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Biopharma business models in Canada

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This article provides new insights into the different strategy paths or business models currently being implemented by Canadian biopharma companies. Through a case-study methodology, seven biopharma companies pertaining to three business models were analyzed, leading to a broad set of results emerging from the following areas: activity, business model and strategy; management and human resources; and R&D, technology and innovation strategy. The three business models represented were: model 1 (conventional biotech oriented to new drug development, radical innovation and search for discoveries); model 2 (development of a technology platform, usually in proteomics and bioinformatics); and model 3 (incremental innovation, with shorter and less risky development timelines).

Introduction

The Canadian biotechnology industry has grown rapidly since it emerged at the beginning of the 1990s. The industry more than doubled in size between 1994 and 1997 from 121 to nearly 300 companies. In 2003, there were 500 companies, expanding to 668 in total by the end of 2009. Of 300 active biotechnology product candidates for health and therapeutic use developed since the initiation of the industry, 60 had been approved for use by 2009 (http://www.biotech.ca). Despite Canadian biotech revenues growing by 9% to US$2163 billion in 2009, R&D spending fell by 44% and the number of public Canadian companies fell from 72 to 60 [1].

Canada is also noted in the industry for its ability to attract and retain top scientists and the continued support for R&D from both government and private funding sources. Venture capitalists have oriented the industry towards the therapeutic human health area. Drug discovery companies operating in the basic research and product development stages, which license their technologies to suitable companies in the biotechnology or the pharmaceuticals industry, are preferred by the funding actors. In Canada, there are approximately 175 companies specializing in therapeutics and biopharmaceuticals, which accounts for one quarter of the biotechnology industry as a whole.

The main purpose of this article is to gain insight into the different business models currently being implemented by biopharmaceutical companies in Canada. To fulfill this goal, some of the basic features that characterize the three different business models most commonly followed by biopharmaceutical companies in Canada are explained: the first is based on new drug development, the second on incremental innovation and the third is a platform technology model. The first and third of these are often discussed in the literature but less information is available regarding the second model. The characteristics of these different types of business model are outlined and then results from seven case studies are mapped onto these models under four headings. The choice of the companies visited was guided by representatives of the biotechnology system in the Quebec region.

Business models in biotechnology

There is no generally accepted definition of the term 'business model.' Definitions at the strategic level emphasize the market positioning of a company, its interactions across organizational boundaries and its growth opportunities. By contrast, business models focus on activities that capture value from early stage technology, and are defined as a coherent framework that takes technological characteristics and potentials as inputs, and converts them through customers and markets into economic outputs [2]. Thus, business models are conceived as a device that mediates between technology development and economic value creation.

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To innovate properly, business models need to ensure that the technological core of the innovation delivers value to the customers. However, creating value from technology in biotechnology faces significant uncertainty, both in the technical and economic domains. A major challenge in many biotechnology start-ups lies in the failure to discover appropriate business models that are capable of realizing the latent value in technologies. Accordingly, it becomes crucial to discover new ways of mapping between technical potential and economic value.

Business models are also defined as a 'concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture and economics are addressed to create sustainable competitive advantage in defined markets' [3]. According to this definition, as young biotechnology companies move from the research phase to the production and marketing of new products, they face an important dilemma: whether to increase vertical integration within the company by producing and marketing their products themselves, or whether they license their products to someone else and instead concentrate on research.

Another study reports on the disappointing financial results of the sector, and disputes the assumption that biotechnology leads to significant improvements in drug R&D discovery; the study also observes no discernable differences in the R&D productivity of biotechnology and large pharmaceutical companies [4]. The mismatch in most biotechnology companies rests on having wrongly borrowed business models, organizational strategies and approaches from other high-technology industries. Science-based businesses entail unique challenges that require different kinds of organizational and institutional arrangements and different approaches to management [4].

The biotechnology industry, which was once managed within the boundaries of corporate R&D laboratories, is now being pushed towards governance by the invisible hand of drug and financial markets. To succeed in managing science-based businesses, new organizational innovations are particularly necessary [5]. Unlike other start-ups, biotech companies face prolonged periods of risky investment in research and have three fundamental needs: (i) to encourage and reward profound risk-taking over long-term horizons; (ii) to integrate knowledge across highly diverse disciplinary bodies; and (iii) cumulative learning [5].

The environment for the biotechnological business models is viewed as challenging [6], with a clear move away from the largest pharmaceutical companies towards collaborating more closely with smaller biotech companies and other organizations. Two main models are suggested [6]: the fully diversified and the federated models, with two extensions, the virtual and the venture variants. In the federated approach, a company creates a network of separate entities with a common supporting infrastructure that share a mutual goal. In the virtual variant, most or all of the operations of a company are outsourced and the company acts as a management hub by coordinating partner activities. The venture variant entails investing in a portfolio of companies in return for a share of the intellectual assets and/or capital growth they generate, rather than outsourcing specific tasks. By contrast, in the fully diversified model, the company expands from its core business into the provision of related products and services. This model requires substantial investment in new equipment, premises and personnel, as well as major cultural changes.

Understanding the implications of the different business models is essential to entrepreneurs and investors, as diverse business models call for different capabilities. The most commonly identified positions are as follows (from http://www.healthonomics.org/2008/01/biotech-business-models.html):

- The technology platform model: start-ups that rent or sell their technology to pharmaceutical companies. They build strong intellectual property (IP) protection through patents and bail out quickly if better technology comes onto the market.
- RIPCO model: start-ups that research and develop a new drug to license it finally to a large pharmaceutical company in exchange for a royalty on sales, the so-called Royalty-Income Pharmaceutical Company (RIPCO).
- FIPCO (fully integrated pharmaceutical company model) model: start-ups that launch their own drug. Such start-ups are unusual owing to the large amount of capital needed and the high risks involved.
- NRDO (no research-development only) model: start-ups that buy a promising 'discarded' drug from large pharmaceutical companies and use their own technology to bring it to market and make it profitable.
- Similarly, another study identified four business models for biotechnology [7].
- The vertical model: a fully integrated organizational structure with access to internal development, manufacturing and marketing capabilities.
- The product business model: aims to generate value by moving products along the drug development chain process and either licensing them out or taking them through to market.
- The platform business model: focuses on the discovery and development of a technological platform to aid the drug development process. It aims to generate value through licensing, subscription and service fees for the technology platform.
- The hybrid model: a blend of the product and platform business models that generates a pipeline of products.

Another study focuses on the components that give shape to the business models: value proposition, value-chain structure and revenue generation [8]. The biotechnology industry can hence be divided into companies that create tools and technologies, and those that develop and market products. Success depends largely on their licensing ability to transfer the IP rights of the tools or technologies for an appropriate value in either consolidation agreements or partnering relationships. Similarly, the continuing evolution of biotechnology business models involves reviewing and contrasting the origin, the value generation potential, the risk profile and the revenue stream in the fully fledged pharmaceutical company business model, the product business model, the platform or tool business model and the hybrid business model [9].

The technology platform model is growing in importance and is believed to be more probable to become successful. However, the ability of such companies to be successful over the long term as they are currently configured is doubtful [10]. To avoid this risk, the technology platform should gradually turn into a proprietary R&D discovery effort and ultimately transform the organization into an emerging pharmaceutical company.

Although most dedicated biotechnology firms (DBF) are willing to license their products after clinical phase II, when the ratio between the market value and development expenses is at its maximum, data on alliances formed in 2008 (http://www.recap.com) suggest that approximately half of the alliances involving licenses are formed before clinical trials, and that only approximately 20% are formed after phase II. Licensing in phase III, when the risks of failure have substantially declined, is clearly of great significance and the value of such licenses is much higher than those formed earlier in the process. However, although many biotech companies aim to reach phase III before licensing, the evidence suggests that most cannot wait that long (http://www.recap.com).

Biopharmaceutical business models for Canada

In this section, the three business models that probably best represent most of biopharmaceutical companies in Canada and the USA are introduced.

Model 1: new drug development

Model 1 focuses on the search for radical innovation based on discovery, drug development and new therapies. Companies operating under model 1 are usually founded by an individual or an entrepreneurial team from a research environment, such as a university, a research center or a hospital. However, the research spin-off category largely prevails and the development process of the product candidates is long and costly.

To undertake the risky bet on in-house research on a long-term basis, such companies need to be supported by external investors, usually venture capitalists. Financial pressure during the early stages of development remains until they manage to become public. This significant jump in the status of the company is only feasible when prospects and expectations are openly favorable, encouraged by a worthy IP portfolio and the proximity of product releases targeting sound and fast growing markets.

Clinical phases II and III are the most decisive for the eventual success of projects pursuing radical innovations based on new molecules that are indispensable for more effective drugs and therapies. The development process comes to an end with the final approval by the US Food and Drug Administration (FDA) or other country-based regulatory institutions some 12–15 years after the firm is set up. Two options emerge at this stage: first, the company can go ahead and market the product on its own or, alternatively and more commonly, the company can out-license the product to one or several big pharmaceutical companies in search of a worldwide launch and sales.

Model 1 is a high risk–high reward approach. The overall probability of success is 30% in companies that get past phase I, 14% in those that go beyond phase II, 9% for phase III and 8% of those that gain the final approval of the new drug application [11]. Another study estimates that approximately one in eight drugs that start phase I are eventually launched on the US market [12].

In the event of categorical success, two possible alternatives emerge: (i) re-invest in in-house R&D, aimed at either strengthening the initial R&D program or starting brand new projects; or (ii) acquiring one or several highly viable biopharmaceutical companies at the preclinical or clinical phases. This strategy seeks to shrink considerably the development timelines and avoid unnecessary risks by betting on companies having successfully surpassed the first development stages and coming closer to the crucial breakeven point.

The second option is the most preferred by CEOs, although it is not always accessible. Another alternative is to sell the company to a larger pharmaceutical or biopharmaceutical business. Profits can be sizeable provided the product attains either broad-ranging success in large pharmaceutical markets or moderate success if it targets more restricted segments.

Model 2: development of a technological platform

Model 2 aims initially to develop new technologies or tools (e.g. proteomics, genomics, metabolomics, biocomputers, microarrays, etc.), known as a 'technological platform,' and is expected to yield revenues 3–5 years after the initial R&D investments. This timeframe is significantly lower than the timing and costs of a new compound. Provided that the sale of the technological platform, or the services attached to it, are broadly accepted, the company will grow in size and prospects. At this point, it becomes public and gathers more resources, which are often devoted to acquiring or taking control of biopharmaceutical companies that have filed patents and are well positioned to succeed in the preclinical and clinical phases. Consequently, by following this path, some model 2 companies indirectly end up following the model 1 path. This assumption is supported in that many companies tend to use the competitive advantage provided by the platform to search for their own proprietary therapeutics, and often transform themselves over time into 'pure' drug development companies [13].

Model 3: incremental innovation through already existing products

Model 3 involves lower R&D requirements and thus requires lower levels of innovation and risk. This model is followed by companies that are not looking for new drugs but instead aim to improve products that already exist on the pharmaceutical market. A significant proportion of companies following this model in the Canadian market were set up, or at least supported, by large pharmaceutical groups. Spin-offs are viewed by these large companies as an appropriate entity to undertake the R&D activities required to fulfill incremental innovation programs. Research activities are oriented towards technological development rather than towards the generation of new knowledge. Consequently, patent filing is not usual under this model.

Unexpectedly, the timeline needed to carry out these incremental innovation programs is not short at approximately 10 years. This is because the launch of more advanced versions of existing drugs does not free the company from carrying out a range of clinical tests and approvals. Depending on the volume of resources generated after the launch to market, the company will be able to choose between starting a new long-term R&D program in line with model 1 (either on its own or by acquiring another firm) or more often, continuing to work to an incremental innovation approach to improve other drugs from the same large pharmaceutical companies.

Results

The core of this article rests on the analysis of seven biotechnology companies within the drug development area on a case study basis. The companies were chosen after several databases were analyzed and following discussion with experts in the Canadian biotechnology system. Qualitative results were obtained from the information gathered from in-depth interviews. The analysis was a pilot study that was limited to a micro-level based on case studies that create the basis for a broader cross-case analysis. The work is exploratory and relies on analytical generalization in the aim of obtaining new insights into several key issues of the business model concept in the biopharmaceutical sector. In choosing a methodology to test a conceptual framework empirically, case studies are a useful approach as they enable the complexities and subtleties of actual business models to inform the theoretically developed framework. However, the business model framework is complex and generalizations are not easily justified.

All the companies were located in metropolitan Montreal and differed from each other in the number of employees, range of activities and public or private nature, among other factors. Two companies followed model 1, three came under model 2 and two corresponded to model 3. To provide a thorough report of the biopharmaceutical business models, the analysis of these seven companies is divided into the following headings or areas: (i) activity and strategy; (ii) management and human resources; and (iii) R&D, technology and innovation strategy

Activity and strategy

Model 1

Companies following model 1 are usually willing to out-license early-stage products as a result of a lack of resources to carry out the costly clinical development phases and the marketing of new products. The business model 1 product development process, which ranges from scientific activities through to the launch of end products, is long and one in which companies can choose one of three different paths: (i) to sell ideas or concepts to others; (ii) to make a deal with a large pharmaceutical company in return for royalties, which enables them to retain up to 10% of the total price of the end product; or (iii) to become a fully fledged biopharmaceutical company, which implies looking 10 years ahead and avoiding making any deal with pharmaceutical companies too early.

Companies devote long periods of time to the development of their products. After release, R&D efforts tend to focus on two routes: (i) to maintain the product at the 'harvest' phase as long as possible; and (ii) to start developing new products that can replace and substitute the products at the maturity phase.

Model 2

The most common process followed by companies using model 2 involves the following stages: (i) short-term investment to obtain a leading technological platform; (ii) selling services based on this platform to large companies and thus generating revenues; and (iii) starting a new R&D program for future drug development.

In this business model, two main phases are usually planned: (i) to bring in enough money to build a strong intellectual property foundation; and (ii) mergers and acquisitions. Once the company attains a strong cash position, the intention is to acquire external scientific development from other companies. The strategy is to look for good opportunities for investment in start-up companies. The core technology frequently developed by companies following this model is sold under license agreements to leading large pharmaceutical companies.

Model 3

Products released by model 3 companies aim to incorporate incremental innovations and, consequently, benefit from shorter development timelines, lower development costs, reduced risks and faster market penetration than new chemical entities that have not previously been on the market. The main steps in business model 3 are: (i) marketing a first improved product; (ii) continued advancement of an existing clinical pipeline; (iii) expansion of the proprietary clinical pipeline; (iv) co-promotion opportunities to help develop a sales and marketing infrastructure; and (v) selective acquisition of complementary drug delivery technologies in combination with later-stage products.

Management and human resources

Model 1

Biopharmaceutical companies following model 1 need to offer researchers certain freedom to operate. If constraints prevail and their working environment is not conducive enough, they tend to lower their creativity levels. Leading scientists stay motivated and have a key role in the start-up phase when they feel they are actively contributing to basic science [14]. Product development involves multidisciplinary teams comprising members from different departments within the company and the research and medical community, the managerial staff of the company and the regulatory environment. Together, they form a group with a broad outlook. By contrast, companies run by researchers who are too focused on scientific discovery usually lack the capacity to understand the general overview of the business. This impedes the shift from a science-based orientation to a market and management orientation. The model 1 companies that are too driven by research performance tend to dismiss the economic performance, marketability and profitability of the project they are working on.

Model 2

In the management domain, it is important for model 2 biopharmaceutical companies to: (i) properly adapt their structure to growth as it happens; (ii) apply a strategy that involves a precise allocation of resources; and (iii) cope with tensions with scientists when the innovation strategy turns out to be incremental (scientists find it hard to work in a structured, formal environment that entails more repetitive rather than creative work). As far as management styles are concerned, model 2 biopharmaceutical companies are not free from tensions between scientific expertise and business priorities.

Model 3

The management style that best defines model 3 companies is quick, decisive movements that minimize mistakes and the chances of error, and keep employees motivated and committed.

R&D and innovation strategy

Model 1

All the major factors that shape corporate strategy, such as growth prospects, generation of profits and opening up new markets, ultimately depend on innovation capacity. This, in turn, is closely linked to the R&D strategy followed by the firm. Collaborative linkages with universities are essential for model 1 biopharmaceutical companies.

Model 2

Technological platforms limit the opportunities and set the boundaries of the research to be carried out; thus constraining R&D. One of the risks in model 2 is that once the technology platform has been built up, innovation might be mainly understood in an incremental sense. What really matters is the capacity to solve problems, rather than making big discoveries.

Model 3

The aim in model 3 companies is not to develop radically new drugs but to create new improved versions of existing drugs, and make them more effective and user-friendly. The purpose and the means to achieve them are fairly clear from the initial stages of the drug improvement process.

Conclusions

One of the starting points of this article was the recognition of diverging business models applied to the biopharmaceutical industry in Canada, which can be extended to the USA and other leading drug discovery countries. The aim of the article was not to discuss which of the three proposed models should prevail, but instead to illustrate the features and implications of each model from the data obtained from two or three companies representative of each model.

For any start-up business, it is essential to choose the most suitable business model. Consequently, this article provides some clues that could help companies to face up to the unique challenges affecting the management of science-based businesses more efficiently [4,5]. Companies that follow models 1 and 2 are more research-intensive, and commonly aspire to sell licenses of their technology or products to large companies that will take the project through further phases of development, and bring them to market.

The challenge in most biotechnology companies lies in turning the business model into a powerful device that mediates between technology development and economic value creation [2]. It is important to be efficient in the transition from a science-driven to a market-driven approach so as to create value in model 1 companies. The two companies visited stated that they would prefer to become fully fledged

biopharmaceutical companies and thus keep control over marketing and sales. In both cases, product development involved multidisciplinary teams and the ability to reconcile successfully both the scientific and management sides of the company. Model 1 companies are, in theory, the least eager to undertake the required shift from a science-based orientation to a market and management orientation. Companies that are too driven by research performance tend to overlook the economic performance, marketability and profitability of the project they are working on.

As far as R&D and innovation strategy are concerned, market leadership is believed to be firmly connected with the ability to push research and technological frontiers through significant discoveries and inventions. However, these companies must strive to reach the release phase to obtain a return on their investments and make a profit. The future prospects of model 1 companies depend more on the innovation capacity displayed throughout the whole process compared with the other two models, from very early R&D through to the effective launch to market, either alone or through alliances with partners. This study confirmed the prevalence of the RIPCO model (http://www.healthonomics.org/2008/01/biotech-business-models.html) in model 1 companies. This model licenses new drugs to a large pharmaceutical company in exchange for a royalty on sales. The FIPCO and NRDO models are unusual, whereas the federated model [6] has a better chance of becoming the most widespread for models 1 and 2 companies.

In model 2, companies tend to develop a technology platform first before starting a drug development program that is partly funded with the revenues generated through out-licensing agreements of the platform with large pharmaceutical companies. As far as knowledge generation is concerned, platform-based companies display a more internally driven profile, whereas classic drug development companies (model 1) need to rely further on external partners, especially academics.

As for management style, the biopharmaceutical companies in model 2 are not free from tensions between scientific expertise and business priorities, although they are less driven by researchers' viewpoints than in model 1. Specialization in a technological platform sets the boundaries of R&D in companies, hence limiting the opportunities to expand to new areas of drug discovery with their own resources and staff. This impediment can be overcome through the acquisition of discovery-led start-ups with promising prospects. Although building a technology platform is not the sole purpose of these companies, once the platform is ready, the view towards innovation tends to diverge. For some companies, innovation will be understood in an incremental sense, whereas others will attempt to start up a new drug development process in-house or through external acquisitions. The main challenge in these companies remains how to discover appropriate business models that are capable of realizing the latent value in technologies [2].

Business model 3 differs from the models shaping conventional biotechnology and pharmaceutical companies as it is the only one that only seeks to incorporate incremental innovations to existing end products. This business model category has been largely overlooked by previous studies in the literature. The best definition of the essence of model 3 companies is a follower strategy of creative imitation. By dismissing the risky, costly path of drug development, model 3 is a relatively low risk–low return strategy. It is also the only approach where innovation is viewed in an incremental sense and oriented towards market needs. It appears as the most 'managerial' business model, where the influence exerted by scientists is slight. Improving effectiveness and user-friendliness are two of the most promising fields for these companies.

In short, research activities in model 3 companies are oriented towards technological development rather than knowledge generation. As opposed to the other two business models, these companies are market oriented from day one. As they are more attracted to the market than to research, such companies also find it easier to recruit and retain first-class management staff.

In sum, most of the biopharmaceutical industry companies in Canada fall into one of the three business models discussed. To improve learning of the features and implications of each business model and to fuel linkages between them will be important for the correct development and consolidation of the biopharmaceutical industry in Canada and other countries.

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