Naming the Pain in Requirements Engineering  
Design of a Global Family of Surveys and first Results from Germany

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**Requirements Engineering in practice we have experienced**

<table>
<thead>
<tr>
<th>ID</th>
<th>Usability (NFR)</th>
<th>A system component shall save user's edits whenever possible.</th>
</tr>
</thead>
<tbody>
<tr>
<td>010PE01</td>
<td>Performance (NFR)</td>
<td>The perceived response time shall not be too high.</td>
</tr>
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</table>
Requirements Engineering in practice we have investigated

A Case Study on the Application of an Artefact-Based Requirements Engineering Approach

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Heusing Security Requirements Using an Extended Quality Model

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Information and Software Technology

I. INTRODUCTION

Field study on requirements engineering: Investigation of artefacts, project parameters, and execution strategies

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ABSTRACT

Context: Requirements Engineering (RE) is a critical discipline mostly driven by uncertainty, since it is influenced by the customer domain or by the development process model used. Volatile project environments restrict the choice of methods and the decision about which artefacts to produce in RE.

Objective: To investigate RE processes in successful project environments to discover characteristics and strategies that allow us to elaborate RE tailoring approaches in the future.

Method: We perform a field study on a set of projects at one company. First, we investigate by content analysis which RE artefacts were produced in each project and to what extent they were produced. Second, we perform qualitative analysis of semi-structured interviews to discover project parameters that relate to the produced artefacts. Third, we use cluster analysis to infer artefact patterns and probable RE execution strategies, which are the responses to specific project parameters. Fourth, we investigate by statistical tests the effort spent in each strategy in relation to the effort spent in change requests to evaluate the efficiency of execution strategies.

Results: We identified three artefact patterns and corresponding execution strategies. Each strategy covers different project parameters that impact the creation of certain artefacts. The effort analysis shows that the strategies have no significant differences in their effort and efficiency. Conclusions: In contrast to our initial assumption that an increased effort in requirements engineering lowers the probability of change requests or project failures in general, our results show no statistically significant difference between the efficiency of the strategies. In addition, it turned out that many parameters considered as the main causes for project failures can be successfully handled. Hence, practitioners can apply the artefact patterns and related project parameters to tailor the RE process according to individual project characteristics.

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Problem Statement

- Investigations in RE **remain isolated**
- **Generalisations difficult** as no (grounded) empirical survey basis available
  ➔ **Continuous replications** necessary to steer (problem-driven) research
Basic idea: Internationally distributed collaboration
Objectives

Establishment of an **open and generalisable** survey basis for RE

„Naming the Pain in Requirements Engineering“ (NaPiRE)

- Expectations and status quo in RE
- Problems and needs in RE

Approach: **Structured family of surveys**

1. Yearly **collaborative instrument design**
2. Yearly **independent surveys** in different countries
3. Yearly **collaborative synthesis and publication**

Principles

- **Openness** and transparency
- **Anonymity**, but closed
- Instrument based on **theory and expectations**

[www.re-survey.org](http://www.re-survey.org) (coming soon)
Our approach

**Preparation**
- Conceptualisation of research questions
- Initial creation of questionnaire
- Presentation & discussions at communities

**Validation**
- Internal validation
- Implementation / correction
- External validation
- Industrial pilot

**Initiation**
- Creation distribution list
- Invitation
- First interpretation
- Data analysis & interpretation
- Baseline Report
- Replication Report
- Synthesis & reporting

**International Replication**
- Creation distribution list
- Invitation
- Data analysis & interpretation

**International Communities**
- ISERN '12
- EESEMMod (MoDELS '12)
- EASE '13
- Replication Report
- Synthesis Survey Report

**Online Survey**
- Creation distribution list
- Invitation
- Data analysis & interpretation

**Data Analysis & Interpretation**
- Planning
- Replication
- Global Replication
- Synthesis & reporting

**Spreadsheet**
- Dissemination
- Creation distribution list
- Invitation
- Data analysis & interpretation

**Germany**
- Conceptualisation of research questions
- Implementation / correction
-Synthesis & reporting

**Yearly RE Community Report**
- PROMISE Repository
Our approach

We are here...

Actually, we are reaching this point...

**Summary**

For many years, we have observed industry struggling to define a high quality, maintainable requirements engineering (RE) and maintenance, which results in industrial replications and problems. Although we are investigating the discipline with a plethora of empirical studies, these studies either concern on validating specific methods or on single companies or countries. Therefore, they allow for limited empirical generalisations.

**Objective**

The objective of this study is to compare the state of the practice in RE in Germany with the results of an international survey on software practitioners in industry. The survey was conducted to gather insights on the current status of RE practices in Germany and to identify areas for improvement.

**Method**

The survey was conducted via an online questionnaire distributed to a sample of German software practitioners. The questionnaire was designed to assess the current state of RE practices in Germany and to identify potential gaps or areas for improvement. The survey questions were based on a structured framework that covered various aspects of RE, including requirements elicitation, specification, validation, and management.

**Results**

The survey results showed that RE practices in Germany are generally comparable to those in other countries. However, there were some notable differences, particularly in the areas of requirements elicitation and specification. The survey also revealed a number of challenges faced by German software practitioners, such as the lack of structured methods, inadequate tools, and insufficient training.

**Conclusion**

The results suggest that the survey design and data collection methods are well-suited to be replicated and, thereby, to create a generalisable empirical basis of RE in practice.
Instrument for NaPiRE - 2013

Research questions

1. What are the expectations on a good RE?
2. How is RE defined, applied, and controlled?
3. How is RE continuously improved?
4. Which contemporary problems exist in RE, and how do they manifest themselves in the process?

• Theory of expectations based on available surveys
• Questionnaire with 35 questions
  • Closed and open questions
  • Implemented via the Enterprise Feedback Suite
• Available at www.re-survey.org (soon)
• Invitation of participants from existing research co-operations
First NaPiRE results from Germany

Study population

- German companies only
- Response rate: 55% (105 invitations, 78 participants, 58 completed questionnaires)

General characteristics

- Most respondents in large enterprise (median: 251-500 employees)
- Most respondents work in globally distributed settings (97%)
- 80% of respondents with more than 3 years of experience
- 19% customer role, 47% role of contractor, 38% product development

Main business area

<table>
<thead>
<tr>
<th>Service</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Custom software development</td>
<td>36%</td>
</tr>
<tr>
<td>IT consulting</td>
<td>36%</td>
</tr>
<tr>
<td>Project management consulting</td>
<td>35%</td>
</tr>
<tr>
<td>Software process consulting</td>
<td>31%</td>
</tr>
<tr>
<td>Standard software development</td>
<td>28%</td>
</tr>
<tr>
<td>Embedded software development</td>
<td>7%</td>
</tr>
</tbody>
</table>
First NaPiRE results from Germany

**RQ 1: Expectations on good RE**

**What do you see as a barrier for an RE reference model?**

<table>
<thead>
<tr>
<th>I disagree</th>
<th>Neutral</th>
<th>I agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing willingness for change</td>
<td><img src="Image" alt="Bar Chart" /></td>
<td><img src="Image" alt="Bar Chart" /></td>
</tr>
<tr>
<td>Higher process complexity</td>
<td><img src="Image" alt="Bar Chart" /></td>
<td><img src="Image" alt="Bar Chart" /></td>
</tr>
<tr>
<td>Higher communication demand</td>
<td><img src="Image" alt="Bar Chart" /></td>
<td><img src="Image" alt="Bar Chart" /></td>
</tr>
<tr>
<td>Missing possibility for standardisation</td>
<td><img src="Image" alt="Bar Chart" /></td>
<td><img src="Image" alt="Bar Chart" /></td>
</tr>
<tr>
<td>Lower efficiency</td>
<td><img src="Image" alt="Bar Chart" /></td>
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</table>

**Top rated answers in follow-up questions**

- RE improvement considered as most beneficial and most challenging
- Important for RE reference model: Support for agility and guidance for tailoring
- Biggest motivation for RE reference model: QA of artefacts
First NaPiRE results from Germany

RQ 2: Status quo in RE

How do you elicit your requirements?

- Workshops
- Change Requests
- Agile approaches
- Prototyping
- Other

Top rated answers in follow-up questions

- Motivation for reference model: Company-specific demands (64%)
- Tailoring: By project lead based on experiences (62%)
- Control: Constructive quality assurance (53%)
First NaPiRE results from Germany

RQ 3: Status quo in RE improvement

No prescriptive RE improvement

“I am not convinced of the benefits of external standards.”
First NaPiRE results from Germany

RQ 4: Contemporary problems in projects

- Interpretation: Need for agility?

- Interpretation: Need for artefact definition and QA?

Overall frequency
Cause for project failure

Incomplete/hidden reqs. 31
Moving targets 22
Time boxing 22
Separation reqs. from solutions 20
Under-specified reqs. 16
Communication flaws to customer 16
Communication flaws in team 13
Inconsistent reqs. 13
Communication flaws in team 12
Missing traceability 11
Gold plating 11
Unclear non-functional reqs. 9
Terminological problems 9
Insufficient support by customer 8
Unclear responsibilities 8
Volatile domain 5
Weak access to customer needs 3
Insufficient support by project lead 3
Technically unfeasible reqs. 3
Innovation vs. formal acceptance 2
Weak relationship to customer 2
Weak domain knowledge 2
Weak domain knowledge 1
Summary and future work

Summary of results

• Design of family of RE surveys
  – Collaborative design of instrument
  – Establishment of infrastructure
• First results from Germany (completed)
• First replication in Netherlands (ongoing)

Next steps planned for ISERN 2013

• Synthesis of studies, publication, and disclosure of data to PROMISE repository
• Organisation of thematic workshop
  – Adjust instrument
  – Define process for replications
  – Provide infrastructure
You are cordially invited to join us!

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