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Best Practices for Collaboration Between Industry and Academe

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Best Practices for Collaboration Between Industry and Academe

By R. Russell Rhinehart | Operations & Management

Summary

Better collaboration between academic institutions and industry practitioners can improve outcomes for industrial businesses and the schools, professors, and students they depend on.



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Academic research about education is what substantially shapes higher education, which often leaves manufacturing and industrial businesses complaining about how new engineering graduates lack industry readiness. But if teachers had a better grasp of the applications and perspectives needed by industrial businesses, they could do a better job of creating an educational environment that generates fit-for-employment graduates. Additionally, with better collaboration, the creativity and expertise of academics could be a problem-solving resource for industry.

There is a need for industry to more effectively engage academic experts, and for more useful knowledge exchange. Although automation professionals and faculty are effectively working together in some places, there is a gap between

what industry practitioners need and what academic experts provide. More frequent and influential collaborations can lessen that gap.

First, understand why a gap is there. Here are several reasons, categorized by contrasting terms:

Practicable-possible

Although industry requires what is practicable, faculty research is guided by what might be possible (and its mathematical demonstration). That means the knowledge being published in academic journals (like *ISA Transactions*) rarely affects the practice. Even if relevant, the journal articles require substantial cultural translation to become implementable. If academe is to support the practice, the practice needs to find a way to shape academic research.

Urgency-analytical

Academics work in a precommercial environment and have the investigative time to seek a clear and comprehensive system view of the fundamentals associated with a technical discipline. They want to discover nature and fundamentally defensible procedures. In contrast, practitioners tend to focus on immediate solutions for specific application cases, often using intuitive actions, workarounds, or a shotgun approach. Although true knowledge would be useful to them, situation urgency means practitioners often miss fundamentals that could become helpful.

Sufficiency-perfection

Industrial applications of technology are performed within a complex context, constrained by safety, regulations, human aspirations, and more; they are also applied on nonlinear processes. Such aspects are usually imprecisely quantifiable. Application success requires simple solutions, both mathematically and procedurally. By contrast, to achieve career goals,

academics often seek complexity of mathematical analysis and proofs of certainty. These necessarily require an idealized context. One side is seeking perfection in an idealized context, while the other is seeking sufficiency in an ambiguous context.

Fruition-fundamentals

Industry wants to make things happen, to create and sustain a productive process or a marketable product. Academe seeks to discover the fundamental principles about nature. One focuses on how to do it, or the synthesis. The other focuses on defense of claims, or the analysis.

When people on one side read the publications of the other, they find little to nothing to address their needs. It is not that one side is doing it all wrong. Each side is doing what is right within its dissimilar environment. The gap between them—the differing goals, motivations, and measures of success—is what makes collaboration difficult.

About the survey

Collaboration, while difficult, is not impossible. In fact, the examples shown elsewhere in this article involving Miami University of Ohio, University of Michigan, and Purdue University are the results of successful collaborations. To bridge the gap in more places and for more institutions and industry practitioners, the International Federation of Automatic Control (IFAC) conducted a survey of best practices.

ISA is one of nine professional societies in the American Automatic Control Council (AACC), which represents the U.S. to the IFAC Industry Committee (figure 1). An IFAC Industry Committee task force created the survey and analyzed the results, which are presented here.

The survey had 19 questions, about half of which solicited open text responses.

The link to the survey was distributed within commercial publications, as well as via direct emails to the members of the IFAC Education and Industry Committees and ISA Divisions. Recipients were encouraged to further distribute the survey to their network of professional contacts. Approximately 260 individuals opened the survey, and 125 completed it.

Of those who provided geographical information, most are from Europe and North America. A total of 24 nations from six continents are represented, with the U.S. and France being the two largest contributors.

Most survey participants have experience in academia. In all, about 60 percent identify with academe and 40 percent with the practice; some claim significant experience in both. It is worth noting that many control practitioners are part of nonprofit, government, military, and even academic organizations, not just industry. So, we use the term “practice” to include all professionals who practice automation and control, regardless of their place of work. That is why we replaced the commonly used expression “university-industry collaboration” with the more inclusive “academic-practice collaboration” throughout the survey and this report.

The 12 academic disciplines represented in the survey were dominated by electrical, industrial, chemical, mechanical, and computer engineering. The 14 technology application domains were primarily represented by process, energy, and manufacturing. The nine practice sectors were substantially represented by industrial suppliers, industrial users, service providers, and vendors. The eight academic sectors involved were primarily research and graduate programs. Interestingly, most of the research entities listed their focus as application rather than pure science.

<p>The International Federation of Automatic Control (IFAC) is primarily an academic organization seeking to share automation possibility, theory, and analysis worldwide. The American Automatic Control Council, a consortium of nine U.S. professional societies (of which ISA is a member) represents the U.S. to IFAC. The IFAC Industry Committee, established in 2017, has had a core task of promoting interaction between academia and automation and control practitioners in industrial, nonprofit, military, government, and other institutions by helping each side understand the culture and the motivation of the other.</p> <p>The author greatly appreciates the members of the IFAC Industry Committee task force who created the 2021 survey of best practices and analyzed the data. They include:</p>							
David A. Anisi, associate professor, NMBU/UiA, Norway	Philippe Goupil, aircraft control system expert, Airbus, France	Chris Manzie, professor, The University of Melbourne, Australia	R. Russell Rhinehart, professor emeritus, Oklahoma State University, U.S.	Tariq Samad, director, management of technology, University of Minnesota, U.S.	Bran Selic, president and founder, Malina Software Corp., Canada	Atanas Serbezov, professor, Rose-Hulman Institute of Technology, U.S.	Jaroslav Sobota, control system engineer, Centrum LTD, Czech Republic

Figure 1. About the IFAC Industry Committee

Understanding collaboration

Collaboration can take many forms, all of which can be mutually beneficial. Collaboration is an activity whereby individuals work together for a common purpose to achieve a common target benefit. Essential skills include trust, tolerance, self-awareness, empathy, transparency, active listening, and conflict resolution. Collaboration is not people working independently and following their own paths. Collaboration means accepting the experience of the others in the joint effort.

Examples of collaboration include industry practitioners helping in classrooms by providing guest lectures on topics and application perspectives often omitted in education. They could provide case studies for teaching examples or student projects. Industry could help in laboratory experiences by providing equipment and technical support.

With such collaboration comes many benefits: The teaching faculty comes to better understand the needs of the practice. Respectful relations are formed for possible future problem-solving benefit. Contact with students gives industry folks a recruiting advantage. Students benefit from the exposure and enjoy the real-world insight.

As a reciprocal, industry could host academic associates at invited seminars or

short courses for employee continuing education and skills development. The experience shapes the academic focus, improving both teaching and research.

Another example is industry-sponsored research projects for undergraduate or graduate students. Preferentially, these are precommercial investigations designed to help practitioners answer their questions or explore a possibility that might seem promising. The sponsorship could be one on one or within a consortium, and the students and faculty would be allowed to publish the results.

Industry also could hire faculty on an individual basis to solve a problem or to help develop a product, or it could engage equipment, faculty, and students to provide support through a university contract. Here, intellectual property (IP) concerns related to rights to inventions and patents would restrict academic publication. Myopic lawyers within both the industry sponsor and the academic institution seem to place IP possession above the benefit of collaboration and argue that their side should have exclusive rights. The IP impasse is often a barrier to collaboration, but when agreement can be reached, product and process development is enhanced.

The five players and their motivations

The survey reveals that five separate groups are involved in any academic practice collaboration. Each group must have an incentive to participate and to invest its resources to make a collaboration successful. The collaboration needs to be structured so each of the players experiences a benefit that justifies its investment. Each group also has its own culture and way of interacting. A collaboration must permit those diverse ways to synergize. The five groups are students, faculty, academic institutions, practitioners, and practice entities. Here is what motivates each to collaborate.

Students

Students are seeking practical knowledge and experience about the industrial context, which will lead to career and employment opportunities. Students are excited to work on real-world problems, to have access to state-of-the-art hardware and software, and to relate the theory learned in class to specific practical situations. Students want to work with industrial mentors to gain in-depth understanding of the nontechnical side of practice, such as soft skills, project management, and market-driven decision making.

Faculty

Top incentives for faculty are professional development and funding. Professional development includes staying current with the state of the art in the field, selecting relevant research topics, validating ideas, having access to actual data, networking, and maintaining visibility through academic publications. Research funding is required to build a research group, support equipment and travel, and provide summer income. Industry-funded projects provide the means to support and sustain an academic group. Sponsored projects identify ideas faculty can use for their more science-oriented research.

Other incentives for faculty are practical relevance of the curriculum and personal satisfaction. Collaboration with practice makes faculty more comprehensive teachers and mentors to their students, due to exposure to first-hand knowledge about technology, practices, expectations, and opportunities. Industrial collaboration can provide a unique and advantageous perspective on the state of the art. The ability to steer the students in the right direction naturally leads to personal satisfaction.

Academic institutions

Academic organizations seek funding, reputation, and societal impact. Sustainable programs tied to the practice community attract high-quality students, which in turn brings more interest from prospective partners to collaborate. Student participants typically are offered employment in the

partner organization, which elevates the reputation of the academic institution. Universities like displaying collaborative programs and societal impact in their messages to alumni and when reporting to legislatures. Secondary benefits are acquisition of facilities, networking, and education quality.

Practitioners

Top priorities for practitioners are professional development, career promotion, and better ability to hire qualified personnel. Professional development includes access to new ideas, technological surveillance, refreshers on theoretical fundamentals, engagement in fundamental research, and peer benchmarking. Incentives also include personal satisfaction as a mentor, attending conferences, publishing in scientific journals, and an opportunity to influence the education of the next generation.

Collaborative projects with academia also provide an opportunity to train and evaluate potential employees before extending a job offer. In addition, student allegiance to the corporate collaborator is a recruiting advantage for students who are familiar with the technologies and practices of the corporation.

Practice entity

Top incentives for industrial companies and other practice entities are new ideas, new product/process development, access to new knowledge, recruiting, and brand-name recognition. Even if the involved students accept employment elsewhere, they might have a preference to use a collaborator's product there, and their in-school affirmation of the experience will aid the sponsor's recruitment of other students.

Companies may view collaborations with academia as low-cost research and development initiatives, or as investments in workforce development. The benefit-to-cost ratio is often enhanced when government funding also supports the initiative. Demonstrating societal responsibility is another

motivator, achieved by helping and stimulating academia to focus on real-world problems and opportunities.

Ensuring collaboration success

Collaboration is not a one-sided game. An erroneous industry view is that a company hires the academic to develop a solution, the same way it might hire a consultant. An erroneous academic view is to take the position and the money and run (in pursuit of scientific publication). Notably, people may claim their academic-practice partnership is a collaboration, but in a collaboration the individuals share, are flexible, and accept each other's perspectives.

Mutually beneficial collaboration requires all players to understand how the others perceive the initiative, and to help provide what the others will interpret as a win. It may require each player to give up on getting its primary "win" and to settle for a secondary benefit, so that other players also can experience a win. For example, faculty may primarily want to use industrial funding to support mathematical analysis and journal publications. This provides little value to an industrial sponsor. It is acceptable to pursue and publish mathematical analysis, but also seek to return the sponsor's interpretation of benefit.

As another example, industry may primarily want, in return for a bit of funding support for a student, to be able to claim all rights to the lifetime of knowledge that the faculty advisor has acquired. Alternately, industry should accept the workforce development benefit of their contribution. Success requires each entity to find a way to shape the process and outcomes to satisfy their values, while making it satisfactory to the other entity. To create a win-win (actually win-to-the-5th-power) means that the process and outcomes that generate success for all may be suboptimal for any one entity. Industry practitioners are familiar with this condition of suboptimally operating one process unit to maximize manufacturing.

Collaboration also means mutual respect for the viewpoints and experience that the other has acquired. Having acquired career success, key individuals on either side of the gap are strongly immersed in their way of doing things. They have their own terminology, symbology, values, and conventions and often do not understand the other's situation, ways, and needs.

Several survey respondents reported that players on either side belittled the "inferior" experience and context of the other, which alienates the other and effectively undermines collaboration. It is important for experts in one domain to respect and understand the viewpoint of those in the other domain, and to help the other acquire a comprehensive view. It is also important for experts in one domain to accept what the others would like them to understand.

1. Address a common purpose, a shared vision.
2. Define success and deliverables (objectives, goals, schedule, milestones).
3. Build realistic expectations (compatible with skills and resources).
4. Define responsibilities.
5. Appoint a project manager/program director who can bridge the gap.
6. Ensure a commitment to share adequate resources (funding, data, time, staffing).
7. Gain support of leadership and participants (ensure all see their "win").
8. Stay engaged and connected.
9. Build mutual trust, respect, and personal relationships.
10. Partner with organizations where there are other beneficial interactions (workforce development, employee training, technical access). Synergize.

Figure 2. Top 10 ways to improve collaboration

As the survey results indicate, two aspects of collaboration are central to the success or failure of practice-academe initiatives: Give the other collaborator adequate wins and respect the other's experience. A summary of the top 10 ways to improve collaboration is listed in figure 2; full survey results are available in the tables below.

What to avoid when collaborating

A list of aspects and attributes that create barriers to collaboration came out of the survey as well. Collaborative programs break down when one entity seeks to impose its way on the others. This might be the university claiming all rights to IP, industry imposing barriers to all publications, a faculty researcher taking the funding and steering the project for his or her preferred outcomes,

industry seeking to manage the researchers with weekly reporting as if they were full-time employees, or the university wanting full control of all financial transactions.

Failure also happens when either side is not fully engaged, not providing the personnel time or resources required to aid the others. Engagement could falter because of personnel movement (either in management or the liaison), a shift in urgencies to be solved, or a “collaboration” that was really motivated by a nontechnical purpose. A collaboration must support the business needs. If it is motivated by an alumnus allegiance to the university, then support will prematurely end when the champion moves.

Final thoughts

Academic-practice collaboration is important to prepare industry-ready graduates and to align faculty research outcomes to have practicable value for practitioners. The structure, activities, and outcomes of any collaboration must be perceived as a benefit-to-cost win for each participant.

Collaboration can benefit industry by shifting academic expertise to provide industrial solutions, which prepares employment-ready graduates and adds value to the economy. Collaboration can benefit academe by providing research topics and funding that lead to research productivity.

A director who understands all cultures and can actively shape the work, communications, processes, commitment, and outcomes to sustain credibility is a strong indicator of collaboration success. On the industrial side, the director needs to be powerful enough to sustain resource allocation during the next “corporate crises.”

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IFAC Industry Committee. We are especially grateful to the 125 survey respondents who provided valuable input and to Control magazine, ISA divisions, and IFAC for soliciting participants.

Successful Collaboration: Miami University of Ohio

The Pulp and Paper program at Miami University of Ohio has a process control minor to prepare engineering graduates to supply industrial needs. To recruit students into this relatively unknown career, collaboration with industry partners offers both a three-week intersession course in the practice of process control and summer internship opportunities for students.



The course segments are offered by application-oriented faculty and practitioners, and the course topics are aligned with both industrial needs and engineering education criteria. The course and internships are attractive for students, and industry is happy that an academic program is supplying their workforce development needs. Visit the [internship site](#).

Successful Collaboration: University of Michigan

The Reconfigurable Manufacturing Systems (RMS) program at the University of Michigan was established in 1996 with partial support from the National Science Foundation as an Engineering Research Center (ERC) to improve manufacturing productivity. It was funded by more than 30 company collaborators.

Benefitting industry, from 1997 to 2012, ERC-RMS produced more than 350

graduate students, most of whom are working in U.S. industry, and improved productivity in more than 69 production lines in 15 factories in the U.S. and Canada. Benefitting academe, application projects have been essential to the career development of many students and faculty and for bragging rights of the university. Although initial funding has waned, the legacy of collaboration, labs and courses, and relevant teaching continues. Visit the Engineering Research Center [site](#).



Successful Collaboration: Purdue University

The Center for Innovation in Control, Optimization, and Networks (ICON) at Purdue University explores innovative control solutions to challenges associated with manufacturing, transportation, supply chains, health care, power, communication, and social networks. These systems are rapidly growing in scale and complexity, driven by advances in autonomy and connectivity. ICON seeks to develop knowledge and techniques for control and optimizing, to customize curricula to meet emerging educational needs, to collaborate with industry to tackle priorities, and to provide employment-ready graduates. It was established in 2020, has about 70 faculty researchers from a dozen departments, has funding from both industry and government, and enjoys strong collaboration with Saab, Rolls-Royce, Northrop Grumman, and John Deere. Students provide biweekly reports to industrial partners who provide feedback direction, advice, and serve on dissertation committees. Visit the [Center for Innovation in Control, Optimization, and Networks](#).



Glossary of Terms and Definitions

Collaboration: an activity whereby individuals work together for a common purpose to achieve a common target benefit. Essential skills include trust, tolerance, self-awareness, empathy, transparency, active listening, and conflict resolution. Collaboration is not people working independently and following their own path. Contrasting collaboration, many respondents provided comments that characterize one group as lacking respect for the skills and ability of the other. Comments accused people from both sides as having an inability to collaborate. Collaboration means accepting the experience of the others in the joint effort. This might be a difficult message for many experts to accept.

Bridge: one player understands the “way” and constraints and needs of the other community and can adapt to bridge the culture, methodology, time, and expertise gaps.

Director: a person who understands both sides of the gap and can get people on either side to do the necessary work and engage in a manner to satisfy the other. The director continually interacts with high levels in the funding organization to keep it committed and satisfied, and also interacts with the faculty researchers to ensure they are on track to return benefit to the sponsor.

Competencies: all the needed and complementary skills and experience. This includes market analysis, legal constraints, implementation economics, implementation context, as well as the academic competencies in mathematical analysis, data analysis, etc. Success on one side of the gap may dupe people into thinking they have strong competencies. But, often, they do not know what they do not know. They need those on the other side of the gap to reveal what is missing.

Commitment: participants in each of the five groups want to see the initiative

generate desired win-win results. Organizations provide the personal time and funding and resources needed by the others to make the project work.

Organizations provide the reward for participation effectiveness by employees.

Concrete: goals, methods, timing, and funding are clearly defined. It means that all parties buy in to the details of the project.

Communication: all parties keep the others informed of progress and issues. Faculty members are used to working in isolation for years on a project and adapting progress to their own goals, which change as experience reveals publishing opportunities. When they do report progress, it could be a major bureaucratic burden (full reports, IP protection, etc.). Communication within the practice-academic collaboration should be informal to make the frequent updates a minor burden. Also, communication skill is important, which means that the academic addresses the project management issues to the practice partner (not glorying in a bunch of theory) by providing results and indicating clear progress along the timelines and milestones. And the practice partner needs to patiently accept the theory when the academic presents it. Perhaps it will be useful. Communication should be frequent, easy, and address what is important to the others.

Practice: all professionals who practice automation and control, regardless of their place of work. The practice is not limited to industry. There are many control practitioners who are part of nonprofit, government, military, and even academic organizations. Accordingly, we have replaced the commonly used expression “university-industry” with the more inclusive “academic-practice” or “practice-academe.”

Key Survey Findings

The following tables list the attributes of the program and of the participants that are essential for success of each. Our analysis combined these results into

“Top 10 ways to improve collaboration” (figure 2).

ATTRIBUTE	FRACTION	CUMULATIVE
Utility to academe/publishable	0.17	0.17
Collaborate	0.13	0.30
Funding	0.13	0.43
Concrete	0.10	0.53

Table 1. Attributes of the *program* that are essential for success for *academe*

Although there were many in the survey, these top four items comprise 50 percent of the count.

ATTRIBUTE	FRACTION	CUMULATIVE
Collaborate	0.34	0.34
Commitment	0.19	0.53

Table 2. Attributes of the *participants* that are essential for success for *academe*

These top two attributes comprise more than 50 percent of the count.

ATTRIBUTE	FRACTION	CUMULATIVE
Utility to industry	0.19	0.19
Collaborate	0.18	0.38
Funding	0.16	0.53

Table 3. Attributes of the *program* that are essential for success for the *practice*

These the top three attributes comprise more than 50 percent of the count.

ATTRIBUTE	FRACTION	CUMULATIVE
Collaborate well, respect and understand each other	0.19	0.19
Aligned and agreed expectations	0.13	0.33
Commitment/dedication/motivation/availability	0.09	0.41
Funding (adequate, flexible, leveraged)	0.08	0.49

Table 4. Attributes of the *participants* that are essential for success for the *practice*

The list of attributes of the participants that are essential for success of the practice is quite small; the top single item comprised 46 percent of the count—very important.

ATTRIBUTE	FRACTION	CUMULATIVE
Collaborate	0.46	0.46

Table 5. Aspects that are essential for collaboration success

These top four represent 50 percent of the total count.

ATTRIBUTE	FRACTION	CUMULATIVE
People cannot relate/adapt to culture, purpose, timescale	0.16	0.16
Inadequate funding, or valuing of in-kind support	0.11	0.27
Lack of utility to either	0.11	0.37
Administrative burden, bureaucracy	0.09	0.46
Poor coordination (events, participation, feedback, etc.)	0.09	0.55
Management not engaged nor accepting long-term timing	0.09	0.63
IP issues, conflicts	0.08	0.71
Independent agenda of researchers	0.06	0.77
Vague and ever-changing objective, method, goals	0.06	0.83
Inflexible (people, goals, structure)	0.06	0.88

Table 6. Aspects that are a barrier to collaboration success

Further reading

Evidence of the practice-academic gap in understanding is represented by the following articles. Some are academic analysis of the literature of collaboration case studies. They focus on discovering truth and present it in a sophisticated (high fog index) style, with secondary importance about what to do and not do for application success. Others seek to understand the problems and focus on what to do to overcome the gap.

Many organizations, as well as individuals, have or had recent initiatives seeking to understand the gap and to provide guidance regarding collaboration best practices in education, or research and development. Despite the diversity of origins, countries, disciplines, methods to discover, and the academic or practice viewpoints of the authors, the bottom line of what to do is aligned with the results presented in the article.

- Awasthy, R., Flint, S., Sankarnarayana, R., and Jones, R. L. (2020) "A framework to improve university-industry collaboration", *Journal of Industry-University Collaboration*. 2(1), 49-62.
- Garousi, V. Petersen, K., Ozkan, B., (2016) "Challenges and Best Practices in Industry-Academia Collaborations in Software Engineering: A Systematic Literature Review", *Information and Software Technology*, 79, 106-127.
- Mastellone, S., and van Delft, A. (2021), "The impact of control research on industrial innovation: What would it take to make it happen?", *Control Engineering Practice*, 111 (3-43)
- Nsanzumuhire, S. U., and Groot, W. (2020) "Context perspective on University-Industry Collaboration processes: A systematic review of literature", *Journal of Cleaner Production*, 258
- Pecas, P., and Henriques, E., (2006), "Best practices of collaboration between university and industrial SMEs", *Benchmarking An International Journal*, Vol. 13 No. ½, 2006 pp. 54-67
- Pertuzé, J., Calder, E., Greitzer E. and Lucas, W. (2010) "Best Practices for Industry-University Collaboration", *MIT Sloan Management Review*, 51(4), 83-90
- Samad T., Bauer, M., di Cairano, S., Fagiano, L., Goodman, B., Goupil, P., Heertjes, M., Mareels, I., Odgaard, P., Rhinehart, R. R., Sanchez-Peña, R., Serbezov, A., and Sosseh, R., (2020) "Industry engagement with control research: Perspective and messages", *Annual Reviews in Control*, 49, 1-14.
- Sauermann, H. and Stephan, P. (2013) "Conflicting logics? A multidimensional view of industrial and academic science", *Organization Science*, 24(3), 889-909.
- Serbezov, A., Rhinehart, R. R., Goupil, P., Anizi, D. A., "Academic-Practice Collaborations in Automation and Control: Keys for Success" IFAC Symposium on [Advances in Control Education](#) 2022 (Hamburg, Germany, 24-27 July 2022).
- Wolfenden, H., Sercombe, H., and Tucker, P., (2019) "Making practice publishable: what practice academics need to do to get their work published, and what that tells us about the theory-practice gap", *Social*

Epistemology, 33 (6), 555–573.

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