

## **EPICAL 2011: Workshop on Empirical Research in Requirements Engineering: Challenges and Solutions**

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### **1 Technical Program**

The EPICAL workshop took place as a half-day workshop on the 31 March 2011 and gathered 14 attendees. The workshop's program featured:

- *Kurt Schneider*: Empirical Methods in RE: Purposes and Pitfalls (Key Note Presentation)
- *Marcus Keutel, Werner Mellis*: An In-depth Interpretive Case Study in IS Requirements Engineering Research: Experiences and Recommendations (Paper presentation)
- Expert Panel with the Panelists:
  - *Joerg Doerr*, Fraunhofer IESE and University of Kaiserslautern, Germany, and
  - *Nazim Madhavji*, University of Western Ontario, Canada.

### **2 Motivation and Goals**

Collective efforts of requirements engineering (RE) practitioners, consultants and researchers have yielded a huge variety of solutions for improving requirements processes and artifacts. While it is generally known that the suitability and effectiveness of most of these solutions is contingent to the context in which they are applied, the body of empirical studies that investigate which RE technique is better for which context, is relatively small (Cheng & Attlee, 2007). With few exceptions, little has been done to systematically aggregate the empirical evidence that can possibly confirm or disconfirm the claims of effectiveness of different commercially viable RE approaches that solve particular RE process-related or, product-related, problems. The RE community acknowledges that carrying out empirical research in RE is hard and even, harder compared to other software engineering sub-disciplines, as RE resides in the problem space, while the other sub-fields are focused on the solution space. This workshop called for the explicit discussion on the challenges in setting up good quality RE research designs and promotes the position that for RE research to yield empirically grounded claims, RE approaches need to be systematically assessed by using empirical research methods, e.g. case studies, experiments, action research.

The primary goal of this workshop is to create a forum and a community to debate the need for, the value of, and the challenges in using empirical approaches to researching aspects of RE processes and products. The long-term targeted outcomes are a preliminary agenda for conducting empirical research in RE, and a plan for establishing a forum for exchange of ideas, research designs and research results within the RE community.

We invite readers to review our web site for further information:  
<https://sites.google.com/site/epical2010/>

### 3 Targeted Audience

EPICAL's long term vision is to bring together practitioners and researchers to debate on the research methods suitable in RE, the criteria for judging RE research outcomes, and the implications of choosing particular research designs for the validity of the obtained results. The workshop organizers are committed to provide opportunities for RE practitioners to learn about how to judge the trustworthiness of the current results of RE evaluation research and how to evaluate RE methods themselves. To researchers, the workshop provides a forum to discuss ideas on how to prepare, execute and interpret empirical studies about the effectiveness of RE approaches, and how to generalize from evaluation studies about a specific approach. The workshop is highly interactive in nature.

### 4 Program Committee

Dan Berry	University of Waterloo, Canada
Jane Cleland-Huang	DePaul University, USA
Daniela Damian	University of Victoria, Canada
Joerg Doerr	Fraunhofer IESE & University of Kaiserslautern, Germany
Olly Gotel	Independent Researcher, New York City, USA
Mahmood Niazi	Keele University, UK
Barbara Paech	University Heidelberg, Germany
Oscar Pastor	University of Valencia, Spain
Bjoern Regnell	Lund University, Sweden
Camille Salinesi	Université Paris 1 Panthéon Sorbonne
Pete Sawyer	Lancaster University, United Kingdom
Kurt Schneider	Leibniz University Hannover, Germany
Inge van der Weer	University of Utrecht, Netherlands
Roel Wieringa	University Twente, Netherlands

## **5 Key Note Presentation: Empirical Methods in RE - Purposes and Pitfalls, by Kurt Schneider**

This key note talk offers a reflection of the following questions that are confronting empirical RE researchers in their studies:

- What are the objectives and results of empirical research methods – especially in requirements engineering?
- What are the pitfalls of empirical research?
- What happens if empirical research is not done?
- What are Best Practices for empirical research?

The talk recommends a number of good practices that researchers could possibly integrate in their research designs and execution plans for their studies:

- Clearly define the purpose of your research effort. Can you achieve it?
- Use threats to validity to guide your experiment design.
- Plan down to the measurement sheet.
- Be prepared for the unexpected.
- Start with a broad claim and add deep details.
- Argue and extrapolate modestly.
- Know your limits. Do not lie!
- Interviews are cheap and weak. What people say they do is not always what they really do.
- Rigour versus relevance: Don't waste time.
- Document your expectations, e.g. using the Goal-Question-Metrics method.
- Don't be afraid of empirical research. It is fun, too!

## **6 Expert Panel**

The EPICAL workshop featured a panel with two experts:

- Joerg Doerr, Fraunhofer IESE and University of Kaiserslautern, Germany
- Nazim Madhavji, University of Western Ontario, Canada

The panel included two parts. First, short presentations of the positions of the participating experts regarding the following two questions:

1. What makes empirical research in RE difficult and different from other empirical studies? What turns the replication difficult?
2. How to generalize from evaluation studies in RE?

Joerg Doerr claimed that carrying out empirical research for RE is not more difficult than empirical research in other software engineering fields. One challenge for research is that RE involves both many technical and non-technical roles. Furthermore, RE is domain-specific and domain knowledge is critical in doing good RE work. Before executing RE research, one should identify those context factors that really matter – among the many which are there in practice. In the RE community, experiments have become a prominent RE research technique. The

main advantage of student experiments is that the students are available and motivated. However, as RE in practice is not done by novices, but by experts, results of student experiments are not valid for practice. This threat is unique to RE, as opposed to some other downstream software engineering phases, for example coding (where a final year master student would behave as a first year software programmer). Experiments should involve senior practitioners. And empirical papers (and events) should be promoted at conferences.

Nazim Madhavji sees the following challenges in empirical RE research: There are only few RE metrics. RE is much focused on modelling and tool development, less on empirical work. RE is human/ stakeholder-centered, and therefore necessitates the application of research techniques from the areas of social-sciences and qualitative research. Measurement tools and guidelines for questionnaires from social sciences should be used where appropriate. Furthermore, a critical mass of researchers and role models are scarce. Lack of time from RE practitioners also is a problem for RE empiricists. Requirements from real-life projects are confidential, so they may not be publishable and it is also difficult for researchers to get access to them. Student projects are not well generalizable, though they are useful as exploratory studies and for initial insights. What makes replication generally difficult is that RE projects are always different from context to context and the research method must be adapted to the context of concern. Evaluation studies in RE can be generalized by showing reliability by replication and by logical induction.

During the discussion, the panellists and the audience converged on the following points:

- Meta-analysis studies on primary case studies in RE are hard, if impossible, to do. This is because there are very few studies in most of the RE sub-areas, and whatever studies are available they are difficult to compare. Moreover, in case study descriptions, not enough context parameters are given and this further impedes such meta-analyses.
- For a RE researcher to be able to find and engage interested and committed practitioners in an empirical research effort, he/she should be prepared to first invest some time and resources in marketing the RE technique that will be subjected to empirical research. Marketing for RE methods is the precondition for empirical research as empirical research needs reference customers.
- Companies are reluctant to adopt university-conceived innovative tools and tool-supported methods, because in most cases these tools are created by graduate students and PhD researchers and the tool-related expertise walks away once their contracts are over. Senior researchers, e.g. professors, rarely keep updating tools themselves, thus leaving a business partner without any support in the long run (should this partner decide for tool adoption).
- The RE community has probably accumulated a number of empirical studies that might have gone unpublished for a variety of reasons, yet these could well serve the purpose of learning and also the purpose of indicating mechanisms existing behind RE phenomena. Empirical studies are unevenly distributed across application domains. For example, there are more studies for systems that have a relatively longer development history such as large

business information systems (e.g. ERP) for which requirements modelling techniques have been existing for more than 20 years.

- Empirical research in RE contributes in two related but different ways to the body of RE knowledge: empirical studies either explore a RE phenomenon or confirm hypothesised relationships in the area of study. For example, experiments typically serve confirmatory purposes and help learn which technique is better in which context, while qualitative case study are suitable to explore RE problems and possible solution options, and help make implicit knowledge explicit.
- Experiments indicate the presence or the absence of relationships among variables that describe RE phenomena. However, to understand why a relationship is present or absent, more qualitative research studies would be helpful. For example case studies that use in-depth interview techniques or focus groups.
- Qualitative research in RE yields conclusions that are bounded by the data. The researcher does not expect ‘absolute truth’ and ‘absolute generalizability’. A discussion on generalizability should be based on searching for those context characteristics that make comparable the settings in which the qualitative research took place with other similar but different settings. For example, if a RE phenomenon has been researched in a small organization, it makes sense to reason about whether it’s logical to observe the conclusions in other small organizations where certain (organizational) mechanisms are in place and others not.

## **7 Acknowledgement**

We thank our PC members, our key note speaker, and our panelists for their participation. Their support and insightful ideas were instrumental to the success of this workshop.