

SEGMENT 3

Industry Sponsored Collaborative Postgraduate Research: Prospects and Challenges

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Introduction

University-industry linkages and their impact on innovation processes especially in the area of research collaboration, has been a longstanding object of analysis in various management studies (Van Looy, Ranga, Callaert, Debackere and Zimmermann, 2004).

Some of the innovative technology transfers today involves collaborative projects with industry. University-industry collaborations often lead to long-term partnerships, creating a pipeline for innovations to swiftly reach the market for which they were created. In these collaborative research arrangements, costs, personnel, equipment, facilities and research capabilities may be shared for mutual benefit, and government participation in project funding is also a possibility. Collaborative research projects provide industry with an excellent means for influencing research funding by capitalizing on the respective strengths of all the organisations involved in the research activity. Considerable demands are placed on postgraduate research students that are involved in research programmes which are undertaken as part of collaboration between a university and

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an industry. A typical collaboration between a university and another partner may involve senior academic and industry professionals, together with other technical and research staff. However, for all these individuals, the collaboration is a day to day work activity whereas, for the research student, each day contributes towards some larger outcome which may only be assessed after a period of time and, even then, this assessment would most likely be made by people outside the scope of the collaboration. The difficulty, of course, is that each partner in the collaboration tends to place a different level of priority on the problem at hand – the industrial partner generally focusing on developmental and commercial issues and the academic partner focusing on the research issues (Toncich, 2006).

General Principles Governing Research Relationships

While the approach taken on any given project would need to be mindful of the specifics of that project, in general, the following principles govern most university-industry research projects:

- The intellectual property assets of industry partners must be respected. Proprietary data belonging to the industrial partner, commercially sensitive information, and potentially valuable results or ideas must be protected from unauthorized, inadvertent, or untimely disclosure;
- The core values of academic freedom must be maintained. The university does not conduct secret research and scientifically significant advances must be publishable in the open literature without unwarranted delay. Reasonable publication delays are permitted to secure intellectual property protection. Publications will not contain sponsor confidential information (including results of standard fee-for-service projects);

- Since much university research is actually performed by graduate students, it is also important to keep their academic needs in mind. Undergraduate and graduate students, postdoctoral fellows, and university lecturer must ultimately be free to disseminate results and defend theses; provided the confidentiality of such result is not in any way compromised.
- Ownership and access rights to intellectual property will be determined at the project outset and will vary from limited or no access, to outright assignment to the sponsor;
- The university and its researchers will retain reasonable freedom to operate intellectual property (i.e. to use the knowledge or intellectual property generated in teaching, in future research, and in the practice of their professions);
- The University does not assume risk for commercial use of research results. Intellectual property provided to a company will be on an "as is" basis and the company will be required to indemnify the University for its use;
- Conduct of research should be in accordance with the university research policies regarding the use of human subjects, animals and radioactive materials (Stiglitz, and Wallsten, 1999).

Intellectual Property (IP)

Intellectual Property (IP) simply refers to creations of the mind: inventions and designs used in commerce. Even though some research relationships between companies and the university allow for company ownership of resulting intellectual property. It is important to note that the University in some cases own the Intellectual property (IP) created during the course of industry-sponsored research. Consulting agreements, fee-for-service agreements and

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internship placements all fit into this category. At the other end of the spectrum, grants and philanthropy provide no access to resulting intellectual property. Between these two extremes, collaborative research agreements, as described above, provide a mechanism for a broad range of options related to the ownership and access to intellectual property. However, the University could grant the industry sponsor a first option to license the IP depending on the agreement (Perkmann and Walsh, 2007).

Types of University-Industry Research Relationships

University-industry interactions occur in many different formats where expectations and requirements vary according to the nature of the interaction. The types of University-industry research relationships include:

- **Co-op and intern placements** where students gain valuable work experience, supplemental to their academic studies, for a fixed term in company facilities.
- **Consulting:** A private arrangement between an individual lecturer/researcher and a company providing for his/her expertise to assist a company on a fee-for-service basis.
- **Fee-for-Service Arrangements:** service contracts for testing, evaluation or analysis of company materials; clinical trials; and space and equipment rentals
- **Grants-in-Aid** provide unrestricted support of research activities of an individual researcher or group of researchers.
- **Philanthropy:** A charitable donation or a gift to the University
- **Research Exchange Agreements** which facilitate the controlled exchange of information, materials, and

software. These include confidentiality agreements, material transfer agreements and end-user software license agreements.

- **Student Project Labs** which provide for practical learning experiences for undergraduate and graduate students as they tackle company identified problems during the course of their studies.
- **Technology Licensing Agreements** which provide access to established university intellectual property in return for a royalty or fee payment (Stephan, 2001).

Sample of Collaborative Research Agreement

Industry-sponsored research agreements provide for the conduct of collaborative or joint research that is of mutual interest to the researcher and the company with shared rights and access to the results. There is an expectation that there may be new IP developed within the project. Most companies use the results of the research as a benchmark to further evaluate the success of the collaboration.

The Project

- What are the start date and the end date of the project?
- If work starts before the agreement is signed, is the agreement to have retrospective effect?
- What resources will each party provide and when?
- Is the university's contribution to be limited to what the funding provided by the sponsor could do?
- Who are the key people involved in the Project?

Background

- What background will each party provide?
- Do other companies in the Sponsor's group need to use the university's background? If yes, will they agree to keep it confidential?

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- Is some or all of the sponsor's background confidential?
- May the university's staff and students publish any of the sponsor's background?

Results

- Which party will initially own the IP in the results?
- If the university owns the IP will it: allow the sponsor and its group companies to use that IP:
 - (a). in a specific field?
 - (b). in a specific territory?
- Agree to negotiate with the sponsor to:
 - (a). take an exclusive license; or
 - (b). take ownership (assignment) of any IP?
- If the University is to grant an exclusive license to the Sponsor, have the basic terms of that license been agreed—payment, IP identified targets, territory, field, duration, reversion?
- If the university is to assign any IP to the sponsor, have the basic terms of that assignment been agreed - payment, IP identified, territory, reversion?
- Have the parties agreed a patenting strategy?
- Will the pponsor contribute to costs incurred by the University in patenting at the sponsor's request?
- If the sponsor owns any IP or has exclusive rights, what rights will the university have:
 - for academic research/teaching/clinical patient care?
 - to use for the project?
 - other?

Financial Contribution from the Sponsor and Other External Funding

- What financial contribution will the Sponsor make?
- Is this a fixed amount or does it depend on amount spent by university, staff costs, etc.?

- What expenditure would the Sponsor re-imburse to the university?
- Is the sponsor paying on a full economic costs?
- How frequently will invoices be rendered?
- Is the project supported by any external funding?
- Are there any terms attaching to that external funding that conflict with what the parties want to do?
- Are any such terms applicable to both parties or just the university?

Confidentiality and Academic Publication

- Is confidential information to be kept confidential indefinitely or for a definite period after the end of the project? If the latter, what period?
- Is academic use/publication of results; sponsor's background permitted in principle, subject to safeguards?

Liability

- Will either party give any warranty: as to the quality of its contribution, or that any IP it contributes or creates will not infringe third party rights?
- Will the sponsor indemnify the university against any third party claims arising from use of results/university's background?
- Is there any financial cap on liability? If yes, what is that cap?
- Is liability for loss of profits, business and contracts to be excluded?
- If the university assigns any IP to the sponsor, will it give a guaranty of full title?

Termination

- May either party terminate if a member of the other's key personnel leave/are unable to continue and the replacement is not satisfactory?

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- If the answer is yes, will the sponsor still pay reasonable employment costs?

(Adapted from The University of British Columbia article on Collaborative Research Agreements)

Prospects

The benefits that accrue to the participants of university-industry research relationships, as well as to society as a whole, are substantive. These benefits range from increased publications in scholarly journals, to meaningful education experiences for students, to new and improved products, processes and services all of which result in wealth creation and an improved quality of life for the citizens.

Industry sponsored research at universities offers opportunities for both researchers and companies. Some of these opportunities are listed below. It is important to note that the key factor in industrial sponsored research is the ability of both parties to satisfy "personal interest" in the specific area of collaboration.

University Opportunities

- Access to challenging problems
- Financial support of research programme – both direct and matching funds
- Valuable educational opportunities for students
- Increase employment opportunities for students
- Access to industry facilities, personnel and data sets
- Additional income through honoraria and the potential for royalties

Industry Opportunities

- Providing a window on the future
- Accessing lecturers' expertise
- Accessing specialty equipment and facilities

- Accessing undergraduates, graduates, and post-docs as potential employees
- Contracting out routine work on a fee-for-service basis
- Leveraging internal research capacity
- Aiding in the renewal and expansion of a company's technology
- Expanding industry market options for new products.
- Aiding industry diversification into new ventures.

There is no one set of rules that could appropriately address the myriad of possible situations and research relationships. Each project needs to consider:

- Nature of the interaction;
- Stage and background of the proposed research;
- Common practices in the technology sector;
- Background rights to intellectual property; and
- Scientific and financial participation of both parties.
- Personal interest of the two parties

However, for a research project to be successful it is critical that all parties involved understand the terms and conditions that govern the contractual relationship of a specific project (Poyago-Theotoky, Beath and Siegel, 2002).

Challenges

The cultures and missions of corporations and universities differ. The companies' underlying goals—and the major responsibilities of management—are to make profit for the shareholders by serving customers, whereas universities' missions are basically to educate and to develop and disseminate new knowledge. While companies have a responsibility to their shareholders to protect the value of their investments, and confidentiality may need to be maintained, the ability of researchers to discuss their work with colleagues and to publish their results is fundamental to the academic enterprise.

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When a university enters into collaborative research arrangements with a company that has no interest in academic outcomes, such company could just take the university as a contract supplier of a service and nothing more. The relationship is not different from that between a consulting house and the company as long as such contracts are fulfilled solely through staff. However, when universities involve postgraduate research students within projects, and academic outcomes are sought within the context of an industrial contract, there may be problem (West, Vanhaverbeke, and Chesbrough, 2006; Toncich, 2006).

The research student should note that the relationship with the collaborating company must be constructed on the basis of mutually beneficial outcomes – the student delivers commercially beneficial outcomes to the company and the company delivers academically beneficial outcomes to the student. The research student should also recognise that the professional relationship with the company should be conducted on a business-like basis, and that the company staff would be assessed on the items that can be commercialised by the company, rather than a series of academic research outcomes. However, if a good professional relationship exists between a research student and a company then it can deliver, to the student, expert professional industry advice; access to industrial machinery, processes or data and, ultimately, long-term employment or references that could add significant professional value to the student (Von Hippel, 1987; Toncich, 2006).

The problem, however, is that a company's perspective on what is of benefit in a commercial sense may be different from the student's perspective. Similarly, the student's perspective on what is of benefit academically may be opposed to the company's perspective. Hence, the three

steps that the research student should take include:

- (1) Acquire an understanding of what research outcomes are beneficial to the company. This can be done through dialogue with the relevant staff of the company over a period of time and, as familiarity between collaborators increases, so too should the depth of understanding of the other partner's perceived requirements.
- (2) Consider how his/her research programme can specifically contribute to those outcomes and still remain intact as a postgraduate research programme. This could pose a challenge because many companies focus upon developmental and commercialisation issues.
- (3) Design how to formally propose a realistic set of outcomes for the programme, given a set of achievable commercial and academic outcomes. However, some research students put forward unrealistic goals that cannot subsequently be met just because they want to please industry partners while others could refuse to move away from academic goals and lose the support of the industry partner. It is after due consultation with the research supervisors that the proposal should be presented to the collaborating company as a starting point for negotiation on the project (Perkmann and Walsh, 2007; Toncich, 2006).

There are several key factors that influence a company's decision-making during the course of a research project. So, an employee, within a collaborating company, needs to be able to report back to higher levels authority in the organization the following types of information:

- The current status of the project.
- The current set of proposed outcomes that would be delivered.

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- The time at which those proposed outcomes would be delivered.
- The equipment and resources that would need to be Provided by the company in order to enable those proposed outcomes to be delivered by the student.
- The consequences of not providing appropriate resources to the project on the outcomes of that project.
- After sometimes, the company will start to evaluate the progress of research against the funds it has invested. There must be sufficient indices to justify the research continuity.
- The company takes a risk by funding a project which only has a limited probability of delivering some commercial outcome (Toncich, 2006; Russo, Van den Berg and Lavanga, 2007).

University Restrictions

- Students participate in collaborative research projects to enhance their academic experience. These arrangements must not delay or interfere with the academic studies or progression.
- Conduct of research has to be in accordance with the university research policies regarding the use of human subjects, animals, radioactive materials and biohazards;
- Some collaborative research arrangements may give rise to Conflict-of-Commitment or Conflict-of-Interest situations which require approval and management prior to the commencement of the project (Toncich, 2006; Russo, Van den Berg and Lavanga, 2007).

An important factor that influences the research student within a collaborative research project is the instability within a company. Professionals move from company to company, or from one position to another, within three to five year time-windows. For example, if a university decides to enter into a collaborative Doctoral research programme with a company for a period of four years and the time

between the initial meeting of the collaborators and the commencement of the first research student is up to a year, the company representative might move on to a different position before the conclusion of the student's research programme. This means that a research student would need to form a new relationship with a different company representative mid-way through a research programme. This tends to have serious consequences—existing bonds and relationships are broken and, worse still, a new representative is forced to take over an existing research project for which he/she may have little or no interest. All the more reason for the student to ensure, from the outset, that deliverables are clearly stated in writing and discussions are carefully documented (Toncich, 2006; Perkmann and Walsh, 2007).

When dealing with large organisations, the student also needs to consider the consequences of dealing with a smaller company. During the course of a three-year programme, small companies can suffer considerable turbulence through changing economic conditions or, in the worst-case, face closure or absorption into some other entity. A research student always needs to consider such worst-case scenarios because they do arise from time to time. Again, forward planning and what-if analysis can sometimes prevent corporate turbulence from creating crises with the research student's programme which, generally, needs to move on to an academic conclusion even if an industrial partner ceases to exist. Another issue, in terms of turbulence within a collaborating company, relates to the dynamic nature of the marketplace. Over the course of a three-year research programme, a company may change its collaborating staff, corporate strategies or product development.

A research student can feel as though he/she has been left out when such directions have changed. The key factors involved in minimising the potential damage of such

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changes according to (Toncich, 2006) are to:

- Recognise that directional changes are one of the major challenges in industry-sponsored collaborative research.
- Know that changes may occur during the course of the programme
- Be prepared to change the direction of industry research programmes and to renegotiate potential outcomes.
- Be aware that industry collaborators may change along the way and be ready to form new relationships with replacement staff that may have only limited interest in the current research project

In the final analysis, if a collaborative research programme is based solely upon a project, rather than a student's ability to interact, negotiate and change with the company, then the research project tends to disintegrate when corporate turbulence does arise. Industry-oriented research students may well ask why they should be burdened with issues of negotiation and interaction when their ultimate objective is an academic one. Industry-based research involves far more than just academic ability and the rewards are far more than just academic credentials. Those that enter into such programmes would be able to use the resulting negotiation, interaction and planning skills to great advantage in their later careers.

To this end, those that survive the challenges of the collaborative research environment will potentially be high calibre researchers with both academic rigour and industrial practicality. They will be individuals who can conduct research and move the research forward towards commercialisation in an industrial sense. In the short term, they will need to endure some complex challenges that arise from the sometimes awkward relationships between universities and industry.

To understand the conflicts between industry and academia, it is important to recognize that an employee, within a collaborating company, who is entrusted with the task of ensuring the smooth progress of the collaboration, will be subject to corporate timeframes that are endemic within the organisation. For example:

- A company which is predominantly based upon unskilled workers, performing manual tasks, will be accustomed to measuring human outcomes in seconds or minutes.
- A company predominantly employing trade/technical staff will measure its outcomes in minutes or hours.
- A company with professional staff will measure outcomes in days or, sometimes, weeks

A research student, on the other hand, will enter into the company environment with time-frames which are typically measured in years. Even when companies have their own internal research and development facilities, such individual research time-frames are difficult to reconcile against normal corporate practices. Most companies want a situation whereby student use of its facilities for test or performance evaluation be structured in such a manner that the production, daily target is not affected in any way. A good industry research student will develop the skills that are necessary to bridge the conflicting expectations and to divide his/her research programme and its outcomes into units of time that can be easily understood by the industry collaborator (Toncich, 2006).

Conclusion

There are a number of reasons why students should be involved in industry collaborations, despite the difficulties that such programmes can engender. One of which is that the difficulties that arise in such programmes could also be good challenges and opportunities. Some graduates view the world

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in a binary way, with opinions appearing altogether correct or altogether incorrect. Collaborative research programmes could, on the other hand, graphically illustrate how two seemingly irreconcilable perspectives can be generated and both would still appear valid. Research students can gain an appreciation of the differing perspectives, and how they can effectively be bridged. Such students are often far more effective as professionals than those who solely master the processes of pure academic research (Toncich, 2006; Russo, Van den Berg, and Lavanga, 2007).

Research students should endeavour to face the challenges of collaborative postgraduate research because of the nature of what is learnt through industrial development processes. The burden of taking esoteric concepts and converting them into applied principles and products, that function reliably and can be delivered for a reasonable cost, is one which places an entirely different perspective on pure research. Research students soon discover that esoteric research ideas can be a relatively insignificant commodity once the complexities of the development and commercialisation process are injected into the cost equation.

The challenges of collaborative postgraduate research can be considerable in terms of time and workload. For instance, an industry-based postgraduate research programme can be twice the workload of a pure research programme because it takes on the composition of both a developmental project and an academic research exercise. The benefits, on the other hand are also considerable. Those who succeed in these programmes are generally far more desirable industry employees than pure researchers because they tend to be better negotiators and have a better grasp of the role of research and how it can lead to commercialization. These benefits can translate into career mobility and good financial returns on the long run (Von Hippel, 1987; Toncich, 2006).

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