Software Engineering Research under the Lamppost

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I’m looking for the best software testing method.

Outline

- Some challenges in applied research
- Convenience research
- Five levels of closeness academia-industry
- Success factors for academia-industry collaboration

Challenges in Applied Research

- Conduct relevant research
- Conduct research that is used
- Conduct research that make a difference (academically and practically)

But, how do we conduct research?

Convenience Research

- We study open source projects
- We use students as subjects
- We look at online databases
- We study small software systems
- We build open source software

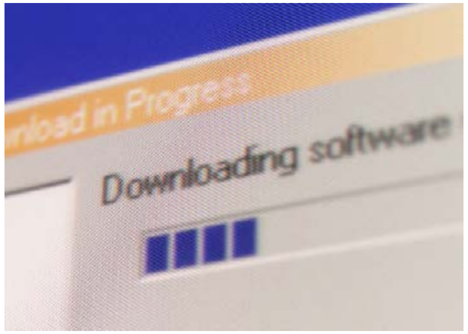
Is this wrong? Is this under the lamppost?

Well, it is at least far from optimal if aiming to support industry developing software-intensive systems.

Open Source Projects

- What is data from open source generalizable to?
  - Other open source projects?
  - Industry?
- How much do we actually understand the context?
  - Do we know how development is done?

Or are we simply looking at open source because they are easy available online?



Students as Subjects

- Students are often used in experiments
  - Are they representative of industrial software engineers?
  - Do we know how to compare students with industrial engineers?

Or are they used because they are available for the researchers?

Not so surprising:

- Our paper ”Using Students as Subjects — A Comparative Study of Students and Professionals in Lead-time Impact Assessment” is one of my most highly cited papers. Why?

-> We got very similar results for students and professionals. Why?

- Was the teaching able to convey how industry works?

Online Databases

- Do we really understand the data?
- Do we know sufficiently about the context of the data?

Or do we use them because they are available?

One advantage is of course that we may get access to more data than we can collect ourselves.

Small Software Systems

- Systems studied are often open source software (easy access)
- Industrial systems are many times very large, but some open source systems are too
- Systems are built as systems-of-systems

Systems are many times too large to understand, and hence we are many times forced to study a smaller system or parts of a system.

- But is the system we study representative?
- If so what is it representative of?

Build Open Source Software

- We build our own systems
- All too often a system is built as part of a research project or as part of a PhD student's dissertation
- Our own systems do not have direct customer or market requirements
- Our systems are often prototypes

What are these representative of?

They are easy accessible since we build them ourselves. The software may be innovative, but what can we learn from the actual software.

Our Options

Options and in my view obligations:

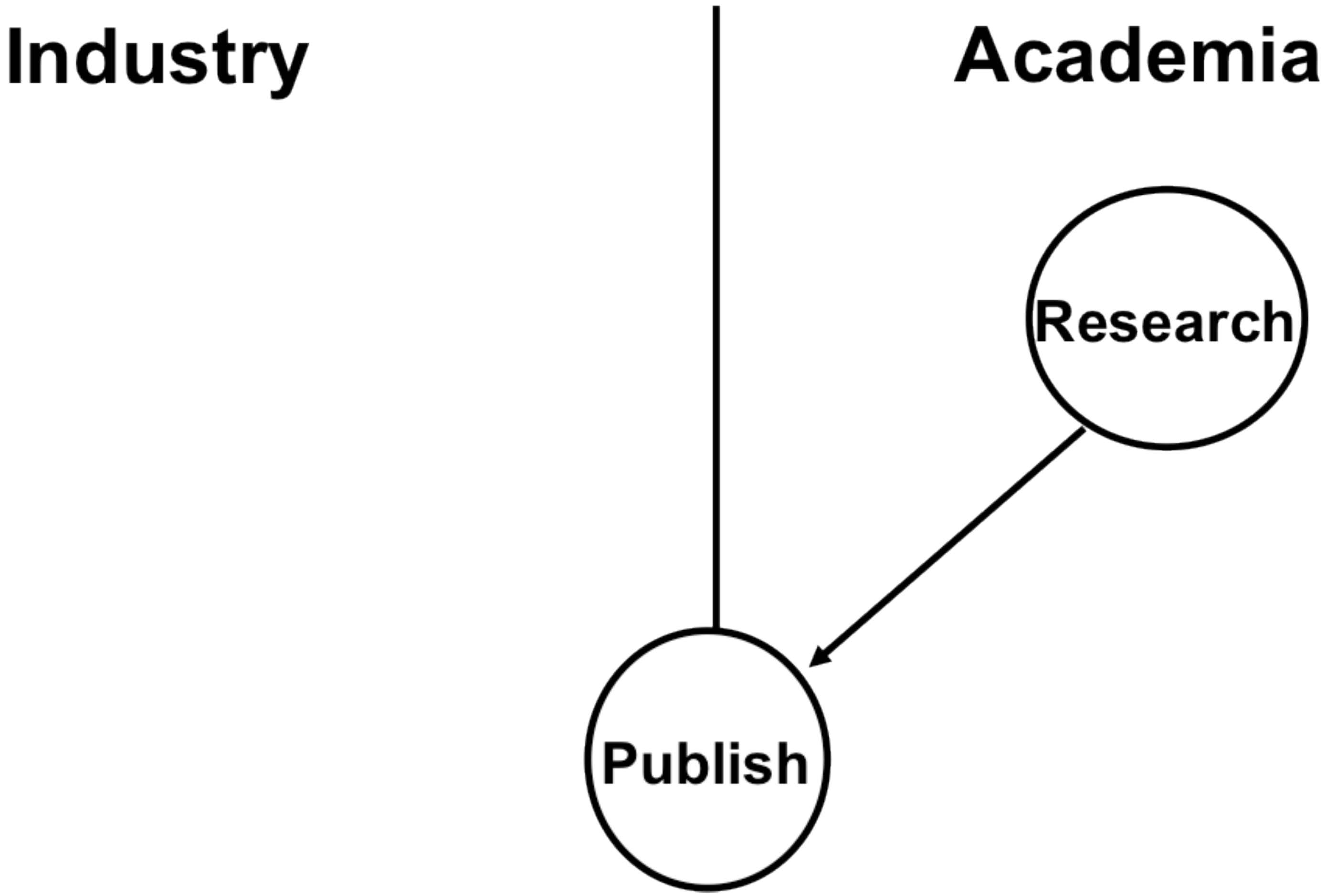
1. We must understand how the research relates to industry (I would argue that we do not)
2. We should work with industry

In Sweden, most of the applied research has to be supported in-kind or with cash from industry to obtain funding from several research foundations. Thus, we are more or less forced to go for option 2.

Collaboration Academia-Industry

Five levels of different closeness between academia and industry.

Level 1: Not in Touch



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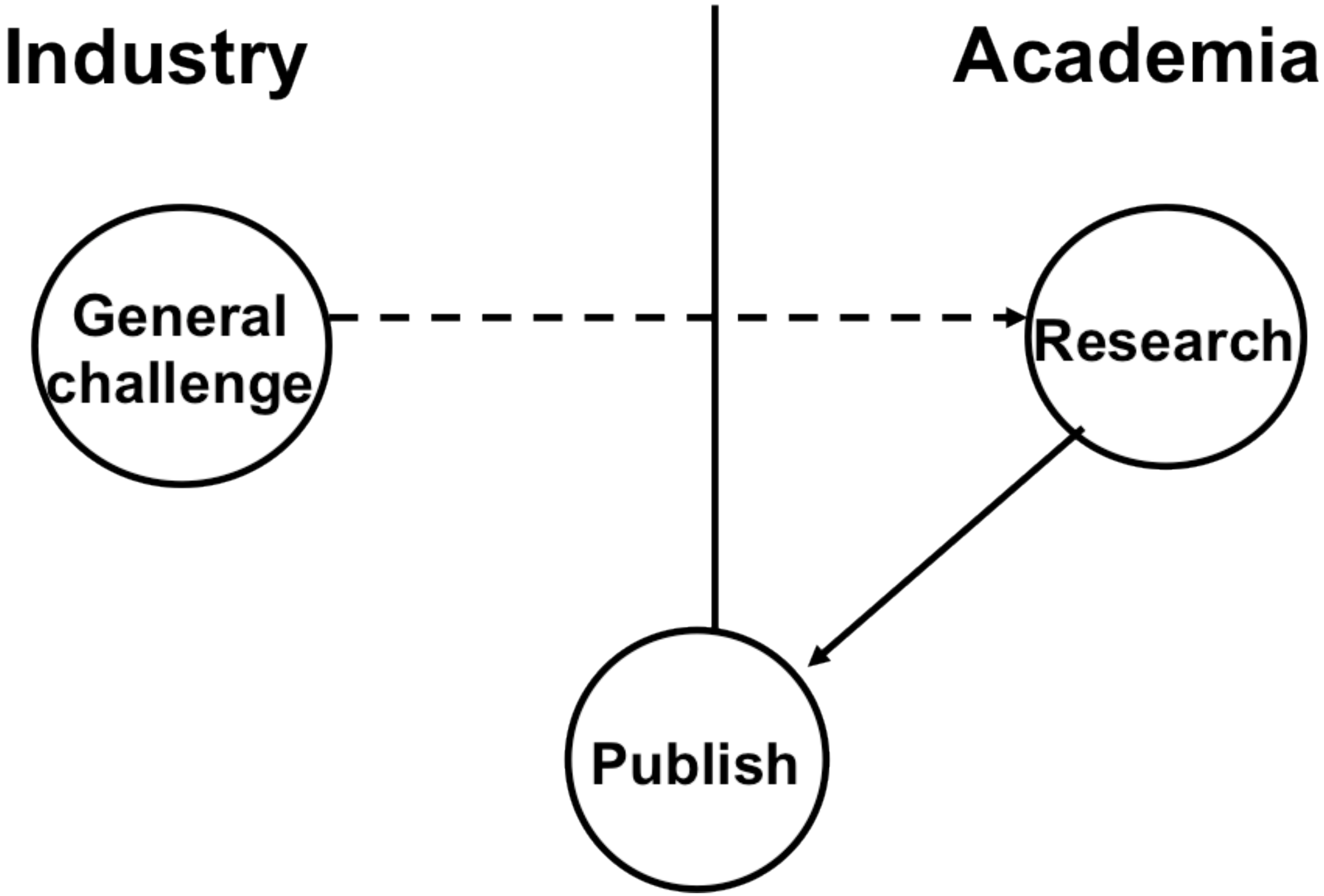
Level 2: Hearsay



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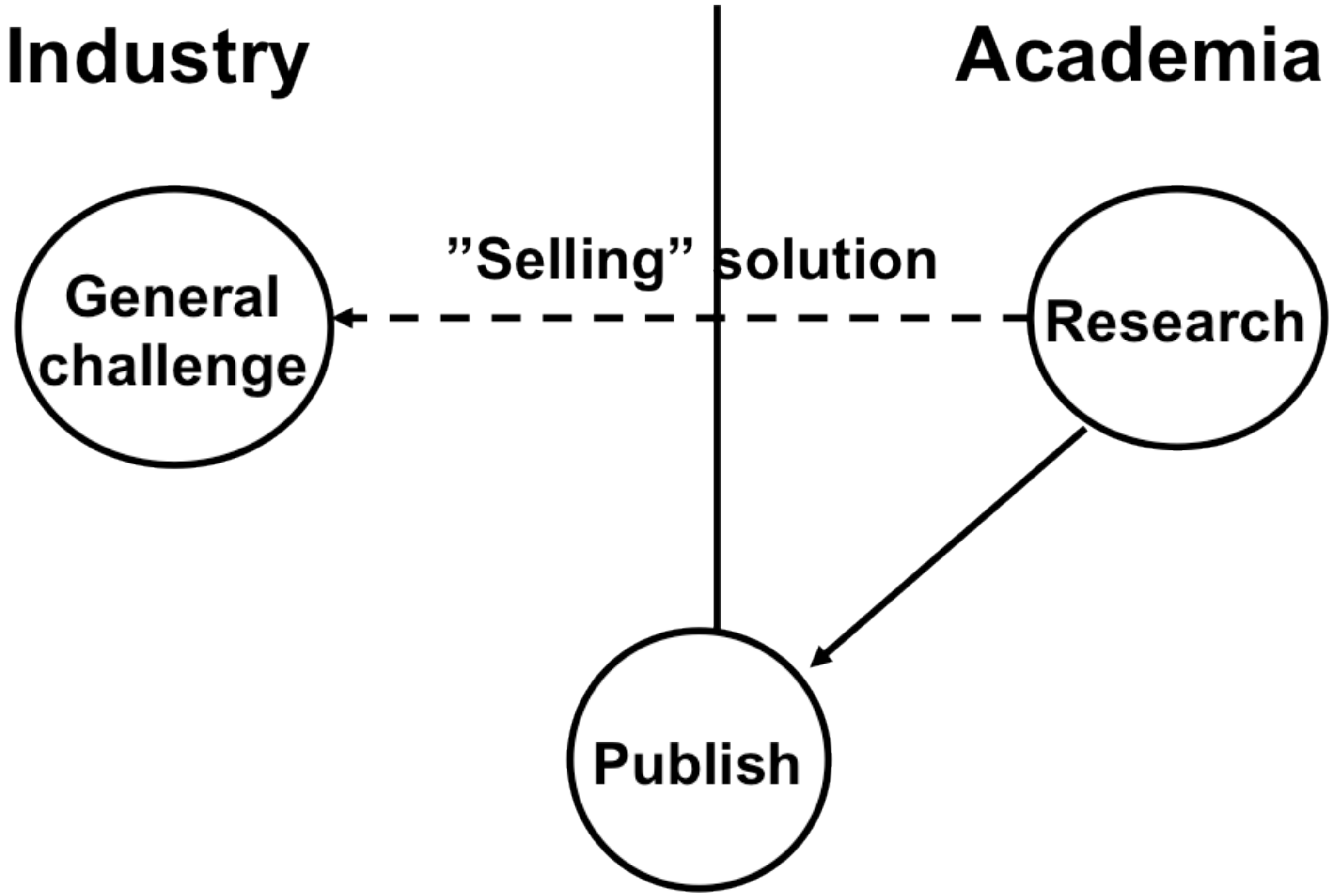
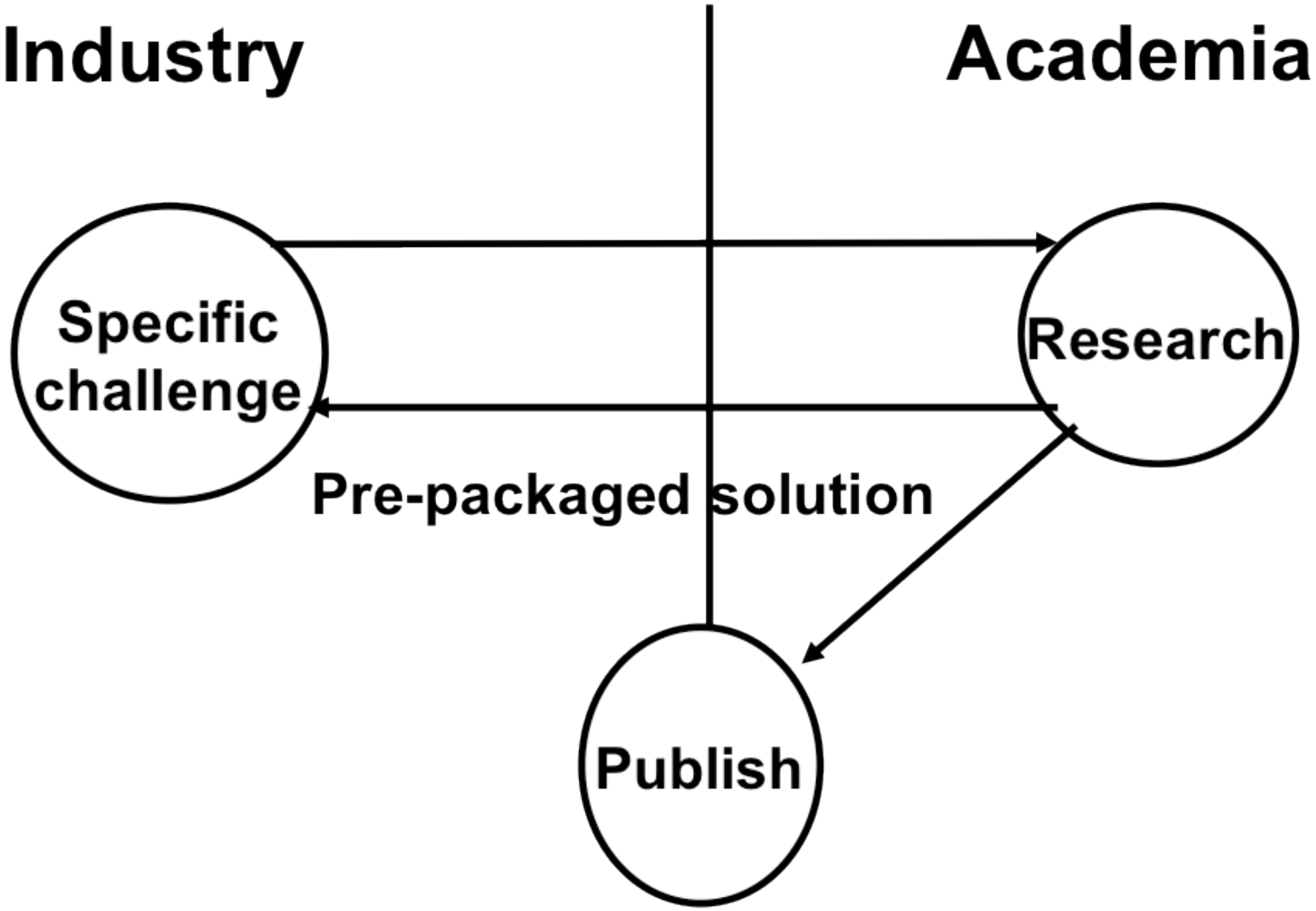
Level 3: Sales Pitch



Level 4: Offline



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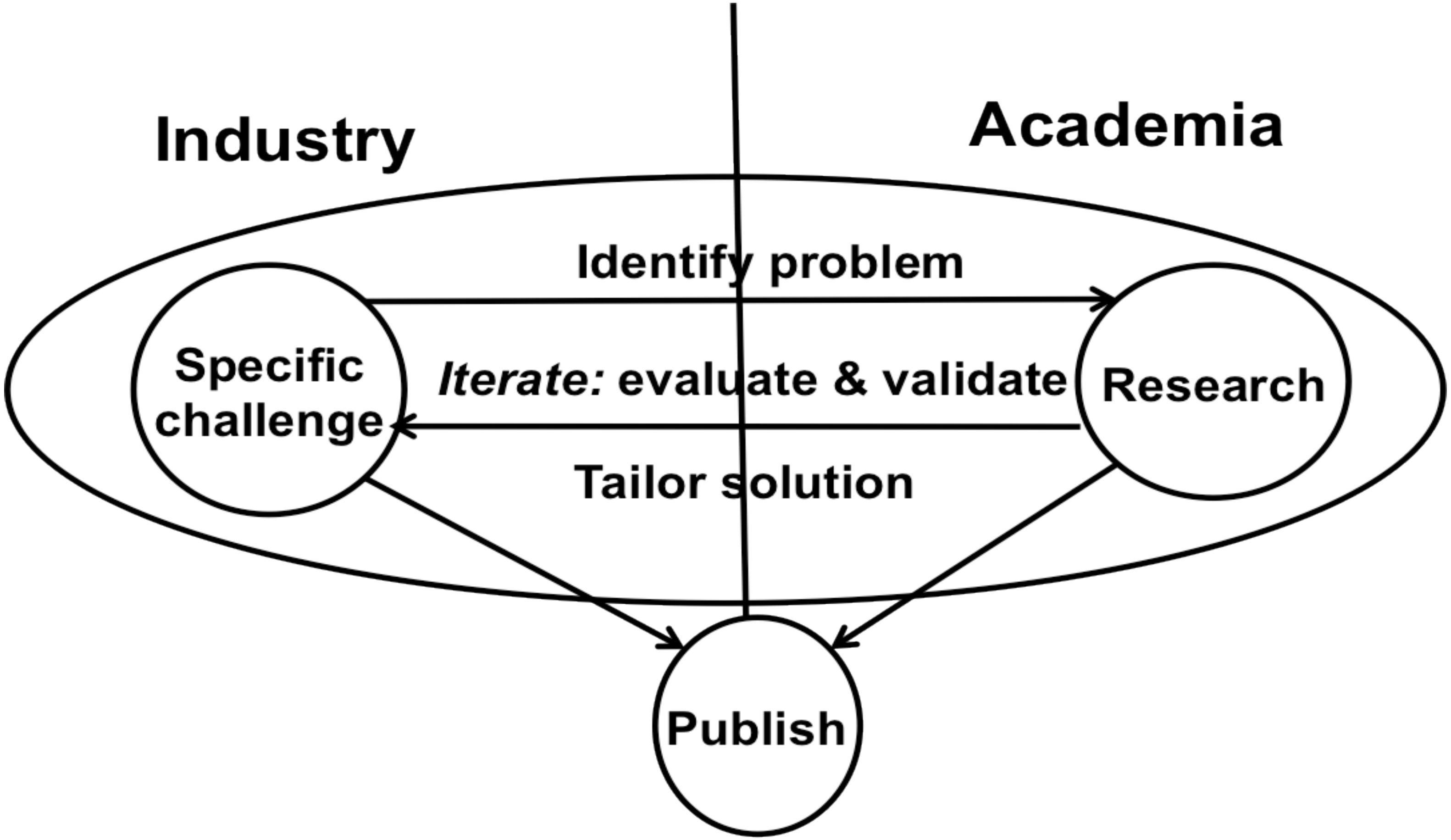
Level 5: One Team



Experience

- Academia-Industry collaboration since 1993
- Current industry partners in software engineering – approximately 15 different partners in 6 different projects
- Differentiate between consultancy and research – make partners understand how to work with academia and the opportunities

Top 10 – Our experience from working for 20 years with industry

Top 10 Challenges based on 20 Years of Collaborative Work

Four areas (and 10 non-prioritized challenges):

- **General** – This group relates to challenges to the general relationship between industry and academia.
- **Industry** – Challenges in this group concern specific issues to be addressed at the industry side of the collaboration.
- **Academia** – In a similar way as for industry, there are some specific challenges related to academia.
- **Research** – The actual conduct of the research comes with some challenges too.

Top 10 – General

- ***Trust and respect*** – Academia has to acknowledge and respect the experiences and expertise of their industry partners in developing industrial software-intensive systems, and industry has to respect the deeper knowledge coming with being a researcher.
- ***Roles and their goals*** – Each individual must try to understand the roles, responsibilities and goals of the other people involved in the collaboration.
- ***Knowledge exchange and not technology transfer*** – It must be understood that knowledge has to be exchanged, not just transferred from academia.

Top 10 – Industry

- ***Management*** – If to succeed in a long-term and mutually beneficial collaboration between industry and academia, there must be management commitment (on the right level).
- ***Champion*** – A champion is always needed, and a person cannot be assigned to be the champion; it must be a commitment.

Top 10 – Academia

- ***Social skills*** – Physical presence and communication help in building trust and respect, and is almost a prerequisite for a successful collaboration between industry and academia.
- ***Commitment to company needs*** – Companies have expectations. This implies that researchers must be aware of the expectations and be committed to deliver according to them not to disappoint their industry partners.

Top 10 – Research

- ***Software engineering as a design science*** – The researcher should be able to study and evaluate the problem area to better pinpoint the actual problem, and hence design a solution or improvement.
- ***Integrate into daily work*** – This is a key issue to keep industry interest and commitment, i.e. tie the research into the daily work at any industry partner.
- ***Ability to combine quantitative and qualitative input*** – The researcher must be able to conduct a combined analysis of different types of data.

Summary

- We must understand how to make our research relevant for industry
- We must be able to make the research useful and used by industry
- We must improve our ways of working with industry

If not, we are in my view looking under the lamppost, and we have very little impact on how software is actually developed and evolved.

Thanks for your attention!

Questions?