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Research Motivation

- **Support awareness**
  - Software engineering principles in the scientific software development community

- **Studies suggest**
  - Agile methods are well suited to scientific software development
    - requirements emergence, iterative workflow, tacit knowledge in the scientific research process
  - These findings may not be representative of all factors
    - documentation needs, employee turnaround, non-experts, student developers, well defined and stable project requirements

- **An empirical approach**
  - Enhances our ability to understand the scientific project context without bias
  - Boehm and Turner Model provides a mechanism to categorize project characteristics
Research Goals

- **To generate** a set of testable hypotheses for future evaluation
- **To study** scientific software development project characteristics
- **To increase our understanding** of scientific software development project characteristics
- **To provide guidance** to scientific software developers
- **To foster collaboration** and discussion about qualitative research approaches at SECSE09
Related Work

• **CS&E Case Study Foundations:**
  - Software Development Environments, Carver et al.
  - High Performance Computing (HPC), Basili et al.
  - Risk management Analysis, Sanders and Kelly
  - Workflow Systems, Woolard et al.
  - Scientific Software Development Models, Segal et al.
  - Interpretive analysis of agile methods using the Boehm and Turner model, Segal

✓ **Agile Studies:**
Findings from Literature Review

- Few studies that evaluated projects of various size and in multiple CS&E disciplines
- No identified studies that categorize project characteristics using the Boehm and Turner Model
- Concerns over participant exposure and wide variety of interpretation of software engineering methodology
- The Boehm and Turner model provides an approach to evaluate scientific software development projects not based on practices but *actual processes*
Boehm and Turner Model

• Provides criteria for comparing and contrasting project characteristics:
  – *Plan Driven Approaches*
    • Predictable and stable
    • Documented requirements
    • Systematic engineering processes
    • Requirements/Design/Build Paradigm
  – *Agile Methods*
    • High change environments
    • Undocumented requirements
    • Rapid responsiveness
    • Tacit Knowledge/Simple Design

• Characteristics
  – Application, Management, Technical, Personnel

• Critical Agility/Plan Driven Factors
  – Size, Criticality, Dynamism, Personnel, Culture
Dimensions Affecting Method Selection

Data Collection

• Convenience sample
  – Government, academic and commercial scientific software development projects

• Projects of varying size
  – Number of software development personnel

• Interviews with scientific software developers:
  – Field Memos and Notes
  – Semi structured interviews (open and closed end questions)
  – Interview protocol tailored to elicit project characteristics without using software engineering “buzzwords”
  – Questions based upon our interpretation of the Boehm and Turner sub categorizations of agile and plan driven criteria
Planned Data Analysis

• **Stage 1:** Grounded theory method
  – Largely a creative process
  – Seeking patterns and trends in the data
  – Textual encoding of interview questions
  – Analysis and comparison of observations from field memos

• **Stage 2:** Reconciliation of interview data to the Boehm and Turner Model to be used as a baseline for analysis

• **Stage 3:** Produce polar chart representations of the data per scientific software development project
Limitations and Risks

• Our approach does not fully compare/contrast the data collection and analysis strategy with other studies.

• Little prior experience with the empirical validation using this model in the CS&E domain (limited knowledge base).

• Potential difficulty in producing the representations consistent with the Boehm and Turner model.

• Problems in interpreting participant responses based upon interview questions.

• Our approach is somewhat dependent upon Boehm and Turner’s model.
Contributions

• Provides a greater understanding of scientific software project characteristics through an exploratory in depth qualitative analysis

• To our knowledge this is a new approach comprehensive approach for understanding CS&E project characteristics

• Creates a set of hypotheses for further evaluation and testing in different project environments

• Increases scientific software developer decision making ability about what types of processes might be appropriate

• Fosters additional discussion and collaboration
References


