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life sciences industry
and academia

Life Sciences



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Cultivating innovation beyond corporate walls

Alliances between the life sciences industry and academia

By Salima Lin, Teri Melese and Julia Chang

Past collaborations between the life sciences industry and academia have not always been successful, due in part to the conflicting needs of university research and commercial viability. However, industry needs academia to stimulate innovative product development, and academia needs industry to fund research and provide careers for graduates. A new study by IBM Global Business Services and the University of California, San Francisco, reveals the business models and attitudes that can help make these collaborations successful.

Executive summary

The life sciences industry does not have a particularly good record for managing alliances with academia. But as a growing number of companies turn to universities to supplement their own research, various new models for collaborating are emerging. Yet none of these new models addresses the many differences between industry and academia, with the result that both partners remain frustrated.

Research conducted by IBM and the University of California, San Francisco (UCSF), suggests that four steps are essential to realize the full potential of industry-academic partnerships:

1. Understand and appreciate the value a partner brings to the alliance.
2. Align the goals, expectations and approaches of the respective partners before signing the contract.
3. Select the most suitable model for collaborating given the nature of the research project and, thus, the information that must be shared.
4. Manage multiple industry-academic alliances like an investment portfolio in order to eliminate redundancies and capitalize on any synergies between research projects in different therapeutic areas.

IBM and UCSF's research also suggests that other measures will be necessary to overcome some of the industrywide obstacles to developing a new generation of safer and more effective treatments. One such measure is more effective classification of different

kinds of information, so that industry executives know what they can freely share with academic research partners without jeopardizing their companies' future revenues. Another is the creation of non-exclusive consortia in pre-competitive areas of research.

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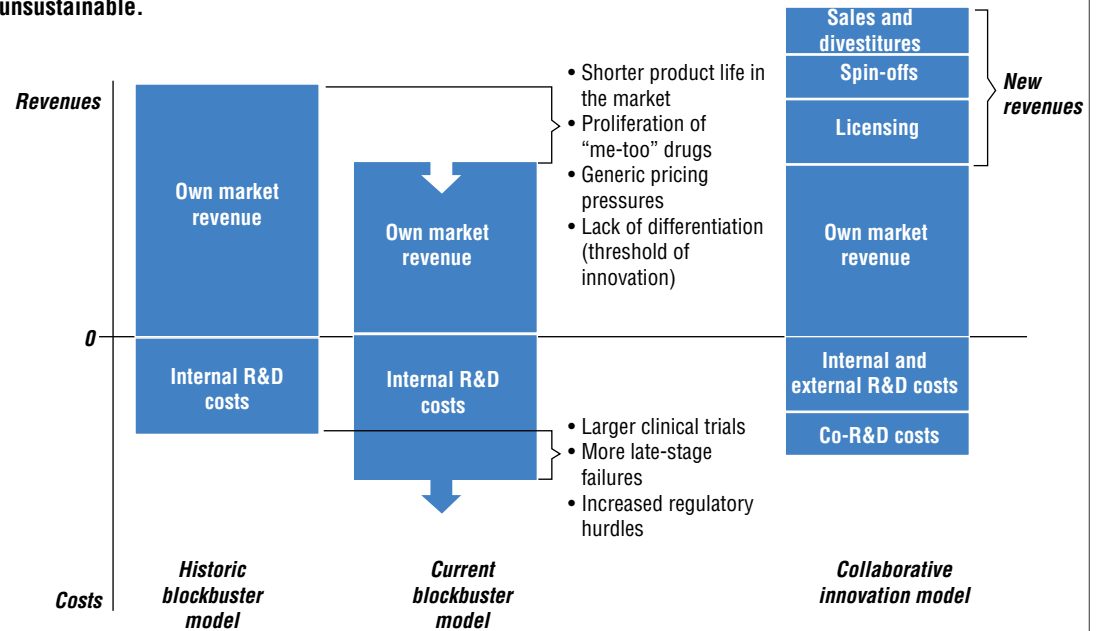
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Introduction

When Henry Chesbrough coined the term “open innovation,” he meant that knowledge is widely distributed in the modern world, and that companies should not just rely on internal sources of innovation; they should also use external ideas.¹ Today, a growing number of firms are turning to external organizations to supplement their own research and development (R&D). In fact, 71 percent of the chief executives who participated in IBM’s 2008 Global CEO Study, and who also plan to change their enterprise models, intend to focus on collaborating with other organizations.²

The trend towards open innovation is particularly marked in the life sciences industry, largely because it has been struggling to develop good new medicines by itself. Between 1993 and 2004, spending on biopharmaceutical R&D increased by 147 percent, yet the number of new drug applications submitted to the U.S. Food and Drug Administration rose by just 38 percent.³ With little to show for all the money they had invested and patent expiries set to erode a substantial amount of their revenues, many companies realized they needed to look beyond their own walls (see Figure 1).

FIGURE 1.
An illustration of why the current model for producing biopharmaceutical innovation is economically unsustainable.



Source: Henry Chesbrough, *Open Business Models: How to Thrive in the New Innovation Landscape*. Boston: Harvard Business School Press, 2006; IBM Global Business Services.

Industry is recognizing that academic researchers need to be long-term partners, not short-term employees.

However, as the number of alliances and in-licensing transactions increased, so did deal prices, which soared 45 percent between 2004 and 2007.⁴ Many companies were thus forced to look further upstream for new and more cost-effective sources of innovation, such as academia.⁵ Since the beginning of 2008, Merck, GlaxoSmithKline, Astra Zeneca and Pfizer have established industry-academic partnerships to advance drug discovery in many therapeutic areas.⁶ But few companies have paid sufficient attention to how these partnerships should be structured to realize their full value.

The challenges to industry-academic collaborations

Pharmaceutical companies traditionally funded academic research as a cost-effective way of accessing developing science and building goodwill with leading universities. They often provided research funds with little or no expectation of a return on their investment. This *laissez-faire* attitude permeated into the corporate management of such projects. Few, if any, companies installed reporting structures or measured the results of the work they sponsored.

But as the industry started to invest more strategically in academic research, attitudes changed. Most companies assumed, because they were providing the money, that they could dictate issues like the confidentiality and ownership of intellectual property. Some companies also stopped funding without notice, forcing academic researchers to scramble for new funds to support their grad-

uate students and postdoctoral candidates. Such indifference generated considerable hostility among academic researchers. Reports that company-sponsored research was biased further pushed away many academic researchers fearful of compromising their own academic integrity.⁷

Humbled by this experience and in need of the sort of innovation that had given rise to the biotech era, the industry recognized academic researchers needed to be viewed as long-term strategic partners, rather than short-term employees. As a result, many companies are refining their approach to collaborating with academia and adopting a middle course. Interviews conducted by IBM with some of these companies and the academic researchers with whom they work reveal seven key collaborative models currently in place, each with strengths and weaknesses (see Table 1, page 5).

Yet, despite the development of these new models for collaborating, the differences between industry and academia remain largely unaddressed, leaving both companies and academic researchers frustrated. Our research suggests four steps are essential to fully realize the potential of such relationships:

- Recognize the value a partner brings to the alliance
- Align the goals, expectations and approaches of the respective parties
- Select the most suitable collaboration model
- Manage industry-academic collaborations like an investment portfolio.

TABLE 1.
The main models used in industry-academic partnerships.

Model	Description	Advantages	Disadvantages
Principal investigator	<ul style="list-style-type: none"> A company establishes a relationship with a single principal investigator to research a specific problem. 	<ul style="list-style-type: none"> The principal investigator has access to company resources. The company has control over the purpose of the research. 	<ul style="list-style-type: none"> Substantial management time and resources is consumed as the number and variety of collaborations grow.
One company-one university	<ul style="list-style-type: none"> A company selects a university with a number of principal investigators to work on a problem. Their efforts may or may not be coordinated across projects. 	<ul style="list-style-type: none"> One large collaboration is easier to coordinate than many smaller projects. Master agreements facilitate the exchange of information and resources between the parties. Long-term projects create trust. 	<ul style="list-style-type: none"> The company assumes the university has the expertise to conduct the research. Working with one company may limit the scope of the research. The university is seen as an extension of the company, rather than an independent entity.
University consortium	<ul style="list-style-type: none"> A company hires experts from different universities to work together on a problem, with each contributing his or her unique skills. 	<ul style="list-style-type: none"> Access is provided to many more sources of information and skill. Choosing real experts enables the company to address the problem more holistically. 	<ul style="list-style-type: none"> More initial preparation is required. The company must bridge the gap between experts and maintain their focus.
Large institute	<ul style="list-style-type: none"> A company provides a large donation to fund an existing academic institute or establish a new one. 	<ul style="list-style-type: none"> The entire institute (or much of it) works on the problem. The company has control over the purpose of the research. 	<ul style="list-style-type: none"> Not all the experts may reside at the chosen institute. The researchers cannot share resources with other universities.
Competition	<ul style="list-style-type: none"> A company appoints multiple investigators to study the same problem. It funds the team that solves the problem first during the next phase of research. 	<ul style="list-style-type: none"> The researchers have a strong incentive to work fast and are more likely to achieve the research goal. 	<ul style="list-style-type: none"> The company invests in overlapping research. The team that finishes first may not be the best for doing further research. The researchers cannot share resources with other universities.
Venture capital	<ul style="list-style-type: none"> A company provides several experts with seed money to start a company focusing on a specific issue. 	<ul style="list-style-type: none"> Targeting the experts provides the depth of knowledge to tackle the problem more fully. 	<ul style="list-style-type: none"> The experts must sever their academic ties, thereby forfeiting a major source of information and ideas. The costs and risks are high.
Fee-for-service	<ul style="list-style-type: none"> A company defines a problem and solution, and contracts out the work to one or more universities. 	<ul style="list-style-type: none"> The company may save money by using an external body. The researchers can leverage the cross-pollination of ideas across departments. 	<ul style="list-style-type: none"> The researchers feel like temporary workers rather than partners. Defining the challenge limits the value the university can provide.

Source: IBM Global Business Services.

Academia and industry should work to align project goals, expectations and approaches.

Recognizing the value a partner brings to the alliance

If they are to realize the potential of industry-academic collaborations and build true partnerships, both industry and academic researchers must understand and appreciate the strengths each party brings to the collaboration. Recognizing what each has to offer will remind the two parties that they need to work together to meet their objectives.

Some of these goals will relate to the project in hand, but advantages can also be derived from contributing to each party's continued success. Companies need academia to develop the next generation of scientists, for example, while academic researchers need industry to provide a source of employment for their graduate students and postdoctoral candidates. Understanding the immediate and long-term value of collaborating will help both parties seek a mutually beneficial arrangement.

Aligning the goals, expectations and approaches of the respective parties

It is also important to align the goals, expectations and approaches of the two parties. This is an issue of identifying the academic scientists best qualified to meet a company's needs and of working together to define the problem, research goals and approach.

Sometimes, in their eagerness to collaborate, the parties do not clearly communicate objectives and expectations before signing a contract, which can lead to considerable problems later on. Trouble is often in evidence in four specific areas:

- Differences of opinion about what is valuable
- Conflicts of interest
- Cultural gaps
- Funding challenges.⁸

University researchers and companies typically define value in different ways. For an academic researcher, it is likely a discovery or invention that pushes the boundaries of scientific knowledge. For a company, it may be a discovery or invention with real-world applications.

Academic and industry researchers, likewise, have different attitudes about confidentiality. Academics can make a name for themselves by publishing their research, while companies usually keep results proprietary to protect the interests of their shareholders. Moreover, universities are limited by federal and state laws regarding ownership of the intellectual property generated by their faculty. So there may be significant conflicts of interest over the rights to, and application of, joint research.

Universities and companies also have quite different cultures, which shape how the people working for them think and behave. For example, academic researchers define their own goals, objectives and timelines, whereas companies define those for the researchers they employ – and any changes must be approved by senior management. Similarly, academic researchers willingly share their knowledge with industry executives because they are not competing to publish that work, whereas industry executives are more tight-lipped because they are concerned about giving away proprietary knowledge. And,

academic researchers prize their intellectual freedom, whereas companies are more interested in getting the results they want.

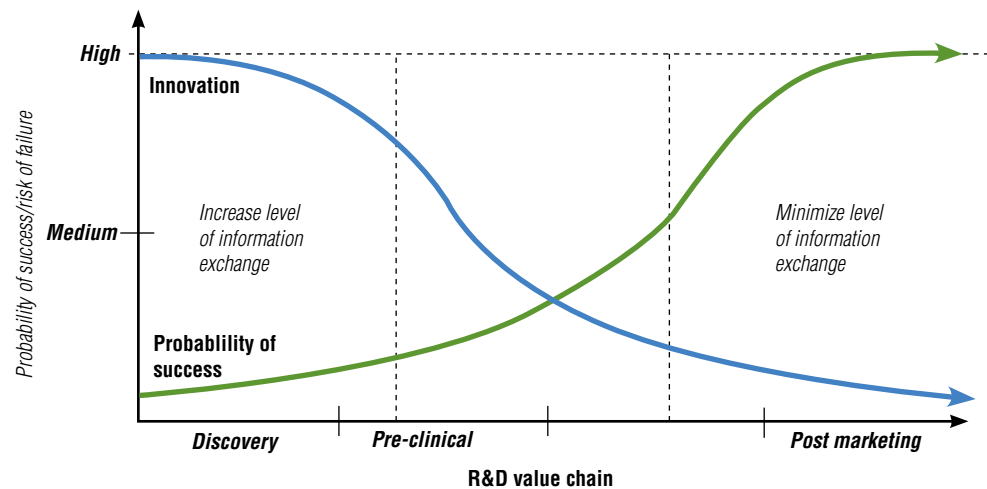
Finally, funding may become a major source of dispute. Companies perceive that they pay, on average, between US\$30,000 and US\$50,000 for a single project.⁹ But many academic researchers say that this is insufficient to generate any real innovation, given how much it costs to employ a team of graduate students and postdoctoral candidates. They estimate that US\$250,000 to \$300,000, spread over a period of three to five years – in line with the level of funding provided by the National Institutes of Health – would be a more realistic sum.¹⁰ The rigorous annual budgeting process that companies go through often compounds this problem. Companies generally expect to pay for modules of activity that produce some value rather than for the salaries of the academic staff with whom they work.

It is imperative that companies and academic researchers work together to resolve such issues before starting to collaborate. Only then can they create a process and end product that will deliver on the expectations of partnership.

Selecting the most suitable collaboration model

When selecting a collaboration model, companies should understand the point in the R&D value chain in which the research will take place. Research projects that occur at the start of the chain require relatively free information exchange to drive innovation and offset the low probability of success. Conversely, in those that occur in the later stages of the value chain – where the focus is on commercial viability testing – information sharing should be more restricted to safeguard proprietary knowledge (see Figure 2).

FIGURE 2.
Different levels of information exchange, and thus different collaboration models, are needed at different points in the R&D value chain.



Source: IBM Global Business Services.

Master agreements can provide the foundation for knowledge, data, material and resources sharing.

Managing industry-academic partnerships like an investment portfolio

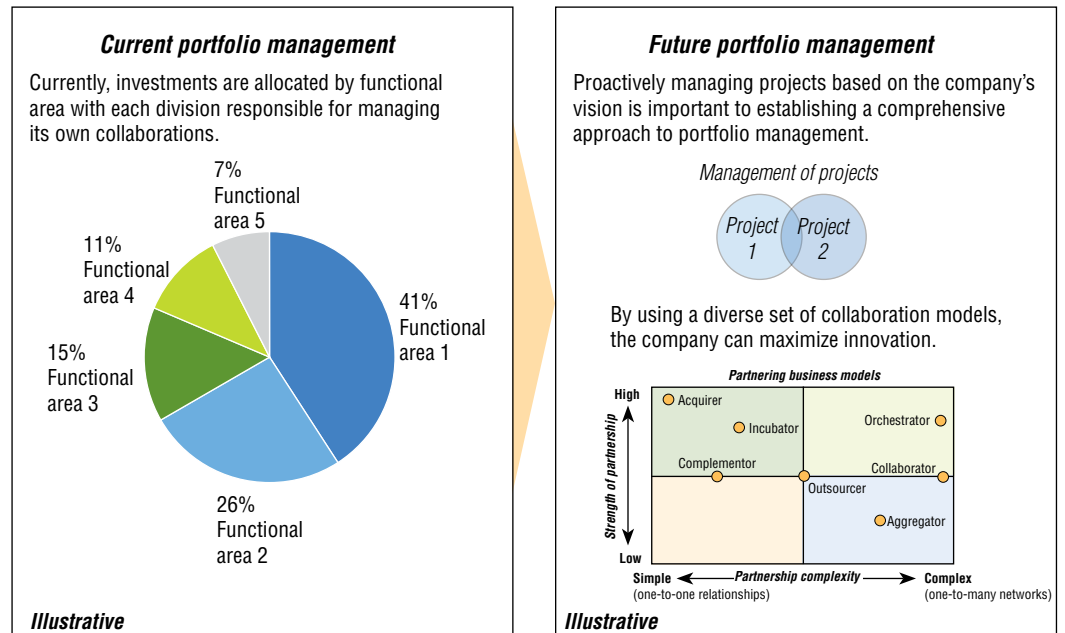
Once a company has selected the most appropriate model for collaborating, it should treat its industry-academic collaborations like an investment portfolio (see Figure 3). Most companies currently choose research projects by consensus within a therapeutic area and rely on individual knowledge of previous projects to avoid any duplication. However, this becomes more difficult over time, as people rise up the hierarchy or go to other organizations. It is therefore essential to document all collaborations properly and create visibility to everyone in the company.

Managing multiple research projects as an investment portfolio enables a company to eliminate redundancies and capitalize on

any synergies between research projects in different therapeutic areas (for example, nanotechnology has applications in both diabetes and oncology). It also facilitates the development of a master agreement to cover all the collaborations into which the company enters with a single university, regardless of the funding therapeutic area.

Master agreements streamline the process for establishing new collaborations. When properly crafted, they also provide a foundation for creating a secure interface between the participating organizations that enables researchers to freely share knowledge, data, materials and resources. The development of a good master agreement, therefore, requires a common vision and expert input from legal counsel, business development personnel,

FIGURE 3. Industry-academic alliances should be managed as a portfolio to optimize the benefits they each generate.



Source: IBM Global Business Services.

researchers and management – including those at the very top of the organizations concerned.

Adopting a new attitude to information

Although developing a strategic approach to industry-academic collaborations is an important step in cultivating innovation, it is not sufficient to produce the revolution required to develop safer and more effective treatments, particularly as R&D costs soar and the “price to play” becomes prohibitive. A new attitude to information is critical.

Companies typically use patents in one of two ways, sometimes described as “block to fence” and “block to play.” The first of these strategies entails patenting a core invention and numerous substitutes to create a protective layer around the core and prevent competitors from copying it. The second encompasses using patents as “bargaining chips” in the division of rights between the producers of complementary research or technologies, where access to one is essential if the other is to be enjoyed.¹¹

Pharmaceutical companies currently tend to use the former strategy. They usually patent all information – even if they do not know if it will be of value – to block their rivals from working in the same space.¹² But while this strategy is effective in curbing imitation, it hinders the industry from becoming more innovative, since researchers are forced to spend time and money repeating previous work. Moreover, as scientists delve more deeply into the intricacies of the human body, it is questionable whether any one company can

hold a monopoly on the understanding of any specific disease.

A better approach, we believe, would be to segment information into three categories:

- Information a company can commercialize
- Research that can safely be sold to a third party
- Information that can be shared openly.

Educating employees about these distinctions would enable them to understand what they can freely disclose to academic research partners without fear of jeopardizing future revenues, thereby increasing the potential for innovation.

It would also allow companies to use the proprietary information they generate more productively. Core business information should clearly be safeguarded. But non-core information, such as data derived from toxicity assays, could be sold to other organizations at market value, using the sort of valuation processes already in place to determine the value of patented discoveries and inventions.¹³ Any company that fears giving its competitors an advantage could delay selling the data until it is entirely safe to do so, although it should bear in mind that the value of its research could depreciate over time.

Several forums for selling research already exist. They include InnoCentive, which offers awards ranging from US\$5,000 to US\$1,000,000 to scientists who can solve the problems that are posted online; and yet2.com, which focuses on bringing buyers and sellers of technologies together.¹⁴

Creating new innovation models

Once companies can manage their information more effectively, they can also develop new models for generating innovation. Rather than working with one or more research institutes on specific projects, for example, they could establish alliances in areas of pre-competitive research. This would overcome the drawbacks associated with most of the current models, which address the needs of a specific company but do not encourage the sort of information-sharing needed to deliver the next wave of innovation.

In the past five years, for example, almost every major biotech and pharmaceutical company has implemented a proteomics program to study the role of proteins in disease pathways.¹⁵ However, lack of standardization across the laboratories conducting the research has made it difficult to compare and validate results.¹⁶ Consequently, the field of functional proteomics has progressed slowly.

Establishing areas of pre-competitive research, with open standards and protocols, would enable companies to pool their knowledge and move beyond the preliminary stages of research. A number of public-private consortia already work on this basis. One such instance is the RNAi Consortium, which is developing various RNAi technologies that may enable

the scientific community to probe the functions of human and mouse genes.¹⁷ Others include the Biomarkers Consortium, which aims to develop and validate biomarkers for detecting, diagnosing and treating diseases, and the Diabetes Genetic Initiative, which is seeking to identify the genetic connections between Type 2 diabetes and other cardiovascular risk factors.¹⁸

Conclusion

Industry-academic collaborations are likely to continue playing an important role in developing better treatments. Any pharmaceutical company that wants to capitalize fully on such partnerships should adopt a strategic approach that takes the interests of both parties into account. It will also need to treat its alliances with academic researchers as a portfolio, both to reduce the duplication of effort and optimize the synergies across therapeutic areas.

But no matter how successful such alliances are, they will not be sufficient to generate the innovation required to make a great leap forward. But we believe only by distinguishing between different kinds of information, identifying areas of pre-competitive research and pooling their resources, will pharmaceutical companies ultimately be able to develop medicines that break completely new ground.

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