Managing Technical Debt: An Industrial Case Study

Managing Technical Debt Workshop
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Motivation

• Lack of empirical research for practitioners

• Identify best practices regarding Technical Debt (TD)
  – Characterization
  – Consequences
  – Addressing
  – Prioritization
Taxonomy

McConnell

Intentional

Unintentional

Fowler

Reckless

“We don’t have time for design”

Deliberate

Inadvertent

Prudent

“We must ship now and deal with consequences”

“What’s Layering?”

“Now we know how we should have done it”

Rothman

Design Debt  Code Debt  Testing Debt  Defect debt  Documentation debt

Source: Google Images
Cost Estimation

You know it is not my interest to pay the principal, or my principal to pay the interest.
(Richard Brinsley Sheridan)

Nugroho et al
Principal → Repair Effort
Interest → Maintenance Effort

Chin et al
Principal
Recurring interest
Compounding Interest

Curtis et al
Principal
Number of should-fix violations
Hours to fix each violation
Cost of labor.

Source: Google Images
Decision Making

Prioritization techniques [Seaman et al]

- Cost Benefit Analysis approach
- Analytic Hierarchy Process (AHP)
- Portfolio approach
- Options approach

Prioritization factor [Snipes et al]

- Severity
- Existence of a workaround
- Urgency of the fix
- Effort to implement the fix
- Risk of the proposed fix
- Scope of testing required

Decreasing order of importance
Research Questions

• RQ1: How can technical debt be characterized to distinguish the impacts of certain types of debt?

• RQ2: What are the consequences of technical debt on the development process?

• RQ3: How is technical debt addressed?

• RQ4: How can technical debt be prioritized so that the most critical ones are addressed first?
Study Context

- Mid-size industrial partner
- Specializes in communication devices
- Division adopted Scrum in 2012
- 28 Scrum teams
- 2000 employees
- 250 engineers
- In-house training
Potentially Shippable Increment

- **Review**
- **Planning**
- **PSI**
- **Retrospective**
- **Daily Scrum**
- **Release**

Iteration 2 weeks

5 iterations
User Story Color Codes

- Feature
- Planned Defect
- Design Spike
- Automation Debt
- Infrastructure Debt
Data Collection

Phase 1
Duration: 3 days
Observation

Phase 2
Duration: 3 days
Interviews
(Focus: agile adoption)

Phase 3
Duration: 2 days
Online Questionnaire
Interviews
(Focus: technical debt)
## Coding Scheme

<table>
<thead>
<tr>
<th>Codes</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Definition</strong></td>
<td>Words/phrases used to define/describe technical debt</td>
</tr>
<tr>
<td><strong>Categories</strong></td>
<td>Different types of technical debt</td>
</tr>
</tbody>
</table>
| **Causes and Impact** | Causes - Motivations behind incurring technical debt  
                        Impact - Consequences of technical debt |
| **Prioritization**  | Techniques/process to prioritize technical debt                              |
| **Management**      | Tracking/managing/handling technical debt                                   |
Definition & Categories

**Definition**
- Get things out quickly
- Conscious decision
- Create bad software
- Something that will hurt you later

**Categories**
- Code design debt
- Unit testing
- Automation debt, fix defects and bugs
- Test debt, bug debt

**Research Question 1**
How can technical debt be characterized to distinguish the impacts of certain types of debt?
Definition & Categories

Research Question 1
How can technical debt be characterized to distinguish the impacts of certain types of debt?

Management Categories
- Infrastructure Debt
- Automation Debt

Engineers Categories
- Code design debt
- Unit testing
- Automation debt, fix defects and bugs
- Test debt, bug debt
Consequences

• Lack of insights

if [the debt is] not solved for two years, it kills a project

Research Question 2
What are the consequences of technical debt on the development process?
Management

- Dedicated teams for TD reduction
- Teams assign about 20% of PSI time for debt reduction

Research Question 3
How is technical debt addressed?
Prioritization

Customer Requests

Severity of the debt

Research Question 4
How can technical debt be prioritized so that the most critical ones are addressed first?
Limitations

• Study carried out with one partner
  – Development of software for communication devices
  – New to agile

• Researcher bias in the interpretation of results
Conclusion

• Goal: understand how technical debt is characterized, addressed, prioritized and assess its impact

• Results

<table>
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<tr>
<th>Taxonomy</th>
<th>Management</th>
<th>Consequences</th>
<th>Prioritization</th>
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What’s Next

• Focus on consequences of technical debt
  – Investigate appropriate models to assess impact of debt
  – Evaluate risk associated with taking on debt

• Replicate study with industrial partner (as process matures) and other partners
Thank You

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