Formal Peer Review

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Industrial Case Study

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Background & Objectives

- Background
  - Most studies focused on code reviews and open source community
  - Lack of data from diverse disciplines, large-scale industrial environment
  - Perception is that all data must be peer reviewed
- Objectives
  - Establish metrics for determining FPR effectiveness
  - Determine relative effectiveness of FPR practices
  - Evaluate feasibility of FPR practices based on effectiveness measures
    - Is the high cost of FPRs justified for all scenarios?

Introduction

- Formal Peer Review (FPR)
  - Formal process of reviewing output of development/verification activity
  - Benefits are well-accepted
  - Practices vary widely and are inconsistent
  - Laborious and costly
    - Meeting-based FPRs costlier with no demonstrated higher defect detection
    - Hinders wide adoption of FPR practice
- Main Results
  - Little correlation between labor and defects
  - Early FPRs much more effective
  - Some boundary conditions encountered during analysis

Study Process

1. Goal-Question-Metric (GQM) to determine measures to determine FPR effectiveness
2. Define effectiveness model
3. Analyze 100 FPRs from safety-critical system development company
4. Further analysis of 197 FPRs with subset of measures
5. Identify conclusions and further studies

Goal-Question-Metric (GQM)

Goal: Do the results of a FPR justify the cost spent performing the FPR?

Questions

Q1: What is the cost of a FPR?

Q2: What is the effectiveness of a FPR?

Q3: Is there any relationship between FPR effectiveness and review type?

Q4: Is there any relationship between FPR effectiveness and review size?

Metrics

- **M1**: Review Type
- **M2**: Defect Count
- **M3**: Labor Hours
- **M4**: Review Size

- M1 needs to be quantified

GQM M1 (Review Type) Factor

- Assigns a factor to each review type
  - Weighs the cost of fixing a defect when allowed to propagate into the product
  - The code is the product, therefore cost = 1.0 for code defects

Phase	Review Type	Cost Factor	M1 Factor
Requirements	Requirements	1X	10
Design	Design	5X – 7X	2
Build	Code	10X – 26X	1
Test	Test	50X – 177X	0.237
N/A	Document	N/A	0.2
N/A	Configuration Accounting	N/A	0.1

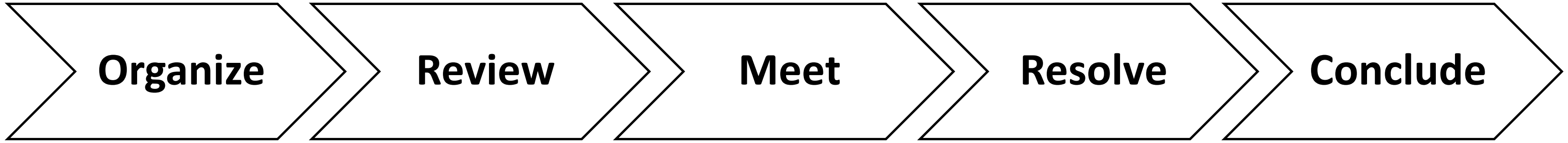
FPR Effectiveness Model

- Simple model to quantify effectiveness
- Future studies may refine the model

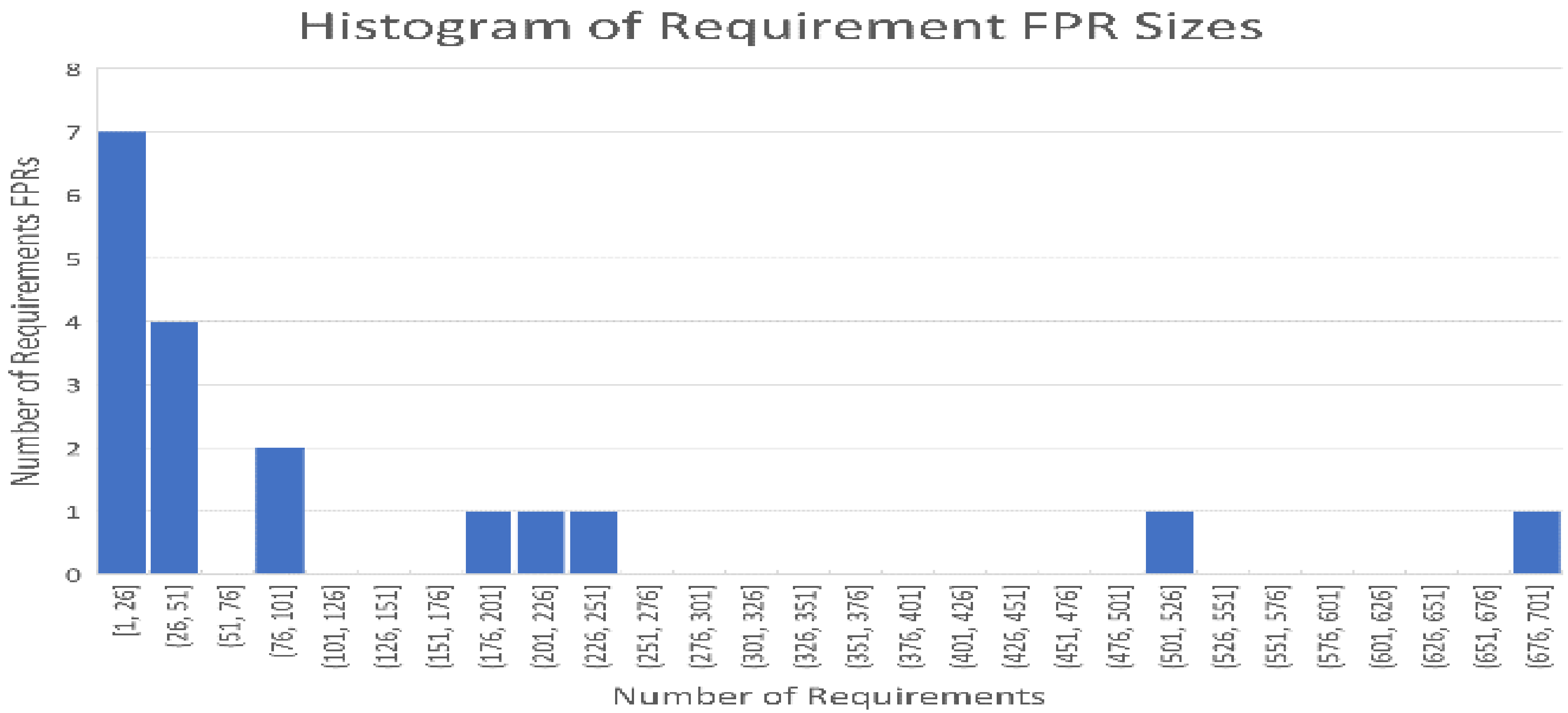
$$\text{FPR\_Eff} = \left(\frac{Defects}{Labor\ Hours}\right) \times \text{Review Type Factor}$$

Company Background & FPR Process

- Safety-critical aerospace system developer
- Highly-regulated industry, ARP4754A, DO-178C, DO-254
- FPR process used by Systems, Software and Firmware engineering



Requirements Review Analysis



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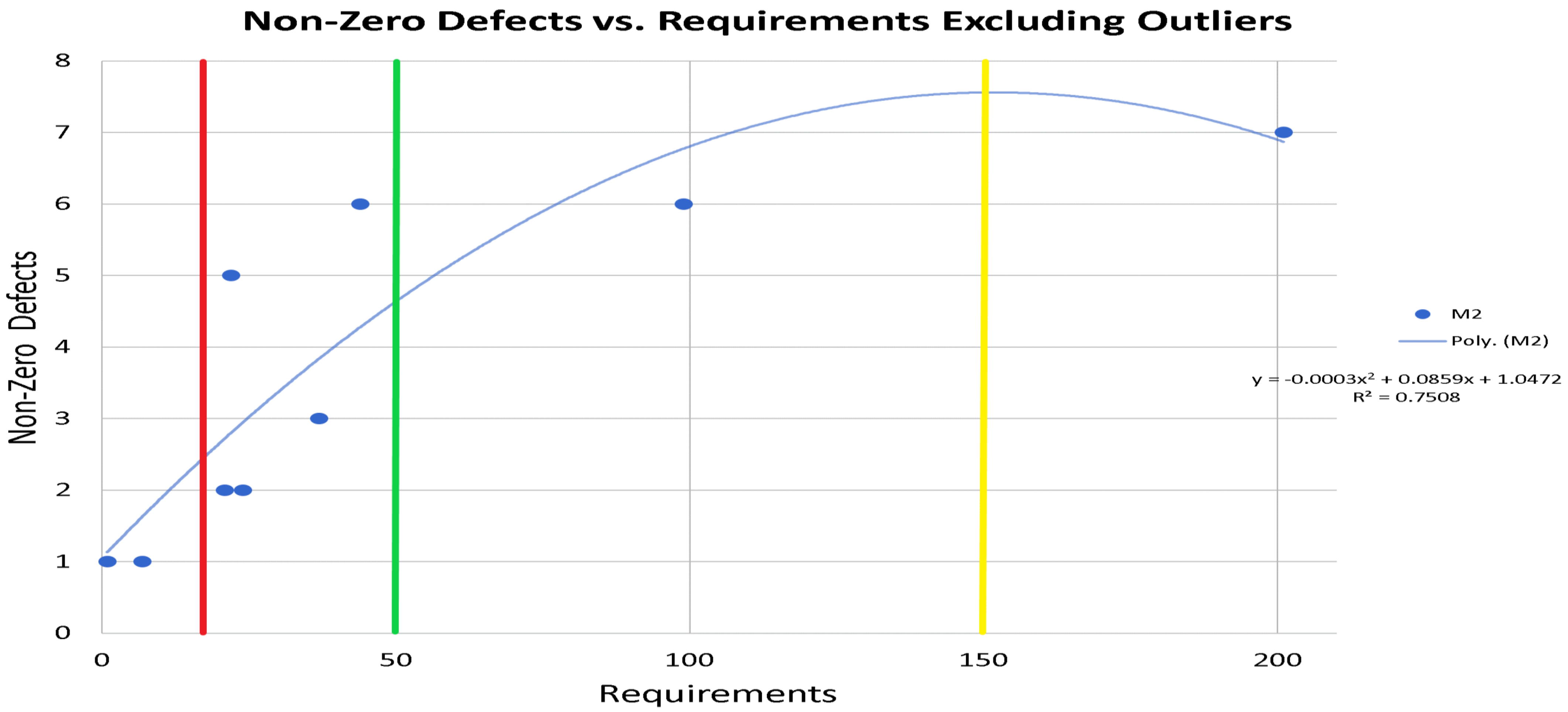

Conclusions

- FPRs are more effective when conducted early in the life cycle
- There may be a correlation between review size and effectiveness
  - Large review sizes did not yield higher defect detection
  - Small review sizes may not be effective
  - There may be a range of review sizes that optimizes defect detection
- Sample sizes too small to reach definitive conclusions
- Additional studies are necessary to refine model, identify correlations