Collaborat

Content by
Donald Rumball

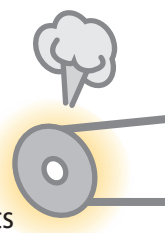
Edited by
Dave Gahunia

R&D

in Canada's smaller companies

THUMBNAIL

Globalization has made research and development (R&D) and commercialization activities critical to the survival and success of companies of all sizes. However, it's harder for smaller companies compared to bigger companies. Given the limited resources and high associated risks involved in innovation development for small and medium-sized companies (SME), it makes sense to partner with other organizations in a collaborative project to achieve innovation.



Cool Companies magazine believes collaborative innovation is just emerging. This article presents results of a recent case study[1] that explores the collaborative activities of a handful of Canadian companies. It offers practical insights to pioneering leaders seeking to enter collaborative innovation relationships today. Included are the identification of 6 types of collaboration relationships, and 3 case studies that provide key insights into the way collaboration works and doesn't work.

[1] "Case Studies of Collaborative Innovation in Canadian Small Firms, May 2007" Researched and written by Donald Rumball for Industry Canada. The study can be found at http://www.strategis.ic.gc.ca/epic/site/sbrp-rppe.nsf/en/rd02182e.html

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Motivation for Collaboration

In the ever-growing global economy, innovation, research and development (R&D) and commercialization activities have become increasingly critical to how firms achieve long-term competitive advantage and success. This imperative presents fundamental challenges as to how firms organize their innovative activities.

Innovation is difficult to "manufacture" and complete successfully. Spending on R&D is one measure of innovative effort, but large R&D expenditures do not always guarantee successful innovations. In particular, the ability to translate new ideas into a business application (i.e. commercialization) is a critical element in the process. Innovation also depends not just on technology but on factors such as human resource strategies and management capabilities.

Innovation is important to firms of all sizes, but smaller firms have a harder time developing innovation. Given their limited resources, they are likely to be more successful if they collaborate with other organizations. Research suggests, however, that smaller firms often do not collaborate because they face significant barriers. They suffer from the inability to identify suitable partners, to forge co-operative agreements and to acquire tacit knowledge.

It would be helpful, therefore, to look at examples of small firms that have been effective in conducting R&D in collaboration with other organizations. Such collaborations can also extend into commercialization efforts as well.

Types of collaborative

In looking at collaborative innovation, there are 2 basic sets of circumstances that establish 2 different dynamics of collaboration—research push and commercial pull. These collaborations can be further divided into 6 different types.

Research Push

The first category—research push—usually involves a young business that is built around some intellectual property (IP) that has the potential to be commercialized. The challenge in these firms is to build the infrastructure for a successful company, including hiring appropriate managers, financing the research phase prior to revenue flows and protecting the IP. Part of this evolution includes "beta-testing," where the technology firm finds a co-operative client that agrees to be the test bed for fine tuning the product during the process of implementing it for their own operation.

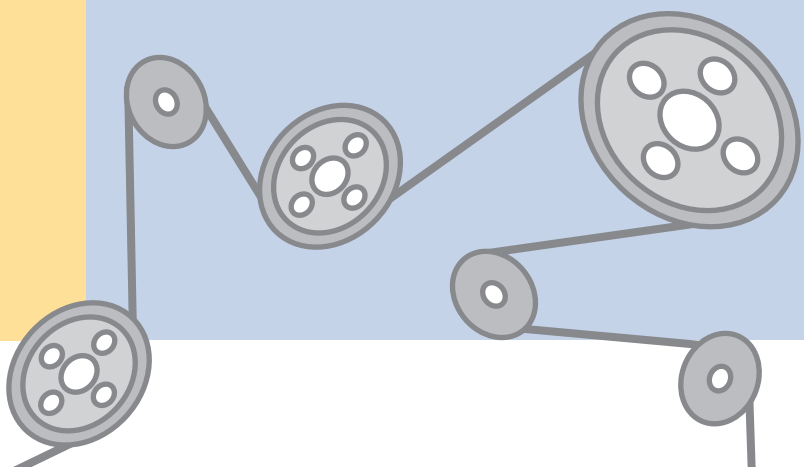
There are 2 types of research push collaborations:

1 Spinoffs

A university-based researcher launches a new venture to commercialize research perfected in the university's labs

2 Contract research

A spinoff performs contract research for a large company that, during the course of adapting the SME's (small and medium-sized companies) IP to the client's requirements, serves to refine the technology into a commercially viable form.



Commercial Pull

In the second category—commercial pull—the demands of clients are driving R&D. All firms that have successfully navigated the research-push phase go on to the commercial-pull phase as they diversify their original technology through the development of new products and processes. This diversification includes not only new product development, but also the research agenda itself, which comes to be determined by market considerations rather than scientific curiosity. There is a second source of commercial-pull firms— those that may not originally have depended on protected IP for their growth, but, as their client base widened, have developed an R&D unit to enable them to respond to client needs.

There are 4 types of commercial pull collaborations:

Sponsored research

3

An SME contracts with researchers to perform R&D that it requires (SME owns the resulting IP).

Joint ventures (JVs)

4

An SME has identified a market for a product and needs R&D to develop the product, so it signs an agreement with a large organization to develop the solution jointly (Shared IP).

Invention watch

5

An SME builds a relationship with researchers whose work is relevant to its business so that it can identify inventions that it might be able to commercialize (IP bought or licensed).

Invention brokering

6

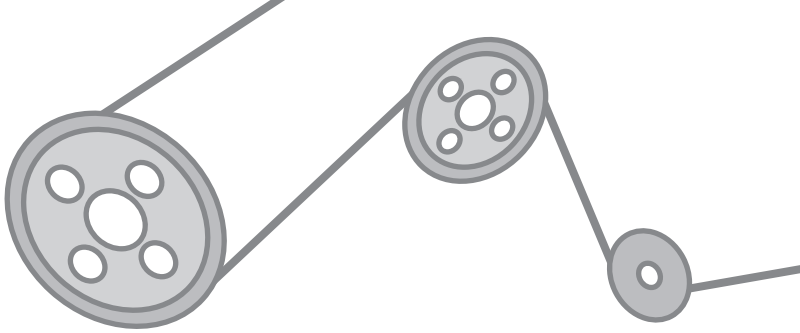
Same as invention watch, but the active agent is the intermediary rather than an SME and the motive is to ensure that inventions with commercial potential don't fall between the cracks.

General Insights

- Perhaps the strongest message to emerge from this case study is the degree to which it all boils down to the individual. Successful business development is not only about science and technology. Individuals make an enormous difference; good personal relationships, inspiring mentors and advisors are key.
- SMEs need a strong base of technical competence that will make it worth the while of universities and companies to collaborate with them.
- SMEs need a clear understanding of and sensitivity to the different cultures of collaborators; as they cannot change these cultures, they have to work around them and appreciate their strengths.
- The financial and human resources to "stay the course" are essential – whether it be in negotiating agreements or in persisting with the research through difficult or even seemingly hopeless periods.
- It is important to have open and frequent communication with the collaborator, thereby enabling problems and roadblocks to be identified early; this is more important than formal structures for communicating.
- One of the main barriers to collaboration is the ability to access potential partners—researchers in the case of SMEs new to R&D, large firms in the case of SMEs seeking joint ventures. Establishing networks between stakeholders and persistence appear to be the most promising solutions.
- Collaborations generally demand detailed written agreements that establish the rules for IP ownership and participation requirements. These agreements can often extend to 50 pages or more.
- Spinoffs need to make the transition from research push to commercial pull as rapidly as possible.
- During the risky phase of business development between launching a spinoff and commencement of revenue flows, there is a lack of financing. This financing would be best supplied by angel investors.
- The selection of the CEO for a spinoff is of critical importance. Perhaps the most critical aspect to the success of collaborative innovation is the importance and difficulty of attracting top-notch talent to lead spinoffs.

Collaborative R&D

The C3 Group



The C3 Group of the Waterloo Region, Ontario is an engineering and specialty construction firm that started out as an offshoot of a civil construction company. As the firm grew, it faced more complex problems and these have driven its R&D efforts. It was established in 1973 by Cam Wood, and it expanded into specialty services in the 1980s when Murray Gamble joined the business. In the past few years, the firm has expanded rapidly. It now has 150 employees and annual sales of $50 million.

Annual sales in 2006: $50 million
Employment in 2006: 150
Average annual growth rate 2001-2006:
Sales 41%. Employment 16%
Exports (as % of sales): 10% to 15%
R&D (as % of sales): 3% to 5%
website: c3group.com

Innovation needs

C3 is not a technology company whose sole reason is to develop technology that will give it a breakthrough product which it must protect with a patent. It is more like the majority of SMEs that do R&D—it is interested in applying new technology to solve its own and its clients' most challenging problems. It may develop the appropriate technology itself, wholly or in part, or it may license it from another company and, if necessary, refine it or extend it to suit its clients' needs.

C3 does not, in fact, hold any patents, but it has played a vital role in the development of a number of patents and earns its living from the profits it makes applying specialty technologies. It is, in other words, an engineering firm whose product is its innovativeness within a few narrow niches where it has developed significant expertise.

Approach to collaborative innovation

C3's innovation collaborations emerge from either planned or serendipitous contacts with its clients or its network of existing collaborators. In many cases, the resulting research does not initiate a new product line—it is a one-off project that develops expertise within the company and cements relationships with collaborators and clients.

C3 has collaborated with several organizations, including both universities and private sector companies and it has collaborated in both directions—transferring technology from researchers as well as contributing its own research to other organizations.

C3 Group has developed an impressive array of technological expertise but it has no ambition to scale it up into a big business. It is determinedly a niche player, enjoying a degree of dominance within a range of markets that are generally too small to interest large firms. "Ideally we'd like to see a market that's $25M to $50M," Murray Gamble says, "because then we can dominate this little wee vertical. The big companies won't approach a market unless it's a billion dollars or more, and typically then they're spending at least $5M to $10M on the R&D to service that market. So we stay in markets that the big guys are even interested in. That way they don't come chasing us. They can't even get their big machinery fired up to be bothered for the $25M or $50M market.

If firms such as C3 try to go up against very large firms, "they'll crush you like a bug," says Gamble. "You don't have enough money to take them to a protracted court battle. They know you can't stay the course, so they tell you to get lost. The reality of IP (intellectual property) for a small company is that, if you're in a big market place with so much at stake, and the big guys want it, your only chance of survival is to pair up with another big guy. But if you're trying to survive as a small enterprise, taking on the big guys, it can be very difficult."

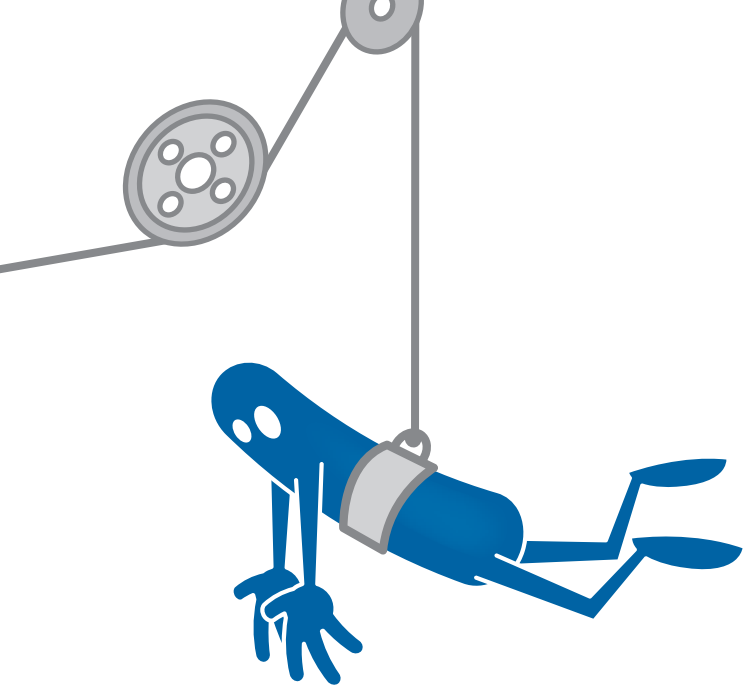
An example

Several years ago, C3 licensed a technology owned by a large billion-dollar company. Originally the technology was used for one construction related application; later, the technology was adapted to remedy problems associated with another construction problem and that was the application that prompted C3 to license the technology for Canada. In the meantime, C3 engineers found a researcher at a Canadian university who could help apply the technology to a new application. (The exact names of the large company, the university and researcher have been held confidential because the resulting application has not yet been announced publicly.)

C3 started a three-way negotiation with the large company and the university. It took C3 a year and a half of patient negotiating to put together the terms of this collaboration.

Structuring the collaboration

The 3 parties agreed to break the project down into 3 or 4 phases, each of which will be treated differently. At the outset of negotiations, C3 and the university recognized that they had no claim on the large company's technology, although they claimed some IP for their prior work. In the subsequent phases, the contributions of the 3 parties differ significantly and the agreement provides that each party be compensated with IP ownership in proportion to its contribution. Finally, if unanticipated new developments of the technology emerge in the course of the project, ownership will be split roughly equally. "It's



basically a royalty-sharing agreement with licensing agreements thrown in," says Gamble. "Because [the large company] is the big guy with the big legal department, we're comfortable with them holding the majority of the IP, because, should someone want to rip off the technology, they'll think twice about ripping [the large company] off."

Gamble found the interests of the large company and C3 to be compatible. "[The large company] is a product company," he says. "They want to make money on a product. But that's not where we make much money. We make money on the application of the technology. So what we did was get exclusivity in the Canadian marketplace for anything that came out of this development project. Plus, because it had a bigger application in the US, C3 and the university get a share of those royalties as well. We even agreed—and this is what clinched the deal—to give up the rights for the rest of the world. It didn't take much modeling for us to see that, if this thing's successful, we'll do very well and we're not going to cry over the fact that we didn't do even better."

The value of collaboration

Gamble is enthusiastic about working with large institutions and corporations: "From a risk management point of view, it's way better to have that high-powered theoretical proof behind you when you're going out to the market with a new technology. And [the large company] has a lot of high-level marketing power; all they've got to do is push it out through their distribution channels. These guys also have legal muscle; they have brain power and credibility. What's neat is that they both see value in us, which is figuring out if the technology works or not. Those guys could spend 5 years figuring out a program to do that."

In general, the collaborators with C3 perceive C3's intended market as relatively insignificant to their own objectives, which has made it easier for C3 to negotiate collaborative arrangements with them. However, there is a prerequisite. In all cases, C3 has needed to demonstrate solid credibility in terms of its technical competence before the research partners would agree to collaborate.

Key Insights

- A strong focus on clients is one of the best signposts to productive R&D.
- Protection of intellectual property (IP) is expensive and time consuming. Often, high-tech SMEs have to sell their businesses to large corporations to protect what they have. In addition, patents are not always the key to competitive success, particularly in industries that are moving so fast that patents become obsolete long before their expiry.
- In collaborations with large firms, SMEs can best protect their intellectual property in 2 ways:
  (1) establish a niche market that is too small to interest large firms or
  (2) cede IP ownership to the large firm in return for a guarantee of exclusive rights to supply the product.
- It is vital to have a written agreement. It is important to detail things as much as possible. In other agreements, C3 has been tempted in the past to keep the agreement vague and trust in everyone's good faith. "With some researchers, for instance," he laughs, "we tried: 'Why don't we work that out later?' Well later they would come up with something and of course they thought it was worth a billion dollars and we thought it was worth a million. How do we resolve that? You really do have to have that stuff sorted out ahead of time."
- SMEs need a realistic appreciation of their own strategic objectives and of their assets in the eyes of collaborators—and a willingness to not seek a greater share of IP than they deserve. IP sharing formula should be a fair reflection of what each party brings to the table. "In my experience," says Gamble, "when you try and take a piece of something and you're not putting anything into it, it's a recipe for disaster. The best deals are the ones where you sit down and you really think about who's bringing what to the table. What are everyone's goals? They're all different. What does everyone do best? Then settle into those categories and go for it."
- It is important to understand the different cultures in one's collaborations – particularly the constraints and pressure points. In this example, the university and large company both have their own deep-seated cultures and all 3 parties in the collaboration have wildly different objectives and concerns.

Verafin

Verafin Inc. of St. John's, Newfoundland sells a software package that can detect money-laundering transactions in financial institutions. The company now has about 140 customers, in both Canada and the United States. Its 3 founders are Jamie King, Raymond Pretty and Brendan Brothers, all graduates of the faculty of engineering at Memorial University of Newfoundland (MUN).

R&D needs

Verafin has made a breakthrough in the financial industry by applying the techniques of artificial intelligence. The idea that is driving Verafin—the application of AI to systems in financial institutions—is not patentable beyond the specific applications developed by Verafin. Other companies will enter the field—particularly the firms that are currently serving the big banks. Speed is therefore essential for Verafin's R&D program—and going it alone is really not a viable option.

Verafin sees R&D as being at the core of its survival and success. Building a business around the exploitation of a single technology is also not an option. "Right now I think our technology is changing faster," says Jamie King, "and I see a very finite lifetime for our product." Verafin therefore places a great deal of emphasis on continuing fundamental research—including research into emerging technology that may not produce a marketable product until several years later (if ever, perhaps).

Approach to collaborative R&D

As part of this aggressive approach to R&D, Verafin has built a special relationship with Memorial University of Newfoundland with the intention of making it a permanent collaboration. "It's a forever type of thing," says King. "We hire work-term co-op students, we hire graduate students—and we're trying to fund graduate students. Now we're trying to go that further step and fund bigger projects with the university. I think that, in today's world, for a technical company, we would like to have an entire lab of people working on some of the things that we want to do tomorrow that we can then maybe partly license or partly just turn them into products and deliver ourselves. That's the future for any company like us—to do R&D with universities. And I think universities are going in that direction as well."

Collaboration partners

Verafin has developed collaborations with Memorial University of Newfoundland's Faculty of Engineering and Applied Science and Faculty of Business Administration.

One of the critical moments in any technology firm is getting the first customer to use and appreciate the product. Verafin was fortunate in gaining the collaboration of a local institution, the Newfoundland and Labrador Credit Union, which worked closely with Verafin to refine and perfect the product once Verafin had developed a working model of the software.

Verafin's collaboration with Precarn in a $2 million project is currently the centrepiece of its R&D effort. Precarn is an unique organization that seeks to make Canadian firms more globally competitive through the increased development and use of intelligent information and communications technology (iICT) and expertise. Precarn allows any intellectual property that is developed through its projects to remain the property of the lead company, but it requires that its other members be allowed to use the technology in unrelated fields. It also requires that any project it finances includes collaboration between the company and a university.

Key Insights

- Collaborative innovation with the private sector and with the university is essential for survival for firms that have technology with a global market—and making the university a long-term partner in research offers an effective way of doing this.
- Product development was highly flexible—the final product was radically different from the product that the researchers worked on originally; and their follow-up products, are taking them in yet another direction.
- Jamie King says much greater emphasis should be placed on marketing. Specifically, this means being disciplined in identifying your niche market and pacing the development of that market in proportion to the company's growing resources.
- The presence of an entrepreneurial culture in the university increases the flow of commercialization and quality.

Polyplan

Polyplan Technologies Inc. of Montréal, Quebec was a technology leader in manufacturing process management. The company was founded by Dr. Clément Fortin and 4 fellow professors at École Polytechnique in Montréal who defined the process, wrote the code and created a prototype of the system.

In its 8 years as a Canadian technology company, Polyplan raised more than $10 million in financing, but, once the financial institutions had gained control, they sold it. An American company purchased it in 2005; the technology lives on, used widely by large multi-national manufacturing companies around the world.

The net financial effect was a small loss for the investors. The net economic effect was the loss of what could have been a major Canadian technology firm. The reasons for this lie at the heart of the transfer of university technology (mainly the selection of the management team, the adequacy of the support systems and financing) plus the challenge of trying to launch a new IT product in the depressed market that followed the dot-com bust.

Commercialization needs

In a piece of software that is designed for the enormous networks of manufacturing plants, the technology that comes out of a laboratory cannot hope to fill all the needs of such a large system. It must be configured for each manufacturing organization.

Before the venture was even launched—Fortin, through a personal acquaintance at Bombardier Transportation, established that Bombardier had been looking for just such a system. This encouraged them to launch the company in 1998.

Approach to collaboration

The collaboration with Bombardier unfolded in 2 steps. The first was a pilot project that started in 1999 to demonstrate the software could be configured to Bombardier's needs. The second stage, starting in 2000, was full production implementation of Polyplan's software throughout Bombardier's transportation division's 24 plants around the world.

Polyplan nearly lost this contract at one point when Bombardier Transportation restructured its management team. This caused a radical change in strategies and priorities. "We had to work very hard to regain the contract," says Fortin. "It was very rocky. We had SAP [a competitor] pushing on one side, Dassault [another competitor] pushing on the other. For a small company start up, it was difficult. But we managed to do it."

One of the factors that made a difference for Polyplan was that it had, in the meantime, negotiated a licensing agreement with the consulting arm of Siemens. It was a nonexclusive agreement that gave Siemens the right to market and sell Polyplan's technology worldwide and it gave Polyplan credibility at a critical moment in its development.

Polyplan negotiated a global license of its software technology with Bombardier. During the negotiations, Bombardier told Polyplan that it owned the IP because of the work its employees had done to customize it. Fortin was able to prove that they had contributed nothing to the technology, by showing that the generic version had 6,000 parameters, while Bombardier's version had 30,000. "We had that proof," Fortin says, "but if we had started negotiating the license at that point without it, we would never have succeeded." C

Key Insights

- It is essential to put in writing what the company expects to deliver, even if it is on only one page. "When the client comes back to you to say you haven't delivered, you bring out this one page and you say, 'Well this is what we delivered, and this is what's written.' It can save your life," says Fortin.
- Polyplan's contract with Bombardier that led to fees of $1 million was 1 page long. This level of informality put a greater strain on the management of the collaboration. For many comparable agreements, the document can run to hundreds of pages.
- Fortin acknowledges that, at the outset, he felt the technology was 80% of the challenge. "Of course you need good technology," he says, "but, in the end, the technology is one component of a complex matrix. A company like this is one third technology, one third marketing – trying to find the right market for what you're doing – and one third the quality of the people you have."
- Polyplan closed a financing deal in April 2001 during the dot-com bust. The new investors, at the last minute, demanded Polyplan achieve annual sales of $3 million within 2 years. This proved to be too difficult in the economic conditions. "I shouldn't have accepted this milestone at the last minute," says Fortin. "It was not in the investors' original offer, and it was not what we had accepted.