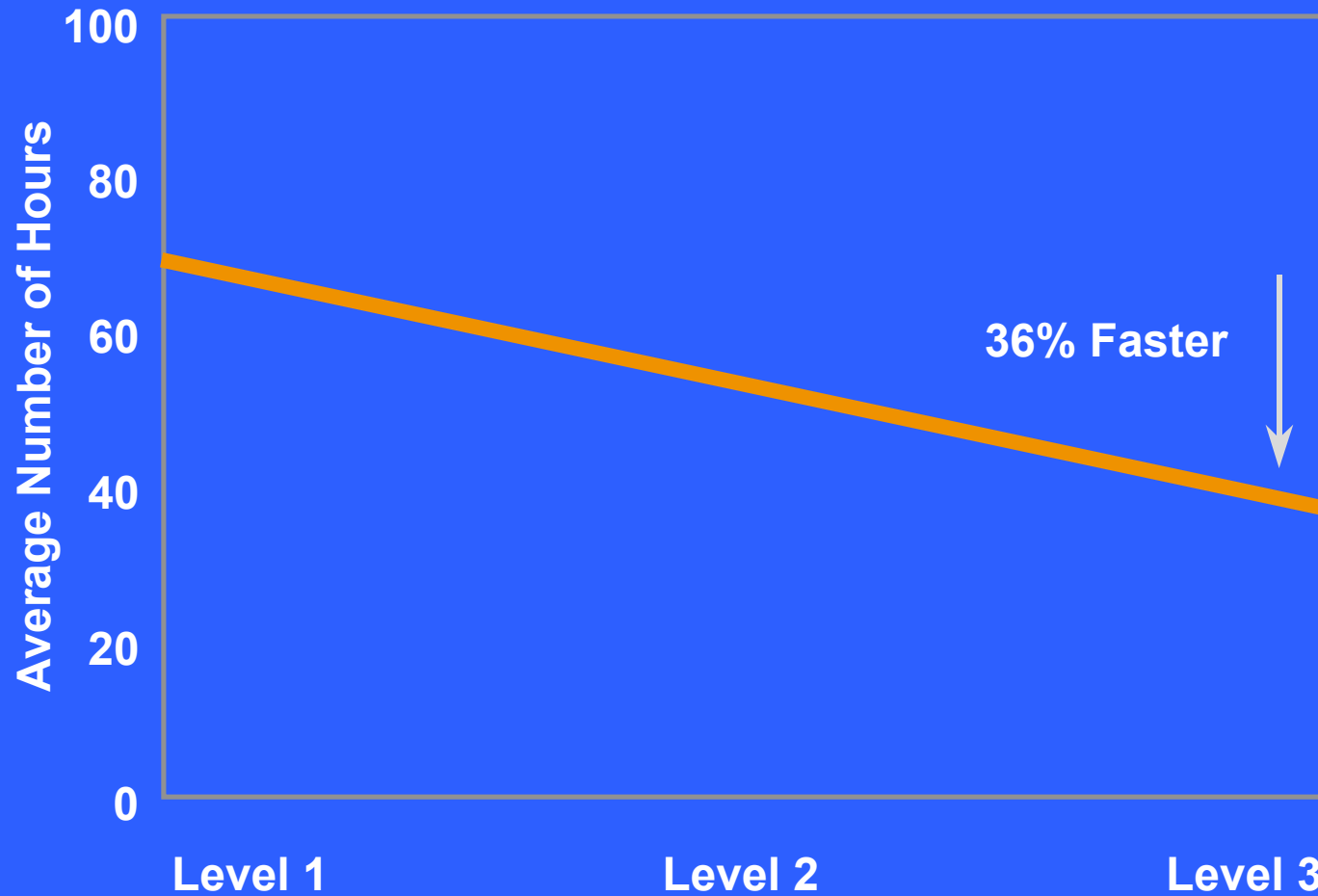
# Post Release Defects



(Based on 120 projects in Boeing Information Systems)

# Cycle time

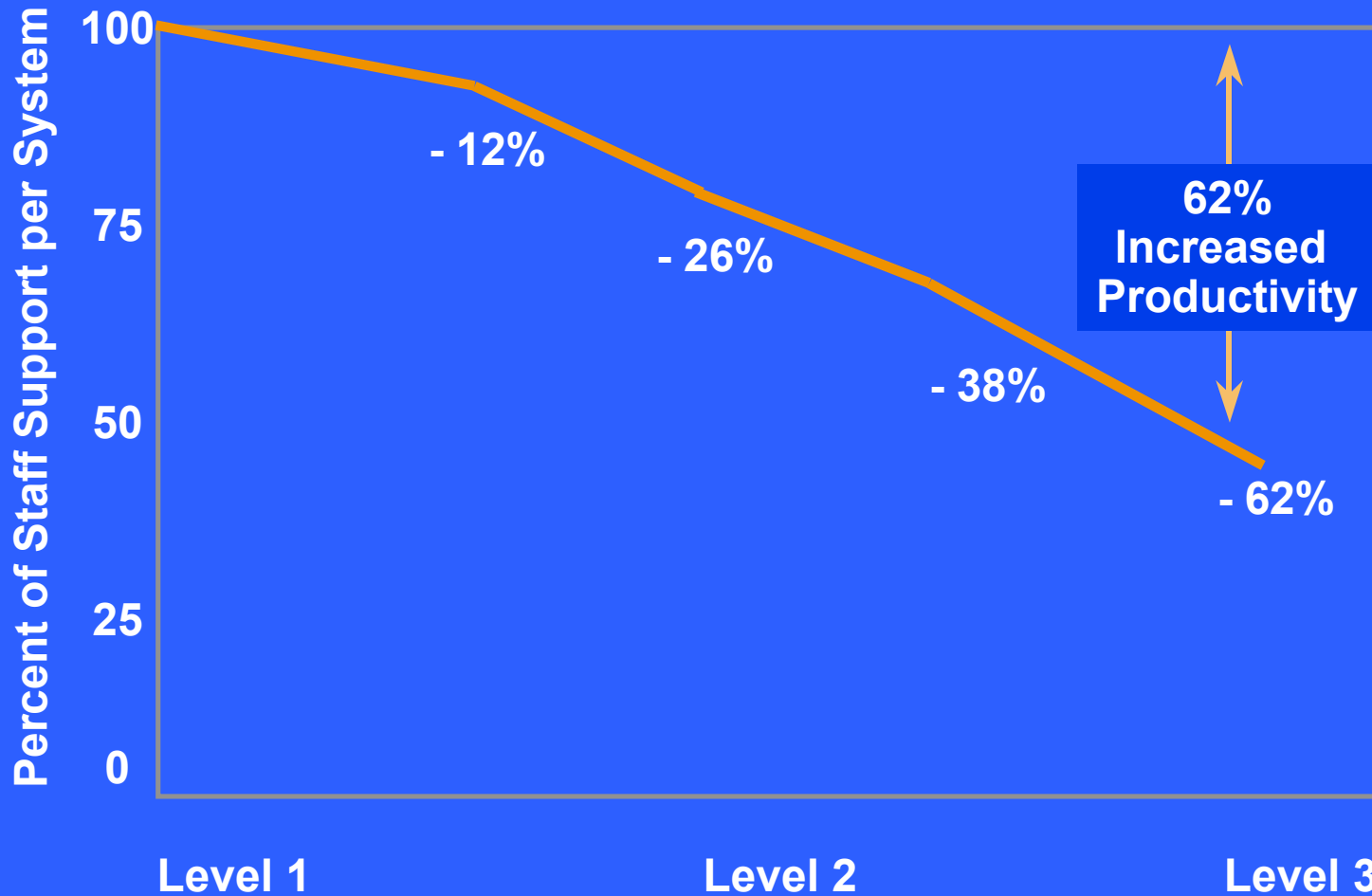
(Average time to complete a request for services)



(Based on 120 projects in Boeing Information Systems)

# Productivity

Reduced Staff Support per System = Increase Productivity



(Based on 120 projects in Boeing Information Systems)

## Is Level 3 Good Enough ?

**Many managers believe that level 3 is good enough.**

**Limited data at higher levels discourage the community to go further.**

**Many organizations stopped their process improvement at level 3 and found that they slipped back to lower level.**

**Few realized that the journey has just begun .....**

**We only had the appetizer ....**

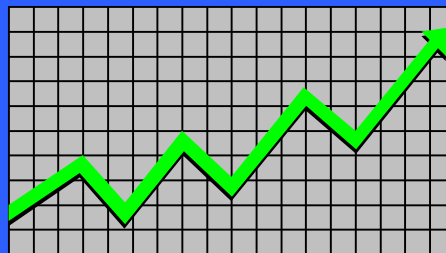
**We have not start the main course .... Yet.**

## Process Improvement Results

6 organizations in Boeing (28 projects) participated in the study of higher maturity levels (Level 4 & 5).

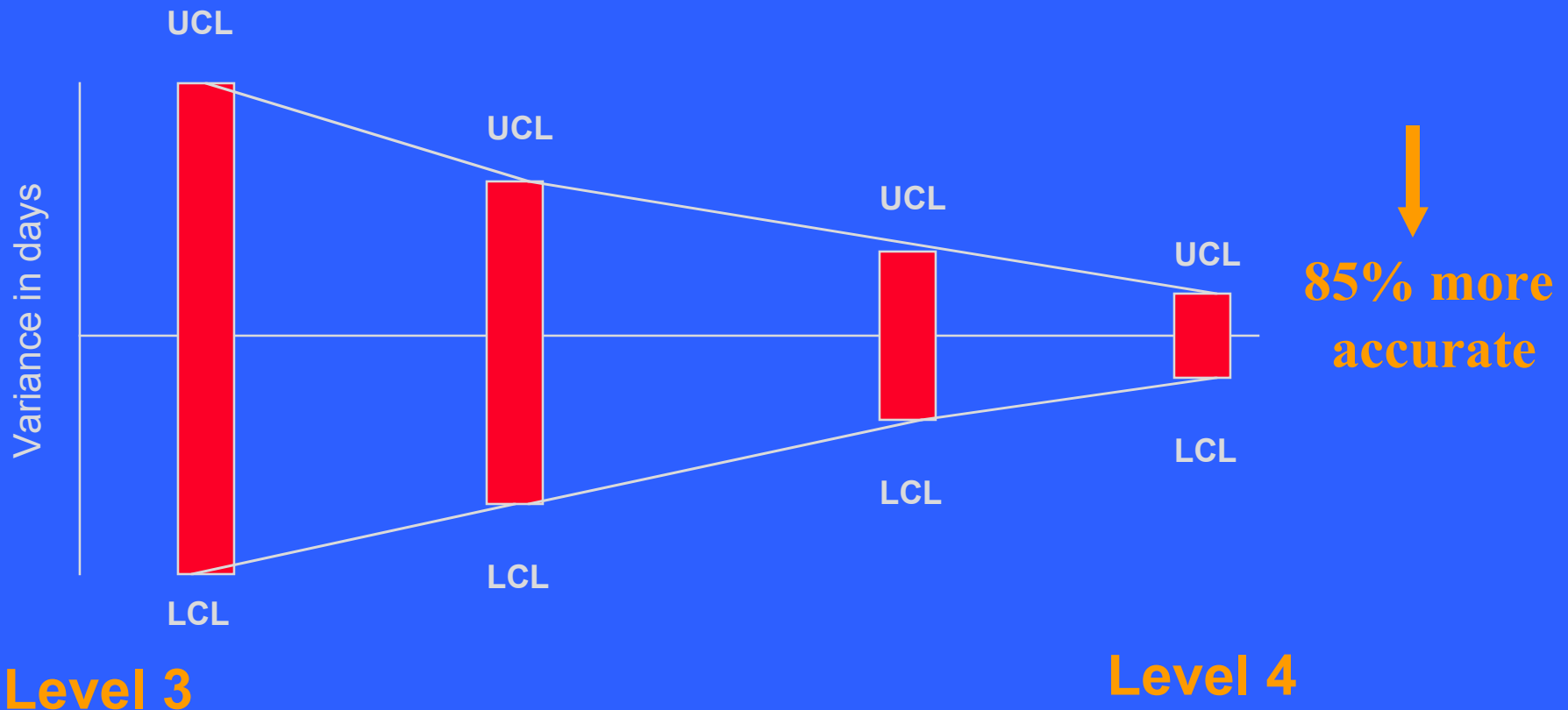
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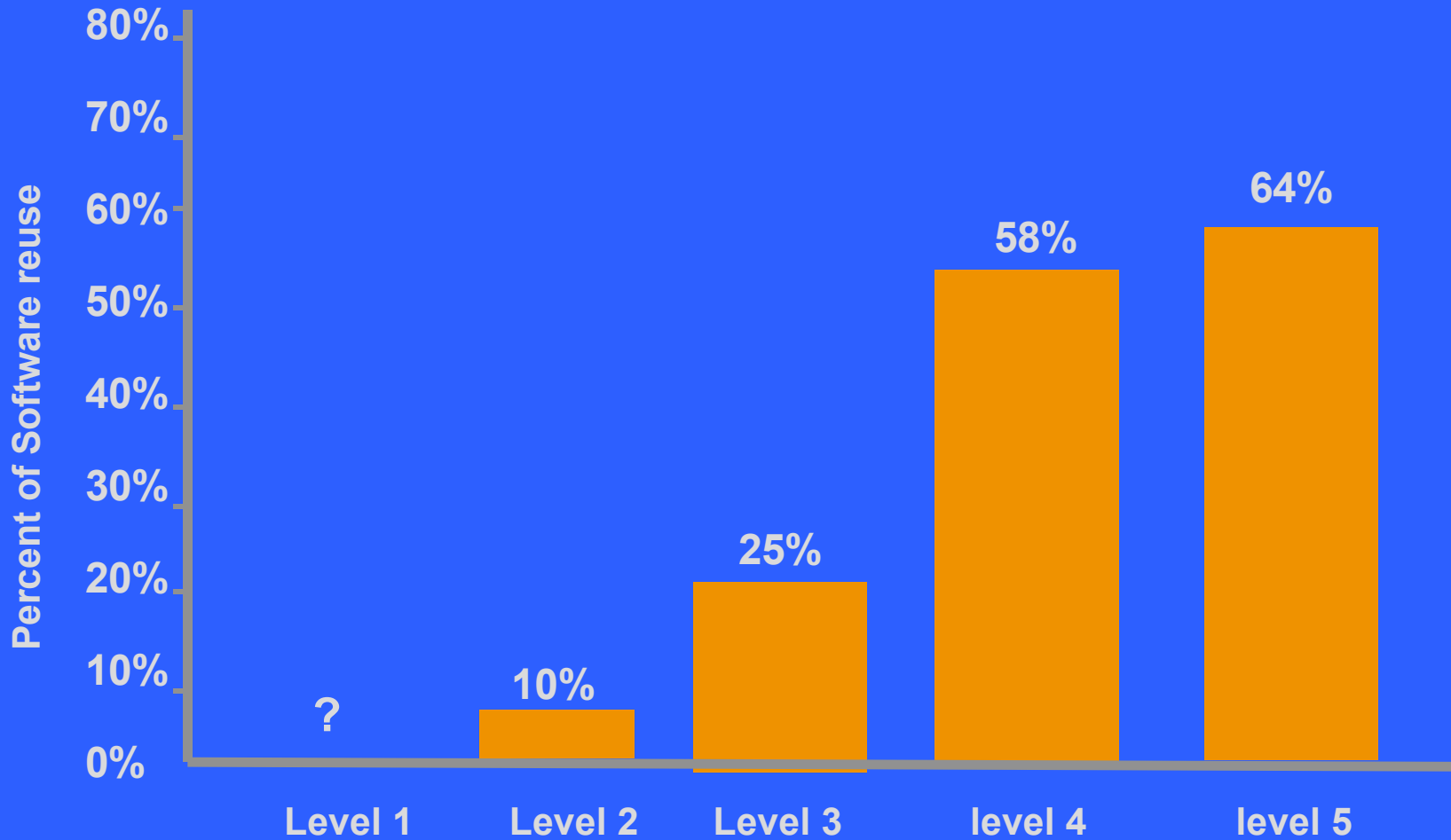
# Schedule Variance

Schedule variance: Number of estimates vs. actuals in days



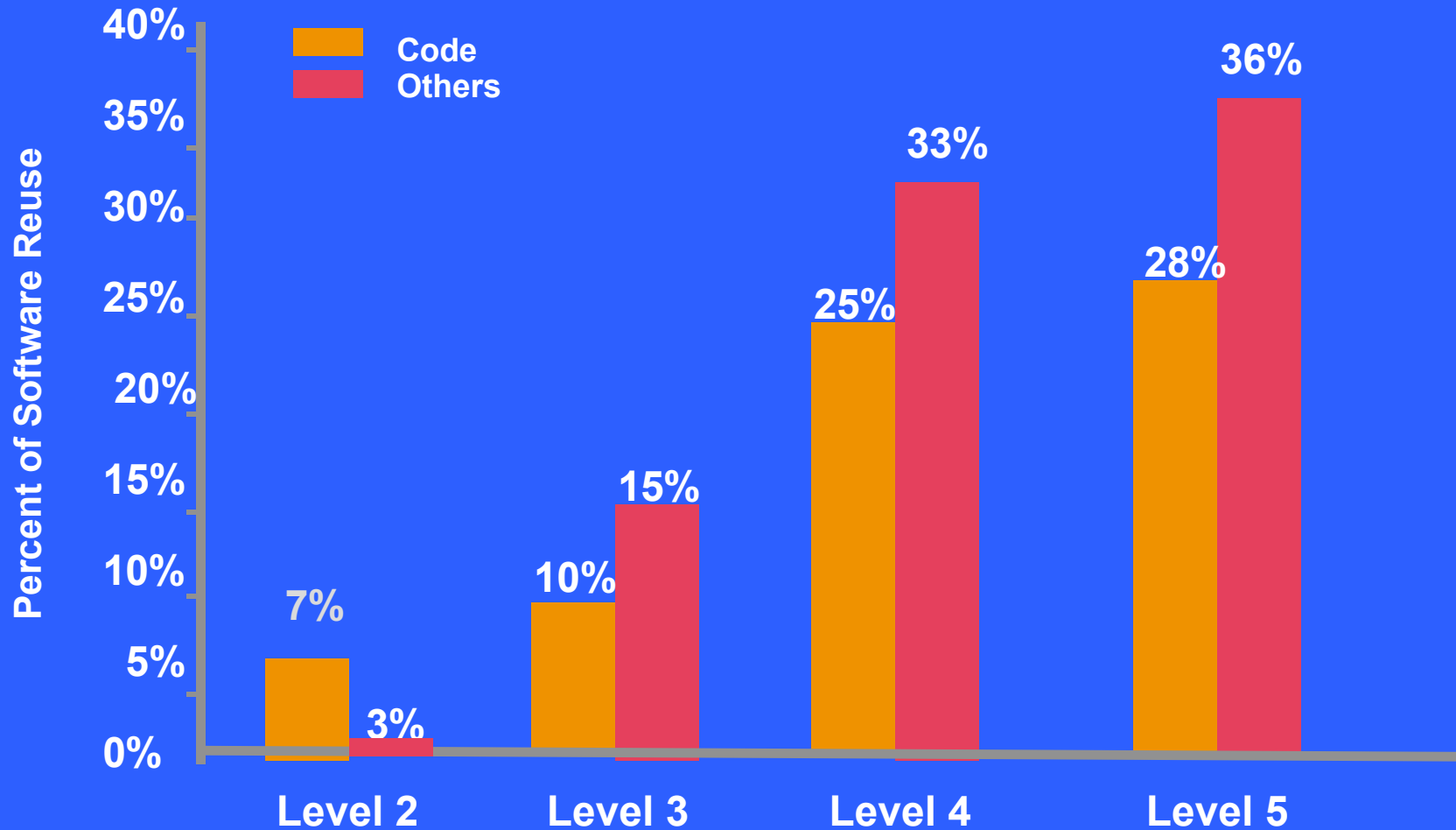
Based on 6 organizations assessed at level 4 & 5

# Software Reuse



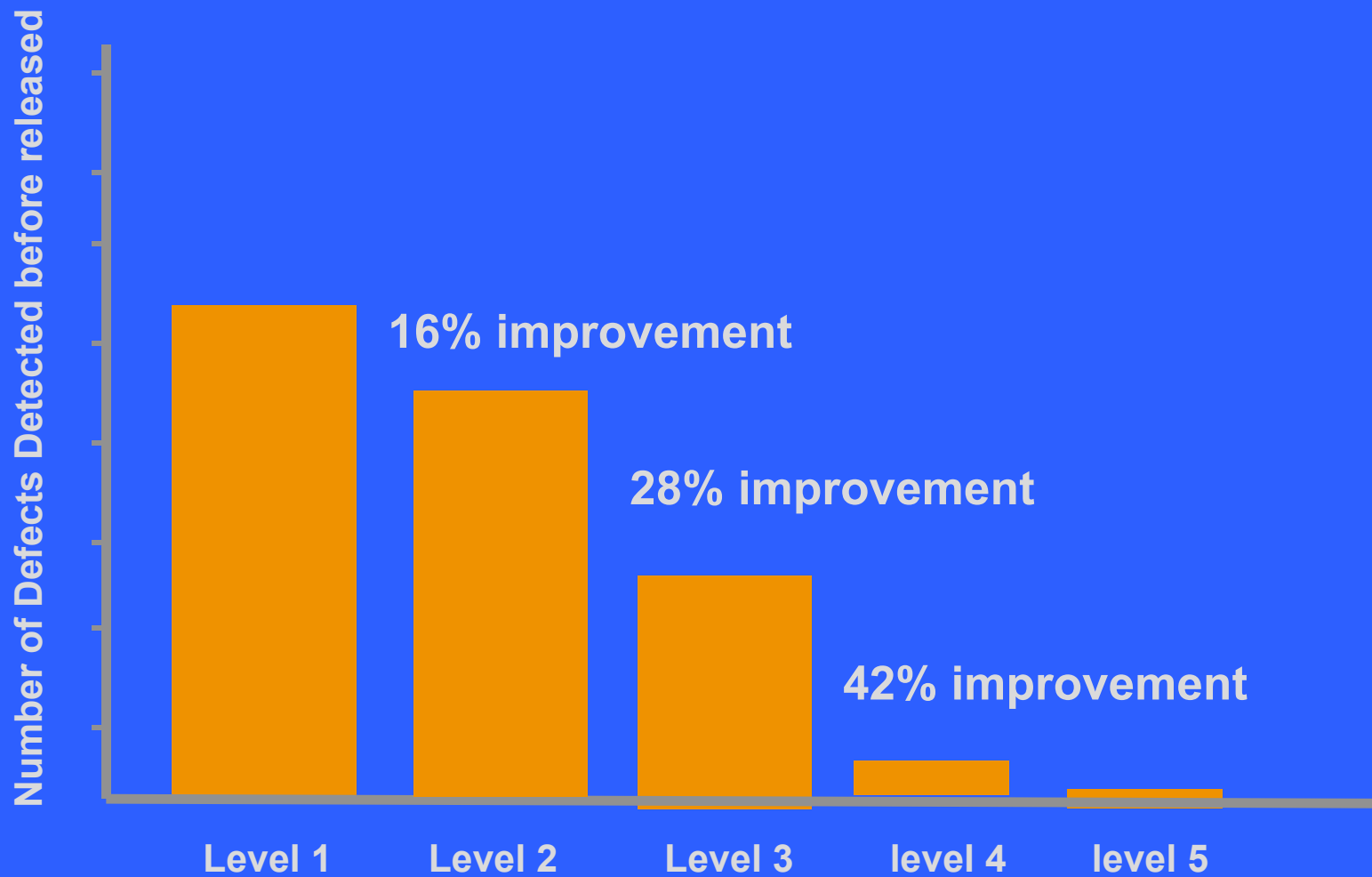
Based on 216 organizations assessment between 1991 to 2000

# Software Reuse



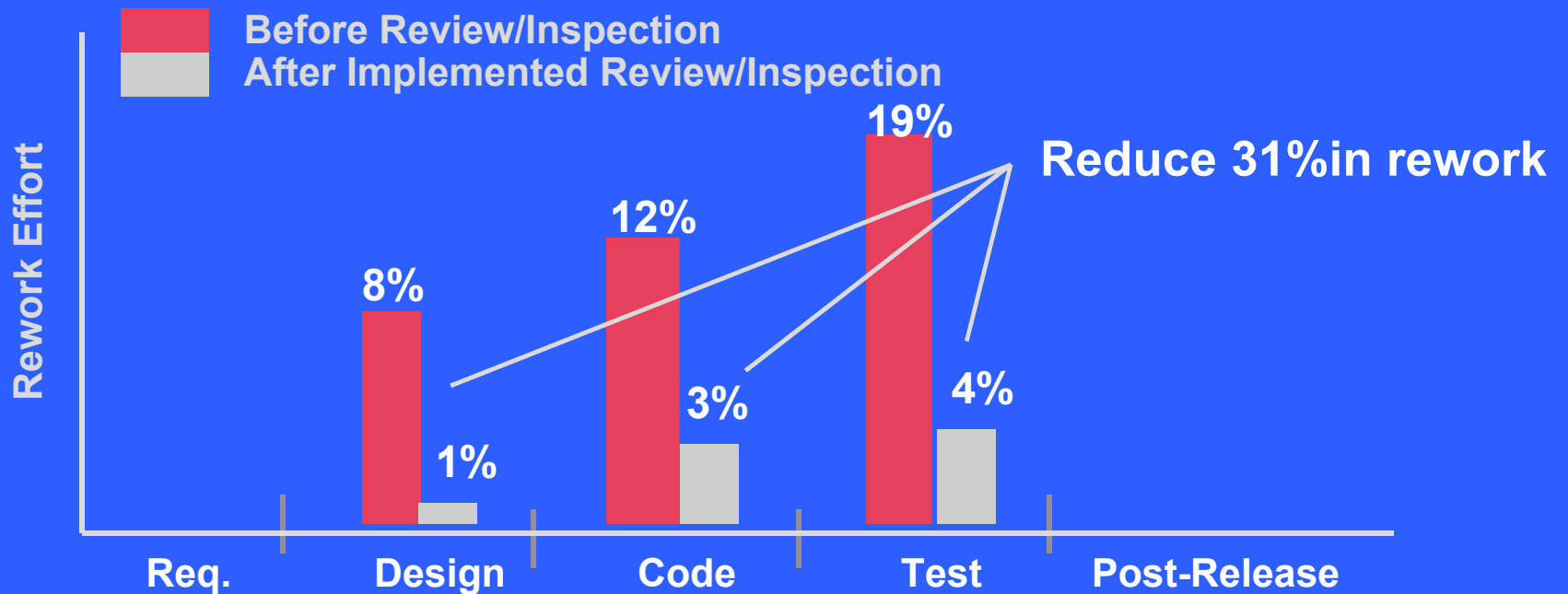
Code reuse: No modification  
Other reuse: Templates, Test cases etc.

# Pre-Released Defects



Based on 216 organizations assessment between 1991 to 2000

# Formal Review & Inspection Benefit Ratio



Formal Review & Inspection increased design effort by 4%  
 decreased rework effort by 31%

Cost: Benefit ratio is 4% : 31% or 1 : 7.75

Based on 6 organizations assessed at level 4 & 5

## People Improvement Results

**Boeing Information Systems conducted the first joint assessment for Software and People CMM in 1996.**

**Boeing Information Systems began to use the P-CMM as framework to improve its workforce practices and retain skilled workers in 1997**

**12 joint assessments of software and people conducted to date - 4 organizations achieved P-CMM level 2**

## Results

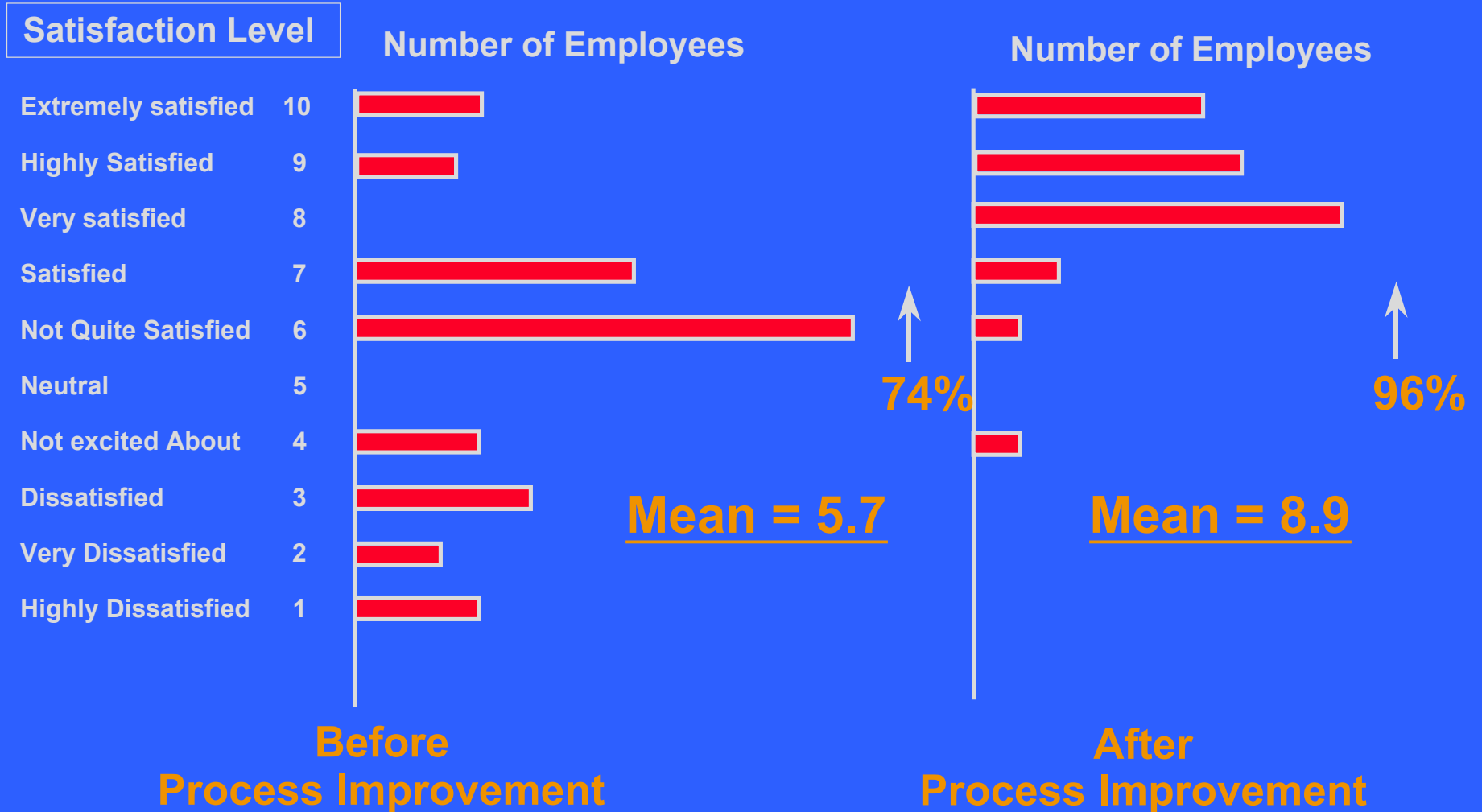
### Employee Turnover (Software):

|                   |                                    |
|-------------------|------------------------------------|
| Industry data     | 16% (1998 benchmark data)          |
| Boeing            | 10% - 12%                          |
| Boeing (P-CMM L2) | 3% (75% left return within a year) |

### Employee Satisfaction (Scale from 1 to 10):

|                   |                           |
|-------------------|---------------------------|
| Industry data     | 6.8 (1998 benchmark data) |
| Boeing            | 5.7                       |
| Boeing (P-CMM L2) | 8.9                       |

# Employee Satisfaction



## Technology Improvement

The Boeing Company conducted 3 pilots of the Personal Software Process (PSP) and Team Software Process (TSP) in 1998 in organizations already achieved level 3.

Two organizations achieved level 4 in 2000 - 10 months faster than other level 3 organizations

Data analysis indicated that PSP and TSP did accelerate the rate of improvement by 30% and have better product quality, cost, and cycle time performance

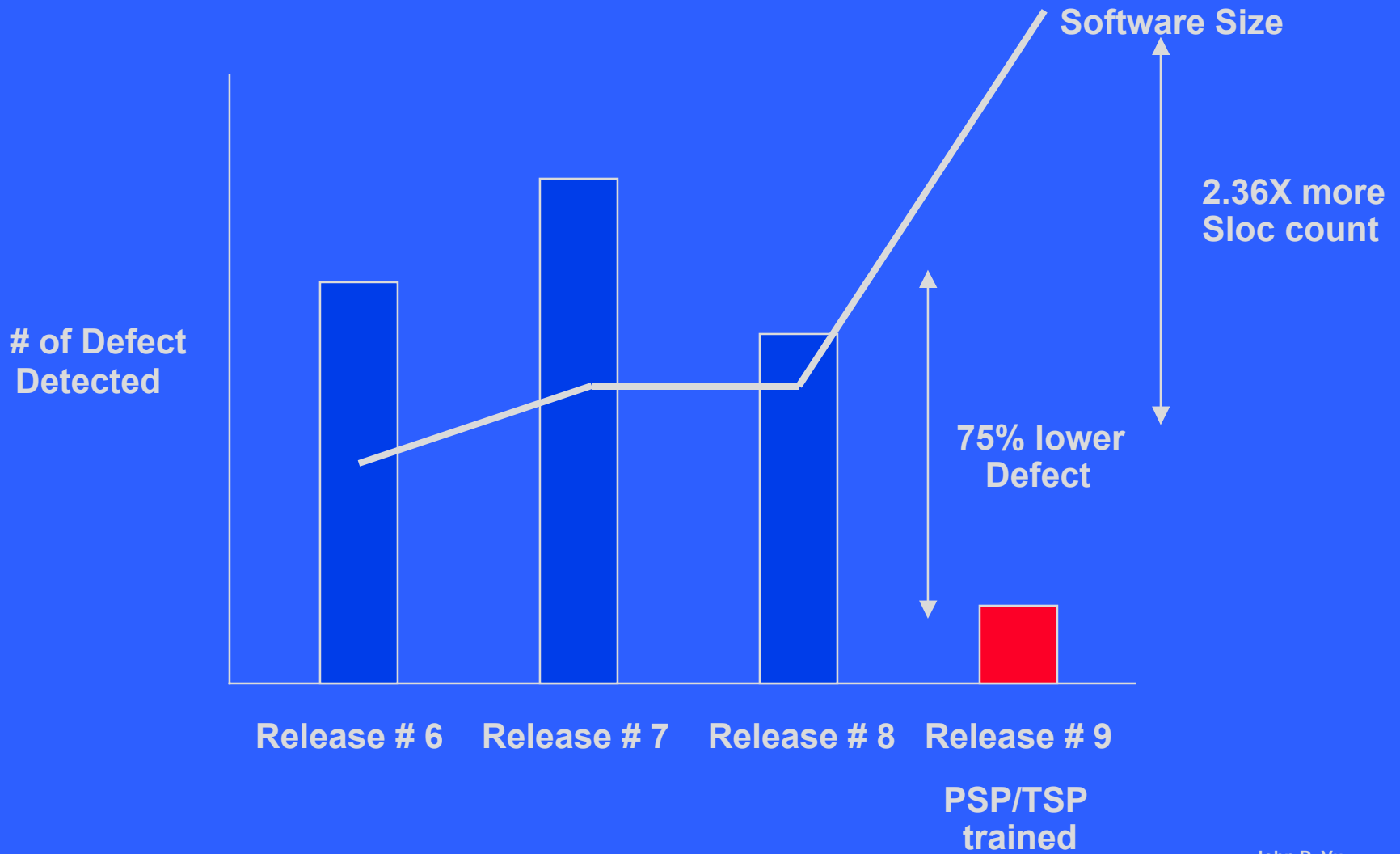
## Time To Move Up A Maturity Level

Average time to move to next level:

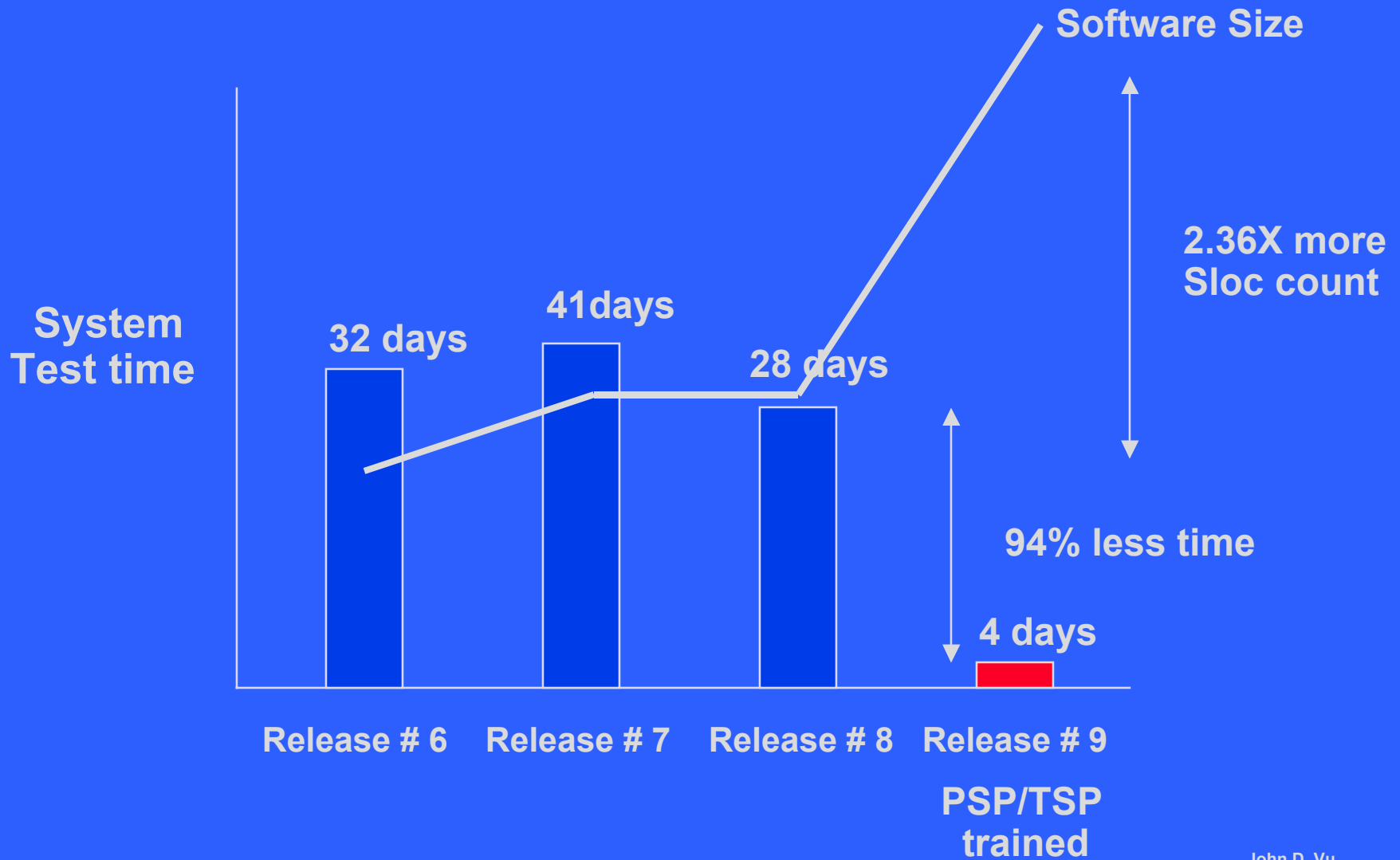


Based on 216 organization assessments conducted between 1991-2000

# PSP Benefits



# PSP Benefits



## Summary: The Journey at Higher Levels

**Most organizations meet projected business goals**

**90% of defects are captured before release**

**94% of projects meet schedule estimates**

**Software reuse increases 64%**

**Test time reduces by 94%**

**Organization productivity increases 70% over level 3**

**Customers satisfaction increases 12% over level 3**

**Employees satisfaction increases 20% over level 3**

**Employee turnover is 3% vs. industry at 12%**

## **Un-quantifiable Benefits: Organization Culture**

**Users and developers working together as one team**

**Greater cooperation between teams (Different projects)**

**Roles and responsibilities are clear and better defined**

**Minimum impact when staff changes occur**

**People understand & appreciate this new way of working together**

**Increase mentoring among senior & junior people**

**“We have lots of fun here”**

## We Believe

There is a systematic approach to improve the way software is developed and maintained.

There are stages of process maturity in which the organization will improve by following a recommended sequence to decrease risk and increase software performance.

By following an evolutionary path the organization will continuously improve their knowledge to produce better, faster, higher quality products, and achieve customer satisfaction.

## Conclusion

**Process Improvement using the Capability Maturity Models such as SW-CMM, P-CMM will help organization improve its software process, attract and retain skilled workers, and achieve its business objectives.**

**Adopting PSP/TSP in concert with process improvement activities will accelerate organization maturity and determine which organization has the potential to deliver higher quality products at reasonable cost to the customer.**