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Get the Cogs in Synchrony – Time Horizon Aspects of Industry–Academia Collaboration

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Abstract

In industry–academia collaboration projects, there are many issues related to different time horizons in industry and academia. If not addressed upfront, they may hinder collaboration in such projects. We analyze our experiences from a 10 year industry–academia collaboration program, the EASE Industrial Excellence Center in Sweden, and identify issues and feasible practices to overcome the hurdles of different time horizons. Specifically, we identify issues related to contracts, goals, results, organization (in)stability, and work practices. We identify several areas where the time horizon is different, and conclude that mutual awareness of these differences and management commitment to the collaboration are the key means to overcome the differences. The launch of a mediating institute may also be part of the solution.

1 Introduction

Long-term industry–academia collaboration involves many challenges. One key challenge is the difference in time horizon between industry and academia. Industry is concerned with market changes and product plans, which have months rather than years as their time horizon. Academia is based on learning cycles of generations, and years are the time horizon for education programs. These differences may create friction and frustration in industry–academia challenges, like cogs rotating at different speed.

However, since the differences are mostly by design, we should rather learn to live with them, or change the design, i.e. to get the cogs in synchrony.

In this paper, we analyze the time horizon aspects of a long term industry–academia project, based on our experiences from shaping and running the EASE Industrial Excellence Center¹, and the Sigrun Software Innovation and Engineering Institute². The authors represent three stakeholders in this collaboration project, the largest industry and academia partners, and an institute organisation, aimed at mediating, among others, the time horizon aspects.

Published models for industry–academia collaboration focus on *activities*, as proposed by Gorschek *et al.* [?], or *relations*, as proposed by Sandberg *et al.* [?]. Other work includes surveys of *success factors* [?], *experience reports* on specific projects [?] and summaries of *challenges* for the industry–academia collaboration [?].

Sandberg *et al.* stress the time horizon aspect, stating: *Although it's relatively easy to agree on challenges and goals, view-points differ regarding variables such as relevance, rigor, time horizons, planning practices, and predictability*[?]. Wohlin's identified challenge to *Integrate into daily work* [?] is highly related to time horizons. Runeson notices that

¹<http://ease.cs.lth.se>

²<http://www.sigrun.se>. The organizational host for Sigrun is currently under investigation, but for simplicity, we refer to it as a separate unit here as it has been up till now.

[a]ppreciation in industry ... comes with fulfillment of short to medium term project goals, while the incentives in academia is related to publications and citations – with year-long feedback cycles[?]. Further, he observes these differences scaled down to the daily planning: *Researchers make commitments far ahead of time for e.g. conference organization and teaching, while industry staff re-plan their commitments on daily, or even hourly basis, for higher management* [?].

The paper is structured as follows. In Section ??, the industry and academia contexts are described. In Section ?? we discuss the different time horizons in industry and academia, and consequences for the collaboration. We conclude the paper in Section ??.

2 Context

The context in which these observations are made is an industry–academia ecosystem on software engineering in southern Sweden, which consists of three universities, a dozen of larger industry players and many small software companies. Within this ecosystem, we specifically focus on the EASE Industrial Excellence Center, the Sigrun Software Innovation and Engineering Institute, and their industrial partners.

The EASE Industrial Excellence Center is a ten year endeavor to create and utilize knowledge in the field of *embedded applications software engineering*. The center started in 2008, and has recently passed a mid-term review by external reviewers, and is revising its plans for the second half of the duration. The center has a turnover of 10.5 MSEK per year, which corresponds to 7.5 FTE (Full Time Equivalents) in academia and 1.9 FTE in industry, of which 5.9 FTE are PhD students. The center is funded 1/2 by industry (of which 1/3 is in kind), 1/3 by the academia partners, and 1/6 by Vinnova³.

EASE is based on the long term *collaboration*

³<http://www.vinnova.se>, The Swedish Governmental Agency for Innovation Systems

between *Lund University* (LU) and *Blekinge Institute of Technology* (BTH) as well as four software-intensive companies with offices in southern Sweden: three product providers: *Sony Mobile*, *Ericsson*, *Axis* and *Softhouse*.

The research agenda that has been – and is continuously – developed in collaboration with the industrial partners and has been focussed on two main areas and four themes, with example results listed as references:

- Software Engineering
 - analysis and assessment of agile and open source software engineering practices [?]
 - models and tools to bridge gaps between information artifacts for requirements and testing [?]
- Software Technology
 - tools for ubiquitous interaction and configuration [?]
 - implementation of speculative parallelization in web browsers [?]

The industry–academia collaboration has a long tradition in the region, which can be described as an industry–academia collaboration ecosystem. For example, the Bluetooth communication protocol and standard emanates from the industry–academia collaboration between Lund University and Ericsson in the 1980's. The software engineering collaboration dates back to the 1990's in the form of various, shorter collaboration projects, typically 3-4 years, and student projects, while the work to establish an industry–academia center started 1999. Some startup funding was granted by a public funding agency, but it took until 2007 before the long-term center funding was in place.

Sigrun was founded in 2010 to constitute a bridge between applied software research and industrial practice [?]. Sigrun promotes openness by creating a forum for open collaboration and exchange of software, development

and business experience, and software innovations. Research and innovations are brought to practical use mainly through running innovation projects including participants from academia, product companies, consultant companies, and public organizations. The goal of innovation projects is to try out new technology, processes, or services in practice in an industrial setting. Sigrun is open to membership for large companies, small and medium-sized enterprises, startups, and public organizations.

A mid-term review of the EASE Industrial Excellence Center was conducted early 2014, based on a self-assessment report [?]. In their evaluation report, the external reviewers note on collaboration aspects, that *[t]here is evidence of excellent collaboration between the academic and industrial partners involved in each theme. Circulation of information and of researchers between academia and industry works very well and has become part of the Centre's culture[?]*. They also note on the time horizon for the results from the center: *The evaluation team appreciated the fact that these results are directly useful to the industrial partners, but have all the potential to be generalised to other applications and domains [?]*.

3 Time Horizons

In this context, we have analyzed the time horizon aspect of five important areas for the industry–academia collaboration, namely, contracts, goals, results, organization (in)stability, and work practices. The selected areas represent aspects with time horizons ranging from the overall contract and goal setting, down to getting the practical collaboration done. There may be other areas worth analyzing, but these represent key aspects which cover the full range of time horizons. Each of these is discussed below and summarized in Table ??.

3.1 Contracts

Setting up an industry–academia program is a joint venture, which requires shared risk taking. In our context, the academic partners

Table 1: Typical time horizons in industry–academia collaboration (years)

<i>Area</i>	<i>Industry</i>	<i>Academia</i>
Contracts	1 – 3	3 – 5
Goals	1/4 – 3	3 – 5
Results	0 – 3	3 – 10
Organization	1 – 3	5 – 10
Work practice	0 – 1/2	0 – 3

employ most of the staff, and consequently take the financial risk for the project. Therefore the contracts are needed to mitigate and share these risks. From the academic point of view, the time horizon for the risk is up to 5 years, when it comes to recruit PhD students (they are employed on 5 year contracts in the Swedish system). Combined with strong labor laws, the setup creates a viscous financial system that takes time to change. As a large share of the research is funded by external, temporary projects (about 2/3 of the research budget for the faculty of engineering), the financial risk for the academic side of the collaboration is significant.

From an industrial point of view, budgets are laid out annually, and long term commitments are very hard to fit in to the budgeting system. Even under a signed contract, the partners have to fight for the funding internally in the companies, especially in hard financial times.

This conflict is inherent in the external funding system for academia, and is a hurdle for any externally funded research project. *The key contribution to mitigate the problems is to have continuous, high-level industrial and academic commitment for the industry–academia collaboration*. This is a shared activity and thus, the responsibilities and risks must be shared. In the case of EASE, it is reported in the self evaluation report: *The companies have kept their support despite industry down-sizing, change of ownership, and hard financial times [?]*. However, this is the outcome of continuous work by

industry and academia stakeholders, to secure the funding.

In the EASE context, we have also established Sigrun, the Software Innovation and Engineering Institute, to mitigate some time horizon challenges with respect to contracts. With Sigrun, project with shorter term commitments and contracts may be launched. This has enabled new partners to enter the ecosystem of industry–academia collaboration. However, still there is a need for some major and sustainable actors, to take the driver seat and defend the long term perspective, since the academic partners do not have financial resources on their own to drive the whole ecosystem.

3.2 Goals

The mission of the EASE center is stated in general terms, without any time horizons, *to contribute to provisioning of competence in terms of knowledge and people, through a continuous exchange loop between industry and academia, involving research challenges, industry personnel, researchers, students and research results.* [?]. The strategy addresses the time horizon somewhat, when stating that *[t]he strategy of the industrial excellence center is to utilize the opportunity to work on a comprehensive long-term view on a coherent set of problem areas, which have a high potential for advancement of the engineering of embedded software applications, in close cooperation and continuous exchange between industry and academia* [?]. Further, when enrolling PhD students in the center, the goals of their education program has a 4–5 year time horizon, while industry project goals may be within 1–3 years, and improvement goals may range a few years.

In the establishment of the center, the CTO of the major industrial stakeholder at that time, Dr. H.C. Mats Lindoff, stated that their main driving force for the research center was to 1) be able to recruit well educated software engineers, which requires 2) a good engineering school in the region, which 3) is based on good researchers and teachers. His primary

goal of establishing the center was to ensure high quality researchers and teachers, leading to his company’s primary goal of recruitment.

This is however, a top management view of the goals of the industry–academia collaboration. Climbing down the hierarchies tend to turn the goals into more directly related to the current business, and making them more short term. This is specifically valid for software engineering research, where the organizational unit for collaboration is the development unit – not a separate industrial research unit – and thus competing with the near-term goals of projects and product deliveries. Runeson concludes that *it shall be noted that the target organizations for the collaboration project are fully operational product development organizations, working at the critical time-line of product deliveries. Industrial research organizations naturally have more similarities to the academic organization; however, they do not offer an environment to study and impact on the software engineering practices, possibly on the software technology only* [?].

As a consequence, *the overall goals, like the contracts, must be firmly anchored in top management. Then, the overall goals must be broken down into sub-goals, that are feasible for the collaborating level of the organisation.* Among those sub-goals are to achieve results that are operationally useful, which are delivered incrementally, while keeping the overall goals long term.

3.3 Results

Collaboration between a software development organization and a research institute have different principal expectations on research results. Industry expects results that are useful to their specific organization and context. Research strives for generalization and next generation ground-breaking solutions. This sounds like an inherent conflict by design, impossible to solve. However, as the EASE evaluation team concluded, *these results are directly useful to the industrial partners, but have all the potential to be generalised to other applica-*

tions and domains [?]. What is the trick to get the cogs in synch?

One key solution to combining the two is to *conduct case studies* [?]. Runeson *et al* define case study as *an empirical enquiry that draws on multiple sources of evidence to investigate one instance (or a small number of instances) of a contemporary software engineering phenomenon within its real-life context, especially when the boundary between phenomenon and context cannot be clearly specified* [?]. From that definition, it is clear that one instance of a phenomenon is a valid research endeavor. Further, the enquiry should take place in *its real-life context*, i.e. in a company, product, project etc. Hence, delivering results to one instance is sufficient for both the company and academia. Then, adding more instances to the study adds to the generalizability for the researcher, and for the companies, it implies spreading the knowledge and experience as well as an opportunity to get experiences back from peer (noncompetitive) companies, e.g. in other industry domains.

Combining long term general results with short term usefulness, may also be achieved by *releasing results incrementally* [?]. An exploratory case study (e.g. Bjarnason *et al* [?]) may function as a basis for direct learning in the involved companies, and as a basis for generalization and theory building, as done in the case of EASE [?]. Further, the launch of the Sigrun Innovation and Engineering Institute was also aimed to focus more on near term issues, arranging workshops and seminars, as well as specific smaller projects, which may move results into practice in a shorter time interval.

Additionally, it shall be noted that expected results in industry may be different from what academia expect as results. An example appeared recently in the EASE project, where the industry representative expressed expectations on general guidelines for method selection, which were interpreted very ambitiously by the academia representative, who estimated man-years to be needed to meet the expectations. However, after some clarifying discus-

sions, the academia representative realized that a regular review of existing research would be well in line with expectations – requiring only a few week’s work.

3.4 Organization (in)stability

Studies of industry–academia success factors emphasize the role of the *champion* [?, ?, ?], i.e. a contact person, *who is committed to facilitate and contribute to a successful collaboration* [?]. However, as the time horizon of industry–academia collaboration is far longer than the lifetime of an industrial organization, the champion may move around to new positions in the organization, and the position in the organization, where a contact person is needed may be in lack of a champion.

The champions are not only persons appointed to a role, but they must possess some inherent curiosity and willingness to go beyond their job description to learn something new, for their own and their companies’ sake. However, as a starting point, the industry partner should appoint a person at a feasible position in the line organization to function as a stakeholder of the research results. The line organization has the responsibility of the long term competency development, and mostly also for the provisioning of working practices and tools. In reorganizations or job rotations, the identification of a new person to function as a stakeholder must look for a combination of organizational position and willingness to become a champion.

3.5 Work practice

The shortest time horizons in a industry–academia collaboration project is the daily work practice, such as planning meetings, reading and writing. Also here, the academic partners have longer cycles compared to industry. As mentioned in the introduction, Runeson concluded based on his part time work in industry that *[r]esearchers make commitments far ahead of time for e.g. conference organization and teaching, while industry staff re-plan their*

commitments on daily, or even hourly basis, for higher management [?].

Further, the fact that different organizations collaborate, implies that no joint calendar management system exist, which often leads to the use of Doodles and e-mail to book meeting – a far more complex way than using a joint calendar management system. This is the same for any kind of two organizations collaborating, and consequently also present in industry–academia collaboration settings.

There are no silver bullets that solve this issue either. However, *mutual understanding and respect for each others planning horizons help making the work practice function*, despite different horizons.

4 Conclusions

We conclude from the analysis of contracts, goals, results, organizational stability, and work practices, that there are different time horizons in industry and academia. Industry time horizons are generally shorter compared to the academic perspective, creating significant risks for frustration and miscommunication. In order to support industry–academia collaboration, the cogs must be in synch.

From the example of an industry–academia ecosystem in Southern Sweden around the EASE Industrial Excellence Center, we identify that 1) mutual awareness of these differences is the starting point to help addressing them, at all levels from top management to practitioners. Conducting case studies and delivering research results incrementally also help bridging the different time horizons. Further we conclude that for the long term success 2) top management commitment is central to help industry balance the short term daily work with long term goals of the collaboration. Specifically, the assignment of responsibilities to the line organization to find champions for the collaboration is important over organizational changes. We have also launched 3) a special organizational unit, The Sigrun Innovation and Engineering Institute, aimed to bridge industry and

academia through shorter term contracts, activities and projects.

Even though these findings are deducted from one industry–academia ecosystem only, we assume, based on case study methodology [?] that the lessons learned are applicable to other industry–academia ecosystems as well.

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