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

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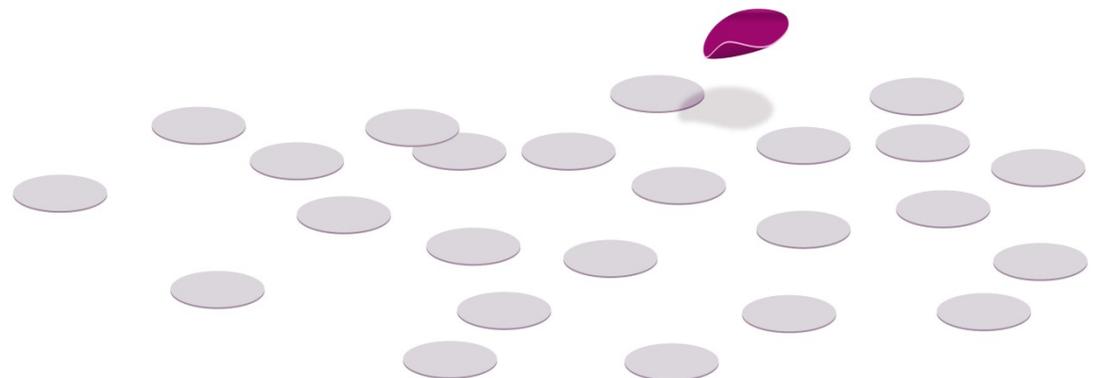
Who we are…

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

Implementation of IT projects

Precision thinking leading to appropriate IT solutions

Technology Consulting

Competency that leads to sustainable solutions

Collaboration with Universities

Supporting knowledge exchange, publishing results

Agile methodology since 1996
iteratec stands for iterative software technologies
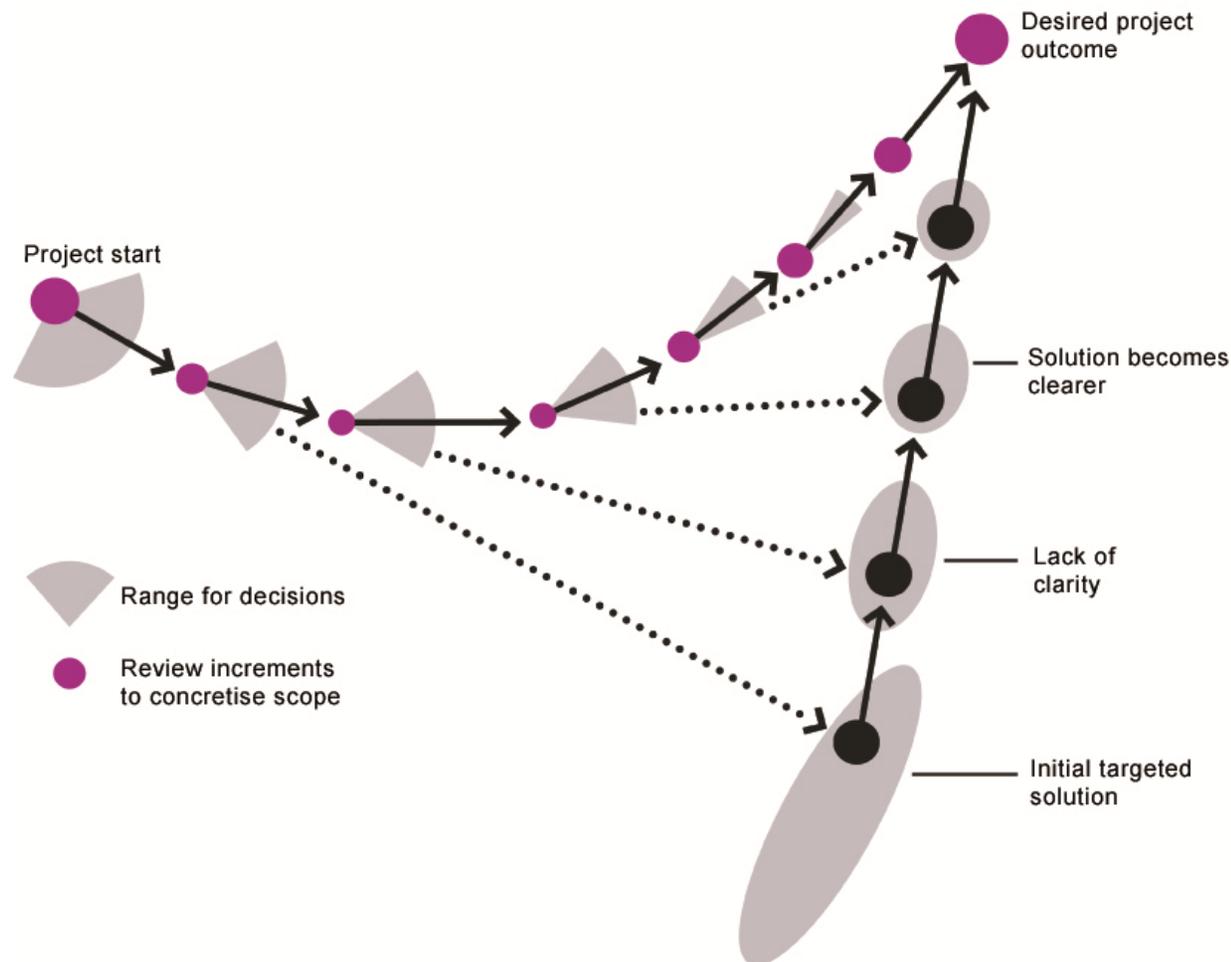
A lack of focus at the start of the project as well as changes in the general constraints and the acquisition of knowledge during the project lead to:

"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 maintainabilty 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

SmartCampus – InfoService (IS)
Architectural design
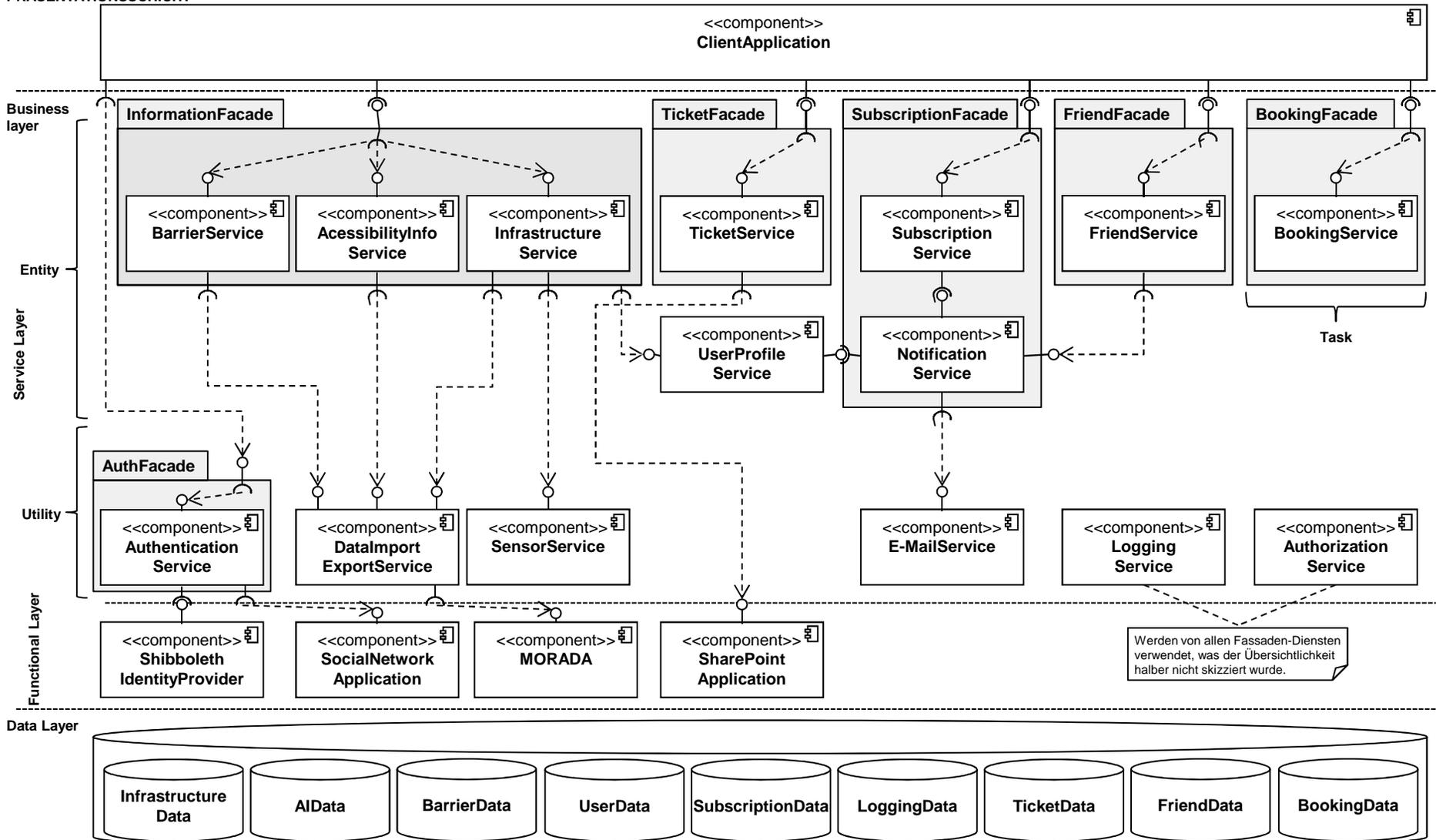
Developing a quality report for software maintainability assessment
## Research Questions

- **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?

Industry

3

1

3

2

18

Research

1

25

60

Only Germany companies and institutions
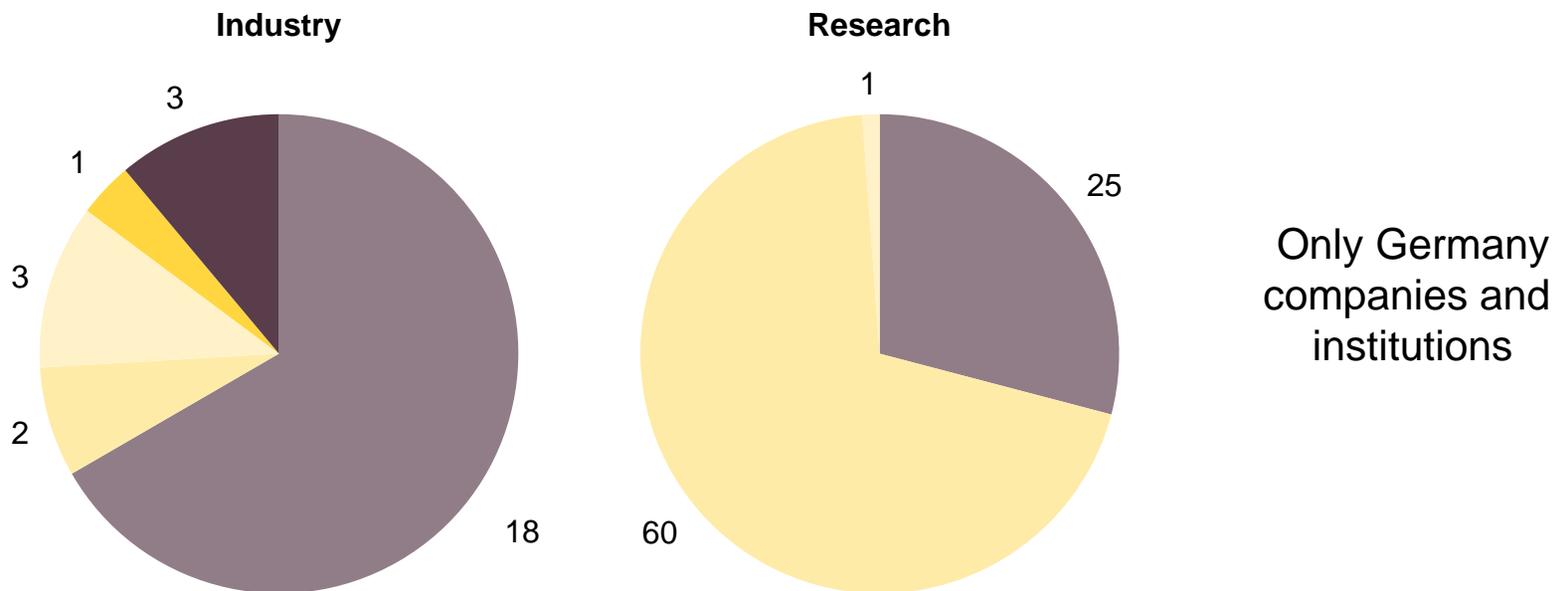
Our study design and the study population…

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?
Falls Ihr Unternehmen/Ihre Institution keine Software-Qualitätssicherung durchführt oder hierfür keine bestimmten Techniken einsetzt, bitte im Feld "Weitere Techniken" folgende Eintragung vornehmen: "KEINE".

☐ Konformitätsprüfungen   ☐ Software-Tests

☐ Reviews / Audits   ☐ Verwendung bestimmter Vorgehensmodelle

☐ Software-Metriken   Weitere Techniken: [_____]

4. Werden in Ihrem Unternehmen/Ihrer 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
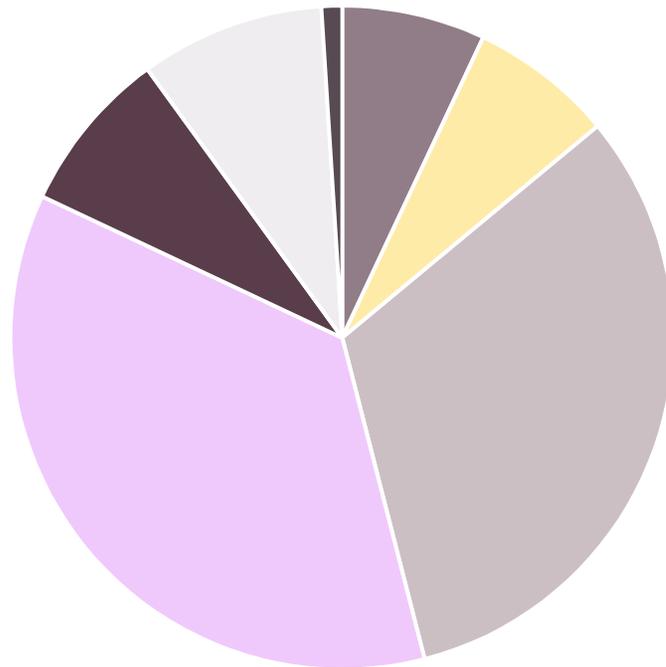
- 1-10
- 11-50
- 51-250
- 251-1000
- 1001-10.000
- 10.001-100.000
- > 100.000

Number of years that respondents are working in the domain
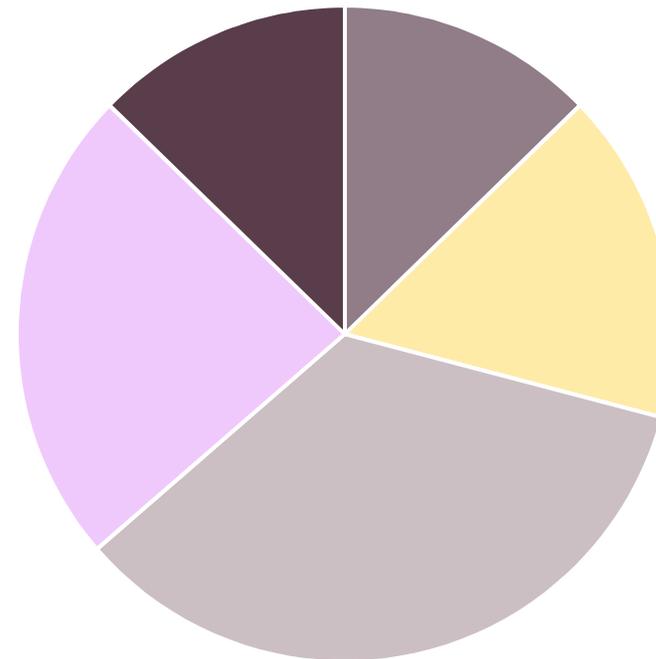
- <1
- 1-3
- 3-5
- 5-8
- 8-10

The result of the conducted study…

Research Question 1

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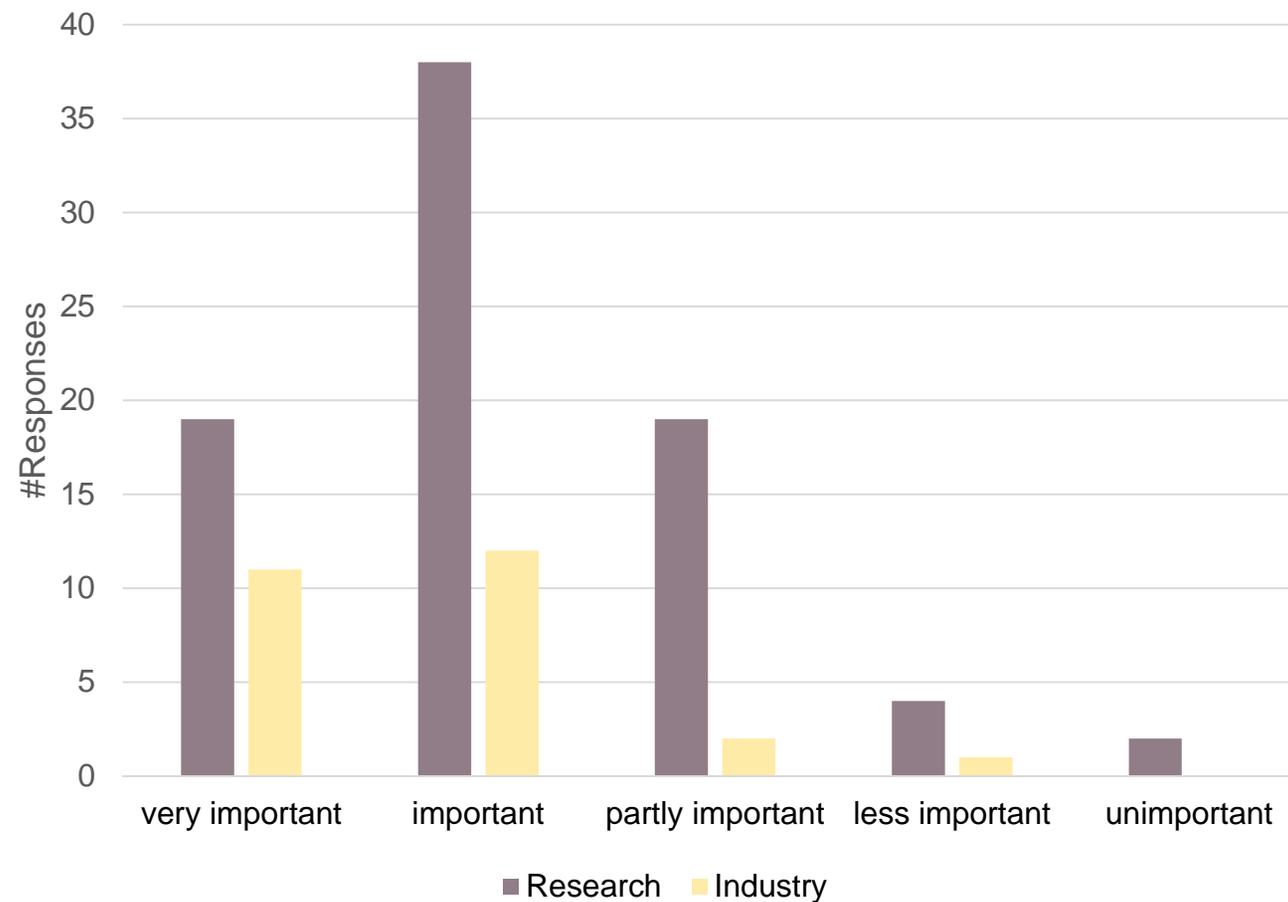
Research Question 2

Is maintainability considered to be important in research and industry?

# Which information should be part of a quality report [...]?

Industry: n = 23; Resarch: n = 60
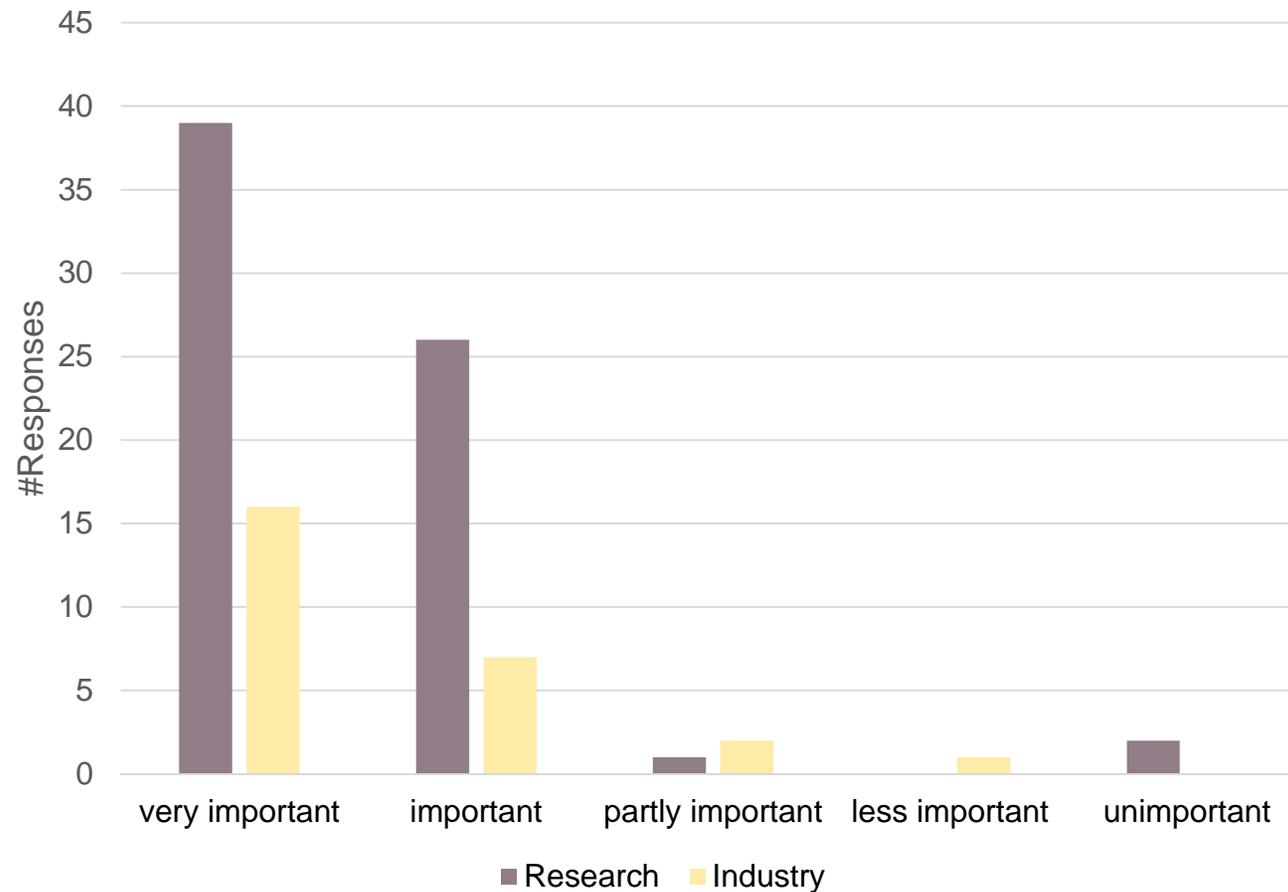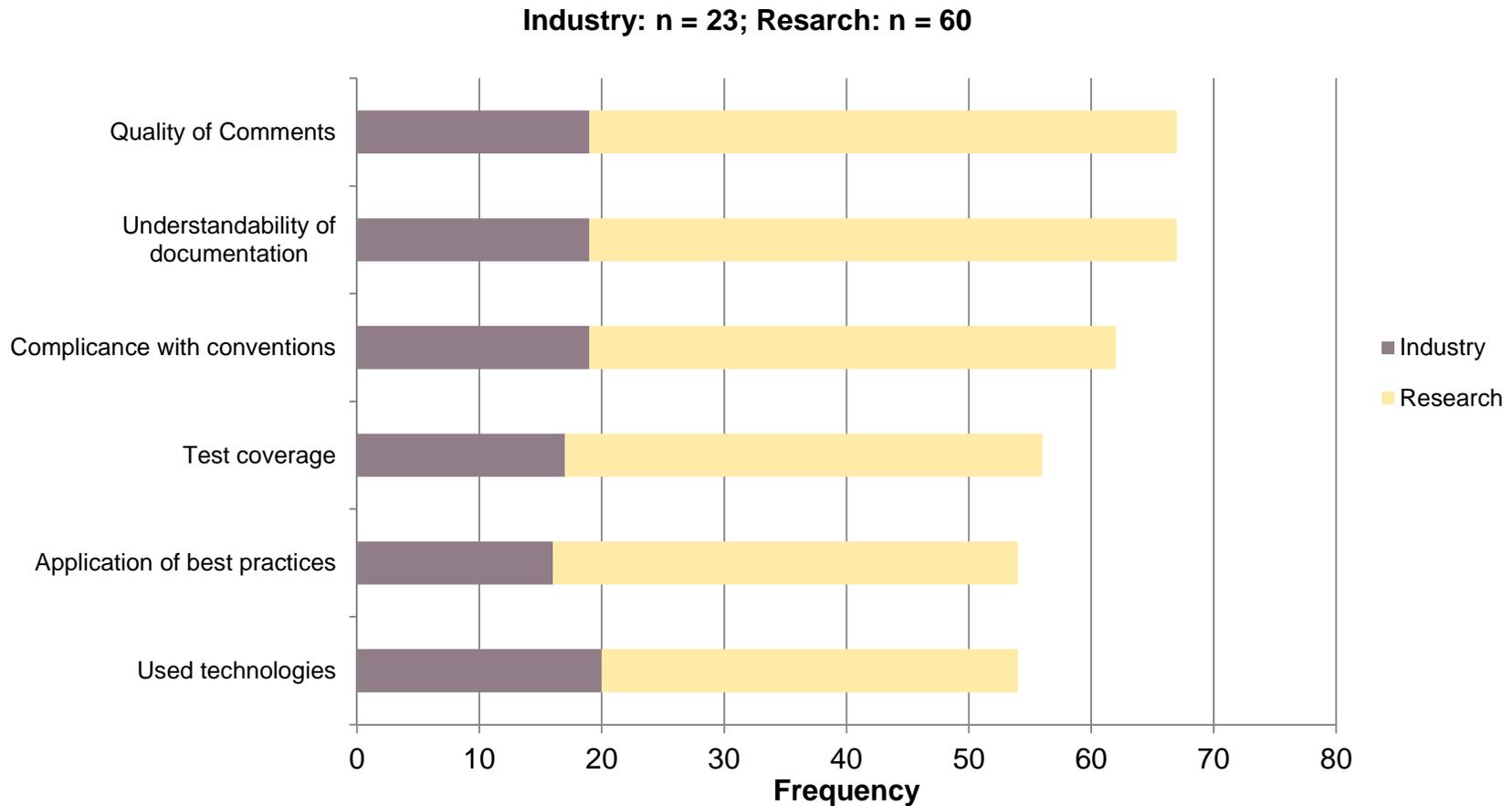
Research Question 3 (2)
Which information should be part of a quality report [...]?
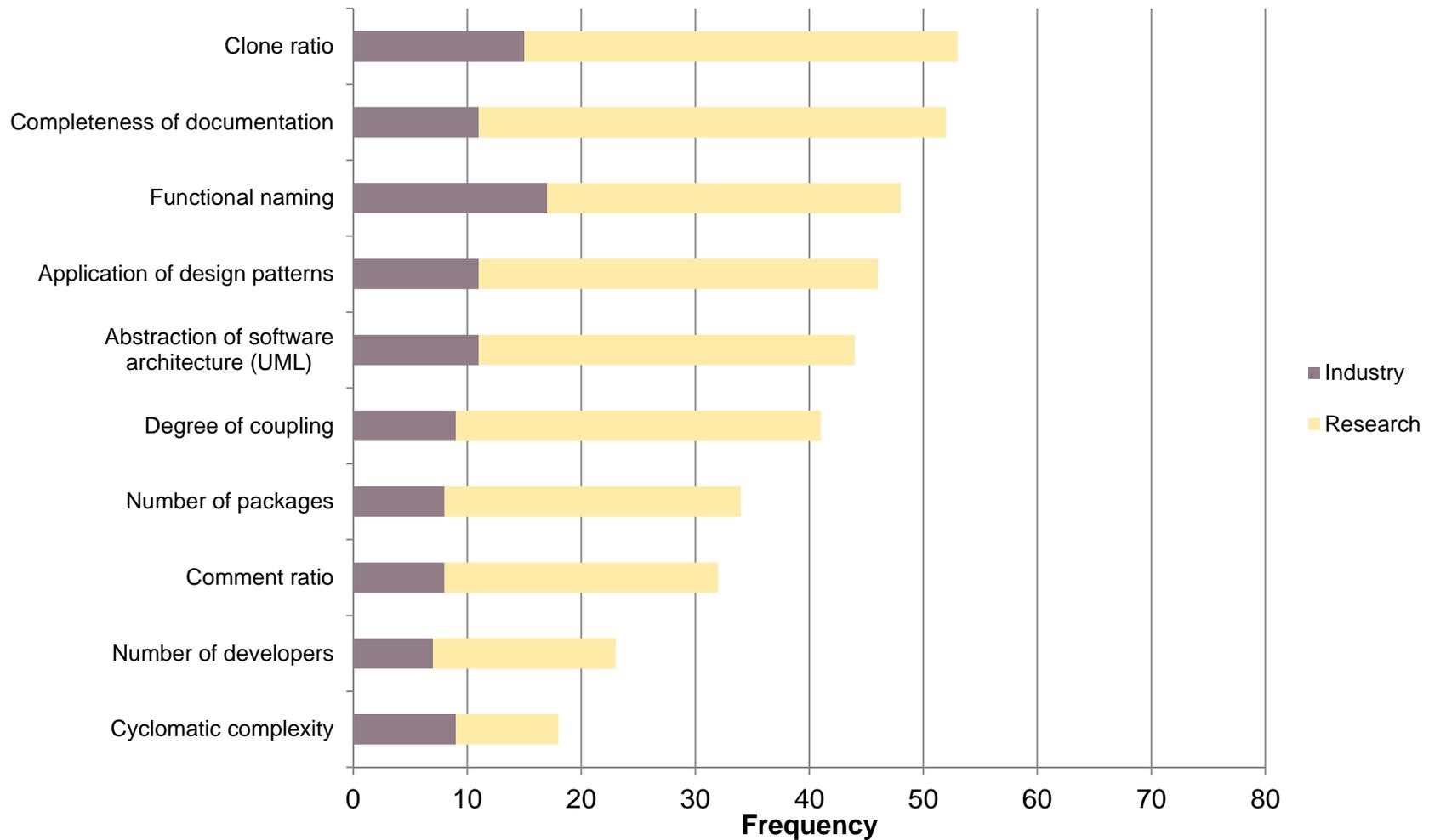
Research Question 4
How important are the given quality report properties?

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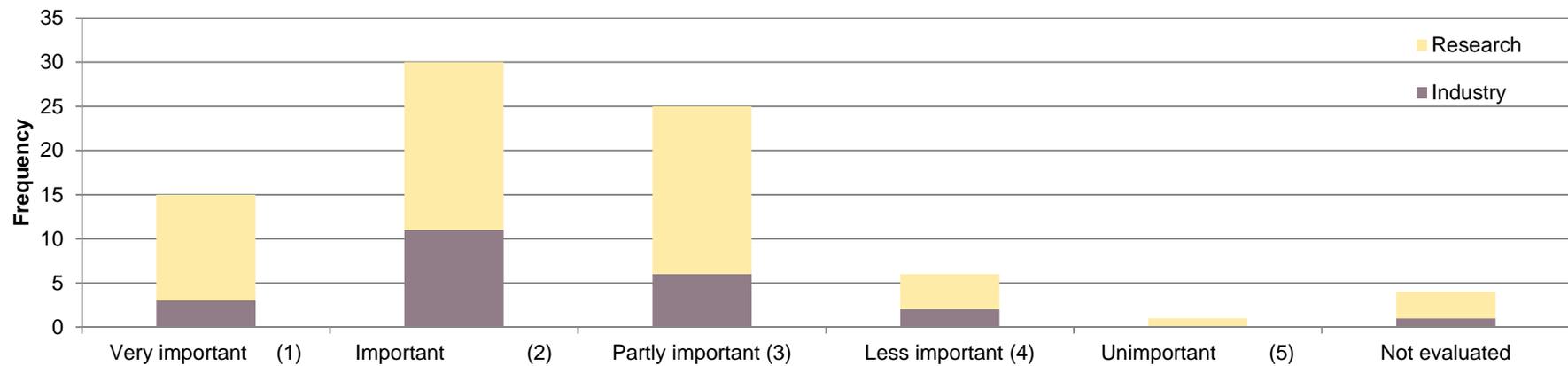
Consistency
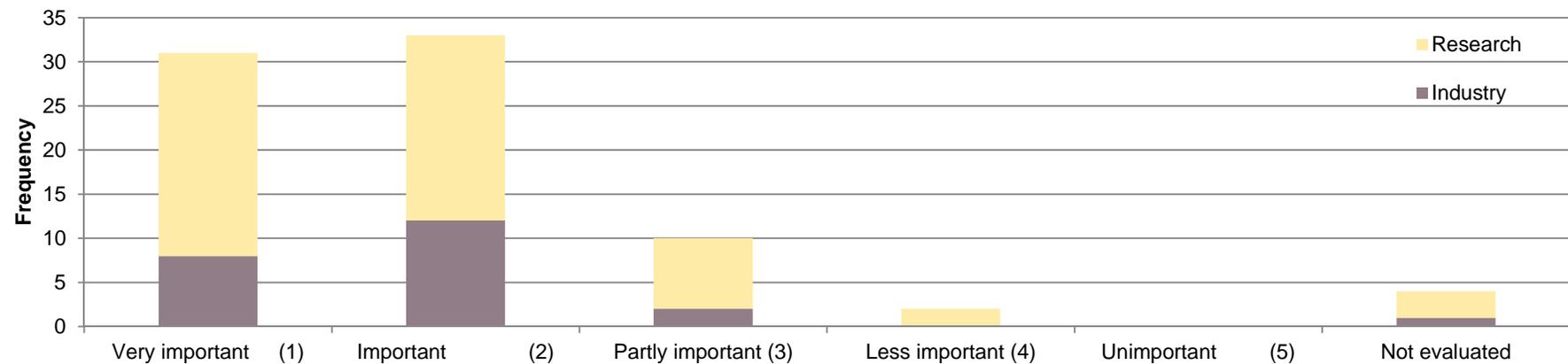
Research Question 4
How important are the given quality report properties?

Correctness
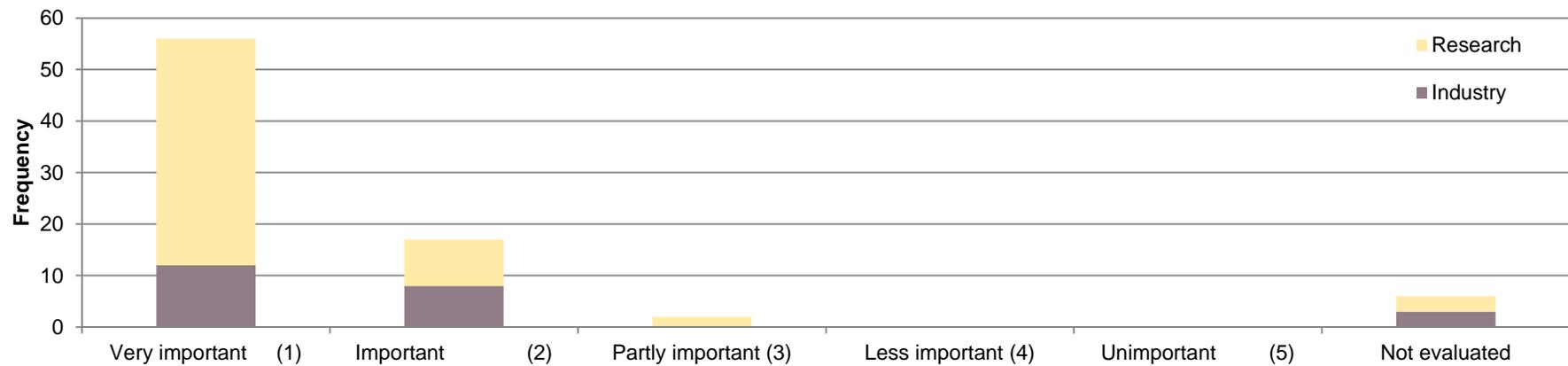
Traceability
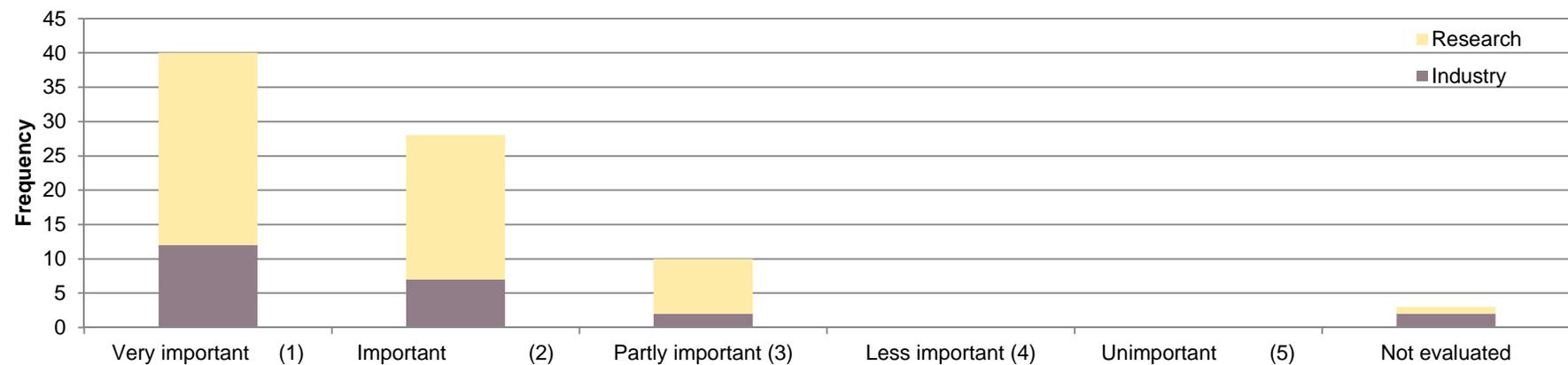
Research Question 4

How important are the given quality report properties?

Structuredness
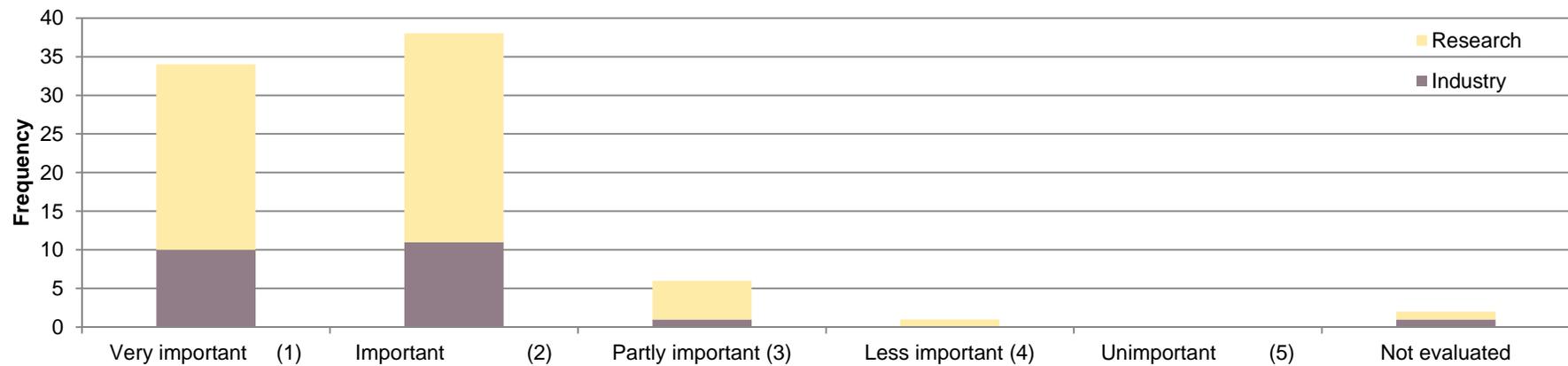
**clarity**
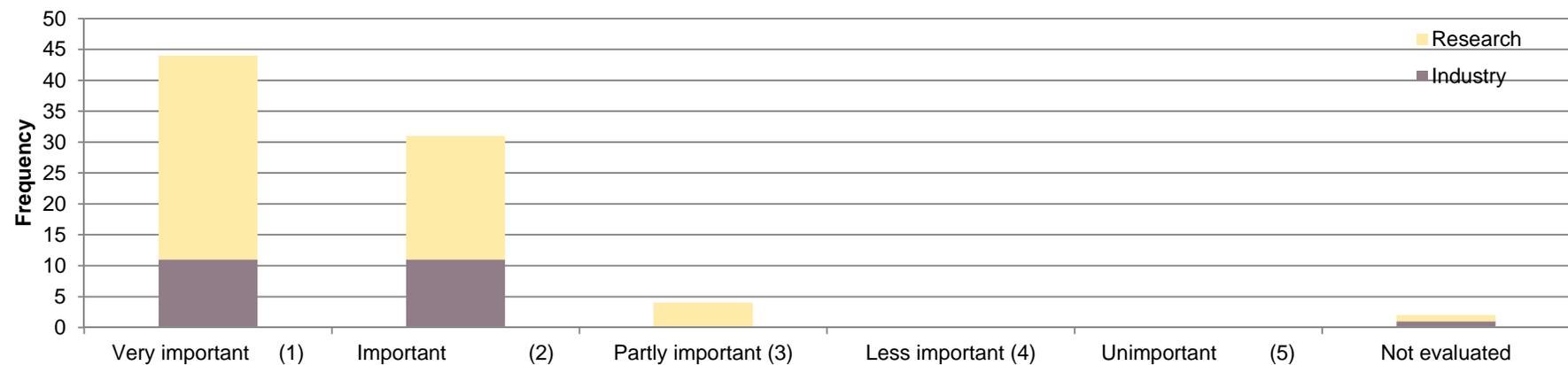
Research Question 4

How important are the given quality report properties?

Understandability
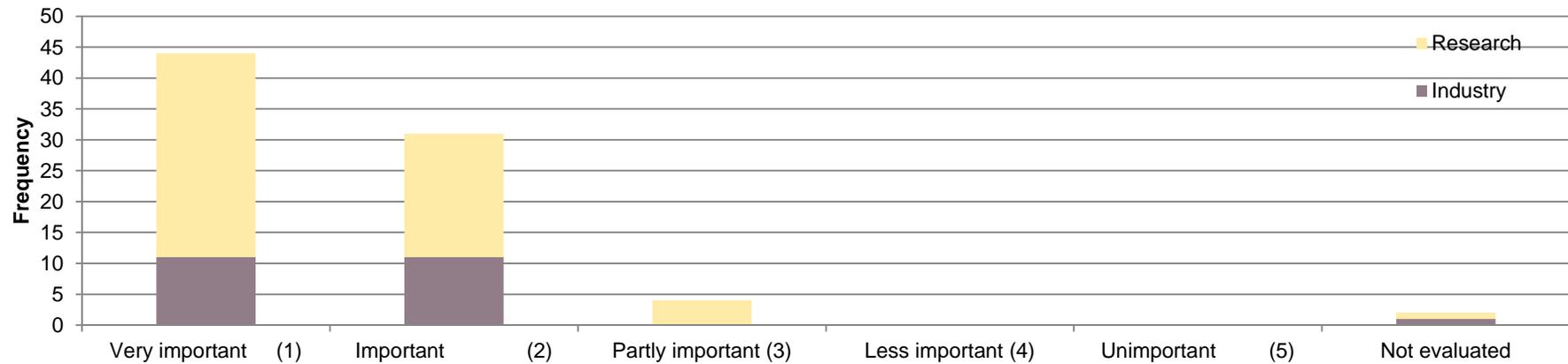
Completeness
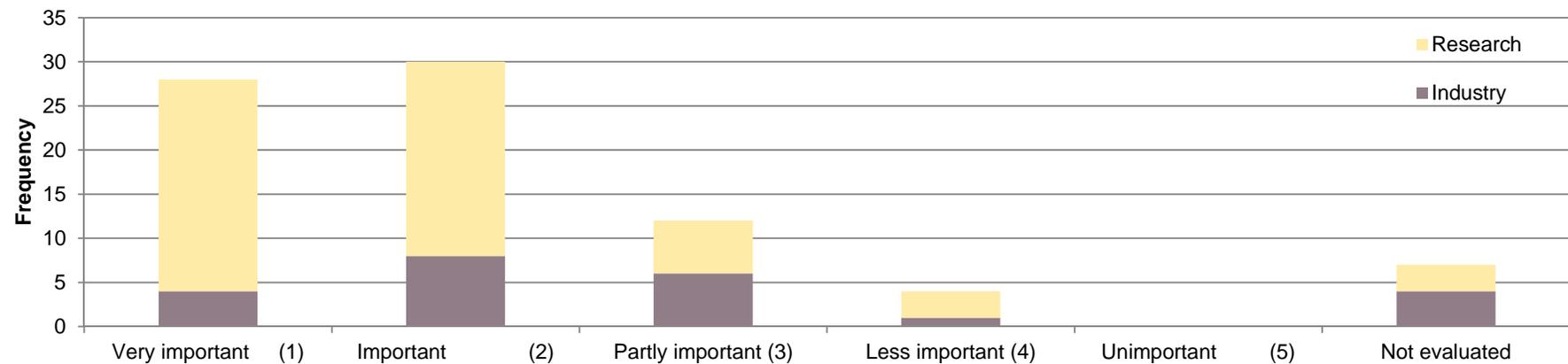
The derived quality report…

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)*   ⓘ   ✖

No	Rule	Severity	# Count
1	Control structures should use curly braces	Blocker	41
2	Magic numbers should not be used	Blocker	31
3	Mutable members should not be stored or returned directly	Critical	37
4	Exception handlers should preserve the original exception	Critical	5
5	Short Variable	Major	25
6	Empty Line Separator	Major	11
7	Missing Constructor	Major	24
8	Member variable visibility should be specified	Major	15
9	String literals should be placed on the left side when checking for equality	Major	14
10	Uncommented Empty Constructor	Major	13

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

Thank you for your attention

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