

Innovation Through Collaboration: Company-University Partnership Strategies

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ABSTRACT

Open Innovation, through partnerships across a community such as a network of university researchers, is an alternative mechanism to stimulate corporate growth and build value in contrast to proprietary innovation. In this paper, we build on our experience and strategies presented at previous workshops. We outline a business process model based on use cases for establishing and leveraging company-university collaborations, both to extract value in terms of the development and inspiration of new intellectual property and the recruitment of top technical university talent.

Keywords

strategies; tactics; collaborations; innovation; research partnerships; use cases

1. INTRODUCTION

Henry Chesbrough [1] highlighted the differences between “open innovation” and “closed innovation” (also known as “proprietary” or “internal” innovation). In the past, companies attempted to hire all the “best and brightest” people in their industry and developed products internally by tightly controlling intellectual property. However, in the 21st century no one company can generally control innovation in their industry since the breadth and mobility of talented people and ideas is global. There is greater value to be gained by leveraging partnerships that don’t carry the cost burden of internal research resources. “Open Innovation” by companies blends internal and external ideas. External ideas can be identified through VC (Venture Capital) investments, corporate mergers and acquisitions, corporate joint ventures and partnerships, participation in standards organizations and open source communities – and university collaborations (the focus of this paper).

Company-university collaboration is a complex activity to set up and manage. Many companies don’t fully leverage or understand the dimensions of university collaboration, and most academics are not aware of the full range of company partnerships available. In this paper, the authors will outline best practices and business processes that contribute to successful collaborations and build mutual value for the companies and universities.

We begin with a summary of strategies for building collaborations, followed by the outline of a business process model based on use cases that details some of the most frequent real-world collaboration scenarios. While the number of variations of these scenarios is potentially infinite, a good understanding of core collaboration models will enable companies to find new ways to improve their collaboration capability, and will help university researchers recognize some of the management and intellectual property challenges (IPR) that are important to their company sponsors.

As Fraser noted in a recent issue of the HP Innovation Journal [2], innovation can be modelled into three horizons [3]. These horizons are nominally labeled H1, H2, and H3. H1 represents a near term R&D development cycle of less than 18 months, H2 represents a mid-term innovation cycle of 18 to 36 months, while H3 represents an imagination cycle of more than 36 months. In terms of university research, H1 innovation is well matched for tactical R&D contract research where the outcomes and deliverables are anticipated and reasonably well defined. H2 innovation is more focused on the exploration and prototyping of new technologies (e.g. through memberships in research consortia). H3 innovation is more of a blue-sky future view, focused on strategy, and the incubation of disruptive technologies.

Once upon a time, large industrial research organizations (e.g. Bell Labs, IBM Research, Intel Research, HP Labs, Oracle Labs, Microsoft Research, etc.) had the luxury of open budgets and schedules [4] with an emphasis on H3 innovation. However, in the 21st century the drumbeat of corporate fiscal quarters does not afford this luxury. Customers and shareholders now demand an accelerated growth in product functionality and capability. Mostly gone are the days of monolithic systems with lengthy pay-back plans – development cycles are shorter and more

agile by necessity. The tech giants of today may become the dinosaurs of yesteryear, so leveraging university research to complement an internal research organization is a path to stimulate growth and increase value through collaborative partnerships. This could make the difference between corporate longevity (profitability) and a rapid spiral to oblivion (bankruptcy).

2. STRATEGIES FOR BUILDING COLLABORATIONS

In the 2016 edition of the ICSE SER&IP workshop, the authors presented a paper on collaboration strategies [5], which outlined company issues and strategies for effective collaboration. Companies look to achieve results, attract talent, and build company reputation for innovation. In return, universities get access to corporate resources, as well as calibration of their research in a real world context and employment opportunities.

The 2016 paper provided detailed steps based on experience for companies to build and grow a company-university collaboration program. The essential first steps include:

- Identify collaboration goals early
- Select the right university partners
- Choose one or more collaboration models
- Set expectations at the start of the relationship
- Track the results and make them visible

Collaboration models are structured around gift awards, research contracts, internships and fellowship programs, product donations, consortia memberships, etc. Each model has different objectives, overhead costs, governance requirements and interaction requirements.

What kinds of benefits should companies consider in the planning process? There is value in scouting new technology areas, developing new business models, building and evaluating prototypes. Collaborations can speed the application of new skills and knowledge within a company. The collateral of research investments to support collaboration will indirectly improve a company's ability to recruit talented staff.

There are potential pitfalls to collaboration. Companies need to protect their proprietary IPR. There should be clear agreements about the IPR in every collaboration to avoid mismatched expectations which might lead to million dollar lawsuits as in the case of WARF (Wisconsin Alumni Research Foundation) vs. Intel [6].

Companies use open innovation models and gifts to support exploratory research in order to limit overhead costs and the complexity of research contracts. However, companies should exercise caution to ensure that research gifts do not lead to conflicts-of-interest related to insider information. Finally, as in any long-term relationship, churn will happen. For example, there will be changes in product direction and corporate budgets, as well as the disappearance of company partners and executive sponsors due to corporate restructuring and layoffs.

3. PLANNING AND FUNDING COLLABORATION

Companies may use several funding models for university collaboration programs:

- Central funding – Corporate-wide engineering organization or Human Resources (HR/Staffing)
- Distributed funding – business division or directly from a project or departmental budget
- Company Philanthropic funding (cash, equipment, and services)
- Corporate Leader Philanthropic funding – (e.g. Gates Foundation, Hewlett Foundation, etc.)

Philanthropic funding is much desired by both companies (for tax benefits) and universities (limited restrictions on usage). However, in order to receive tax benefits there can be no quid pro quo benefits – for example, the company cannot have early access to research results.

Corporate funding, whether it is central or distributed, is generally proportional to the profitability of the organization. Funding from a corporate business unit is generally tactical (H1 Innovation) to support near-term R&D, while corporate-wide funding is more likely targeted towards H2 and H3 strategic innovation.

When profits decline, corporate funding for university research can shrink precipitously limiting university collaborations.

In comparison to engineering based university relation programs, a company's HR/Staffing investments are generally focused on scholarship/fellowship programs and campus recruiting – e.g. support for student

organizations, speaker series and pizza nights to boost company visibility on campus, or other such programs. Not surprisingly if a company isn't in growth mode, recruiting is limited.

Often companies use a hybrid blend of funding models. Government funding (e.g. matching grants) to support a university research project can help reduce a company's direct costs. But a company-university collaboration program can never be merely a low/no-cost solution for a company, because universities are motivated to recover operational costs and to extract a fair market value for their research.

4. USE CASES TO MODEL BUSINESS PROCESSES

To analyze the business process of company-university collaborations we use the software requirements practice of Use Cases [7]. Use cases are a good analysis tool for understanding the essential elements of the business since they are based on the identification of actors, goals and scenarios. A use case business model is a simple scenario-based model to describe the behavior of a system. A use case model consists of three parts: a list of actors (the people and roles involved), a short list of key goals (what the stakeholders need to accomplish), and a set of scenarios (short stories that describe the most common interactions between the elements of the system). When we employ use cases to model a business system, the actors are the participants in the business scenarios and the goals are some of the results that the participants expect to achieve.

Each scenario has resources and constraints. The resources include the skills and knowledge of the participating actors, the existing intellectual property that each participant is allowed to share, and the time and budget allocated to the collaboration. Most of the constraints are related to the corporate and university policies and regulations, such as financial management rules and processes for handling and releasing proprietary information.

The use cases in this paper are a subset of a more complete use case model, which can be found here: http://manclswx.com/papers/collab_ucs.html.

5. ACTORS IN THE COLLABORATION MODEL

The use case model for company-university collaborations is multi-faceted. It involves several strategic and tactical roles on the company side – for example, R&D managers, architects, senior technical staff, etc. The role of “collaboration manager” is essential as the number of university collaborations increases – to organize and connect company R&D (Engineering), Executives, HR, Legal, Finance, Philanthropy, Sales, and Marketing resources.

Company R&D managers evaluate the need for collaboration when current and future product plans can benefit from open innovation. They may identify some technologies (such as development tools, frameworks, high-performance databases, communication utilities, or specialized hardware) that are needed to augment the company's ability to deliver high-quality products. Or they may identify additional technical experts that would help accelerate the development of new products.

Who is involved in establishing a collaboration? It is common to have some involvement of executive managers – to choose the types of collaboration, to sign off on the potential external partners, and to set the basic rules how the collaboration will operate. Other roles include:

- Technology transfer agents who provide training and coaching based on the collaboration results
- Invited speakers (e.g. company executives, R&D staff) by university partners
- University alumni (company staff who are alumni of potential university research partners)
- Company “alumni” who have transitioned to academia

The roles on the academic side of the collaboration need to be analyzed in more detail than just the traditional division of students, professors, professional staff, and university administrators. It is more useful to structure the academic actors into these categories:

- Research collaboration leaders (Principal Investigators – PI)
- Research collaborators (faculty, research staff, students)
- Collaboration governance managers (contract and philanthropy management, department heads, deans, etc.)

These are the university stakeholders in the research collaboration. The role of the oversight staff is to ensure that the initial collaboration agreement complies with the rules of the university – gifts and grants are used in accordance with university policies, the rights to publish research results are clearly defined, and so on.

In some collaboration models, there are special roles to consider: Individuals working outside of their normal workplace:

- Student interns as company employees
- Professors on sabbatical or as consultants working temporarily at or with the company
- Company staff as visiting university faculty

6. KEY GOALS IN THE COLLABORATION MODEL

In a use case model, the main use cases are connected to key goals of the actors. In this model of company-university collaborations, the most important goals are the events in a company that trigger a company executive or R&D manager to establish a collaboration program, as well as the motivations of university staff to seek out collaboration opportunities.

What are some of the most common goals that shape the collaboration process? Some goals are very specific, others are more general. A company may want to work with university partners:

- to develop a specific set of tools or frameworks to for new products and services
- to create new ideas
- to explore areas of interest (or possible dead ends)
- to build mindshare (public attention to the company)
- to attract new talent

University staff and students may want to work with company partners to:

- calibrate research results in a real-world environment
- explore a group of tools to use on large-scale data
- help professors and students to formulate new research questions that have practical applications
- find employment opportunities for students

For companies, the most important goals are tied to four classes of objectives:

- enhanced revenue from new company products
- long-term benefits from the company's increased ability to attract talented employees
- longer-term benefits from accumulating valuable intellectual property and patents
- increased company innovation brand value

For universities, the most important goals are connected to four objectives:

- funding/equipment to support university research
- research products (articles, papers, impact on policy)
- ROI and intellectual property (including patents)
- employment opportunities for students and researchers (internships, sabbaticals, full-time roles, etc.)

7. USE CASES

There are two important use cases for company driven collaboration partnerships. Our first use case is the outline of a single collaboration engagement to work on a specific problem or technology. The second use case describes a more wide-ranging collaboration program.

A. Company driven project based partnership

There are many reasons for a company to trigger the creation of a university collaboration: a need to produce specific development-related results quickly at a low cost, to leverage existing expertise in specific university research groups, and/or to foster more in-depth research in a topic.

The main sequence of events in this use case: The collaboration starts with a tactical internal company decision to fund a specific research or prototyping effort (see Fig. 1) – usually tied to a specific company product line. R&D managers establish the budget and the research objectives. Next, a company manager (acting in the role of Collaboration manager) identifies a set of potential collaborators and starts a dialog about the goals and work program. These goals might be decided in informal negotiations, or more formally through a published Request for Proposals (RFPs) to a select list of potential collaborators. University researchers (professors and students) write

and submit proposals. The company selects one or more of the university groups and begins contract negotiations (see Fig. 2). The contract details the statement of work (SOW), personnel and resources to be provided by participants, the schedule, procedures for tracking and making changes to the plan, intellectual property agreements, and conditions for contract termination. During the term of the contract, staff members on both sides of the collaboration make periodic reports to their respective leaders, and the leaders negotiate adjustments to the research program as needed.

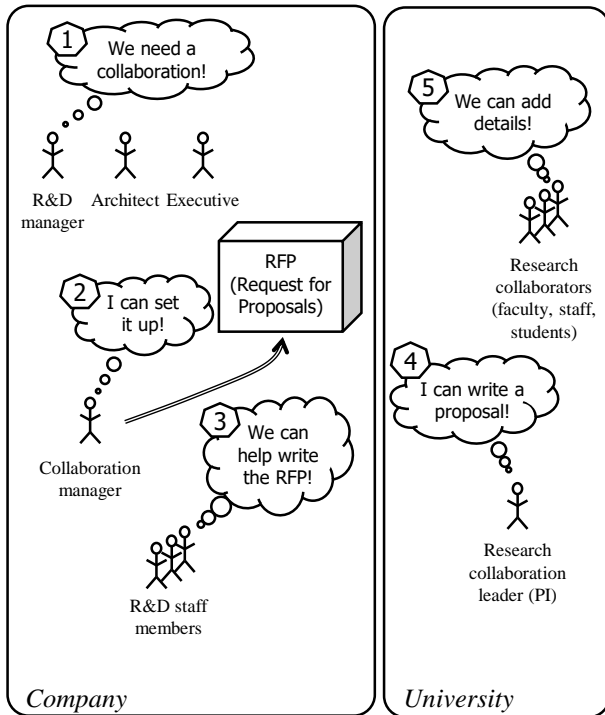


Figure 1 – Initial steps for creating a new collaboration

There are two options in the initial steps of this scenario. Some companies may prefer to start the process with informal discussions with a few university professors. This is an efficient way to begin individual collaboration projects with a short horizon (H1 = tactical R&D contract research). These engagements typically have a small scope and short duration. A formal RFP is preferred for H2 and H3 research, especially when a company wants to invite proposals from many potential contributors. In both cases, the collaboration partners need to have a clear understanding of the work to be performed at the end of the negotiations.

In the process of selecting the right research partner, a company may consider opportunities to leverage government programs that promote research in certain fields or that provide incentives for regional development. For example, some government programs may provide matching funds to support a research collaboration – as part of an integrated plan to provide economic development or tax incentives or other benefits attractive to the company.

In the process of setting up a research contract, the company might choose a directed research strategy or a gift research strategy, and the choice will depend on what the company expects to achieve.

- In a directed research program, the company and the university work jointly to achieve contractual objectives.
- In gift based program, the company supports a program (generally outlined by a university research proposal). However, the company has no direction nor does it receive proprietary results. Rather the results may be placed in the public domain for community good by the university through publications, contributions to open source libraries, etc. A company gift research program is a good way to build relationships, promote brand, and support early exploratory work – however there can be no expectation of delivered value other than a tax benefit. Gifts must be at “arm’s length” and there can be no expectation of reciprocity or early access to research results.

For improved collaboration, participants in the collaboration should understand the goals of the other parties. University researchers should propose work that matches the research horizon expressed in the company’s RFP. Professors want to be able to publish research results. Ben Shneiderman [8], in his advice to university researchers, explains that they must promote their research ideas to become “rich and famous.” Today, research is frequently promoted through websites, web videos, and social media – not just through old-school journal and conference publications. Although it is possible for companies to negotiate research contracts with very restrictive rules about publication and disclosure, companies will likely have a better collaboration relationship if they adopt an open innovation model of collaboration.

The schedule of meetings and deliveries for a collaboration program should also accommodate calendar challenges on both sides. Some companies have rigid product delivery cycles – and it may be difficult to deliver collaboration work products or have collaboration meetings in the weeks around a major product release date. Similarly, universities have schedule constraints, such as exams, holiday breaks, department meetings, conferences, and consortia reviews.

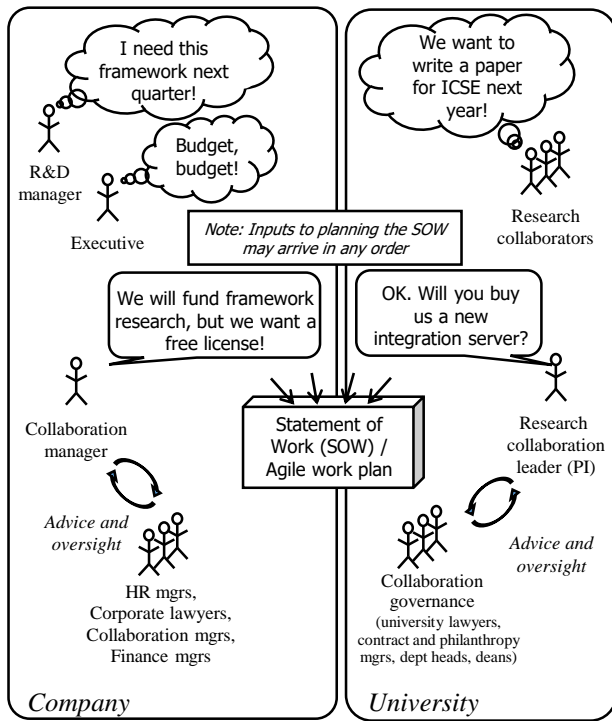


Figure 2 – Negotiating a collaboration contract

B. Company driven – multiple program-based partnerships

As companies find that they are doing more collaboration engagements, they may decide they need to have more commonality in the process for starting and executing collaborations. Companies often make an internal decision to fund several research projects (program) in a specific technical domain, or to fund research projects to build relationships with a group of collaborating academic partners (see Fig. 3).

The key actors for this use case are the Collaboration manager (a company manager who sets up and coordinates the program), executives or product managers who provide the funding and decide on the guidelines of the program, and the university researchers who submit proposals to the program.

While research grants and gifts from a company to university researchers may be made on an individual stand-alone basis – they achieve greater impact if done on a coordinated basis. The coordination may either be local to an individual business unit or site – or organized and funded centrally.

Both strategies work. If funded locally, geographic proximity may be leveraged where the university is “local” to the company site – a many-to-many (company and university researchers) interaction – alleviating the challenges created by travel (time, budget). Local proximity to the university encourages company staff to attend departmental

seminars, participate in mentoring projects, and more freely collaborate in research activities. Similarly, university researchers may be invited to give research presentations at the company or short-courses. Company employees are also more likely to study for advanced (masters, doctoral) degrees.

If the university partner is not near the company location, the relations are more likely to be virtual, and technology options such as video web streaming and audio conferencing are useful tools for supporting collaboration. Universities such as MIT, Stanford, and UC Berkeley regularly stream their consortia meetings, guest lectures and courses. However, it is interesting to observe that many universities have not yet tapped into virtual collaboration opportunities.

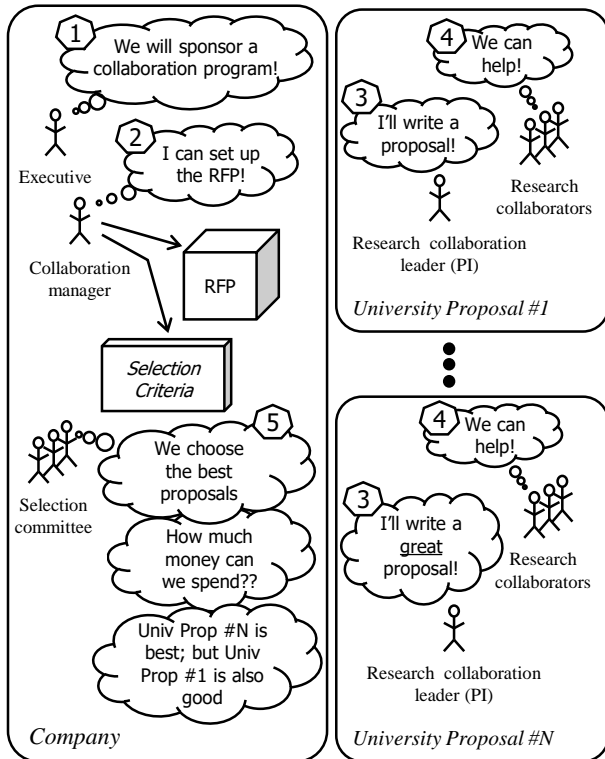


Figure 3 – Company collaboration RFP program and selection scenario

Central corporate coordination may take one of two different routes:

- RFP research program where the program consists of “open” or “targeted” calls for research proposals in defined areas of interest.
- A company may directly approach specific universities or group (usually a specific research program or university research consortia) to co-create a strategy for collaboration.

In both cases, there will be some effort needed to convert the proposals and strategies into a concrete plan. This plan should be a formal agreement (contract) to define funding, interactions, ownership of resulting intellectual property, and anticipated outcomes (schedule, deliverables).

1) RFP Program. An RFP program is a systematic vehicle to collect and then assess multiple research proposals. To be efficient, a web interface and database can be used to manage submissions, reviews, assessments, approvals, rejections and associated correspondance.

RFP programs have different phases (submission, review, funding, and outcome tracking) and require:

- effective processes to triage and select proposals
- funding processes (both internal and external)
- feedback loops for internal and external partners

RFPs should be reviewed to ensure they aligned with the company’s research objectives and product roadmaps. Once proposals are received, reviewers must assess the proposals for relevance, inventiveness, the likelihood of

success, budget, existing relationships, collaborative planning (e.g. internships, sabbaticals, tech transfer), and fit with company strategic technology plans.

For example, at Cisco's Research Center, new RFPs were published regularly (www.cisco.com/research) sponsored by senior technical staff – and proposals reviewed and funded each quarter [9]. In 2013, the majority of projects were funded philanthropically from a \$5M annual research philanthropy budget. Occasionally there were issues when sponsors left the company without transitioning their program – another less serious issue, but still politically challenging, was when senior technical staff desired to fast-track a proposal without the appropriate due diligence.

At the end of the research funding cycle (generally 15 to 18 months after the initial approval), an assessment by both the sponsor and the university researcher was documented. Measurable benefits were student internships (attracted by the collateral of collaborative research) and full time hires of graduate students and post-doctoral fellows.

2) University consortia. University consortia are another vehicle for collaborative research. Generally, consortia are well established organizations (both virtual and physical) consisting of groups of researchers and students – supported by multiple companies. Their “critical mass” multiplies the effect of research investments and broadens their scope. However, consortia collaborations are not without challenges which include:

- Governance might not align with company priorities
- Membership fees may require considerable fiscal commitment (\$1M) over 1 to 5 years
- Termination may require 1 year's notice or more
- Intellectual property is likely non-exclusive to any one member and may require additional licensing
- Derived company value depends entirely on company representatives and their effectiveness

3) Gift programs. One approach for a company to build relationships with many universities is to focus on gifts rather than directed research grants. There are four major motivations for corporate gifts to university research groups:

- Increase R&D Capability: Improve the capability of company research in technologies in priority areas.
- Talent Acquisition: Create goodwill and a basis for future joint work
- Improve Corporate Brand: Through association with globally branded universities
- Build Community: Create visibility for corporate products and services through donations etc.

As described earlier, research can be funded with gifts which provide tax benefits to the company. The challenge is that gifts cannot result in any quid pro quo – for example, early access to results. Gift program governance requires careful understanding of government compliance and conflict-of-interest guidelines.

Government regulations must also be considered when setting up corporate gift programs. In the US, the ITAR (International Traffic in Arms Regulations) and EAR (Export Administration Regulations) rules must be observed. These rules apply to many aspects of research associated with big data, encryption, communication, etc.

Research gifts can be a valuable mechanism for funding parts of the research community – assuming that benefits flow from the university to the broader research (industry and academic) community for all to leverage. It is critical that the gifting process follows clearly established guidelines on ethics and process. A research gift program should support “openness” rather than competition. Companies generally want to avoid the situation where a university uses the gift to create intellectual property that cannot be leveraged by the company – not withstanding its financial support.

8. ROLE OF COMPANY EXECUTIVES IN COLLABORATIONS

A collaboration program needs to be flexible in order to adapt to unexpected events, including independent actions by corporate executives. Executives can impact negatively existing collaboration programs – e.g. by making unfunded commitments. However, executives are important stakeholders in the collaboration process and they are likely best positioned to identify and promote the strategic goals of a company's collaboration program.

C-level (e.g. CTO) collaboration program sponsorship can help mitigate requests from other executives that create budget challenges or that clash with established business processes. For example, if an executive makes an unfunded commitment (such as a \$1M contribution for a university chair, a new lab, or a fellowship), it is important to flag the issue and perhaps coordinate directly with an existing (funded) program.

Executives can break logjams and accelerate projects stalled due to red tape or lack of corporate visibility. A discussion between a company CEO and a university president can remove obstacles very quickly. However, there are reasons to be wary of fast-track projects and due diligence is required to ensure that company, university, and government regulations are followed and that there are no hidden conflicts of interest.

Collaboration managers should have flexible plans to support changes in strategic direction. One approach is to allocate a contingency budget that includes several priority – but not necessarily urgent – program budgets. Managing cash flow is important to ensure that budgets are spent and accounted for quarter by quarter. The timing of university commitments (e.g. contracts, gifts, etc.) can be unpredictable due to research delays or onboarding of staff and students. Therefore, it is essential to understand what budget commits will actually close before the end-of-quarter and whether there will be unspent budget.

9. FAILURE SCENARIOS

A. Lack of response to an RFP

In some cases, a company may publish RFPs and receive either no proposals or superficial proposals that don't meet the company needs. Reasons for the lack of response include: lack of visibility for the RFP, too much process (paperwork for proposal submission), and a perceived low return on investment (ROI) by university researchers.

To mitigate, the RFP process should be as 'light' as possible and should be socialized to make it visible broadly in the research community through campus interactions and conferences. An RFP is a two-way communication tool that asks prospective collaboration partners to explain their research plan, anticipated outcomes, and previous related successes. An RFP should be designed to make the proposal evaluation process transparent, quantitative and objective – providing an auditable basis for comparison of proposals.

B. Contract impasse between company and university

When a company has selected a university partner, the collaboration process can still “fail at the start” if the two parties can't agree on contract terms. A company should know that a research or gift contract with a university is different than a contract with a supply chain corporate partner.

University related contracts should be more flexible in the Statement of Work (SOW) – schedule, meetings, deliverables, and treatment of proprietary information and press releases. A good practice is to use an agile approach to project planning – define an initial set of objectives, but make adjustments based on intermediate research results.

A company may find that for some research areas, their primary goals may be related to inspiration, building innovation brand and attracting talent – these goals can be better served by the simplicity of philanthropic gifts rather than the complexity of research contracts.

C. Company resources

University collaboration programs are frequently affected by challenges beyond their control – e.g. a corporate reorganization or poor quarterly results. Collaboration managers have a responsibility to track collaborations and make results visible. Visible results that influence revenue streams to the satisfaction of senior executives are beneficial. University researchers should be aware of how the research needs of their company collaboration partners may change over time.

10. SUMMARY

A simple use case model shows the typical lifecycle of a collaboration relationship and the motivations of the participants. While a use case model could have hundreds of detailed use cases, the use cases we have outlined are the useful first steps to establish or improve a program.

There are resources available for both university and company staff interested in building collaborative partnerships – for example those provided by the UIDP [10] (University Industry Demonstration Partnership) and AUTM [11] (Association of University Technology Managers). In the US, the NSF (National Science Foundation) supports cooperative research between industry, academe, and government and similar programs exist in other countries to be leveraged in support of company-university partnerships [12].

In conclusion, there are five main messages from our use case analysis of the collaboration process:

- A well-structured collaboration program will deliver value to all participants – companies and universities and by extension shareholders, students, and international community interests. A company’s collaboration program should have a collaboration manager role – someone who can plan and communicate information about the program’s goals, resources, strategies, and impact.
- Companies look for “intellectual property created” as one measure of the value of a collaboration. However, corporate decision makers should be made aware of other benefits such as: company innovation brand, marketing collateral, recruiting top technical talent, influencing government policy, leveraging government funding, competitive analysis, and tech trend sensing.
- University researchers obtain value in several ways from collaboration: financial support, real-world calibration and validation of their research work, access to company resources, employment opportunities (including internships), and increased visibility and fame for their work.
- The oversight roles in the collaboration process are critical to help avoid research efforts that might undermine a company’s existing product lines, conflicts over future use of intellectual property, and inattention to regulations.
- Companies will be more successful at innovation if they “grow” a set of experienced collaboration managers who can guide the setup and execution of productive partnerships.

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