Developing a Quality Report for Software Maintainability Assessment: An Exploratory Survey

SOFTENG 2016
Pascal Giessler, Manuel Gerster, Michael Gebhart, Roland Steinegger, Sebastian Abeck
Who we are…
iteratec areas of expertise
We feel at home in many areas

**IT Management Consulting**
The most simple and effective way to align business and IT

**Technology Consulting**
Competency that leads to sustainable solutions

**Implementation of IT projects**
Precision thinking leading to appropriate IT solutions

**Collaboration with Universities**
Supporting knowledge exchange, publishing results
A lack of focus at the start of the project as well as changes in the general constraints and the acquisition of knowledge during the project lead to:

„Moving Target“

iteratively enhance the evolving versions until the desired project outcome is achieved
The considered problem…
Problem

Changing requirements or new demands over time

- Software product usually satisfy one or business/user needs
- **BUT**, requirements can change over time due to changing:
  - Market conditions
  - Customer behaviour
  - Business strategy/ orientation

- As a result, software modifications have to be made **fast with low costs**
  - **Important**: Design and develop software products with maintainability in mind

- Unclear: How to analyse and assess the maintainability of a software product?
  - There is no uniform set of quality metrics
  - There are no common quality indicators

*Goal: Analysis and assessment of maintainability of software component*
Context and Environment

SmartCampus

- Collection of functionality for students for supporting their life on the campus of the university
- Examples
  - Find a free working place for students
  - Determine the route to a certain room (lecture hall, library etc.)
- Smart Campus is designed in a service-oriented way
  - Collection of RESTful web services
- User Interface is developed as mobile web application

Goal: Designing a quality report for SmartCampus to derive its maintainability characteristic
Developing a Quality Report for Software Maintainability Assessment: An Exploratory Survey
Developing a quality report for software maintainability assessment

Research Questions

- **Approach**: Conducted explorative study with to answer the following research questions:
  - RQ1: Is quality assessment considered to be important in research and industry?
  - RQ2: Is maintainability considered to be important in research and industry?
  - RQ3: Which information should be part of a quality report for the purpose of software maintainability assessment?
  - RQ4: How important are the given quality report properties?

![Pie charts showing distribution of responses regarding software maintainability assessment in research and industry.](image)
Our study design and the study population…
Study design
Umfrage Online (German only)

Entwicklung eines Qualitätsberichts

1. Wie wichtig ist Ihnen die Entwicklung von qualitativ hochwertiger Software?
   - sehr wichtig
   - wichtig
   - bedingt wichtig
   - weniger wichtig
   - unwichtig

2. Wie wichtig ist Ihnen eine Qualitätsbewertung von bestehender Software (z. B. zur Identifikation von Verbesserungsmöglichkeiten)?
   - sehr wichtig
   - wichtig
   - bedingt wichtig
   - weniger wichtig
   - unwichtig

3. Welche Techniken setzt Ihr Unternehmen/Ihre Institution zur Software-Qualitätssicherung ein?
   - Konformitätsprüfungen
   - Reviews / Audits
   - Software-Metriken
   - Software-Tests
   - Verwendung bestimmter Vorgehensmodelle
   - Weitere Techniken: [Field]

4. Werden in Ihrem Unternehmen/Ihre Institution die im Rahmen der Software-Qualitätssicherung gewonnenen Ergebnisse in Form eines Berichtes dokumentiert?
   - ja
   - nein
   - weiß nicht

5. Haben Sie im Rahmen der Software-Qualitätssicherung (z. B. Review, Audit) bereits einen Qualitätsbericht (*) gelesen oder selbst erstellt?
   (*) Zusammenfassung der Ergebnisse einer Qualitätsanalyse in Form eines Dashboards. Ermöglicht es einer Expertin/einem Experten, eine zuverlässige Aussage über die Qualität der Software zu treffen.
   - ja
   - nein

6. Welche Informationen waren Bestandteil dieses Qualitätsberichts?

- Development of our study in three phases
  - Planning and preparation
  - Initial sketch for the survey
  - Pretest and improvement

- 23 different questions
  - 8 open questions
  - 12 closed questions
  - 3 partially closes questions
Study population
Size of companies/ institutions

Size of companies and institutions of the respondents by the number of employees

- 1-10
- 11-50
- 51-250
- 251-1000
- 1001-10,000
- 10,001-100,000
- > 100,000

Number of years that respondents are working in the domain

- <1
- 1-3
- 3-5
- 5-8
- 8-10
The result of the conducted study…
Research Question 1

Is quality assessment considered to be important (research/industry)?
Research Question 2

Is maintainability considered to be important in research and industry?

![Bar chart showing responses to maintainability importance.

- Very important: Research (40), Industry (15)
- Important: Research (30), Industry (25)
- Partly important: Research (5), Industry (10)
- Less important: Research (2), Industry (5)
- Unimportant: Research (1), Industry (1)]
Research Question 3 (1)
Which information should be part of a quality report [...]?

Industry: n = 23; Research: n = 60

- Quality of Comments
- Understandability of documentation
- Compliance with conventions
- Test coverage
- Application of best practices
- Used technologies

Frequency
Research Question 3 (2)
Which information should be part of a quality report [...]?
Research Question 4
How important are the given quality report properties?

**Configurability**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Very important (1)</th>
<th>Important (2)</th>
<th>Partly important (3)</th>
<th>Less important (4)</th>
<th>Unimportant (5)</th>
<th>Not evaluated</th>
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<tr>
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</table>

**Consistency**

<table>
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<th>Frequency</th>
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</table>
Research Question 4
How important are the given quality report properties?

Correctness

Traceability
Research Question 4
How important are the given quality report properties?

Structuredness

clarity
Research Question 4
How important are the given quality report properties?

**Understandability**

** Completeness

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The derived quality report…
Excerpt of our quality report

Compliance with convention

Amount of compliance violation. \((NOCCV)\)  
\[256\]  
Ratio on compliance violation \((ROCCV)\)  
\[0.14\]  
Most frequent compliance violation \((MFCCV)\)  

<table>
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<th>Rule</th>
<th>Severity</th>
<th># Count</th>
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<tr>
<td>1</td>
<td>Control structures should use curly braces</td>
<td>Blocker</td>
<td>41</td>
</tr>
<tr>
<td>2</td>
<td>Magic numbers should not be used</td>
<td>Blocker</td>
<td>31</td>
</tr>
<tr>
<td>3</td>
<td>Mutable members should not be stored or returned directly</td>
<td>Critical</td>
<td>37</td>
</tr>
<tr>
<td>4</td>
<td>Exception handlers should preserve the original exception</td>
<td>Critical</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Short Variable</td>
<td>Major</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>Empty Line Separator</td>
<td>Major</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>Missing Constructor</td>
<td>Major</td>
<td>24</td>
</tr>
<tr>
<td>8</td>
<td>Member variable visibility should be specified</td>
<td>Major</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>String literals should be placed on the left side when checking for equality</td>
<td>Major</td>
<td>14</td>
</tr>
<tr>
<td>10</td>
<td>Uncommented Empty Constructor</td>
<td>Major</td>
<td>13</td>
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</table>
Conclusion and Outlook…
Conclusion and Outlook

Quality report for software maintainability assessment

- **Conclusion**
  - Quality assessment is considered to be important in research and practice
    - Goal: Identification of areas of improvements
  - Software maintainability is very important for respondents from research and industry
  - There is no uniform set of quality metrics and indicators for a certain quality report
    - Not all of them can be measured automatically e.g. due to the lack of domain knowledge
  - All quality report properties are considered as very important or important
    - Correctness, traceability and understandability (most important)

- **Outlook**
  - Categorization of the identified metrics and indicators
  - Identification of additional metrics and indicators of each category
  - Examination of several tools for static code analysis
    - Hybrid approach that combines automatic and manual analysis
  - Generation of a tool-based quality report
Automation

QA82 Analyzer

![QA82 Analyzer](image-url)
Thank you for your attention

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