On the Value of Essence to Software Engineering Research: A Preliminary Study

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Overview of Presentation

1. Background: Essence and Empirical Research
2. Essence As Framework for Empirical Research
3. Experiences Applying Essence as Framework
4. Conclusions and Future Work
Motivation for Writing Paper

Is Essence a/the bridge?
What are the issues in research?
Does Essence provide any value?
Issues in Software Engineering Empirical Research

• Software engineering research is more advocacy than validation. Empirical research is important (Glass)
  • Applies to SEMAT Essence too!
• However, there is no accepted framework for reporting findings – what to include/exclude/emphasize
  • Difficult to report results
  • Difficult to compare results from different authors
  • Difficult to generalize (in general or for the reader)
• References
  • Dyba˚ and Dingsøyr (2008)
  • Jedlitschka, Ciolkowski, and Pfahl, (2008)
  • Petersen and Wohlin (2009)
  • Feldt and Magazinius (2010)
  • Murphy-Hill and Williams (2012)
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What to Describe?

- What do we want to describe? Amongst other things:
  - Case study context
  - The solution: when is it applicable (it’s sweet spot)
  - Reader’s context

Concepts:
1. Comprehensiveness
   - How well we describe
   - How much we know
2. Distance (Applicability)
   - How close are the contexts

Blind spot?
Describing is modeling. Models give information a structure.

We need a domain specific model.

- Essence provides a software engineering model
  - Comprehensive
  - Model based
    - Object oriented
  - State-based
  - Extensible
Augmenting Essence with Properties of Interest

- Essence Objects (e.g. Alphas)

  - Team
    - size
    - experience
    - organization

  - Software System
    - size
    - complexity

  - Team-Software System
    - Ownership

- Essence Object States (i.e. Alpha States)

  Conceived → Bounded → Coherent → Acceptable → Addressed → Fulfilled

  Measures
  - work-in-progress
  - Backlog size
  - Value added effort
  - Non-value added effort
  - Waiting time
Analysis: Comprehensiveness and Distance

- Context (of Case Study, Solution, Reader) Description

\[ P_{E\text{Web}} = \{ \text{Team-size: 3, Team-experience: student,} \]
\[ \quad \text{Team-distribution: co-located,} \]
\[ \quad \text{Software System-technology: web } \} \]

- Comprehensiveness (wrt some dimension)

\[ C_{\text{Essence}}(P_{E\text{Web}}) = 4 \]
\[ C_{\text{Team}}(P_{E\text{Web}}) = 3 \]
\[ C_{\text{Stakeholders}}(P_{E\text{Web}}) = 0 \]

\[ C_{\text{Team}}(P_{E\text{Web}}) \in \text{strong} \]
\[ C_{\text{Stakeholders}}(P_{E\text{Web}}) \in \text{weak} \]

- Distance (between Practice A, and Case Study)

\[ P_A = \{ \text{Team-size: small, Team-distribution: co-located,} \]
\[ \quad \text{Software System-technology: web} \} \]

\[ D_{\text{Team}}(P_A, P_{E\text{Web}}) \in \text{near} \]
\[ D_{\text{Stakeholders}}(P_A, P_{E\text{Web}}) \in ? \]
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Two Ways to Conduct Research

• Approach #1
  • Select a case study, hypotheses, etc.
  • Observe and evaluate.
  • Report using Essence as a framework
• Approach #2
  • Take existing empirical research
  • Re-write report/evaluation using Essence
• We chose #2
  • Implication: existing empirical research must have some level of credibility and rigor – Where to find them?
Empirical Studies of Agile Software Development

• Dyba˚ and Dingsøyr, "Empirical studies of agile software development: A systematic review." (2009)
• Searched for empirical studies up to 2005, inclusive.
• Identified 1996 studies from the literature
• 33 were found to be research studies of acceptable rigor, credibility, relevance, and were primary studies.
Selected Case Study: Its Objective

- Juha Koskela and Pekka Abrahamsson, “On-site customer in an XP project: empirical results from a case study”
- Objective of case study:
  - “Many authors claim that on-site customer involvement is often difficult to realize or even unrealistic due to the required customer work effort. “ assess whether the role of the customer representative is too demanding in an extreme programming (XP) environment.
  - This study was conducted in a university setting with students (as team) and staff (as customer).
Selected Case Study: Its Conclusion

- Juha Koskela and Pekka Abrahamsson, “On-site customer in an XP project: empirical results from a case study”
- Conclusion:
  - Customer was present with the team 83% of his time
  - Only 21% was actually working with the team
- Remarks:
  - The developed solution had not been used as actively as intended.
  - The reason for this can be attributed to the relatively poor usability of the system.
  - It suggested that the customer needed to invest in user-centered design (UCD) to address this issue.
Re-Describing and Re-Analyzing the Case Study

- Steps to Report Empirical Research

1. Describe Formulation
2. Describe Research Context
3. Describe Research Execution
4. Analyze and Draw Conclusions

“many authors claim that on-site customer involvement is often difficult to realize or even unrealistic due to the required customer work effort. “

What does customer involvement involves?
What else does the customer need to do to ensure success (quality, etc.)?
Case Study Research Formulation

• What are the properties (quantities, variables) of interest?
4.1 Research setting

A team of four developers was acquired to implement an intranet application (called eXpert) for managing the research data obtained over years at a Finnish research institute. The four developers were 5-6th year university students with 1 to 4 years of industrial experience in software development. Team members were well-versed in the Java programming language and object-oriented analysis and design approaches. Two weeks prior to project launch the team performed a self-study by studying two basic books on XP [i.e., 2, 3]. A two day hands-on training on XP practices, the development environment and software configuration management (SCM) was organized to ensure that the team has a basic understanding on XP issues and the technical environment. Development environment (http://www.eclipse.org), which is an open source software engineering tool manufacturers. The project's SCM tool and JUnit testing and JUnit are integrated as a default written in Java and JSP (JavaServer Page) storing the data of links. In addition, used because it implements JSP 1.2 standard.

The team worked in a co-located office (first author) shared the same office space and workstations were organized literature to support efficient teamwork.
Case Study’s Execution (Traditional versus Essence)

<table>
<thead>
<tr>
<th>Collected data</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calendar time (weeks)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0.4</td>
<td>8.4</td>
</tr>
<tr>
<td>Total work effort (h)</td>
<td>195</td>
<td>190</td>
<td>192</td>
<td>111</td>
<td>96</td>
<td>36</td>
<td>820</td>
</tr>
<tr>
<td># User stories implemented</td>
<td>5</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>34</td>
</tr>
<tr>
<td># Tasks defined</td>
<td>10</td>
<td>30</td>
<td>18</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2. Background information of eXpert project.

Fig. 2. Actual customer involvement.
Case Study Analysis

Did the study capture properties (quantities, variables) of interest?
Case Study Analysis

\[ D(E_{\text{Case-Study}}, P_{\text{Agile}}) \in \text{near} \land E_{\text{Case-Study}} + S_{\text{Agile}} \rightarrow \text{Good-Results} \]

\[
C_{\text{Software System}}\left( P_{E_{\text{Case-Study}}} \right) \in \text{strong}
\]

Things that Stakeholders have to do

\[
C_{\text{Stakeholders}}\left( P_{E_{\text{Case-Study}}} \right) \in \text{weak}
\]

Requirements churn

\[
D(E_{\text{Case-Study}}, E_{\text{Agile}}) \in \text{near} \, ?
\]

\[
D_{\text{Team}}\left( E_{\text{Case-Study}}, P_{\text{Agile}} \right) \in \text{near} \, ?
\]

\[
D_{\text{Stakeholders}}\left( E_{\text{Case-Study}}, P_{\text{Agile}} \right) \in \text{near} \, ?
\]
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Prologue

• Software process (method) is software too

Leon Osterwell 1987

• When developing software

Software System (with bug) → Naïve Team → Fix bug → Software System (with other bugs)

Need better understanding of software system (design/architecture/principles/etc.)

• When using a method (way of working)

Way of Working (with issues) → Naïve Team → Fix issue → Way of Working (with other issues)

Need better understanding of way of working (context/practices/etc.,)
Conclusions

• A (description and analysis) framework is useful
  • Something like Essence can provide such a framework
  • Something like Essence can uncover blind spots
• Perhaps, you can use Essence as a framework in empirical research – as domain and analysis model
Future Work

• An orthogonal set of properties of interest for alphas and relationships, states, etc.
• Some reasoning (logic) calculus to help decide which practice to use, and evaluate (predict) the effect