A Critical Review of Software Engineering Research on Open Source Software Development

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Problem formulation

• A growing concern with the black-and-white portrayal of open source software development (OSSD) within software engineering (SE) research

• Recent empirical research observes how processes and practices differs across OSSD projects

• This has yet to materialize in published SE research on OSSD
Overview

• **Identification of symptoms**
  – In what ways does the SE research literature describe OSSD as a homogenous phenomenon?

• **Diagnosis**
  – Under what conditions can the view of OSSD as a homogenous phenomenon be made and maintained over time within the SE research field?

• **Proposed treatment**
  – What can be done to avoid researching OSSD as if it was a homogenous phenomenon?
Materials

• Publication and paper selection
  – Studied OSSD in the context of SE research
  – Searched with keyword ‘open source’ in 6 leading SE journals
  – Total papers found: 120

• Refining paper selection
  – Removed papers:
    • without the entire keyword ‘open source’
    • reporting from design research released as OSS
    • just use OSS datasets
    • opinion pieces
  – Total papers analyzed: 52
Identification of symptoms

How is OSSD described as a homogenous phenomenon?

- Statements about the OSSD model
  - Overgeneralization of salient characteristics
    - Bazaar model / cycle / paradigm of software development
    - Geographically distributed software development
    - Work is not assigned but undertaken
    - There are no plans
    - Is developed by communities of volunteers
    - There being a particular social organization to OSSD
Identification of symptoms

How is OSSD described as a homogenous phenomenon?

• Statements that OSSD is different from SE
  – OSSD different from industrial software development
    • (cathedral vs. bazaar, hacking vs. mechanical forms)
  – OSSD not an engineering method
  – Reversing characteristics of SE
    • SE work is assigned, there is explicit system-level design, there is a project plan, schedule or list of deliverables
Identification of symptoms³

How is OSSD described as a homogenous phenomenon?

• Study claims that OSSD produces superior software
  – Compare OSSD with closed-source software development
Identification of symptoms

How is OSSD described as a homogenous phenomenon?

• Study OSS adoption in commercial context
  – Argue that OSSD is different from commercial OTS and therefore requires a unique approach for evaluation
  – These studies do not challenge the view of OSSD as completely different from SE
Diagnosis

• **Research question**
  – Under what conditions can the view of OSSD as a homogenous phenomenon be made and maintained over time within the SE research field?

• **Approach**:
  – Analysis of individual texts
  – Analysis of SE researchers’ reflecting on what SE research is
Diagnosis: assumptions about SE research

• **Identity of SE**
  – *Goal*: To resolve the software crisis
  – Movement of industry and academic actors to professionalize software development
  – *Approach*: Through the application of systematic, disciplined, and quantifiable approaches to software development

• **OSSD vs. SE**
  – OSSD defies the central claim that professionalizing software development will resolve the software crisis
  – Important to marginalize OSSD to only working in a specific context: geographically distributed volunteers
Diagnosis: assumptions about SE research

- **Prescriptive models**
  - *SE researchers’ identity*: inform SE practitioners on ways to improve practice
  - *SE research focus*: prescriptive models
  - Compared to SE’s prescriptive models, OSSD practice will inevitably seem different
  - SE researchers bypassing the problematic issue that SE research discipline actually knows little about the field they are trying to address: SE in practice
Diagnosis: assumptions about how to do SE research

- **The SE research crisis in the 1990’s**
  - Widening gap between SE research and practice
  - SE research lacking in quality and thereby credibility
  - Very little empirical evidence to support SE claims

- **Out of the crisis**
  - Increased scientific rigor to better validate research claims
  - Increased use of measurement theory and software metrics
Diagnosis: assumptions about how to do SE research

- The problem of comparisons
  - Draw implications across OSS projects
  - Little/no discussions on the comparability of findings
    - How comparable is the defect density of a single user application developed by two OSS developers with a large OSS project?
    - Call for increased multiplicity of research approach
Diagnosis: assumptions about the object of study

- **Case selection**
  - Either study volunteer-based OSSD or adoption of OSSD in commercial context
  - Early descriptions of OSSD turned to prescriptions for choosing instances to study
  - Scientific rigor makes it important to pick “the right” case for validity reasons
Diagnosis: assumptions about the object of study

- **OSS v2.0**
  - Claim: Transformation of phenomenon to a more mainstream, commercially viable form – OSS v2.0
  - Researcher’s focus on community-based OSSD has overshadowed the commercial-ties
  - OSS was conceived by the Linux industry in 1997 to de-politicize free software
Proposed treatment

- The only common characteristic of OSSD is that software product is released under an license compliant with the *Open Source Definition*.

- Be more specific on salient characteristics of OSSD instances
  - Size, community, product
  - Commercial vs. community
  - Geographical distribution
  - Developer demography
Proposed treatment

• How to study OSSD? / implications for method
  – Call for a diversity of approaches
  – In particular detailed studies of the diversity of development practice

• What to study? / implications for case selection
  – Explore the relationship between volunteers and commercial actors
  – Choice of case grounded in salient characteristics of the particular case, rather than as an instance of OSSD