

Industry-Research Collaboration

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During this working group, we gathered a set of guidelines for establishing and maintaining fruitful industry-research collaborations. We divided these guidelines into the collaboration phase (awareness, contact, setup, and research, as will be defined) and, within each phase, to whom the guideline applied (researchers, practitioners, or both). The agreed-upon deliverable from this session was for a subset of the group to submit a longer version of this report to IEEE Software or the Empirical Software Engineering journal as a set of guidelines.

The Awareness phase

During the awareness phase, both the research and practitioner organizations learn about the typical constraints, expectations, and interests of the other side and reflect on their consequences for collaboration and on the opportunities that can arise.

Research organization:

- Be aware that the practitioner organization will be concerned that the research has a return on investment for the software process improvement (SPI).
- Understand that business comes first. The practitioner organization cannot go out of their way to accommodate research. The degree to which this applies depends on the current pressure in the organization.
- Understand that the research must fit with the timelines of the practitioner organization. Be ready when the window of opportunity opens.
- Understand that finding a perfect project without limitations is unlikely. Trade scientific weaknesses for industrial realism in these studies.

Industrial organization:

- A collaboration with a research organization is especially well-suited for strategic improvement activities. Maintaining and evolving technology-based unique selling points in the long run usually requires such collaborations.
- Do not expect a research organization to solve all of the most urgent problems, rather, expect important contributions to the solution.
- Understand that researchers may be deeply interested in issues you deem to be uninteresting. Work together to determine if this disconnect of interest can be reconciled or if it is because the researcher is interested in a state-of-the-art problem which is perhaps too theoretical in current form or if the researcher is interested in a research topic that is unlikely to have practical value.

2 **Lutz Prechelt**, Freie Universität Berlin

- Understand that research organizations are not able to be flexible are with respect to manpower (because both the researcher's time and the supply of graduate students may be limited) and scheduling (which may depend on semester and graduation rhythms).
- Collaborating with a research organization may provide you with an inside track to capable graduates-to-be.
- Published results of studies conducted with your organization can be helpful for marketing and public relations.
- Research funding is often necessary. The academic does not have the time for detailed analysis, and student research assistants usually expect to be paid.

Both:

- Realize that one beauty of the collaboration is the sharing of perspective. Respect your differences in priorities and background and what the other accomplishes in their own field, and learn from each other.

The Contact phase

During the contact phase, both organizations identify one another as suitable collaboration partners, meet representatives of the other side, and build initial trust.

Research organization:

- To meet potential practitioner collaboration partners, visit practitioner conferences, interest group meetings, and fairs. Learn about the problems they consider important. Give understandable presentations that relate to these problems. Talk about relevant related work in addition to your own.
- Contact your former graduates to see if they are possible research partners.
- Have practitioner-oriented information on your web pages, posted prominently. Usually this does not replace active partner acquisition but it can substantiate a first contact that was established via other channels.
- Prepare a one-minute elevator pitch: Who are you? What research questions are you interested in? Why?
- Understand the current business goals that drive a specific practitioner's interest in a collaboration. Discriminate between their urgent and important problems and merely interesting ones. Working on the latter will not get you solid, continuous support.
- If the practitioner organization may be right but the relationship with your first contact person does not work out, ask that person to help identify a contact in that organization that is more appropriate, open, supportive, and influential.

Industrial organization:

- To find potential research collaboration partners, get to know the research groups of nearby universities. Visit them. Invite them to visit your company.

Challenge their research approach and see whether they are open to collaboration.

- Advertise specific collaboration interests at suitable scientific meetings.
- Perform a reality check of the research organization: The researchers cannot know the details of your situation, but they should understand the basic realities, constraints, and forces of practical software development.
- When you propose research to a research organization, try to understand how attractive that research is scientifically and how it could be made more so.

Both:

- Collaborations in which both parties are local are generally more effective. Frequent, direct contact may alleviate communication problems and subsequent conflicts. However, geographically-separated collaborations can work as well.
- In discussing research proposals, work together on the question "What's the benefit for the practitioner organization?"

The Setup phase

In this phase, representatives of both organizations identify and agree on a specific study that they want to pursue together and both explicitly formulate their respective goals and hence increase mutual trust. Further stakeholders meet, buy-in to the research, and get to know each other.

Research organization:

- Understand the current software process at the practitioner organization.
- Plan for making the *economic* payoff of your research highly plausible; perhaps extend the study setup accordingly.
- Unless you perform action research, carefully minimize the invasiveness of your study design. Explain to the practitioners where and how you reduced invasion, where you could not, and why. Find alternative routes together.
- When you present the research goals and approach to practitioner stakeholders, tailor the presentation to their various roles, viewpoints, language, and level of expertise. For each stakeholder group, clearly answer why they might be interested in the research or at least its results.
- Make it clear that scientific publication is for the researcher what production is for the practitioner, and that scientific publication requires detail. A publication strategy describing what will be published, how the data will be sanitized and what will be confidential should be defined early.
- Consider accepting unattractive research content if attractive opportunities appear to be feasible in the future, but only if you are competent at pursuing the former.
- Participants may be concerned if they feel that the study can be used for individual monitoring purposes. Ensuring that this is not the case may improve the cooperation from them.

Industrial organization:

- Identify a champion who will drive the study with the development team.
- Specify how you will reserve the resources required for continuously supporting the research and describe the method of escalation, if needed.
- Be ready to accept publication of information coming from within your organization. Make sure you clarify early what you cannot accept at all to be published and where sanitizing (e.g. by normalization or anonymisation) will be required.
- Obtain broad support for the research, so that the study can continue despite organizational change or personnel turnover.
- Determine if any practitioners want to become co-authors of the resulting publications. These practitioners should be active participants in both the research and the writing (as prescribed by the Vancouver Convention¹ article).

Both:

- Consider running a pilot study first to assess risks.
- Avoid having more than one intermediary on each side. Stakeholders that actively participate in the research should be allowed to communicate as directly as possible. Research is just like software development in this respect. Direct communication is usually cheaper and always much more reliable.
- Intellectual Property issues need to be discussed and settled, particularly if it is expected that a patent-able asset will be created. The research team may need to sign a non-disclosure agreement.
- Make sure there is sufficient management support on both sides.
- Formulate your expectations for the collaboration: Research opportunities, active support from within the organization, permission to publish.
- Likewise, formulate your minimum requirements for a barely acceptable collaboration. This may weaken your position for negotiations, but is helpful for building trust and is essential for long-term collaboration.

The Research/Deployment phases

The partners execute the study, work together, build further trust, obtain results, and deploy new technology into other projects.

Research organization:

- Get to know as many stakeholders of the practitioner software process as you can. Build personal relationships. They are often the source of crucial insights and the basis for keeping up the research until a successful conclusion.

¹ *Authorship: rules, rights, responsibilities and recommendation*
<http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2000;volume=46;issue=3;spage=205;epage=10;aulast=Sahu>

- Have a plan for making faster progress during the practitioner organizations' low-pressure periods, when the practitioners can offer better support.
- If your research will modify the process of the practitioner organization, make sure you provide initial training and continuing support.
- Treat the practitioner organization like a customer: Speak with one voice, be solution-oriented, gently work around idiosyncrasies.
- Steer clear of company politics.
- During the study, provide timely and accurate feedback, not just of preliminary results, but also of other observations that may be of value for the practitioner organization.
- Demonstrate both the short- and long-term payoff from your research.
- Plan to sanitize the results obtained from the research prior to publication such that proprietary information about the company cannot be obtained or even extrapolated from the publication. Allow adequate time (at least a week or two) for company lawyers to review publications prior to their submission.

Industrial organization:

- Make sure the researchers receive adequate support from your staff.
- Students graduate, so expect researcher turnover.
- Treat the researchers like consultants: Assume they know more about their field of specialty but need to be informed about the peculiarities of your situation.
- During the study, provide timely and accurate feedback, regarding both the content of the research and your perception of the collaboration.
- Deploy the practices that can be considered successful research into additional development projects.
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Both:

- Regularly review and revise your common research plan. Communicate problems and complaints openly. Perform risk management (analysis, planning, monitoring, mitigation, follow-up).
- For long-term collaboration, always perform a short postmortem on each study for mutual feedback and optimization of the future research process.

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