Technology Innovation Management Review

April 2013

Open Innovation and Entrepreneurship

Welcome to the April 2013 issue of the *Technology Innovation Management Review*. The editorial theme of this issue is Open Innovation and Entrepreneurship. We invite your comments on the articles in this issue as well as suggestions for future article topics and issue themes.

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Overview

The *Technology Innovation Management Review* (TIM Review) provides insights about the issues and emerging trends relevant to launching and growing technology businesses. The TIM Review focuses on the theories, strategies, and tools that help small and large technology companies succeed.

Our readers are looking for practical ideas they can apply within their own organizations. The TIM Review brings together diverse viewpoints – from academics, entrepreneurs, companies of all sizes, the public sector, the community sector, and others – to bridge the gap between theory and practice. In particular, we focus on the topics of technology and global entrepreneurship in small and large companies.

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Editorial: Open Innovation and Entrepreneurship

Chris McPhee, Editor-in-Chief

Jean-Pierre Segers, Guest Editor

From the Editor-in-Chief

Welcome to the April 2013 issue of the *Technology Innovation Management Review*. This month's editorial theme is Open Innovation and Entrepreneurship, and I am pleased to introduce our guest editor, Jean-Pierre Segers, Dean of the Business School at PXL University College in Hasselt, Belgium (pxl.be), and Chairman and co-founder of Creative Inc. (creativeinc.be).

In May, the theme is Technology Evolution, and our guest editor is Michael Weiss, who is a faculty member of the Technology Innovation Management (TIM) program (carleton.ca/tim), and who holds a faculty appointment in the Department of Systems and Computer Engineering at Carleton University in Ottawa, Canada.

June's issue will not have an editorial theme, but will include articles relating to our overall scope. There is still time if you would like to contribute an article to the June issue, but I would encourage you to get in touch immediately if you are interested.

We hope you enjoy this issue of the TIM Review and will share your comments online. Please contact us with article topics and submissions, suggestions for future themes, and any other feedback.

Chris McPhee
Editor-in-Chief

From the Guest Editor

It is my pleasure to be the guest editor and to explore the theme of Open Innovation and Entrepreneurship. In this issue, the authors examine these two concepts and the points at which they intersect.

Henry Chesbrough first promoted open innovation through his book *Open Innovation: The New Imperative for Creating and Profiting from Technology* (2003; tinyurl.com/ce6bsy8). In this book, Chesbrough described open innovation as "a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market". Traditionally, R&D departments in large companies were viewed as tightly closed and highly secretive. Open innovation prompted a paradigm shift, thereby opening the doors of these large companies to outside input and encouraging a two-way exchange of ideas and information to stimulate innovation.

Today, the perspective is even broader. Open innovation is seen not only from the perspective of large companies, but from numerous types and sizes of organizations that have important roles to play in open innovation. We see the emergence of "innovation hubs" and can view the open-innovation phenomenon from the perspective of regional innovation involving diverse players, including: clusters of universities and university colleges; research centres for fundamental, basic, and applied research; business ecosystems for established companies and startups, government institutions, knowledge centres and research centres, graduates, entrepreneurs, etc.; technology-transfer offices; investments funds; and startup incubators.

Thus, open innovation is becoming increasingly relevant to entrepreneurs and the organizations that support them. In this issue, authors from Belgium and Norway share their academic insights and experiences as they relate open innovation or entrepreneurship, or where these two topics intersect.

Editorial: Open Innovation and Entrepreneurship

Chris McPhee and Jean-Pierre Segers

In the first article, **Wim Vanhaverbeke**, Professor at the University of Hasselt in Belgium – and one of Henry Chesbrough's frequent collaborators on the topic of open innovation – offers a new perspective on open innovation by going beyond the innovation funnel. At its origin, open innovation was closely linked to new product development, the innovation funnel, and business models in large companies. However, Vanhaverbeke argues that organizations in different types of industries can benefit from open innovation even when they are not developing new products or services. The integration of open-innovation initiatives into the corporate strategy of the firm can open up the full potential of open innovation and give it a "second wind" for additional growth.

Next, we have two articles that provide insights and case material on the topic of open innovation in the highly developed Norwegian maritime-oil industry. First, **Marina Solesvik** and **Magnus Gulbrandsen**, from the Center of Technology, Innovation and Culture (TIK) at the University of Oslo, Norway, examine the challenge of selecting partners for open innovation. They consider open innovation from the point of view of causation and effectuation approaches, as well as social networking, by closely examining an open-innovation project in the maritime industry aimed at creating a state-of-the-art hybrid ship that uses liquid natural gas and hydrogen as power sources. The results of their case study will be of interest to policy makers and academics, but practitioners in particular will appreciate the authors' insights on choosing partners for open innovation.

Next, **Tatiana Iakovleva**, Associate Professor in the Stavanger School of Business at Stavanger University, Norway, argues that an entrepreneurial mindset might help small and medium-sized enterprises move toward an open-innovation approach. Using the example of a Norwegian firm operating in the maritime-oil industry, her article shows how innovative action may depend on the combined influence of entrepreneurial orientation within the firm and knowledge-providing cooperative links with knowledge providers. Moreover, this article examines the links between open innovation, the entrepreneurial behaviour of small and medium-sized enterprises, and firm performance.

In the fourth article, I focus on the biotechnology clusters that have been emerging in Belgium over the last few decades within the framework of the regional system of innovation. Through a case-based analysis, I demonstrate that strategic technology partnerships between new biotechnology firms and established, large, and international (bio)pharmaceutical companies have a significant impact on the survival and growth of these new biotechnology firms. I argue that new business models should be developed to foster the creation and growth of new biotechnology firms and lower their exposure to risk. In particular, open innovation could play an increasingly important role in the success of new biotechnology firms. For example, one approach pharmaceutical companies have been taking to replenish their drug development pipelines is not only investing in early-stage biotechnology companies, but also opening innovation centres to help these companies grow.

In the fifth article, **Sven De Cleyn**, **Frank Gielen**, and **Jan Coppens** from the iMinds research institute in Belgium, describe how iMinds' incubation and entrepreneurship programs act as a catalyst for open business ecosystems. Traditionally, universities and public research organizations have emphasized the commercial or societal applications of knowledge and technologies developed within a given research organization. At iMinds, however, the incubation and entrepreneurship program represents a new model of open cooperation, where all relevant stakeholders contribute to a business ecosystem, through which spillover effects are generated to the potential benefit of all participants.

Finally, my special thanks go to Nadia Noori, for introducing me to the TIM program, and to Chris McPhee, for his continuous expert feedback throughout the production of this issue. We hope the insights from these articles will help you in your own efforts with open innovation and entrepreneurship.

Jean-Pierre Segers
Guest Editor

Editorial: Open Innovation and Entrepreneurship

Chris McPhee and Jean-Pierre Segers

About the Editors

Chris McPhee is Editor-in-Chief of the *Technology Innovation Management Review*. Chris holds an MASc degree in Technology Innovation Management from Carleton University in Ottawa and BScH and MSc degrees in Biology from Queen's University in Kingston. He has over 15 years of management, design, and content-development experience in Canada and Scotland, primarily in the science, health, and education sectors. As an advisor and editor, he helps entrepreneurs, executives, and researchers develop and express their ideas.

Jean-Pierre Segers is Dean of the Business School at PXL University College in Hasselt, Belgium (pxl.be), and he is the Chairman and co-founder of Creative Inc. (creativeinc.be). He holds a Master's degree in Applied Economics and Public Affairs and is a former researcher in the Small Business Research Institute at the University of Brussels. His main research interests are small businesses and entrepreneurship; innovation and technology management; national and regional systems of innovation; and public-private partnerships.

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Rethinking Open Innovation Beyond the Innovation Funnel

Wim Vanhaverbeke

> *"We are bound no longer by the straightjacket of the past."*
>
> Douglas MacArthur (1880–1964)
> General of the Army (United States)

In his article, I first argue that open innovation can be applied in situations where companies do not themselves develop new products or services. As a consequence, open innovation becomes relevant for a much larger group of organizations than previously considered. Second, I argue that open-innovation scholars have insufficiently differentiated open-innovation initiatives in terms of their impact on companies' growth: some open-innovation initiatives lead to incremental innovations in an existing business while, in other cases, open-innovation initiatives are used to establish completely new businesses. Both arguments illustrate the need to integrate open-innovation initiatives into the strategy of the firm.

Introduction

Do we need to rethink open innovation? Is this really necessary? In this article, I provide a few reasons why open innovation has to be disconnected from the innovation funnel. Once open innovation is freed from this straightjacket, we might give it a "second wind" for additional growth.

Open innovation has always (implicitly) focused on new product introductions. This is illustrated by the central place of the (open) innovation funnel in Chesbrough's seminal book on open innovation (2003; tinyurl.com/d2l6bqx). Open innovation has been defined in terms of inside-out or outside-in innovation. These two terms implicitly refer to the "open" innovation funnel where external knowledge is acquired to strengthen internal competencies and accelerate the innovation process in the company, and from where unused, internal knowledge is monetized through external paths to market. External knowledge is insourced to develop a new product or business, or internal knowledge is sold to another organization, which deploys it for its own product development. In this article, I provide two arguments to disconnect open innovation from the innovation funnel, opening in this way new directions for future research in this field. First, I argue that organizations in different types of industries can benefit from open innovation even when they are not themselves developing new products or services. This change in perspective makes open innovation relevant for a much broader range of organizations than before. Second, open innovation, with its main focus on the innovation funnel, has implicitly been focusing on R&D projects that, if successful, would bring new growth to existing businesses. Innovation scholars made few attempts to compare the case where open innovation is a means to accelerate growth of existing businesses with the case where it is used to establish completely new businesses.

Both arguments illustrate the need to integrate open-innovation initiatives into the strategy of the firm. It is time that scholars analyze how managers follow a stepwise process to link firms' strategy to open-innovation practices and take the integration of open innovation into strategy seriously.

I explore these two themes in more detail in the following two sections. In the conclusions, I focus on the consequences of this attempt to broaden open innovation for both practitioners and academia.

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Open Innovation Beyond New Product Development

Chesbrough and Vanhaverbeke (2013; *in press: Exploring the Next Wave of Open Innovation Research*, Oxford University Press) show that open innovation can be applied to many more situations than the usual cases where product innovation is essential. We claim that product development is only one activity of the many business activities where open innovation is applicable. Product innovation is not an option in many industries: in many service-oriented industries, product innovation is not generating value for the customer, because they focus on creating solutions for customers rather than producing and selling products. Moreover, in many manufacturing industries, companies produce and sell commodities, and, consequently, product innovation is per definition not possible. Chesbrough and Vanhaverbeke (2013; *in press*) propose that, in these industries, a company (the focal firm) should first determine its strategic drivers that can be leveraged to gain competitive advantage. Next, technological innovations in other companies may be useful in leveraging the identified strategic drivers. Therefore, the focal firm has to set up a network (or a so-called innovation ecosystem) with these companies: technological innovations in the latter will generate a competitive advantage in the former. In short, we should not automatically link open innovation to new product or business development, but rather look for specific competitive drivers relevant in particular situations but not in others.

As an example, take the crude-oil business at a large oil company. The product that this business unit is selling is inevitably a commodity, and product innovation is by definition excluded (at least at the business-unit level). However, as in each business, competitive advantage in the crude-oil business is determined by a number of strategic drivers. Two important strategic drivers are the early detection of large oil wells and the effective drilling of these wells. Competitiveness in the crude-oil business depends on various technologies that increase the productivity of exploration and extraction. Oil companies have to detect the richest oil wells earlier than competitors and drill them more effectively through new technologies that allow them to extract oil at greater depths. Although the oil industry is dominated by large companies with strong R&D capabilities, they rely on specialized oil-services companies such as Schlumberger and others to develop new technologies for oil exploration and extraction: the oil-services sector is a beacon of innovation within the energy industry. Oil-services firms typically receive more patents each year than most of the large integrated oil companies. The oil company gains a competitive advantage if it partners with Schlumberger (usually in combination with other specialized services companies), who has leading-edge exploration and drilling technology. An oil company can set up a research program with these partners and (co-)finance the research and development of new exploration and drilling technology. They become strategic partners in advancing this technology. The oil company will typically require exclusive use of the technology for several years before Schlumberger can sell the technology to other oil companies.

The example of the crude-oil business in oil companies is just one example of how companies that could not be considered as "open innovators" still can drive competitive dynamics through innovation ecosystems. In this setting, it is essential that the partnering companies have networked business models, meaning that the companies' business models that are mutually interdependent. As an example of a networked business model, take the iPhone: Apple creates value by setting up a platform for apps, and the number of apps determines the value of an iPhone for the customer. Obviously, the app-maker depends on the platform to create his value for the customer. Networked or linked business models are in turn a recent development that have received the attention of Osterwalder and Pigneur, authors of the best-selling book *Business Model Generation* (2009; tinyurl.com/cadq9x9). Chesbrough and Vanhaverbeke (2013; *in press*) provide other examples, such as SkyNRG (skynrg.com) and Better Place (betterplace.com), where a combination of linked business models and open innovation can be used to leverage any strategic driver.

Within this extended open-innovation framework, new product development should be considered as a specific competitive driver relevant in particular situations but not in others. To extend the applicability of open innovation, we have to start from the strategy of a business, identify the key competitive/value drivers that should be enacted upon, spot and select the potential innovation partners, and set up a joint project to develop technologies or solutions that will strengthen the firm's competitive drivers. Thus, even in absence of any product or service innovation in the business, firms can still "nurture" their network of innovation partners and value-chain partners to become more competitive. This extension of the original open-innovation concept may lead to entirely new developments in this research field:

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1. *Strategy as starting point*: This shift away from product innovation shows that the competitive position of firms may rely on a broad set of value drivers, going from process innovations, an increase in the productivity of a business, or a improvement of the quality or usability of products. Increasing throughput time, reducing operational complexity and costs, or integrating processes are other examples. Which one to focus on depends on the business context, but in each case, the focal firm can set up a joint research initiative and encourage (technology) partners to accelerate innovation in a particular field. Therefore, instead of starting from the need to open up during a new product innovation process, managers should first identify strategic drivers that can be leveraged by new (technological) developments in partnering organizations.

2. *Wider applicability of open innovation*: extending open innovation in this way makes it more relevant for companies who are recipients of technologies/innovations, such as service industries, low-tech manufacturing industries, and governments. Recipient organizations can initiate and orchestrate the collaborative initiative while technology providers are implementers within this framework. As a result, open innovation is not only relevant for innovating new product innovations but also for innovating and improving services; processes; technologies; management practices; ideas/concepts, strategies, and business models; competence building; etc., regardless of the industry.

3. *Need to change the theoretical open-innovation framework*: The extension of the open-innovation framework also implies that the open-innovation funnel can no longer remain the central framework for open innovation. It should be replaced by a new framework that entails a number of items that are central in the innovation-ecosystem literature (Adner, 2012; tinyurl.com/dxxkw4a).

4. *Managing innovation ecosystems as the new imperative*: Nambisan and Sawhney (2010; tinyurl.com/cr4zcy5) have shown how such an innovation ecosystem has to be managed. However, they limit their attention to firms who themselves are technological innovators and require an ecosystem to get the technology developed and adopted. Our approach is different, leading to a different type of ecosystem and different guidelines for managing the ecosystem appropriately.

Enriching and Broadening Open Innovation by Connecting it to Strategy

Strategic concepts already took an implicitly central place in seminal open-innovation publications (Chesbrough, 2003: tinyurl.com/d2l6bqx; 2006: tinyurl.com/c4cwoha). The business model, for instance, is a central concept in the open-innovation funnel because it determines what external knowledge a firm needs to source from external partners and what internal knowledge can be licensed or sold to other companies. In this way, business models and strategy are already at the heart of open innovation.

Open innovation has to be embedded in firms' strategy to understand the real value of open-innovation initiatives in large companies. I want to illustrate this assertion with three well-known cases: P&G's Printed Pringles, the Swiffer Duster of the same company, and DSM's Emerging Business Areas (EBAs). These examples of open innovation are usually classified as "successes in open innovation" both in professional journals as well as in academic journals. However, these three examples have a different impact on the growth of the company. The Pringles example represents a minor change in the business, the Swiffer duster is an entire new product for P&G, and the EBAs are a bold bet of DSM to generate complete new divisions at DSM within three to 10 years. Open-innovation projects should not be differentiated according to their impact on current or future growth of the company. These projects play a different role in the strategy of companies. We only can estimate the strategic value of different open-innovation approaches if we integrate open innovation into the business and corporate strategy of companies. Several practice-oriented authors have detailed how managers can follow a stepwise process to successfully link firms' strategy to open-innovation practices (Slowinsky and Sahal, 2010: tinyurl.com/d3n8q8u; Kirschbaum, 2005: tinyurl.com/cqzr5xn). Yet, the link between open innovation on the one hand and strategy on the other hand has received scant attention in the academic literature. In contrast with the rapid growth of the open-innovation literature, only few articles have been focusing on open innovation and strategy (Chesbrough and Appleyard, 2007: tinyurl.com/bp9gmee; Dittrich and Duysters, 2007: tinyurl.com/c6rvc6h).

One way to broaden the focus of the current open innovation literature is to link it explicitly to corporate strategy. Popular open-innovation cases illustrate how a firm can benefit using external knowledge sources to de-

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velop new products in existing businesses. This overemphasis on the use of open innovation in existing businesses eclipses other potential strategic uses. At DSM, management has established the EBAs, where complete new businesses or divisions are developed and incubated at the corporate Innovation Center to drive future (and not current) growth of the company by establishing new businesses that do not yet exist in the company (see Vanhaverbeke and Peters, 2005: tinyurl.com/ckk6llb; Wijen et al., 2011: tinyurl.com/c8uob7j). These businesses are developed in collaboration with a broad range of external (technology) partners. The collaboration with external partners can hardly be compared with the inter-organizational collaboration when companies engage in new product development for existing businesses (as in the two P&G cases mentioned above). In sum, open-innovation projects play different roles in the strategy of companies and we need to have a better understanding of how different forms of organization and management help companies to team up with different types of external partners to realize incremental growth in current businesses or growth in completely new businesses. Different strategic growth targets will lead to different ways to organize open innovation, different departments in the organization will be responsible to lead the projects, and the type of partners will also be different depending on the strategic role of the projects. Developing new products in existing businesses is only one possible strategic objective of open-innovation projects. Sourcing knowledge from partners can also be done for other strategic purposes. The development and incubation of early-stage ventures in business areas that are targeted by top management as growth areas (beyond the existing divisions in the company) is another one. Similarly, a firm may use open innovation to realize major corporate changes in the company. Organizing open innovation for reasons of corporate growth and renewal also implies that a firm has to develop new competencies that are not present internally. This offers an interesting perspective on how companies develop new long-term competencies. This, in turn, can be linked to interesting developments about dynamic capabilities.

What are the implications of this change in perspective for future research on open innovation?

1. *Strategy as starting point*: Introducing open innovation is pointless when it is not guided by and embedded in firms' strategy. There is an urgent need to integrate open innovation into strategy and differentiate open-innovation projects according to their role in the strategy.

2. *Understand the diversity of open-innovation projects*: The integrating of open-innovation activities into corporate strategy allows us to explain the large inter-organizational differences in implementing open innovation successfully. A careful analysis of the role of open innovation in firms' strategies provides a better understanding of the multitude of organizational and managerial practices which are nowadays all labeled as open innovation. The diversity of the open-innovation activities is in most cases the result of different strategic objectives firms want to reach with open-innovation activities.

3. *Link open innovation to corporate growth and corporate renewal literature*: The scope of open-innovation activities is, in the current literature, usually determined by the business model of mainstream businesses in a company. The potential benefits of open innovation from a corporate-growth and corporate-renewal perspective are virtually nonexistent in the literature: several companies have successfully used open innovation in growing entirely new businesses outside the existing business, with a fundamentally different approach to open innovation.

4. *Exploration/exploitation*: Once open innovation is tightly linked to corporate (growth) strategy, scholars can use a broad stream of literature about exploration/exploitation (March, 1991; tinyurl.com/8xqlyp5) and the need to have an ambidextrous company (Tushman and O'Reilly, 1996: tinyurl.com/7y8lhm6; Janssen et al., 2012: tinyurl.com/bv9pe5g). "An ambidextrous organization is one that is capable of simultaneously exploiting existing competencies (e.g., satisfying existing customers) and exploring new opportunities (e.g., developing new products)" (Schreuders and Legesse, 2012; timreview.ca/article/522).

5. *Capability building and dynamic capabilities*: When open innovation is embedded as an essential element in corporate growth strategy, we can expect that new competence building will become a central topic. Open innovation is in this case not only instrumental in developing a product during its journey from research to market launch. In corporate initiatives that envision to grow into new technologies and business areas, new competencies have to be built along the way. This offers an opportunity to put the role of open innovation in developing new competencies and dynamic capabilities into the spotlight (Teece et al., 1997: tinyurl.com/cu49okc; Teece, 2007: tinyurl.com/c3m59tv; Helfat et al., 2007: tinyurl.com/cgodvfw).

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Conclusions

When open innovation was launched as a new concept in 2003, it was tightly linked to other concepts such as new product development, the innovation funnel, and business-model change in large companies. Gradually the scope of open innovation has been broadened, introducing new concept such as open business models and open services innovation. In my view, it is time for a new major step forward by integrating open innovation into strategy. This has been a major gap in the open-innovation literature for the last 10 years and this gap has been hampering the progress of open innovation as a useful concept in the mainstream innovation literature.

I have been focusing on two topics in this article. First, open innovation can be useful for companies that are not involved in new product development activities. I have described some examples where companies that are not involved in new product development can benefit by setting up a collaborative strategy wherein the open-innovation activities of other companies (in different industries) help improve the competitive strength of the former. Second, the full potential of open innovation cannot be realized as long as it is not connected to corporate strategy. Some companies use open innovation in a quite different way than the standard case studies we can read in the literature. These firms integrate open innovation tightly with corporate growth and corporate renewal objectives. This leads to a new application of open innovation: when the collaboration with technology partners takes place mainly to build new internal (technological) competences.

Both topics illustrate how important it is to integrate open-innovation initiatives into the strategy of the firm. Several practice-oriented authors described already how managers follow a stepwise process to link firms' strategy to open-innovation practices. It is time that the academic literature takes the integration of open innovation into strategy seriously.

About the Author

Wim Vanhaverbeke is a Professor at the University of Hasselt in Belgium. He is also Visiting Professor at ESADE Business School in Spain and at the National University of Singapore. He has published in several international journals and is co-editor, with Henry Chesbrough and Joel West, of *Open Innovation: Researching a New Paradigm*, a book about the research challenges related to open innovation. He is a dedicated open-innovation researcher collaborating with different partners in universities and companies around the globe. He established the European Innovation Forum with Henry Chesbrough in 2012. He is frequently invited to speak at leading international conferences, and he is an adviser for several globally operating companies. He is co-editing a new book about open innovation, which will be published in 2013.

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Partner Selection for Open Innovation

Marina Z. Solesvik and Magnus Gulbrandsen

> *"An innovation, to be effective, has to be simple and it has to be focused. It should do only one thing, otherwise, it confuses. If it is not simple, it won't work. All effective innovations are breathtakingly simple."*
>
> Peter Drucker (1909–2005)
> Author and Management Consultant

In this article, we consider open innovation from the perspectives of: i) causation and effectuation, and ii) social networking. Our empirical evidence consists of a case study of a late-stage open-innovation project aimed at creating a hybrid ship that uses liquid natural gas and hydrogen as power sources. The results show that the effectuation approach is preferable to open innovation when the initiator of open innovation aims to keep sensitive information inside the closed group, when the initiator has established an effective team of representatives from other firms from earlier innovation projects, and when the participants are geographically close.

Introduction

Open innovation is a popular approach within innovation studies and innovation in practice. Open innovation is defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and extend the markets for external use of innovation, respectively" (Chesbrough et al., 2006; tinyurl.com/d5aaxah). A significant amount of research has been devoted to different aspects of innovation partnerships, such as the motives for, and the impacts of, collaboration. However, the important aspect of partner selection for open innovation has received limited attention from scholars (Li et al., 2008; tinyurl.com/csgdhvq). At the same time, selection of the right partner is probably the most crucial aspect of open-innovation success (Solesvik and Westhead, 2010; tinyurl.com/cujskmc). To better understand partner-selection issues, additional research is warranted to explore which mode of partner selection leads to a more effective open-innovation process.

Effectuation and causation approaches might be applied to explore partner selection for open innovation. Sarasvathy (2001; tinyurl.com/cmjpnxg) suggest that "causation processes take a particular effect as given and focus on selecting between means to create that effect. Effectuation processes take a set of means as given and focus on selecting between possible effects that can be created with that set of means." R&D cooperation is one of the forms of open innovation (Herzog, 2008; tinyurl.com/bs7dgco), and the bulk of it uses causation logic as a given. For example, a firm sets a goal to develop a new innovative product. If the firm's management subsequently decides that it is better to cooperate with others to achieve this goal, managers screen the environment for possible partners. The next step is normally to select one of them and to write a formal/contractual R&D agreement. This agreement will specify obligations in time, ownership, deadlines, milestones, and possibly other aspects. Cooperation either successfully continues or terminates after the goals are achieved.

However, observations of R&D partnerships show that some entrepreneurial firms follow an effectuation path that has a more ad-hoc and bottom-up character (Sarasvathy, 2008; tinyurl.com/c2zknnj). Entrepreneurial firms screen their networks of customers, suppliers, and other actors to find reliable partners (i.e., they ask the question: "Whom do we know?"), they are engaged in existing relationships, and they decide underway what several partners can do together.

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This article focuses on partner-selection issues for open innovation in the maritime sector of Norway. There are many public support programs in Norway that directly or indirectly build upon an open-innovation approach. Firms may receive tax credits for collaboration with universities and research institutes, they may receive direct support for joint R&D with other firms or public R&D units, and various public agencies organize and facilitate clusters and networks at regional and sectoral levels. Hence, firms are continually encouraged to enter into new partnerships and to strengthen and redefine existing ones. The research questions of this study are:

1. Do firms follow causation or effectuation logic when they form open innovation partnerships?

2. How do firms select partners for open innovation?

The study aims to make several contributions to the existing knowledge base. First, the article offers fresh insights to the literature on partner selection in open innovation. Second, the forming of R&D partnerships in open innovation will be considered through the lens of effectuation and causation theory, which is a novel approach to explore R&D alliance formation. The article is constructed as follows. First, we outline the dimensions of effectuation, causation, and social networking approaches. Then, we present the qualitative methodology that we have employed in the analysis. Next, we present the findings and derive propositions. A final section discusses future research that focuses on partner selection for open innovation.

Theoretical Background

Effectuation/causation theory and social networking theory make up the theoretical background of the issues we examine. Effectuation theory is named as one of the key entrepreneurship theories (Moroz and Hindle, 2011; tinyurl.com/c47h9yt). Originally, Sarasvathy (2008; tinyurl.com/c2zknnj) and other researchers used this theory to explain behaviour of entrepreneurs when they start and operate businesses. In this study, we attempt to go further and use the effectuation approach to explore the cooperative behaviour of entrepreneurial firms. But first, a presentation of Sarasvathy's (2008; tinyurl.com/c2zknnj) effectuation theory is required.

Effectuation theory has received much attention from entrepreneurship scholars in explaining the decision-making approach of some entrepreneurs (Fisher, 2012; tinyurl.com/c8yb7rd). Entrepreneurs using the effectuation approach do not have a clear goal when they start the venture. In the first phase of a new venture, an entrepreneur or a top management team asks three key questions: "Who are we?", "What do we know?", and "Whom do we know?". In the second phase, the entrepreneur/top management team asks "What can we do?" with the existing set of resources and networks and decides how much money it is possible to "sacrifice" in the development of the new business (i.e., they follow the "affordable loss" principle). The third phase is "stakeholder interaction", where customers, suppliers, and even competitors, are actively engaged in the new venture development. The fourth and final phase is "leveraging contingencies"; effectuators should be ready to accommodate new pleasant and unpleasant turns of destiny and be ready to transfer them into opportunities. If we observe partner-selection issues for R&D alliances through the lens of the effectuation theory, the top management team selects a partner in the first phase together with an audit of their own personal assets (i.e., skills, knowledge, and resources).

Oppositely, causators act according to a conventional logic known from the business training programs. First, the market is analyzed for prospective opportunities. The analysis is often based on market research and other scientific methods of analysis. After this, an entrepreneur or a top management team sets the goals. Then, the set of means to achieve these goals are determined. In case of a lack of own resources, an entrepreneurial firm might consider forming an R&D alliance and finding a partner who owns necessary resources or knowledge. Then, an entrepreneurial firm screens the market for potential partners. Finally, it selects one suitable partner to form an alliance.

Effectuation/causation theory has largely been developed and employed to analyze individual entrepreneurs or relatively small firms and their management teams. In this article, we apply the theory to a larger firm in a mature industry. We assume that such a firm will be involved in more partnerships and that these partnerships will have taken on an institutionalized character. This means that partner selection probably more often takes preexisting networks as a starting point, corresponding to an effectuation strategy, even though the firm may have the resources to pursue a more formal causation approach.

In general, some authors have distinguished between two modes of partner search: the institutionalized mode or mechanism and the social mechanism (Ran-

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gan, 2000; tinyurl.com/cljdet3). Social network theory adds to the insights from the effectuation theory in the exploration of R&D alliances formation within open innovation. Social capital is related to an ability to benefit from networks, social relationships, and structures (Cope et al., 2007; tinyurl.com/d9zerq4). Social capital originates at the individual level and the organizational level (Nahapiet and Ghoshal, 1998; tinyurl.com/dxarvo6). Davidsson and Honig (2003; tinyurl.com/dyg2u98) noted that "social capital can be a useful resource both by enhancing internal organizational trust through the bonding of actors, as well as by bridging external networks in order to provide resources".

Research Method: A Case Study Approach

This exploratory study was positioned within an interpretive research paradigm. A single case study method (Yin, 2003; tinyurl.com/7ywkcpy) is used to explore the research questions related to open-innovation partnership formation and partner-selection issues for open-innovation development. This technique enables the analyst to get deep insights into the mechanisms underlying the selection mechanism for open innovation. A qualitative case study method is appropriate because the aim of this study is to generate fresh and deeper insights into the process of partner selection related to an open innovation.

The case we selected involved the development of a unique and revolutionary ship that uses liquid natural gas and hydrogen power. It is the only ship of this type under development in Norway. We studied the process of partnership formation for this project and the firms that were involved in the open-innovation process.

In 2012, seven semi-structured interviews were carried out among the participants of an open-innovation project aimed at developing an environmentally friendly hybrid-platform supply ship for a Norwegian shipping company. The interviews subjects included the project managers responsible for the project in the partner firms (i.e., the classification society, the shipping company, the engine producer, and the shipyard). Research institutions were not involved in the project.

In order to triangulate information collected from face-to-face interviews, additional data sources were used (e.g., information from reports, company web pages, other Internet sources, and trade/technical magazines). By combining several modes of data collection, an in-depth description of the partner-selection process was obtained.

Case evidence was analyzed iteratively by clustering and organizing the data around key words drawn from the social networking, effectuation, and causation theory to discover patterns (Yin, 2003; tinyurl.com/7ywkcpy). An iterative analysis relating case analysis was conducted (Eisenhardt, 1989; tinyurl.com/7dfuc3z). This process enabled the detection and understanding of the effectuation, causation, and social-networking activities of collaborating firms to be highlighted, and allowed us to explore the alignment of case evidence with existing theory (Strauss and Corbin, 1990; tinyurl.com/cy7thrz). The data were compared with existing theory and then analyzed in relation to the four phases of the effectuation process. After the data were analyzed, propositions were developed to build theory.

Findings

The shipping company is rather innovation-oriented and the idea of a ship that uses fuel cells emerged from dialogues with the classification society, suppliers, and ship designers. The company had ties to these actors before this idea emerged. Earlier, the shipping company was the first in Norway to introduce an offshore vessel that uses liquid natural gas as its fuel. The Norwegian Government also stimulates green shipping and supports projects aimed to diminish carbon dioxide and nitrogen oxide emission and to develop environmentally friendly technologies. The case project – the development of a ship that will use fuel cells as an alternative power source together with liquid natural gas – was launched in 2003. The use of fuel cells permits a 30 per cent fuel savings, the emission of carbon dioxide is up to 50 per cent less compared to conventional fuel, and there is no emission of nitrogen oxides, sulfur oxides, or particles. Fuel cells use hydrogen, but hydrogen cannot be preserved on board the vessel. Thus, an R&D alliance developed a technology that makes it possible to extract hydrogen from liquid natural gas. Det Norske Veritas (DNV; dnv.com), which is a large and R&D intensive Norwegian company specialized in engineering services oriented at safety, quality, and the environment, is formally responsible for the project. The R&D work within the project started in 2004 and should be completed in 2014. Currently, in April 2013, the project is in its third phase, meaning that the vessel is ready, small models of the fuel-cell device have been tested, and the fuel-cell equipment soon will be installed on board the vessel.

The project used an open-innovation approach and united enterprises based in Norway and Germany. Initially, five companies created an R&D alliance and con-

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tributed 20 per cent each to the new alliance. They were the classification society Det Norske Veritas, two shipping companies (one Norwegian and one Swedish), a Norwegian ship design firm, and a Norwegian automation firm. Later, the Finland-based multinational Wärtsila (wartsila.com) acquired both the ship design and the ship automation firm and now owns a two-fifths share in the R&D alliance. Partners contributed with their core competencies to a new product development. The project was later financially supported by the Research Council of Norway (forskningsradet.no) through a FellowSHIP program and tax reduction schemes. The Government covered about 40% of the R&D expenses. As for partner-selection issues for this project, the parties knew each other before the project started. The project manager of the fuel cell ship at the shipping company who initiated the cooperation stated:

"We did not want to go to the market and announce a tender to develop parts of the project, i.e. ship design or elaboration of the engine. We worked with the partners whom we know over many years. And we are sure that the information will not leak. We know that we can cooperate effectively. We have compatible organizational cultures. And we are geographically close. We [the shipping company], ship designer, automation and engine developer and the shipyard are in the same district. So it is easy to organize meetings and travel will not take much time. The project leader, DNV, is in Oslo. But again, we all have cooperated with DNV for many years. DNV has established a contact with one of the best manufacturers of fuel cells in the world which is situated in Munich."

So, for an open-innovation project, the project initiator wishes to use only reliable partners with whom they cooperated earlier. This finding is in line with a previous study (Kock and Torkkeli, 2008; tinyurl.com/d4n3tsb), where the researchers found out that 65 per cent of open-innovation projects are carried out with "steady partners". So, at the initial stage of project development, the initiator group at the shipping company asked themselves the three questions from the first phase of the effectuation process: "Who are we?", "What do we know?", and "Whom do we know?". In Table 1, the citations from interviews related to the four phases of effectuation are presented. The shipping company had successful cooperation relationships with the ship design firm, a shipyard, and an automation firm, which developed the engine. They have had tight relationships with each other over 20 years and finalized an innovation project aimed at developing a vessel driven by liquid natural gas. The project was completed successfully. The shipping company became the first in Norway to introduce an environmentally friendly gas-driven platform-supply vessel in Norway. This discussion leads to the following propositions:

Proposition 1: *Firms that had mutually beneficial relationships with certain firms in past open-innovation projects would tend to engage the same partners in new open-innovation projects.*

Proposition 2: *Firms that prefer to keep sensitive information related to a product to be created in an open-innovation project, tend to select partners from those firms that they know from the past and have established trustful relationships, rather than select partners in the market.*

Participants in the joint venture for a hybrid ship development are active in serving the highly profitable Norwegian oil sector. Thus, they could afford to use a certain amount of their profits for the new product development (Phase 2). The R&D alliance has estimated how much money they can afford to invest in innovation development and managed to attract money from the national research council to sponsor 40 per cent of R&D costs. Initially, they had a rough idea of what the final vessel would look like, although the construction of the device that produces fuel cells has been changed over the project through close interaction among stakeholders (Phase 3).

The participants interacted not only with each other but also with other firms that did not own stakes in the R&D alliance but also were well known to participants (i.e., a shipyard). A number of contingencies occurred over the project development, and the partners managed to turn many of them into profitable solutions (Phase 4). First, the regulation framework for the use of fuel cells on board ships did not exist. All parties involved in the project contributed to the creation of the maritime rules that will regulate the development, construction, and exploitation of hybrid vessels using fuel cells. Second, the German company has a very wide experience in development and production of fuel-cell aggregates that are used on the ground, such as auxiliary power sources for hospitals. In the open sea, the weather conditions are severe and the fuel-cell machinery is in constant movement. This was one of the problems that practitioners solved in the project, and they have acquired a patent for this invention. Third, hydrogen cannot be preserved on board because it is highly explosive. The alliance has found a way of producing hydrogen on board the vessel. Next, the fuel-cell machinery, which produces electricity to drive the en-

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gine, warms up over the course of three hours and finishes the production of the fuel cells during 24 hours. In other words, the ship cannot stop when it needs to go to the port. The alliance developed special accumulators to collect the electricity that the fuel-cell aggregate produces. Again, this invention was also patented. The partners hope to sell licenses on products they have developed within this project (i.e., outbound innovation). They argue that the demand for environmentally friendly vessels will increase soon because international authorities constantly introduce new rules related to pollution and emission of carbon dioxide and other gases. This discussion leads to following proposition:

Proposition 3: *Initiators of open-innovation projects tend to use an effectuation approach to new R&D venture formation when they have only a rough idea about the final product.*

Conclusions and Implications

This article considered one of the central aspects of open-innovation formation, namely R&D alliances, and in particular the issue of partner selection for open innovation. The concept of effectuation was applied to answer the research questions of this study. The results show that effectuation rather than causation is a suitable approach for open-innovation development under certain circumstances. Innovations are related to sensitivity of information outflow, and initiators of innovation prefer to deal with known partners that they trust, rather than look for new partners in an open market. In this manner, firms may retain certain benefits such as limited secrecy and first-mover advantage even when working in an open-innovation mode. The effectuation/causation dichotomy has earlier been applied largely to entrepreneurs and small and young firms,

Table 1. The effectuation process over the open-innovation process in the shipping company

Phase	Question	Citation
1 Means-driven transformation	Who are we?	*"We are a shipping company that uses a proactive strategy to a new fleet development."* - Head of project in the shipping company
	What do we know?	*"We have developed a new technology that allows ships to use both liquid natural gas and traditional marine oil as a fuel. We have knowledge and competence in new product and revolutionary technology development."* - Head of project in the shipping company
	Whom we know?	*"We have established good relationships with a number of firms (i.e. suppliers, customers, banks, and authorities)."* - Head of project in the shipping company
2 Technology of foolishness	What can we do? (Affordable loss)	*"We freshly developed and implemented a new technology that allows to reduce emission from our ships. We have a good team of cooperation partners who created an innovative vessel. What can we do together further? May be we can try to make a Prius* [a hybrid from Toyota] *in the sea."* - Project engineer in the shipping company
3 Docility	Stakeholder interaction	*"We decided to create a joint venture where each party will have 20% stake. The participants were two shipping companies (one later went out), the classification society, automation firm, and ship design company. The Norwegian government also was attracted to participate and contributed with about 40% of R&D expenses support."* - Head of R&D department at the ship design firm
4 Leveraging contingencies	Making lemons into lemonade	*"Several challenging problems that were on the way to implementing ground-based hydrogen fuel cells technology in the sea occurred on the way, starting from the regulation obstacles together with a number of sophisticated technical tasks. Problems were solved. A number of patents were registered."* - Project manager at the automation firm

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where the actors generally are more resource constrained and may be forced into more open modes of innovation. Our case describes a mode of limited openness: partner selection is based on current trustful relationships, and each partner may be allowed to bring other trustworthy actors into the partnership. But, even when supported by public R&D funding, the network has a limited number of partners, and it has resulted in inventions that are possibly new to a global market.

The results of the study would be interesting to policymakers responsible for the promotion of open innovation and development of innovation systems in key economic sectors. The results will also be of interest to practitioners from firms interested in attracting external knowledge to promote innovation in their firms. The findings also might be useful to open-innovation scholars and academics involved in innovation-development processes together with businesses. Additional in-depth qualitative studies are warranted to explore the applicability of the presented propositions in other industrial and geographical contexts. Large-sample, representative, longitudinal, quantitative studies of firms involved in open innovation with contrasting types of partner selection are also warranted to test the presented propositions.

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Open Innovation at the Root of Entrepreneurial Strategy: A Case from the Norwegian Oil Industry

Tatiana Iakovleva

> *"As they say on my own Cape Cod, a rising tide lifts all the boats. And a partnership, by definition, serves both partners, without domination or unfair advantage. Together we have been partners in adversity – let us also be partners in prosperity."*
>
> John Fitzgerald Kennedy
> 35th President of the United States

This article aims to extend the discussion about entrepreneurial strategies of small and medium-sized enterprises (SMEs) by including the concept of open innovation. How can SMEs overcome the challenges of resource scarcity and harsh competition? How they can gain competitive advantage in today's ever-changing business environment? The answer to both of these questions might be through open innovation: collaborating with researchers, customers, suppliers – even competitors – as well as research institutions and universities.

A common barrier to open innovation in an SME is the perception that it will be too time consuming to gain access to a knowledge base of external knowledge providers and link to "gatekeepers" of knowledge. However, an entrepreneurial mindset might help SMEs to move toward an open-innovation approach, where more codified and transferrable knowledge are important. This article discusses the implications of an entrepreneurial focus for open-innovation activities. The usefulness of the open-innovation principles are highlighted through a case study of an Norwegian SME operating in the maritime-oil industry.

Introduction

Innovation is often viewed as the root of entrepreneurship, a roadmap leading toward sustainable performance and growth of enterprises (Schumpeter, 1932: tinyurl.com/d5enwwo; Davidsson, 2004: tinyurl.com/cod6ba3). It is widely acknowledged that the stimulation of innovative activity is crucial for the competitive advantage and growth of both companies and regions. In most countries, a broad array of policy instruments that stimulate R&D activities, science, and technology are at hand (Jensen et al., 2007; tinyurl.com/d2eub63).

Although some innovations may be spectacular technological breakthroughs, the bulk of innovation in modern societies consists of relatively small improvements that come from day-to-day learning. This is particular true for small and medium-sized enterprises (SMEs), which constitute the driving force of the economy in the majority of European countries (Bosma and Levi, 2009; tinyurl.com/chxg3jc). Smaller firms in particular may face difficulties in scaling up their internal innovation efforts to achieve radical innovations. One possible cause may be their lack of internal R&D departments that, in large firms, are able to push innovation throughout the organ-

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ization. SMEs often also have a limited resource base, do not have access to economies of scale, have a small strategic focus, and risk being locked into their present strategy (Schindehutte and Morris, 2009; tinyurl.com/but24bo). To overcome these obstacles, SMEs may be forced to adopt an imitation strategy with the danger of being captured in between strategies (Anand et al., 2009; tinyurl.com/ctn8gnw). All these factors may hamper innovation and commercialization in this category of firms.

To overcome these challenges, it is useful for SMEs to adopt an open-innovation approach. Open innovation is "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation" (Chesbrough et al., 2006; tinyurl.com/cp5rdys). At the heart of the open-innovation model is the recognition that today, competitive advantage often comes from inbound as well as from outbound connections. Leveraging inbound connections means leveraging the discoveries of others: companies need not, and indeed should not, rely exclusively on their own R&D. Leveraging outbound open innovation means that, rather than relying entirely on internal paths to market, companies can look for external organizations with business models that are better suited to commercialize a given technology (Chesbrough, 2002; tinyurl.com/c72zhqt).

Open innovation has received increasing attention in the literature, but so far it has mainly been analyzed in larger enterprises using on in-depth interviews and case studies (van de Vrande et al., 2009; tinyurl.com/bqgk4t5). Since its emergence, evidence to support the open-innovation model was taken mainly from the so-called "high-technology" industries, such as computer manufacturing, information technology, and pharmaceuticals (Chesbrough, 2003; tinyurl.com/d2l6bqx). However, more recent work by Chesbrough and Growther (2006; tinyurl.com/4xjse3r) has confirmed the relevance of this approach in more mature industries. In non-high-tech industries, when companies look outside for technologies to extend or defend their core business, they minimize risk by investing in technology that is often proven in other applications, rather than investing in "new to the world" technologies. Using the example of a Norwegian firm operating in the maritime-oil industry, this article shows how the innovative action of an SME may depend on the combined influence of entrepreneurial orientation within the firm and knowledge-providing cooperative links with knowledge providers. Moreover, this article examines the links between open innovation, the entrepreneurial behaviour of SMEs, and firm performance.

Entrepreneurial Orientation and Open Innovation

For a small firm in a mature industry, the availability of suppliers and customers is often quite stable. However, while this stability has some positive aspects, such as the predictability of demand and a known path of knowledge, it often limits the firm's ability to innovate and to be more proactive. The extent to which firms emphasize open-innovation principles may depend on the entrepreneurial strategy of the firm (Miller, 1983: tinyurl.com/cus88fa; 2011: tinyurl.com/6jjzdkx). Depending on firm structure, a firm can develop some aspects of the firm's "entrepreneurial orientation". A three-dimensional model of entrepreneurial innovation includes innovativeness, risk-taking, and proactive action (Miller, 1983: tinyurl.com/cus88fa; Covin and Slevin, 1991: tinyurl.com/boxoe7v) and represents a stream of literature that has examined innovation in a consistent way across over 100 studies (Rauch et al., 2009; tinyurl.com/3kjbwfr). The entrepreneurial firms may tend to take more risks and be more proactive in searching for new business opportunities, and they may be more willing to take new ideas all the way to commercialization.

Building on the work of these authors, Covin and Slevin (1991; tinyurl.com/boxoe7v) introduced a scale to describe the strategic posture of firms: "The entrepreneurial-conservation orientation of a firm is demonstrated by the extent to which top managers are inclined to take business-related risks, favor change and innovation... and to compete aggressively with other firms." The conceptual argument suggests that firms benefit from highlighting newness, responsiveness, and a degree of boldness. There is a positive link between firms exhibiting innovativeness, risk-taking, and proactive action, and firm growth and performance (Rauch et al., 2009; tinyurl.com/3kjbwfr). Firm performance should be understood as the multidimensional concept that is attributed to firm sales, turnover, marked share, growth of employees, and other measures. These results hold up across different nations, industries, and other contextual variables (Iakovleva and Kolvereid, 2005: tinyurl.com/cbadur8; Grande et al., 2011: tinyurl.com/cto9ukj). Revisiting his own research, Miller (2011; tinyurl.com/6jjzdkx) pointed out that the degrees of innovativeness, proactiveness, and risk-taking are dependent on the firm structure and type.

Innovativeness (i.e., the ability to introduce new products, services, or processes) is seen as the key element of the entrepreneurial orientation concept. Scholars generally define innovation as the development and

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commercialization of new ideas in organizations manifested in terms of a new product, service, or method of production or a new market, organizational structure, or administrative system (Foss et al., 2011: tinyurl.com/csj3q8f; Damanpour and Wischnevsky, 2006: tinyurl.com/bqdvcnr). In his classic treatment on the subject of innovation, Schumpeter (1934; tinyurl.com/cqcnrfs) defined innovation as "new combinations" of existing knowledge and resources, arguing that innovation thus defined the source of economic and social change. Without innovative efforts by the entrepreneurial individuals, society would in his view be stagnant. However, the scarcity of resources makes the task of innovation extremely challenging for small firms. A mature environment demands significant effort just to stay "above water" because competition is intense and the available resources often are only just enough to continue the existing lines of products and services. In these circumstances, thinking in terms of open innovation might provide new ways of solving the specific challenges facing a small firm.

As van de Vrande and colleagues (2009; tinyurl.com/bqgk4t5) indicate: "Due to labor mobility, abundant venture capital and widely dispersed knowledge across multiple public and private organizations, enterprises can no longer afford to innovate on their own, but rather need to engage in alternative innovation practices". Indeed, recent findings confirm that innovation in SMEs is becoming more open, and many SMEs attempt to benefit from the initiatives and knowledge of their employees. In addition, most SMEs "try to involve their customers in innovation processes by tracking their modifications in products, proactively involving them in market research, etc." (van de Vrande et al., 2009; tinyurl.com/bqgk4t5). One may claim that open innovation in SMEs is mainly motivated by market-related targets, since the main problem for small enterprises is not so much invention but commercialization (Gans and Stern, 2003; tinyurl.com/bnyvk7z).

Open innovation comprises both outside-in and inside-out movements of technological ideas (Lichtenthaler, 2008; tinyurl.com/bwvx23w), and we may expect SMEs to rely on both inbound and outbound open innovation simultaneously (van de Vrande et al, 2009; tinyurl.com/bqgk4t5). The adoption of open innovation may be sequential, starting with customer involvement, followed by employee involvement and external networking, and ending with more "advanced" practices such as IP licensing, R&D outsourcing, venturing, and external participations (Johannisson, 1996: tinyurl.com/cwjwoxo; van de Vrande et al., 2009: tinyurl.com/bqgk4t5).

A Case Study from the Norwegian Oil Industry

In order to illustrate the above argument for the implementation of an open-innovation strategy, the following case study of a small company operating in the Norwegian maritime-oil industry, is provided. The oil industry is one of Norway's largest sources of income, and it is characterized by large customers that have strong ties to government and that yield considerable market power. The suppliers are more fragmented in terms of company size and market power (cf. Fagerberg et al., 2009; tinyurl.com/btv87g9), however, new entrants in the industry meet barriers to entry in terms of demands for capital and a high level of risk. The demand for new technology gives an incentive for the larger oil companies to invest in smaller, startup companies. This description applies to the oil industry generally, but also describes the closely related maritime-oil industry, which provides transportation services and supply for the off-shore oil exploration activities.

Product innovation is of extreme importance in the oil industry for several reasons. First, the industry is capital intensive because drilling and exploration activities are costly. In order to maximize the return of each oil field, the licensees collaborate to apply the best technological solutions for extracting the petroleum resources. Second, drilling and exploration take place in increasingly challenging environments, resulting in greater use of unmanned installation and subsea technology and drilling techniques (Fagerberg et al., 2009; tinyurl.com/bvncmrh). Thus, existing technological solutions approach their technical limits and their cost limits, generating an increasing demand for new technologies. Further, the environmental challenge has received increasing public attention, generating pressures to develop more environmentally friendly technologies. Finally, the demands for increased safety and security are substantial in the sector due to the severe economic, environmental, and social consequences of errors due to technology or processes (Norwegian Petroleum Directorate, 2009; tinyurl.com/ceykzjr).

Despite these incentives for innovation, the high levels of risk and cost that characterize the industry cause it to remain conservative in actually employing new technology. This conservatism creates an environment where only a fraction of newly developed technology succeeds in the marketplace. Today, only very large actors can afford to develop innovations in-house. The general trend is toward collaboration between customers and suppliers, sometimes between competitors, in order to develop new, efficient, and money-saving technologies.

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This trend is particularly apparent in the maritime-oil industry. One of the considerable costs associated with oil exploration are the costs of off-shore shipping. For each day off-shore, the costs may reach hundreds of millions of dollars. Oil companies therefore welcome any solutions that might reduce the off-shore time or make shipping more efficient.

Case details

The case study of this company was performed from 2009 to 2012, allowing us to observe longitudinal changes. This study encompasses semi-structured, in-depth individual interviews to explore the ways in which different actors within a company reflect on their experience with new technology and market challenges. We interviewed a limited number of knowledgeable informants from the company, including the CEO, two engineers, and a business manager. The first interview occurred in 2009; the last one occurred February 2012. Altogether, seven interviews with company representatives were conducted over a four-year period. In addition, we interviewed a business advisor and representative from the region's Chamber of Commerce to obtain an external view on how innovations occur in the maritime-oil industry. The informants were selected to provide inputs from different professional areas, as well as from people with different levels of responsibility and seniority in an attempt to gather and integrate a variety of perspectives. Following Eisenhardt and Graebner (2007; tinyurl.com/ckek69c), it is unlikely that such a varied group of informants engage in retrospective sense-making or impression management. Above all, we followed the firm development through available secondary information, including register information, press releases, and the company's web page.

When the company was created in the late 1980s, the traditional maritime industry in the region experienced a shift toward cooperating with oil industry needs. For approximately 20 years, the company produced off-shore equipment for oil industry ships. The firm therefore had an established market with stable development, and it was mainly relying on its own resources and capabilities to satisfy demand. The company was closely tied to its customers and was dependent upon a few large ones. However, in 2000, the Norwegian oil industry experienced a downshift, which harmed the satellite maritime industry as well. The downshift reduced the demand for the products and services the case company provided, and the company did not allocate any resources to the development of new technologies or products. In 2002, one of the company's engineers come across innovative technology that held promise for the company. The main technological idea behind the new product was to reduce manual labour operations in the offshore platforms and to produce a robotic solution for connecting pipes.

As mentioned earlier, the offshore industry is quite conservative, and the commercialization of a technological innovation is a daunting task. New products should be compatible with existing technology, and they should satisfy all existing rules and regulations, which are quite strict in this industry. Moreover, this is a "financially heavy" industry, and substantial investment is needed in order to develop any technology. The challenges were further compounded by high levels of competition in the industry at that moment and the lack of available resources for companies to implement "side projects".

The case company overcame the challenges of resource scarcity through the principles of open innovation. Instead of accumulating financial and human resources to implement the innovative idea inside the firm, a daughter company was created to allow this product to be tested. With minimal resources, the firm invited valuable partners to cooperate in the development of the product. The technological idea was inspired by the automobile industry, where robotic solutions are often used for automobile production. Although the key idea belonged to the mother company, trusted suppliers from the automobile industry were invited to join the team and to contribute their expertise with robotic production. Moreover, because the product was to be integrated into existing technology, it was essential – for both technological development and for commercialization purposes – to collaborate with future customers. That is, the future customer's involvement and expertise are what makes this story different from the classical scenario of a spin-off company.

The idea was presented to three major oil-exploration companies in the region, which agreed to participate both financially and by providing their platforms for testing the new equipment. The tacit knowledge, experience exchange, and collaboration with these customers are difficult to overestimate. These collaborative efforts were crucial for the success of new product. The funding gained from the collaboration also allowed the company to work with the best research institutions, both in Norway and abroad, to find the best technological solution. As the CEO of the company said: "We have very good partners... their expertise means a lot for the success for this project. Without trusted partners, it would not be possible to achieve this ambitious goal".

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The new company has only seven employees and about 12 advisors that worked on a contract basis. Above that, the company had access to a significant network through its Board of Directors. The Board of Directors was used strategically to enforce company developments, with different members entering along the company development line. Table 1 outlines the main collaborative partners that have contribute to the overall success of the new produce.

Through all the collaboration and knowledge exchange that were emphasized during the launch of the new product, the company was able to successfully create and commercialize a new and exciting technology. Today, the technology is not yet at a mass-production stage, however, the development of the new products is almost complete and potential customers/partners that were involved into the creation process will most likely become first consumers.

Table 1. Collaborative partners and their contribution

Collaborative partners	Contribution
Consultants	Responsible for concrete tasks related to product development and input of expertise
Board of Directors	Links to financial sector, industry, and potential customers
Three oil companies	Potential customers, basis for testing of equipment, shared knowledge for developing of new product
Research institute in Norway	Improvement of technology
Research institute abroad	New radical solutions

Conclusion

Over the past decade, both academics and practitioners have increasingly recognized the need for collaboration and knowledge exchange for successful business development. Innovation, which is often claimed to be the driver of success, is too costly and difficult to implement for small firms operating on their own. The challenges are especially large in resource-intensive industries, where huge investments are needed to develop new products. The overview of the literature suggests that the only way to overcome these costs and to stay competitive is by incorporating the principles of open innovation and combining them with entrepreneurially oriented strategies.

Extending this line of thinking, this article argues that firms employing open innovation are releasing risks because they share the expenses that are related to the generation of innovations. As illustrated by the case presented here, the creation and development of a new product was too daunting a task for the small case company. And, for the young spin-off company, it would have been extremely difficult to succeed if they chose to rely on their very limited human and financial resources alone. Inviting collaborative partners, such as potential customers, research institutes, and contractors, allowed them to pool together a more varied and rich base of resources and knowledge. For small firms, which are limited in their resources, access to this valuable pool can be a great argument to enter an open-innovation relationship. This moderately positive attitude toward risk can facilitate the open innovation approach of the firm. The intensity of knowledge transfer should increase with the degree of openness. The firm's overall strategy can either stimulate or decrease the intensity of these processes. For example, a continuous search for market opportunities and experimentation with the potential responses to changing environmental trends might facilitate contacts with universities and research institutes, as well as interactions and links between suppliers, competitors, and internal interactions. From relying on the traditional relationships with suppliers and customers, the strategy may gradually change toward "opening the gates" for both inbound and outbound open innovation. The firm may see the benefit in communicating their knowledge to potential customers and the potential for exchange with external knowledge gatekeepers. Thus, proactive firm behaviour is positively related to degree of open innovation in the firm.

Open Innovation at the Root of Entrepreneurial Strategy

Tatiana Iakovleva

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Strategic Partnerships and Open Innovation in the Biotechnology Industry in Belgium

Jean-Pierre Segers

> *"Successful innovation is not a single breakthrough. It is not a sprint. It is not an event for the solo runner. Successful innovation is a team sport, it's a relay race."*
>
> Quyen Nguyen
> Professor of Surgery
> tinyurl.com/cg93kwj

Strategic partnerships in the biotechnology industry allow new technology-based firms to gain a foothold in this high-cost, high-risk industry. In this article, we examine the impact of strategic partnerships and open innovation on the success of new biotechnology firms in Belgium by developing multiple case studies of firms in regional biotechnology clusters. We find that, despite their small size and relative immaturity, new biotechnology firms are able to adopt innovative business models by providing R&D and services to larger firms and openly cooperating with them through open innovation.

Introduction

The application of new discoveries and advances in science towards commercial use and for public purposes depends mainly upon actions by entrepreneurs who create new technology-based firms. However, in some industries, such as healthcare and biotechnology, the high cost of commercialization makes it unlikely that any new, small firm can succeed on its own. To overcome this challenge, many smaller firms enter into strategic partnerships with larger firms.

Although the literature on strategic partnerships is well developed, the majority of studies focus on large, established firms. There is absence of studies that look at strategic partnerships – and specifically the role of open innovation – in the development of small and innovative biotechnology firms. This article addresses this gap in the literature with a focus on new firms in the biotechnology cluster in Belgium, where there is a growing trend towards technological and market-driven relationships between large and small biotechnology firms.

For this research, a number of stock-exchange-listed biotechnology firms in Belgium are screened and monitored. Most of these new biotechnology firms are unlikely to become fully integrated pharmaceutical companies, because they are heavily dependent on their large strategic partners, especially for: marketing outlets, resource manufacturing when they reach the commercialization stage, continuing product development efforts, licensing agreements, and milestone payments.

While aiming for sustainable growth, most of the new biotechnology firms in Belgium have not yet reached this level of maturity and are acutely aware of the possibility of takeover. The objective of this article is to develop an understanding of how strategic partnerships influence the development of these new and innovative biotechnology firms and the role that open innovation might play in the success of these relationships.

This article is structured as follows. The first section provides an overview of biotechnology business models to show how strategic partnerships and open innovation are commonly leveraged in this industry. The second section describes the research methodology of this study. The third section presents the results of this study of the biotechnology sector in Belgium. In the final section, conclusions are provided.

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Biotechnology Business Models and Open Innovation

To varying degrees, new biotechnology firms depend on strategic (technology) partnerships with other organizations or large firms. In most of the partnerships, the initial research and innovation developed by the smaller firms is transferred to their larger counterparts. According to Contracter and Lorange (2002; tinyurl.com/colwgoe), "the term "alliances" covers several governance modalities ranging from relational contracting to licensing, to logistical supply-chain relationships, to equity joint ventures or to the complete merger of two or more organizations".

According to Porter (1985; tinyurl.com/bom3jck), "the business model outlines how a company generates revenues with reference to the structure of its value chain and its interaction with the industry value system". In the biotechnology industry, the business model for a new, small company is necessarily dependent on collaboration with other organizations. As Fisken and Rutherford (2002; tinyurl.com/c2xoaxv) explain: "for a biotechnology company, the business model serves to secure value from the company's proprietary technology and know-how and is currently often heavily reliant on large (bio)pharmaceutical or established biotechnology company customers, collaborators and partners".

Biotechnology companies have traditionally used a variety of business models to enter the life sciences, pharmaceutical, or healthcare markets. Fisken and Rutherford (2002; tinyurl.com/c2xoaxv) and Pareras (2008; tinyurl.com/cch3s52) distinguish between three key business models based on the value chain structure of the biotechnology industry:

1. **Product-based**: this vertical business model has its origins in the "fully integrated pharmaceutical company", where medicines are developed by the company from the point of discovery up to the end of clinical trials or up to approval. According to Fisken and Rutherford (2002; tinyurl.com/c2xoaxv) this business model "aims to generate value in progressing products along the drug development process and either licensing them out to pharmaceutical and top tier biotechnology companies or taking them straight through to commercialization."

2. **Platform-based**: with this business model, companies develop a set of tools or integrated technologies and license them out. Revenue can be generated relatively quickly through contract research and services. Thus, this business model reduce risk and the need for venture capital. Parares (2008; tinyurl.com/cch3s52) calls companies following this model "royalty income pharmaceutical companies". These small companies research and develop a new drug, which they eventually license to a large pharmaceutical company in exchange for a royalty on sales.

3. **Hybrid**: this is the dominant business model in the biotechnology industry. It is a hybrid of the product-based and platform-based business models and focuses on generating a pipeline of products. Investors benefit from reduced risks and the possibility of near-term revenue generation. In the hybrid business model, technology platforms are combined with services and the creation of products.

The choice of business model may depend on the type of innovation; indeed, Pisano (2006; tinyurl.com/cmx23cs) distinguishes between "types of pharmaceutical innovations which call for vertical integration and which call for alliance-building and R&D outsourcing". However, for new, small technology companies the high risk and high cost of developing and commercializing a new product on their own make the platform-based and hybrid business models attractive.

O'Doherty (1990; tinyurl.com/cxekka3) argues that "strategic partnerships and alliances perhaps represent the greatest need but also the greatest challenge for small firms and small countries". The challenges include both determining the strategic direction of the firm but also finding "suitable and willing" partners to collaborate with. In the biotechnology industry, open innovation might have a role play in meeting these challenges and in the success of the strategic partnerships, both from the perspective of new, small companies and established, large companies. As, Nigel Sheail, Head of Global Business Development & Licensing at Bayer HealthCare (2012; tinyurl.com/ctqbcap) says: "Partnering and even open innovation is becoming increasingly important for our industry in a world where health systems are undergoing profound transformations." According to the Holst Centre (2013; tinyurl.com/cnskktb), an independent open-innovation R&D centre, "due to the increased complexity of physics, life-sciences, materials, electronics, software, etc., the cost of R&D is growing faster than company revenues. The goal of partnering is to share ideas and efforts, cost and risk of R&D and to reduce the time to market of new product generations".

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In most traditional partnerships in the biotechnology industry, smaller firms perform research and development for the larger firms or transfer innovations to them. However, open innovation is changing the way these firms interact. In the early stages of R&D, open innovation offers "a neutral platform for companies to jointly investigate new and emerging technologies and applications, while sharing risks and costs" (Holst Centre, 2013; tinyurl.com/cnskktb).

The open-innovation approach is providing new ways for firms of all sizes to collaborate, and it is creating opportunities for smaller companies. For example, Johnson & Johnson's pharmaceutical division, Janssen (which was originally founded in Belgium), opened a "Concept Lab and Open Collaboration Space" in San Diego (tinyurl.com/bscccjh). This shared laboratory – and its open-plan office space – provides life-science entrepreneurs with an affordable environment for early-stage research and encourages interaction between startups. According to Weverbergh (2013; tinyurl.com/cqwgauh), "cross pollination between the corporate and the startup world – whether through corporate accelerators, venturing or open innovation like Janssen Labs – is fast becoming the trend that defines 2013".

Research Methodology

To investigate the impact of strategic partnering – and specifically the role of open innovation – on the growth and survival of new biotechnology firms, we employed a case study research design (Yin, 1984; tinyurl.com/clf7wbd). Our focus is new technology companies operating within the biotechnology clusters in Belgium. Through interviews and available secondary data, we screened a sample of stock-exchange listed biotechnology firms, which are representative of the Belgian biotechnology industry. These firms were selected based on several criteria so that the sample would include representation from each of the three business models described above (i.e., product-based, platform-based, and hybrid).

We expect to find that:

1. New biotechnology firms located in Belgium will have to work together with international (bio)pharmaceutical firms to create substantial added value.

2. The success of future new biotechnology firms in Belgium will depend on setting up strategic partnering alliances.

3. Most of the new biotechnology firms in Belgium are unlikely to become fully integrated pharmaceutical companies (i.e., they are unlikely to adopt a product-based business model).

Case Study Results: Biotechnology in Belgium

The life sciences and biotechnology have become important sources of new economic development in Belgium, and many new biotechnology firms in Belgium are university spin-offs. Due to strong collaboration between research institutes, universities, venture capitalists/high-risk finance providers, and existing large companies, strong biotechnology clusters have developed in the regions of Flanders (Ghent and Leuven) and Wallonia (Liège and Louvain-La-Neuve).

The Belgian biotechnology industry is now firmly positioned as the key player in Europe, with a market capitalization of about 30% in the eurozone. Belgium now accounts for more than 150 new biotech firms, which represent 7% of European biotechnology firms and 10% of R&D expenditures (OECD, 2011; tinyurl.com/bqynwvj).

Biotechnology clustering in Belgium is the result of a "regional innovation systems" point of view (Segers, 1996; tinyurl.com/cmt8tgr). The region-specific technology policy in Belgium (Segers, 1992; tinyurl.com/cx4uzno) has been organized around two focal points: i) the existence of state-of-the-art research potential in the country's universities and ii) emerging technology centres, charged with supporting new technology-based firms (Segers, 1993; tinyurl.com/bl58bym).

Over the years, a wide range of incentives have been created for assisting new technology-based firms. The main categories are:

- financial and fiscal incentives (e.g., the Belgian patent income deduction regime)
- employment incentives
- access to seed, venture, and growth capital
- government-supported laboratories and industry-specific collective research centres
- technology clusters and infrastructural incentives
- establishment of incubators in the proximity of universities for stimulating and assisting university spin-offs

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The critical success factors are:

- access to key scientific personnel and mobility of researchers
- access to seed and venture capital
- the number of initial public offerings (IPOs)
- operating losses in the early stages of development
- regulatory approval from the Food and Drug Administration (FDA; fda.gov) in the United States and from the European Medicines Agency (EMA; ema.europa.eu/ema/) in the European Union
- patents and intellectual property rights
- dependence on the strategic large partner(s)
- expected revenues derived from the strategic large partner(s) (e.g., milestone payments)
- manufacturing, clinical trial and regulatory compliance capabilities

Strategic partnerships

Within Belgium's strong regional clusters, we found a large number of strategic technology partnerships between large, international, and established chemical or (bio)pharmaceutical firms and new biotechnology firms. Table 1 lists 10 biotechnology firms from this study, along with details of their strategic partnership alliances. While aiming for sustainable growth, most new biotechnology firms in Belgium have not yet reached an independent stage of maturity and are predominantly driven by the takeover alternative, as was the case in recent years for Movetis (Shire) and Devgen (Syngenta). Up to this point, only ThromboGenics, Galapagos, and UCB have succeeded in becoming mature, self-sustaining biotechnology firms. Box 1 provides further detail on the current "star" in the Belgian biotechnology industry: ThromboGenics.

We observed strong collaboration between research institutions, universities, venture capitalists, high-risk finance providers, existing large companies, and new biotechnology firms. The basic innovative activity occurs mainly in university-based new biotechnology firms (i.e., new, small firms that are spin-offs from university research centres performing state-of-the-art research).

Box 1. The case of ThromboGenics

ThromboGenics (thrombogenics.com) is a biopharmaceutical company focused on the discovery and development of innovative medicines for the treatment of eye diseases. The company was established in the 1980s as a spin-off of the University of Leuven. ThromboGenics developed over the years from a university spin-off to a fully integrated specialty pharmaceutical company. It is now the "star" amongst new biotechnology firms in Belgium.

ThromboGenics' lead product, Jetrea (ocriplasmin), has been approved by the FDA and the EMA, and the company recently signed an important strategic partnership with Alcon (Novartis) to commercialize Jetrea outside the United States (tinyurl.com/c6795v9).

On the other hand, large and international chemical or (bio)pharmaceutical firms participate in or establish joint ventures with university research centres and small, university-based new biotechnology firms. Of the new biotechnology firms in Belgium that were included in this study, most are unlikely to become fully integrated pharmaceutical companies, because they are heavily dependent on their strategic large partners, especially for marketing outlets, for manufacturing resources when they reach the commercialization stage, and for continuing product development efforts. They have to rely heavily on licensing agreements and milestone payments.

Conclusions

Our case-based analysis of the biotechnology industry in Belgium shows that strategic technology partnerships between new biotechnology firms and established, large, and international (bio)pharmaceutical companies have a significant impact on the survival and growth of these new biotechnology firms.

Our evidence supports the assertion by Fisken and Rutherford (2002; tinyurl.com/c2xoaxv): "while a small number of companies with access to a large supply of capital may be able to complete downstream integration and revert to the [fully integrated pharmaceutical company] model, the majority of biotechnology com-

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Table 1. Sample of Belgian biotechnology firms and their strategic partnership alliances

Firm	Platform	Product	Alliances/Partners	Spin-off/out	Location
ThromboGenics	Ophthalmic medicines	Ocriplasmin (Jetrea)	Novartis Alcon (Novartis) BioInvent Roche Rhein Minapharm Bharat Biotech		Flanders (Leuven)
Ablynx	Nanobodies	Alpha-pharmaceuticals	Boehringer Ingelheim Novartis Merck Serono Shire Eli Lilly Algeta	Argen-X (Nanobodies)	Flanders (Gent)
Galàpagos	Rheumatoid arthritis	Biofocus + Argenta: drug discovery divisions	Abbott Laboratories GlaxoSmithKline Eli Lilly Janssen Pharmaceuticals (J&J) Servier Roche Ono Pharmaceuticals	01/2013: acquisition of Cangenix (drug discovery)	Flanders (Mechelen)
Tigenix	Stem cells	ChondroCelect	Cellerix	Cellerix (acquisition)	Flanders (Leuven)
Movetis	Gastroenterology	Resolor	Shire-Movetis	2010: public takeover by Shire	Flanders (Turnhout)
DevGen	RNAi-technology	Hybrid rice	Monsanto Sumitomo Chemical	09/2012: public takeover by Syngenta	Flanders (Gent)
Promethera Biosciences	Cell therapy		Shire Boehringer Ingelheim		Wallonia (Louvain-la-Neuve)
Uteron Pharma	Intrauterine platform		GlaxoSmithKline	01/2013: Uteron sold to Watson Pharmaceuticals (Actavis: USA)	Wallonia (Liège)
MDxHealth	MDxHealth	ConfirmMDx	Merck Serono		Wallonia (Liège)
UCB	Neurology/ immunology	Zyrtec, Cimzia, Vimpat, Neupro, Keppra	AstraZeneca Pfizer Amgen Bayer		Brussels

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panies will instead need to further develop sophisticated relationship management skills in order to extract greater value from relationships with customers, collaborators and strategic partners". Our conclusion is that the future of new biotechnology firms in Belgium lies in the effective establishment of strategic partnering alliances. In future studies, the impacts of open innovation and novel business models warrant further attention.

About the Author

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Keywords: strategic partnerships, biotechnology, Belgium, open innovation, business models, R&D

Incubation Programs from Public Research Organizations as Catalysts for Open Business Ecosystems

Sven H. De Cleyn, Frank Gielen, and Jan Coppens

> *"In many cases, the more you try to compete, the less competitive you actually are."*
>
> Kathy Sierra
> Co-creator of the Head First book series

In many economies, new knowledge and technology creation and transfer towards local entities and new startups have been recognized as catalysts for industry renewal and tools for safeguarding (or even enhancing) a region's employment and prosperity. This article presents a case study of iMinds, a network organization in Flanders, Belgium. The organization fosters interdisciplinary research in information and communication technologies (ICT) and strongly engages in transferring these new technologies towards local actors and in creating and supporting new startups. iMinds' incubation and entrepreneurship programs act as catalysts for open innovation and company startup activities in the Flemish region.

Introduction

Traditionally, Flanders – and by extension Belgium – has been viewed as an interesting location for entering the Western European market. In the 1960s, many large European and American multinationals established production sites and sales and distribution organizations in the region, which brought jobs and welfare. Some of these multinationals were electronics manufacturing companies, such as Alcatel, Siemens and Philips, which increasingly engaged in information and communication technology (ICT) activities. To support these large ICT companies, a large number of suppliers and service providers became established in the region.

The growing group of small and medium-sized enterprises (SMEs) further increased in importance after the divestiture and relocation of corporate activities of the multinational players during the 1990s and early-2000s (similar to what happened in other regions around the world, such as Canada's Capital Region: see Bailetti and Bot [2013; timreview.ca/article/658] for details). Increasingly, employment, growth, and the preservation of prosperity have been depending on these SMEs, which operate in a small, open economy. The latter characteristic forces them to become born-global ventures, competing on a local and international level.

This changing environment called for action and policy change, which could no longer aim to attract activities from large multinational players. As a reaction to these changes, the Flemish government developed new strategic initiatives for certain domains: in 1984, the Interuniversity Microelectronics Centre (Imec; tinyurl.com/d25ku98) was established to foster ground-breaking research activities in micro-electronics; in 1991, the government founded the Flemish Institute for Technological Research (VITO; tinyurl.com/d9n2wfp) to perform research on cleantech and environmental technologies; and then in 1996, the Flemish Institute for Biotechnology (VIB; tinyurl.com/crbtfru) was founded.

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The latest government initiative of this type was founded in 2004 as an independent research institute: iMinds (iminds.be), formerly known as the Interdisciplinary Institute for Broadband Technology. iMinds was given the task of developing demand-driven solutions (i.e., research, innovation and entrepreneurial ventures) for the ICT sector and fostering the business and societal application and adoption of newly developed technologies, knowledge, products, and services. Creating and maintaining a steady supply of new knowledge and technologies in this fast-moving industry has been recognized as crucial for a healthy ICT sector. Thus, the need for innovation and commercialization has been a driving force behind iMinds' activities since its inception. This strategy is supported by findings from academic research, such as a study that pointed out that Europe has fewer "young innovative companies" compared to the United States, while this startup group shows the largest potential in terms of contribution to new economic activities in a region (Veugelers, 2009; tinyurl.com/d55p62f). A clear pillar of activities fostering commercialization and the creation of new technology-based ventures could thus contribute to the business dynamics in a region.

This article describes the iMinds entrepreneurship incubation program as a case study to show how a public research organization can act as a catalyst for open innovation and company startup activities. First, we provide details of the iMinds incubation program. Second, we describe the development and evolution of iMinds' networking function and its emphasis on open collaboration. Finally, we provide conclusions.

The iMinds Incubation Program

iMinds was set up as a focal-point organization designed to link university research to the needs of business and to help build a positive startup and venturing climate. As such, it was designed to be the catalyst for a cluster of innovation (Engel and del Palacio, 2009; tinyurl.com/c3mrauv), a model that had been applied 10 years earlier in the area of biotechnology with the creation of the Flemish Institute of Biotechnology (VIB), which had a similar mission. Over the 20-year period since the VIB was founded, we have witnessed the emergence of a strong biotechnology cluster around this initiative, and the purpose of iMinds is to achieve the same success in ICT. Furthermore, organizations like iMinds form an important part of the "triple helix" model, which creates constructive and mutually reinforcing activities between academia, government, and industry (Etzkowitz, 1998: tinyurl.com/btehl65; Leydesdorff, 2000: tinyurl.com/cy84fo7).

The approach that iMinds adopts in transferring knowledge and technologies towards partners and newly created technology-based ventures (spin-offs and startups) is somewhat different from traditional approaches. Although most universities and public research organizations focus solely on monetizing their own intellectual-property assets, iMinds acts as network integrator by fostering interaction and open collaboration (sometimes, but not always, in an open-innovation context) between various actors in the ecosystem. Even though the collaborative and demand-driven research projects form an important part of these activities (roughly 25 out of the 40 million EUR of iMinds' annual budget are spent on collaborative and demand-driven research), they fall outside of the scope of this article. The incubation and entrepreneurship activities target the support of all ICT-driven entrepreneurial and intrapreneurial projects, whether emerging from iMinds research (or iMinds' five Flemish partner universities) or from external entrepreneurs.

In this regard, several tools are used to foster the open support and interactions between various stakeholders:

1. iMinds' incubation program aims at supporting academic entrepreneurs, students, and independent entrepreneurs, especially in the pre-seed and seed phases. The program is supported by specific tools and projects that target different aspects of the entrepreneurial journey: opportunity recognition workshops to identify ideas that can become business opportunities; entrepreneurial bootcamps that focus on business modeling and (seed) investor readiness and the iStart incubation projects that enable the creation of early-stage businesses by providing financial support (pre-seed funding); coaching and mentoring; an entrepreneur-in-residence program; access to iMinds' network and to specialists for professional advice on, for example, financial issues, branding and sales, legal matters, and intellectual property.

2. As a network integrator, iMinds has set up a "virtual incubator" program to create spillover effects to local and regional communities of entrepreneurs and creative people. Through this program, cooperation with locally embedded (physical) incubators and coworking spaces is initiated. In these incubators, iMinds supports networking events and acts as catalyst to bridge the gap between local communities and actors in other regions. Entrepreneurs supported by the incubation program are also encouraged to establish themselves in one of these virtual incubator facilities to increase their embeddedness in local

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communities of entrepreneurs and creative people. This link increases spillover effects and interactions with other kindred spirits, leading to mutual learning, cooperation, and ultimately, joint business (i.e., coopetition instead of competition).

3. Through the student entrepreneurship program, we support the universities and university colleges in their efforts to embed entrepreneurship and entrepreneurial behaviour as professional skill development in their curricula. Our economic system is evolving from a corporate-managed model to a networked-entrepreneurial model and the education system needs prepare students for this new environment. Some students will want to become entrepreneurs but all of them will need to entrepreneurial if they want to be top performers in their professional career. The iMinds incubator plays a key role in this education process as it provides a real-world environment in which students can learn entrepreneurship "by doing" and where universities and industry work together in an educational context creating a win-win situation. Universities differentiate themselves with innovative education programs and future employers hire graduates that are better prepared for their future jobs. The student entrepreneurship program includes series of workshops, bootcamps, and networking events to give students initial coaching and networking opportunities to develop entrepreneurial skills and an appetite for entrepreneurship.

4. Opening up the program does not only refer to the Flemish or Belgian context. Through an internationalization program, iMinds stimulates startups, spin-offs, and SMEs in its network to act on an international level and connect to other clusters of innovation worldwide (e.g., East and West coasts of the United States, Singapore as hub for South-East Asia, and other European "hotspots"). In this sense, the internationalization tools, including (local) coaching and travel and housing support, helps connect iMinds and its ventures to global clusters of innovation (Engel and del Palacio, 2011; tinyurl.com/c26ffps). This approach also helps startups to be aware of the opportunities and necessity to become global players, which in turn favours job creation. According to Bailetti and Bot (2013; timreview.ca/article/658), this emphasis on early globalization should be one of the main pillars of government-funded programs.

These iMinds programs, which form only a part of the total iMinds incubation and entrepreneurship toolbox, are open to any entrepreneur with an ICT-related or enabled project that is willing to start their business in the Flemish or Brussels capital region. This approach clearly enables iMinds to foster the creation of a real ICT ecosystem, in which all relevant stakeholders (including universities, large corporations, SMEs, startups, entrepreneurs, students, government organizations, other entrepreneurship-supporting organizations, and non-profit organizations) interact frequently, and spillover effects are generated. The next section will illustrate that the individual programs are relevant as such, but the integrated approach of the incubation and entrepreneurship program at local and regional levels is the real differentiator.

Building a Network and Fostering Open Cooperation

The approach adopted by most technology transfer offices of universities and other public research organizations is to support the commercialization and societal impact of the knowledge and technologies developed in their institutions. The same approach was originally the focus of iMinds' incubation and entrepreneurship programs. However, as Figure 1 illustrates, the impact remained rather limited in terms of the number of newly created spin-off projects, at least prior to 2011 when the incubation program was started.

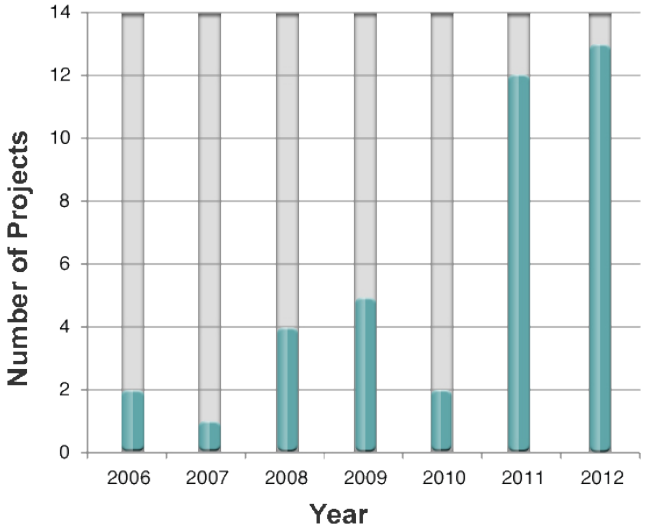

Figure 1. Number of new iMinds spin-off projects per year

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The shift towards a networking function for the incubation and entrepreneurship programs, which already existed at a research level through collaborative and demand-driven research projects, strengthened these programs and created an important amount of spillover effects towards other actors and reinforced the open-cooperation mode with various stakeholders, as described initially by the triple helix model of university–industry–government relations. Some short-term effects are already visible, and some mid- to long-term effects are expected to arise:

1. Researchers and entrepreneurs are engaging to a larger extent in local communities through the networking events, workshops, bootcamps, and other activities. This effect is further reinforced through the virtual incubator network.

2. Increasingly, entrepreneurs external to iMinds are starting to find their ways to our programs and engage in the iMinds community at different levels. Figure 2 illustrates this process and early data about the number of projects supported. Since opening up the incubation program in the summer of 2011, the number of entrepreneurs coming to iMinds for support has been rising. This amount pales before the number of startups currently supported by large programs such as Y Combinator (ycombinator.com), which has supported over 500 startups since 2005 and added 82 new startups in the summer of 2012 alone (Graham, 2012; tinyurl.com/37uzojs). However, keeping in mind the fact that Y Combinator supported only 8 startups during its first cycle in summer 2005 and the young age of the incubation program at iMinds, the early results shown in Figure 2 are encouraging.

   What is even more important, is that the entrepreneurs that originally had been independent of iMinds research started engaging more frequently in collaborative efforts with iMinds' researchers. This growing amount of open cooperation increases direct and indirect spillover effects between iMinds research and other stakeholders – in both directions. Furthermore, it creates more options towards job flexibility between academia and industry, again in both directions. The model's success is further proven by the amount of additional equity funding the incubation projects managed to close after being engaged in the iMinds incubation program; for example, incubation projects benefitted from a 4.7x funding multiplier in 2012, as shown in Figure 2.

3. Even though opening up these programs required an initial investment in terms of people and putting programs in place, the returns for the research organization are manifold: i) human and social capital development for researchers, students, and entrepreneurs have grown through the interactions with various stakeholders and the increasing mobility of people between different actor categories; ii) a grow-

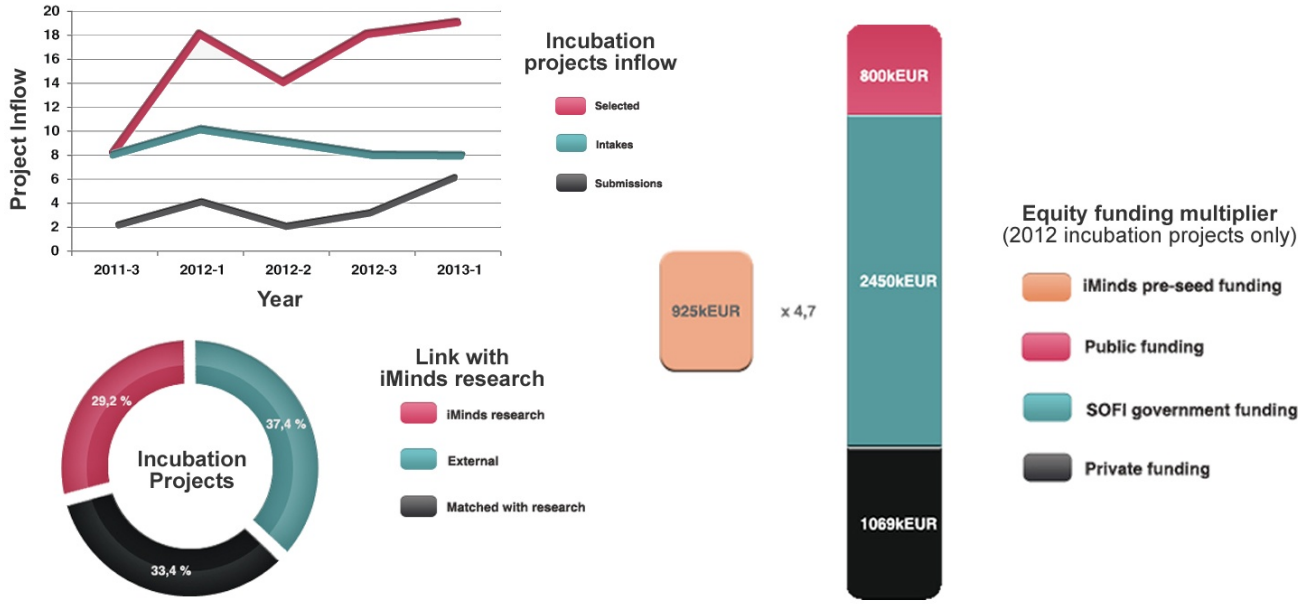

Figure 2. Startup engagement with the iMinds incubation program in terms of project inflow, links with research, and sources of funding

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ing network of people and organizations with new ideas and insights has emerged, to further push the boundaries of knowledge and technologies; and iii) financial return for the research organization will most likely appear, directly through license agreements and equity participation and indirectly through additional research projects together with the research organization (the latter is expected to bring the greatest financial return).

4. An entire ecosystem of entrepreneurs, researchers, service providers, and local entities is developing, allowing participants to cooperate with – and support the success of – new commercialization initiatives.

5. Within the ecosystem, startups are increasingly cooperating with each other and with other small and large companies. Furthermore, the first, albeit small joint business propositions are starting to arise. In this regard, these startups are expected to start reinforcing each other and developing joint offers instead of competing with each other.

The effect of the open-cooperation mode is not limited to the direct programs through which iMinds support incubation and entrepreneurship activities. An entire ecosystem of experts and partners becomes apparent, and a partner portfolio of now over 900 organizations has developed. Furthermore, links with various business angels, venture capitalists, and other financers have been set up. Policy initiatives have started to develop around these core activities, and a network of professional service providers – to support spin-offs and startups with advice and support for legal matters, intellectual property, branding, and other matters – has emerged in a natural way. These connections illustrate the indirect effects of opening up incubation programs to engage a wider community of people in incubation and entrepreneurship activities around the core research activities.

Recently in this journal, Bailetti and Bot (2013; timreview.ca/article/658) described a similar program – Lead To Win (leadtowin.ca) – that integrates the efforts of various stakeholders in supporting technology entrepreneurship in Canada's Capital Region, and they identified job creation as one of the most important functions of an incubation program. We share this view and highlight the importance of the 100 jobs that the iMinds incubation program has created in the Flanders region. By connecting various actors and stakeholders that supporting entrepreneurs and technology-based ventures, the iMinds incubation program plays a direct role in supporting entrepreneurship and job creation.

Conclusion

The traditional approach to technology transfer and entrepreneurship activities at universities and public research organizations emphasizes the commercial or societal applications of knowledge and technologies developed within a given research organization. This article has discussed the case study of iMinds, a public ICT research organization in Flanders, Belgium, where the incubation and entrepreneurship activities have been opened up towards the broader ICT community in the region.

The way iMinds supports present and future entrepreneurs strongly differs from this traditional model. The new model of open cooperation with all relevant stakeholders and embracing external ideas, as well as external entrepreneurs, creates an entire ecosystem of actors amongst which spillover effects are generated. The first direct and indirect benefits for all entities start to appear, in terms of more intensive cooperation and interaction, human and social capital development, spillover effects, and mutual reinforcement. The fuel powering the creation of this ecosystem is the set of tools in the iMinds incubation and entrepreneurship program.

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