Corporate Venturing

Insights for European Leaders in Government, University and Industry

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Corporate Venturing

Bridging the European Valley of Death

1. Challenge

European Valley of Death

Lack of funding for translating European knowledge into marketable goods and services

STRONG RESEARCH ECOSYSTEM

21%

EU research institutions among top-100 worldwide

UNDERUSED POTENTIAL

95%

Estimated 'inactive' patents in Europe

Among other reasons...

When working with a science start-up, European investors are not often interested in the risk and time horizon expected, and corporations sometimes lack the processes or talent to adopt this type of innovation

2. Trend

Corporate venturing

Collaboration between established corporations and innovative start-ups

CORPORATE VENTURING RISING

x4

Companies adopting it since 2013 globally

CORPORATES CONTINUE INVESTING

$134b

Total value of corporate venture capital deals worldwide in 2019

Trying to spot opportunities before their competitors, corporates are...

Sourcing innovation from start-ups in early maturity stages
Adopting more sophisticated mechanisms (not just CVC)
Exploring pre-equity investments for proof of concept

3. Opportunity

Joint Collaborations and Tailored Financing

Find a common ground of interest and enhance this type of collaborations

Promote coinvestment mechanisms for proof of concept

Building coinvestment funds, grouping corporations and investors interested in science start-ups, and enhancing philanthropic funds

Tailor existing investment mechanisms for technology transfer

Adapting the SME-instrument, tracking the evolution of current corporate pre-equity investments in proof of concept, and validating policies through sandboxes

Support further the European technology transfer field

Aligning regulatory frameworks, providing training to academia on industry-engagement, and sharing learnings from success stories

Joint Research Centre

Josemaria Siota, Andrea Alunni, Paola Riveros-Chacón and Mark Wilson
Corporate Venturing: Insights for European Leaders in Government, University and Industry
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European Commission

Executive Summary

This study provides an overview of what corporate venturing is and its potential impact on the technology transfer field. It outlines some relevant aspects, frequent models and current trends. Based on a brief literature review and consultation of a few experts, the analysis provides some recommendations for European leaders in government, university and industry.

Corporate Venturing: Main Characteristics, Historical Development and European Overview

Corporate venturing—the collaboration between established corporations and innovative start-ups—encompasses mechanisms such as challenge prizes, hackathons, scouting teams, venture builders, sharing resources, strategic partnerships, corporate incubators, corporate accelerators, corporate venture capital (CVC), venture clients and acquisitions.

These mechanisms have grown substantially over the past few years. Airbus Ventures, AT&T Foundry, BMW Startup Garage, Disney Accelerator, Shell Ventures, Tencent WeStart and Wells Fargo Startup Accelerator are just a few examples of venturing arms created recently by major companies. Indeed, between 2010 and 2015, there has been a 42% increase in the number of the world's top 210 companies using these mechanisms. Moreover, between 2013 and 2019, the number of annual corporate investments in start-ups has more than tripled, from 980 to 3,232, while the total size of this investment has risen by a multiple of seven, from $19 billion to $134 billion.

Yet the failure rate of some these mechanisms has triggered the development of additional applied research in business literature to tackle this challenge. Between 2015 and 2019, the growth rate of the number of publications about this topic has increased by 18%. Moreover, the topic has been referenced in the media, where mentions have increased 3.1 times over the same time span, and elaborated on further in large innovation conferences, such as MWC (formerly Mobile World Congress) and Web Summit.

These developments have supported the notion that CVC is not the only corporate venturing mechanism. Moreover, although CVC, corporate accelerators and corporate incubators are some of the most-used corporate venturing mechanisms, they are not always the top-performing mechanisms in terms of time to get results or generating the capital required; more sophisticated mechanisms have been developed.

Additional elaborations have concluded that corporate venturing is not only for very large corporations but also for small and medium-sized enterprises (SMEs). Among its benefits, corporate venturing doesn't always require a high initial investment, it can be financially sustainable, it can be useful for early- or late-stage start-ups, and it can serve a more fundamental role than just for communication purposes.

Historically, mechanisms such as CVC date back to 1914, when DuPont invested in General Motors. Since then, there have been three waves of corporate venture activity: in the late 1960s, the mid-1980s and the late 1990s. Fast-forward to today and corporations such as BMW have deployed new mechanisms such as venture clients (which, in this case, occurred in 2015).

Regarding the future, estimations indicate that mechanisms such as corporate accelerators and start-up acquisitions are going to slightly diminish, while others, such as corporate investments, are going to increase.

Corporate venturing is becoming a dominant trend among companies. Additionally, the issue for corporates is no longer where to find start-ups, but rather how to effectively (and a timely way) implement their solutions. In the future, it is expected that mechanisms such as the corporate accelerator may be refined, although it is unclear how. There is also a curent prioritization of mechanisms (those that are more effective and efficient) and concentration in certain geographies (considering not only the invested capital in that region but also the quantity of high-quality start-ups).

Lastly, more successful examples of institutions that mix corporate venturing and technology transfer mechanisms are emerging, in which corporations widen their collaborations with early-stage start-ups,

especially those coming from universities and research institutions.

Currently, European governments are aiming to cover structural gaps in the process, enhancing not only the creation but also the scaling of start-ups through programs such as the Startup Europe Partnership, InvestHorizon, Innovation Radar, InnovFin and the funds-of-funds VentureEU of the European Investment Fund, to name a few.

Although Europe is also enhancing a single market for start-ups, entrepreneurs still perceive a geographical fragmentation in law. This presents challenges to the internationalization of start-ups within Europe. Moreover, corporations sometimes face organizational barriers that slow down the process of collaboration (e.g., risk avoidance, bureaucracy, lack of autonomy, low speed), especially in highly regulated sectors. Additionally, start-ups sometimes suffer from a lack of local funding in later stages.

On the other hand, Europe has a wide range of large corporations and SMEs applying corporate venturing, with many success cases within a context where corporate venturing (and open innovation) is expected to continue growing and within an ecosystem that is building more start-ups with high potential.

Models of Interaction Between Corporations and Start-Ups: A Legal Point of View

This section assesses the different models of engagement between corporations and start-ups, analyzing current trends and the main features presented by each mechanism from a legal perspective. This collaboration is one of the most effective tools to accelerate the cycle of innovation, extract value from technology, reduce risks, enhance business capabilities, quickly develop new capabilities and increase value creation.

In these collaborations, there are different levels of involvement: observatory, partnering and owning. Some models share features of various phases and are not mutually exclusive. Also, some corporations implement various mechanisms in parallel in order to achieve different results.

This section covers the ownership of intellectual property (IP) rights through transparent contract ruling and funding methods. Regulatory competence is essential for start-ups, research, development and innovation. It highlights the need to reorient legislation from industry- to entrepreneur-centric, because start-ups are relevant sources of innovation and productivity for a growing economy. This is reflected in the rise of more imaginative retribution formulas. Remuneration and taxation are also relevant aspects to evaluate in order to improve the success of corporate-start-up collaborations.

Regarding the management of intellectual capital, the main agreements for each model are considered and explained. This section emphasizes the importance of determining ownership of intellectual and industrial property rights (i.e., patents, trademarks, software, domain names, utility models, know-how and business models), as these intangible assets are relevant for start-ups in aspects such as their governance and the development of contracts with other stakeholders.

Financing instruments are also analyzed, highlighting that financial support could be structured through convertible loan agreements or convertible notes, simple agreements for future equity (SAFEs) or warrants. These formulas should be considered by the regulators when approaching the funding methods used by most SMEs in order to create the right incentives for start-ups when receiving funding, including, for example, a proper framework for interest-free loans.

Lastly, the section addresses remuneration and taxation. In corporate venturing, compensation is granted in a different way than traditional venture capital (VC).

Corporate venturing uses various retribution formulas, including a variety of cash and equity from parent companies, depending on the mechanism. These retribution formulas are explained and identified in order to properly assess their impact.

The section also describes how taxation affects the corporate venturing process, identifying available tax incentives that may help foster investments in start-ups to increase productivity and job creation.

Corporate Venturing Group Roles and Current Trends

Companies use formal CVC groups and related venturing approaches (such as corporate incubators and accelerators) for a variety of purposes. The specific focus of venture activities varies greatly. There is evidence that these practices vary across industries.

While a broad aim of CVC is to gain awareness of novel technologies, companies may specifically seek to develop a broad awareness of market developments, identify start-ups for potential acquisition (or technologies for licensing), or develop mechanisms that alert the firm to emerging technological discontinuities (i.e., major technical changes, such as the advent of epigenetics in the pharmaceutical field).

A number of trends have been observed in this domain in recent years: the emergence of the university venturing sector, the creation of a small venture philanthropy community, an emerging interest in early-stage technologies, the substantial increase in the use of incubator and accelerator programs, and the development of novel forms of CVC groups that combine elements of independent VC and corporate venturing.

Major challenges for corporations are related to technology management issues. In addition, venture groups are challenged to find and to develop novelty and innovative solutions in an operating company context of incremental improvement and systematized processes, and often need to carefully manage the interests of multiple key internal stakeholder groups.
The European Union and its constituent bodies could take action in a number of areas connected to corporate venturing, with the aims of maintaining and improving European economic competitiveness.

The Impact of CVC on the Technology Transfer Field: The Developing Role of University TTOs

The lack of funding during the early-stage development of a research project is called the "Valley of Death" and it is at the center of this section's discussion.

In a classic European innovation ecosystem, university tech transfer offices (TTOs) seek to raise investments from the private sector (corporates, etc.) to progress research spin-offs based on IP and to bring them to market. Also, corporates pursue investment opportunities that match their innovation strategy and corresponding activities. While this seems like a perfect match in a university-industry collaboration, when looking at the drivers that motivate this relationship it is possible to observe that universities and corporates have different perspectives on common-ground issues affecting their relationship.

The problem arises when the private sector or investors do not pick up a scientifically marketable idea because it is too risky (as it has not been fully applied yet and its technology readiness level or TRL is too low), generating a financial gap between the ideation and the commercialization. For this reason, it is not surprising that university start-ups in the early stage of development very often encounter a financial gap, which limits their ability to both innovate and commercialize their products or services, and they end up in the Valley of Death.

To respond to the question of whether CVC has an impact on the technology

transfer field, two main considerations have been taken into account. The first indicates the risk of measuring the impact of CVC on the technology transfer field; that is to say that if CVC activities have a positive effect on a firm's long-term economic benefits, these strategic gains are often not evident because usually only a short-term time span is considered when evaluating corporate venturing benefits. The second refers to the fact that collaboration between CVC and university TTOs in the technology transfer field remains predominantly characterized by the sharing-resources mechanism, as prominent universities can afford to support extensive research activity with their own internal research budget and also rely on the entrepreneurial culture of the university and its entourage.

In an attempt to measure the impact that corporate venture capital have on the technology transfer field, findings indicate that the main impact emerges when the IP portfolio is licensed and duly developed into start-ups that will then be commercialized, with the corporate venture capital as an investor at the early stage.

In this context, an ordinary question emerged: If CVC funding is a perfect catalyst for start-ups to overcome the Valley of Death and start-ups are a great source of innovation for big companies, why is the lack of early-stage funding (by corporate venture capital) still causing high mortality to a great number of university start-ups?

To find an answer, this section examines the fundamental issues that affect university-industry collaborations, such as the different time horizons within which universities and corporates operate, invest and plan their activities. Academic research focuses on long-term challenges that are often in conflict with the short-term focus of CVC programs on the financial objectives. Research has also examined the different expectations that universities and industry devise for collaboration on projects, suggesting that university-driven research, though riskier, allows for unexpected and fruitful scientific and technological achievements, with a lot of spillover to other fields. Industrial-driven projects, in contrast, result in more modest achievements but are more likely to be adopted for use by firms that invest in knowledge transfer through several channels; particularly, labor mobility.

Findings highlight that a crosscutting approach is needed to align CVC and university TTO perspectives in order to ensure that these two actors, and individuals from these two sides, can best cooperate. After looking at the experience of prominent university TTOs and their best practices in encouraging university-industry collaboration, some solutions to address the existing issues were identified.

They include the need to find common ground to effectively collaborate and overcome the cultural and communications divide that tends to impair their collaborations instead of aligning their common interests; secure tailored training to understand what meaningful cooperation involves, since a change of mind-set is required to align the time horizons and strategic objectives that corporates and TTOs use to operate and invest together, and encourage proof of concept (PoC) to help evade the Valley of Death, as university spin-offs often develop early-stage technologies that are characterized by long development paths and uncertain commercial potential.

Referring to the latter point, findings indicate that PoC addresses the common issue that arises when the private sector/investors do not pick up a scientific idea because it is too risky due to its low TRL, thereby offering an effective joint activity that can be promoted by both TTOs and corporate venture capitalists to help start-ups cross over the Valley of Death—in particular because the PoC stage proves whether or not there is a market for the product by giving validation that such a need exists and that the product can provide the solution.

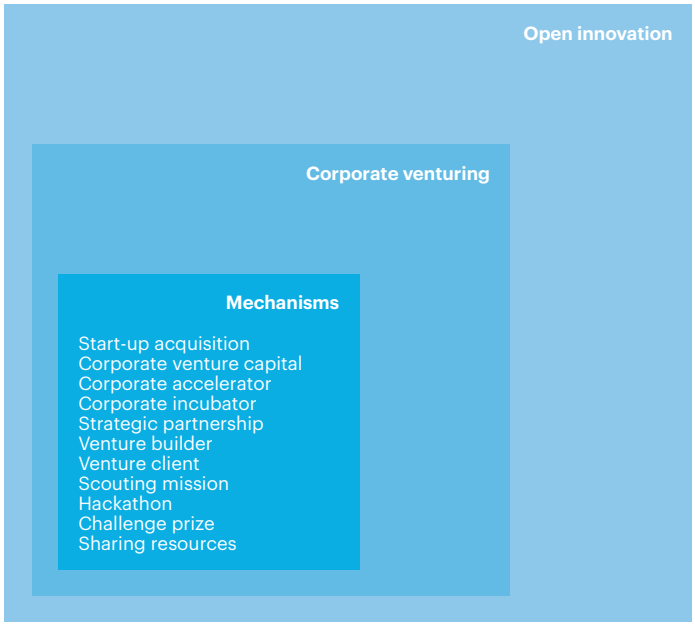
1. Corporate Venturing: Characteristics, Historical Development and European Overview

1.1 Introduction: Collaboration Between Corporations and Start-Ups

Corporate venturing is defined as the collaborative framework between established corporations and innovative start-ups.[1]

These mechanisms—venture clients, hackathons, venture builders, scouting missions, corporate accelerators and more—are clear paths for attracting and adopting innovations by established firms, following the paradigm of open innovation, which assumes that firms can and should use external ideas.[2] (See **Figure 1**). As Schneider Electric's chief innovation officer Emmanuel Lagarrigue said, "Corporate venturing allows established companies to access forms of innovation that are difficult or impossible to produce internally."[3]

Figure 1. Framework of Corporate Venturing



Source: Julia Prats and Josemaria Siota; IESE Business School (2018).

It is important to note that these venturing tools are not being used to replace but to complement and encourage internal research and development (R&D). Existing examples illustrate this interaction in industries such as the media, technology and automotive sectors. For instance, in the case of the media, R&D spending (as a percentage of sales) of companies that use a combination of corporate venturing mechanisms—such as corporate venture capital (CVC), corporate accelerators and corporate incubators—is 2.4% higher, on average, than the R&D spending of the top 30 companies by market capitalization in the same sector.[4]

As explained by the Henkel Ventures head of corporate venturing Thomas Schuffenhauer, "In a world of constant change that defines new value chains, acquiring new skills and collaborating with partners are indispensable for success." He said that corporate venturing complemented other options, such as R&D, innovation, and mergers and acquisitions (M&As).[3]

Though there are many ways of innovating in companies, corporate venturing is an emerging practice that allows a company to source new innovative opportunities and to speed up a solution that is already showing successful results.

Nevertheless, since the model is still emerging, there are a few misconceptions (and unanswered questions) that prevent chief innovation officers from leveraging corporate venturing mechanisms, which means they lose the potential growth such mechanisms offer. Yet is corporate venturing relevant only to executives?

1.2 A Reality Relevant to the Government, Industry and Academia

In Academia—Covering the Gaps in the Literature

Academics and publishers have become more interested in corporate venturing, an unexplored arena with many research questions awaiting answers. Just in the past four years, the number of publications in academic and nonacademic journals has increased 1.8 times and its growth rate has increased by 18%.[5] Academic literature has explored issues such as organizational structure,[6] autonomy,[7, 8] challenges faced by corporations in working with start-ups,[9] the determinants of success[10] and financial sustainability,[11, 12] accelerators,[13] incubators[14] and efficiency of knowledge transfer.[15]

However, current research reveals many topics related to corporate venturing that require further development. Several reports encourage additional research on management systems: how firms can develop better key performance indicators (KPIs) for measuring this activity[5]; how to align the corporate venturing KPIs of the executive committee, the entrepreneur and the corporate venturing unit; and performance comparisons between venture capital (VC) and CVC.

These questions are repetitively suggested and require creative ways to measure the medium- and long-term strategic benefits of corporate venturing activities in a firm. Literature shows that venturing activities have a positive effect on a firm's short-term economic benefits as well as its long-term strategic gains. However, since these benefits take time to materialize, if a short time span is considered when evaluating corporate venturing, these benefits may not be evident. That is why more creative measures are needed in future research.[16]

Then there are other topics related to corporate strategy and its strategic effects: attracting talent, boosting creativity, increasing organizational learning, and more.[16] There are also topics related to integration of innovation value: how firms can integrate the innovation value of these initiatives more successfully[1] and the value created in the collaboration between corporate and private investors when working with a start-up, to mention a few.[11, 17]

More research is also required to explore not only the influence of the institutional context on companies' proclivity to undertake corporate venturing but also the geographical impact of the national culture, in a manner not captured in a typical single-country study. Given the growing interest in corporate venturing on the part of developed and transitional economies, the role of the institutional context deserves more attention in future research. Researchers need to consider the context in which these activities occur.[17]

In Industry—Easy to Understand, Difficult to Deploy

Corporate venturing has grown substantially over the past few years, as confirmed in one of the authors' most recent articles in *Harvard Business Review*. Airbus Ventures, AT&T Foundry, BMW Startup Garage, Disney Accelerator, Shell Ventures, Tencent WeStart and Wells Fargo Startup Accelerator are just a few examples of venturing arms created recently by major companies. Indeed, between 2010 and 2015, there has been a 42% increase in the number of the world's top 210 companies using some of these mechanisms.[1] Since 2013, the number of annual corporate investments in start-ups more than tripled, from 980 to 3,232, while the total size of this investment grew by a multiple of seven, from $19 billion to $134 billion.[18]

Despite these dramatic increases, the success rate remains obstinately low. According to research compiled from interviews with chief innovation officers (CIOs)—and others in similar roles from the United States, Europe and Asia—more than three quarters (77%) of corporate innovation initiatives are failing to deliver the desired results.[19] What are the differences between those that succeed in this endeavor and those that not? There is still a common thought among corporate executives: corporate venturing is easy to understand, yet difficult to successfully deploy.

The attention given to the topic among executives continues to grow. According to the Factiva database, the number of media articles referring to "corporate venturing"—a number that has grown 3.1 times between 2015 and 2019—indicates the high level of media attention received.

This popularity has persisted not only in the media but also in renowned conferences such as the MWC (formerly known as Mobile World Congress) in Barcelona, where corporate venturing has been included as a keynote speech or panel topic since 2017. Another example is Web Summit in Lisbon, the technology conference founded by Paddy Cosgrave in 2009, which gathers chief innovation

officers, heads of innovation and chief executive officers of large multinationals at the Corporate Innovation Summit.[20]

Among industries, there is a close relationship between the speed of innovation the sector demands in order to maintain competitive positioning and a firm's experience in corporate venturing. For instance, firms in high-tech sectors launched corporate venturing units long before firms in other sectors (such as in food processing and consumer goods), which indicates that these sectors may have more evolved and mature practices than others.[1]

There are sectors where many companies have been involved in corporate venturing for more than 10 years (e.g., high-tech) and are currently in the process of consolidation; another group with four to 10 years of such experience (e.g., banking) where companies are currently scaling venturing units; and others with one to three years of experience (e.g., professional service firms) that are laying the foundations.[1]

In the case of the pharmaceutical sector, we identified a broader spectrum in terms of corporate venturing development in companies—some scarcely have a less developed venturing structure whereas others are applying the most advanced mechanisms.[1] In the case of professional service firms, some subsectors, such as technological consulting firms, became involved in corporate venturing early on, while others, such as law firms, started much later.[1]

In Governments—Supporting the Ecosystem

Recently, several initiatives linked to corporate venturing were established by the European Commission. One of the related frameworks is the Startup Europe Partnership (SEP). Some of its goals are scaling up new innovative ventures, scouting the most promising European start-ups and connecting them with large and medium-sized corporations. It is led by Mind the Bridge, in collaboration with the London Stock Exchange program ELITE, Nesta, the European Startup Network, the Scaleup Institute and Bisite Accelerator.[21]

In this partnership, corporations commit capital and talent through the participation of heads of innovation and procurement channels to support start-ups in different ways. Partners include a few leading corporates, educational institutions and investors, such as the European Investment Bank.[28]

Another initiative promoted by the European Investment Fund, is VentureEU, a pan-European VC fund-of-funds program launched in 2018 together with the European Commission, which boosts investment in innovative start-up and scale-up companies across Europe. Backed by European funding to the tune of €410 million, it raised €2.1 billion of public and private investment. In turn, this is expected to trigger an estimated €6.5 billion of new investment in innovative start-ups and scale-ups across Europe, doubling the amount of VC currently available in Europe.[23]

On the start-up side, the ecosystem still demands additional support in scaling. According to the SEP, "Europe has made huge progress in terms of becoming an ecosystem for startups, but where we lag behind is in scaling them. Startups need help to work and expand across Europe [...]."[24]

That is why the wider startup ecosystem and policy makers, too, should be interested in helping corporates and startups work together more effectively.

In this direction, there are many initiatives ongoing such as the investment acceleration program InvestHorizon tailored to European deep-tech entrepreneurs, the data-driven initiative Innovation Radar focused on the identification of high-potential innovators, and the financing tool InnovFin. The last named covers a wide range of loans, guarantees and equity-type funding, which can be tailored to innovators' needs. Financing is either provided directly or via a financial intermediary, most usually a bank or a fund.

According to Nesta, to enhance start-ups in the scaling process, policy makers should continue supporting initiatives that link corporations and start-ups, "through public-private partnerships or by supporting emerging, third party initiatives."[24] They should also "pay attention to Europe-wide initiatives" to "foster a strong European ecosystem and single market for entrepreneurs."[24]

What are the corporate venturing mechanisms that should be highlighted in these collaborations? What are the most frequently applied?

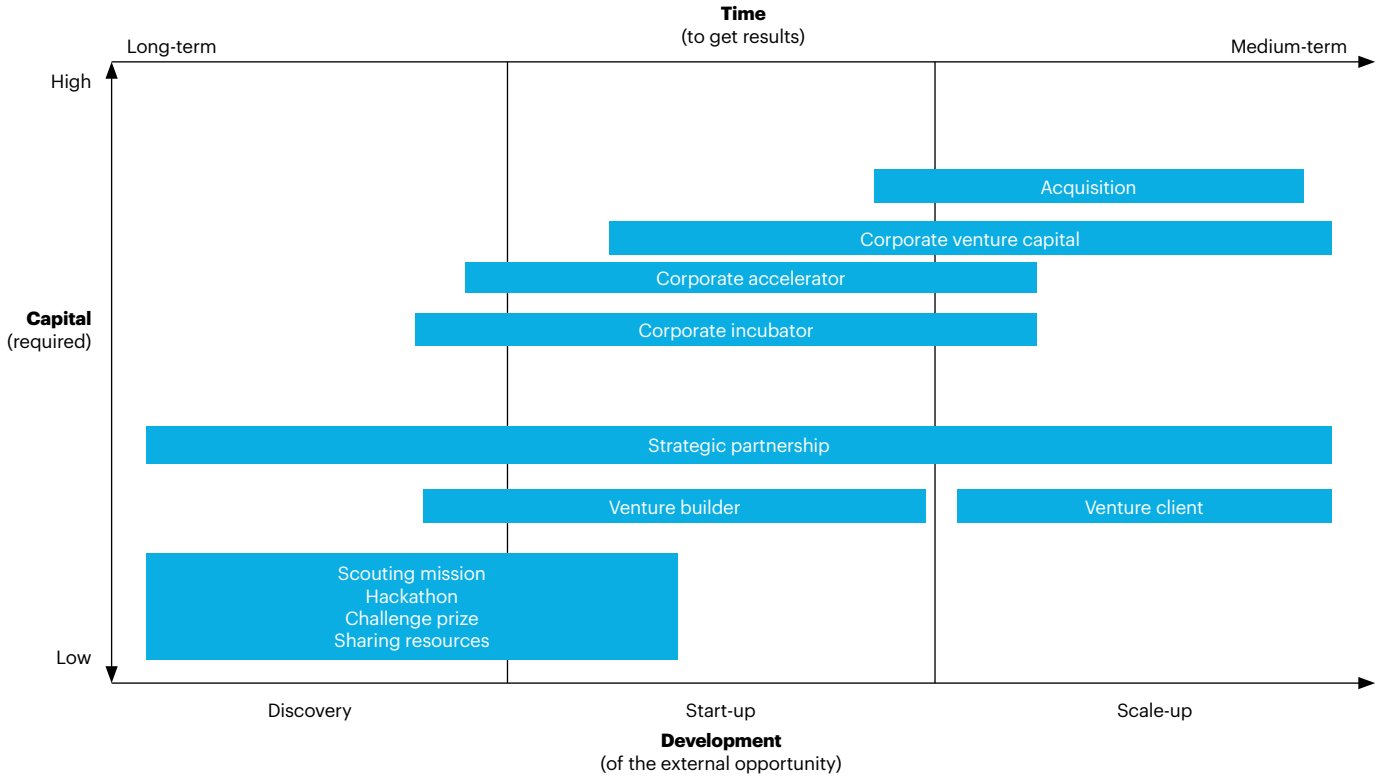
1.3 The Most Common Corporate Venturing Mechanisms

Scrutinizing the mechanisms or venturing tools available to support a firm's innovation strategy, an earlier study identified a sharp rise in a specific set of corporate venturing practices in large corporations over the previous few years. CVC, corporate acceleration and corporate incubation are currently some of the most-used corporate venturing mechanisms.[25, 26]

However, additional mechanisms have recently emerged: from venture clients (or client accelerators) to excubators (or venture builders), hackathons, scouting missions and more. A preliminary study explains the importance of tailoring the corporate venturing strategy, selecting the mechanisms that fit the corporation's objectives—depending on the length of time desired to obtain results from the corporate-start-up collaboration, the capital available to launch these initiatives, and the development stage of the opportunities the initiatives are working with.[1] (See **Figure 2** and **Appendix 6.3**.) Further developments have found that the most frequently used mechanisms are not always those with higher performance in terms of speed and ongoing cost.[27] To understand the trade-off between cost and speed in greater depth, it is important to bear in mind the development stage of the opportunity (i.e., discovery, start-up or scale-up). For instance, the development stage of a discovery found on a scouting mission is different from a discovery found in a scale-up to be acquired.

Figure 3 shows three factors: speed, cost and the maturity of the opportunity. It shows the months required for a corporate venturing opportunity to go through the whole corporate venturing cycle of identification, collaboration and integration (x-axis), along with the ongoing cost of that process—including managerial and full-time equivalent (FTE) costs, and excluding

Figure 2. Corporate Venturing Mechanisms by Capital, Time and Opportunity



Source: Julia Prats, Josemaria Siota, Tommaso Canonici, and Xavier Contijoch, Open Innovation: Building, Scaling and Consolidating Your Firm's Corporate Venturing Unit*, (Barcelona: IESE Business School and Opinno, May 2018).*

investment costs (y-axis), and the development stage of an opportunity (diameter of the circles).

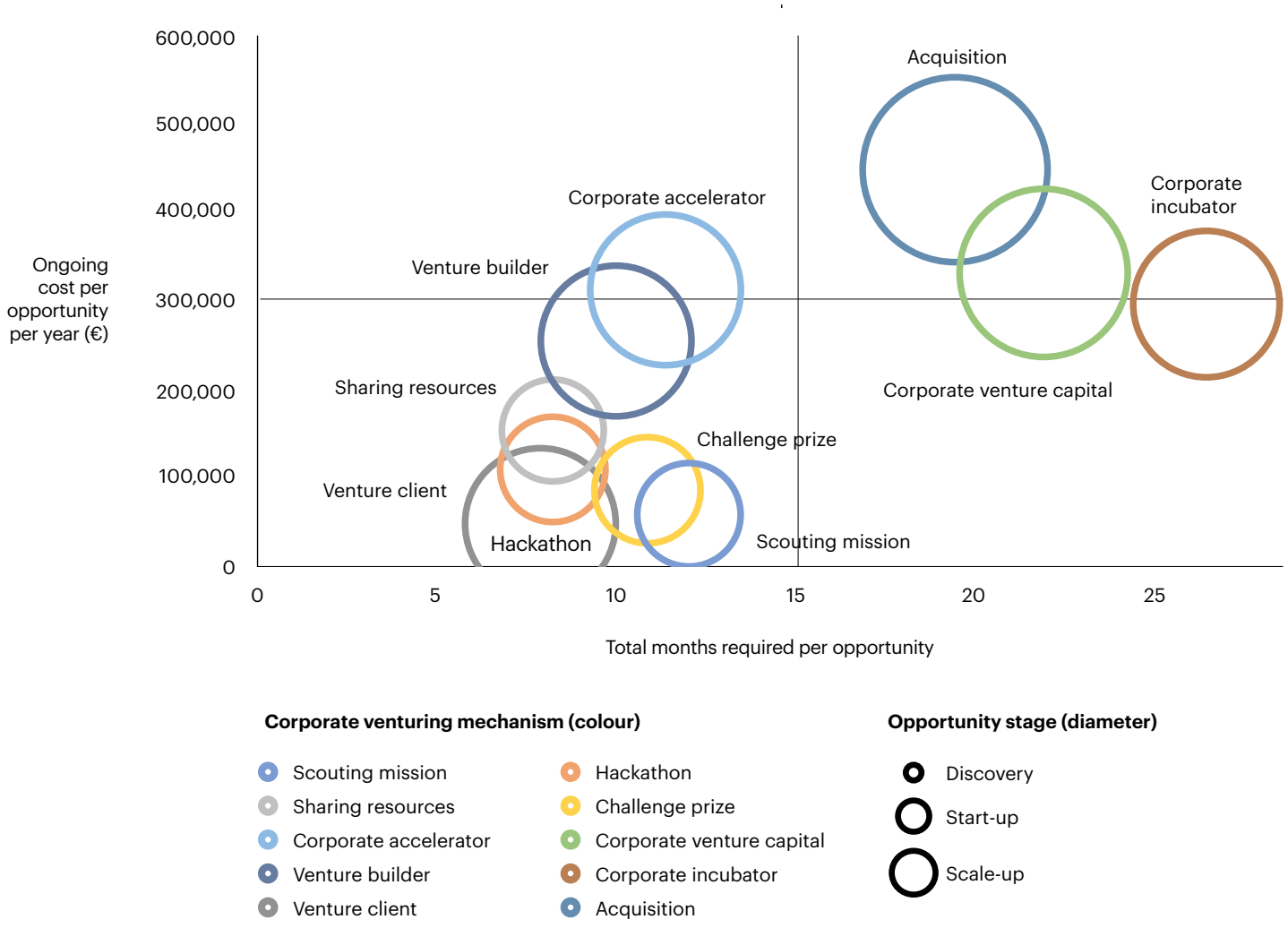
Usually, the more mature the opportunity (either a scale-up or start-up) with which to collaborate, the more time is required to go through the whole corporate venturing process and the higher the ongoing costs per opportunity, as can be seen in the top-right quadrant (e.g., acquisition and CVC) and in the bottom-left quadrant (e.g., hackathon, sharing resources, challenge prize and scouting mission).

However, there are a few exceptions:
First, the corporate incubator is the mechanism with the longest time span, but the development stage of the opportunity is only that of a start-up (not a scale-up). Therefore, the opportunity is at an earlier stage compared with an opportunity from an acquisition or CVC. In other words, it provides a less developed opportunity to the parent company at a slower speed.

Second, the opportunity stage of the corporate accelerator and the venture builder is a bit more developed compared with that of the corporate incubator. The ongoing costs are similar, but these two mechanisms require less time for the corporate venturing cycle, meaning the process is around two to three times as quick.

Last, the speed and cost of the venture client is similar to those of hackathons, sharing resources or challenge prizes. However, the opportunity stage of the venture client is more developed. As we have seen, although the benefits to corporations are clear, there are still some common misunderstandings about the model. What are they?

Figure 3. Ongoing Cost and Time per Opportunity per Mechanism



Source: Julia Prats, Josemaria Siota, Isabel Martínez-Monche, and Yair Martínez, Open Innovation: Increasing Your Corporate Venturing Speed While Reducing the Cost. *(Barcelona: IESE Business School and BeRepublic, January 2019).*

1.4 The Seven Myths of Corporate Venturing

Bipin Sahni, senior vice president of innovation and R&D at Wells Fargo, said that the company had launched its start-up accelerator program in 2014 "to spur innovation for our customers' benefits and expand our vision of the future of financial services beyond the boundaries of Wells Fargo and banking." He added, "When we pitched the idea to senior management, there was just one question: 'Why aren't we doing this already?'"[27]

Nonetheless, beyond these positive considerations, there are still firms that are skeptical of the model. In such cases executives usually share one or more of the following ways of thinking.[5]

Corporate venturing is only CVC: Corporate venturing is "a collaboration framework that acts as a bridge between innovative and disruptive start-ups and established corporations" as the "mean[s] through which corporations participate in the success of external innovation to help them gain insights into non-core markets and access to capabilities."[9] The CVC model—having an internal venture fund to invest in start-ups—has existed for years, with the first pioneer program established in 1914 when DuPont invested in a six-year-old private automobile start-up called General Motors.[28] Nevertheless, the more current and growing aspects are other mechanisms—such as venture builders and venture clients, to mention but two—making this collaboration more sophisticated.[4]

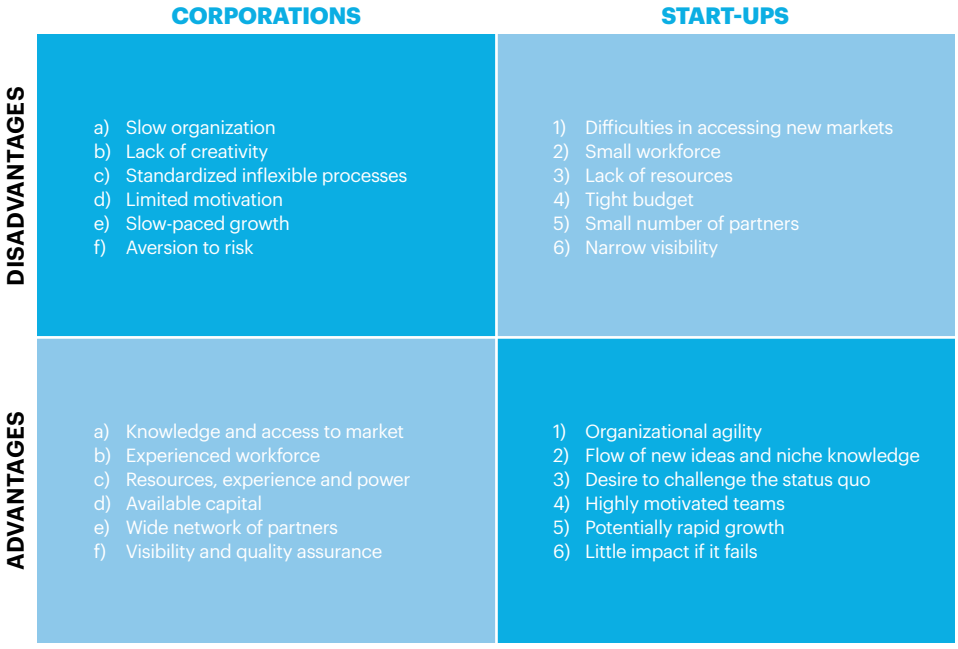
Corporate venturing is only for very large corporations: Although the growing literature on the subject provides more and more examples and data pertaining to large corporations, there are less-known cases of SMEs that are implementing this collaborative framework successfully, such as the renewable energy company Fersa[29] and other European SMEs such as Lékué, Pro Earth, Dearman, BA Systèmes and Jenetric.[30]

Additionally, the mechanisms that are usually mentioned in the literature—such as hackathons, corporate incubators, venture builders and corporate accelerators—can be implemented perfectly well by SMEs. Although such firms might have to focus on mechanisms that are faster and require less capital, because of time and budget constraints, they are still able to implement them. To be effective, such companies should carefully design an attractive value proposition.[1]

Corporate venturing requires a lot of investment to start: While it is true that some mechanisms, such as CVC, require a high level of investment to be started and sustained, other mechanisms require as little as €10,000 to initiate, such as a hackathon.[1, 27]

Corporate venturing is financially unsustainable: As in many business practices across sectors and geographies, some actors perform better than others. There are already many cases of companies that have not only successfully implemented the model but also achieved financial sustainability within their corporate units. Contrary to public belief, according to Harvard Business School professors Gompers and Lerner, the traditional CVC model appears to

Figure 4. The Complementary Perspective of the Corporation–Start-Up Collaboration



Source: Julia Prats, Josemaria Siota, Tommaso Canonici, and Xavier Contijoch, Open Innovation: Building, Scaling and Consolidating Your Firm's Corporate Venturing Unit, *(Barcelona: IESE Business School and Opinno, May 2018).*

be at least as successful as those backed by independent venture organizations, especially for investments in which there is a strategic overlap between the corporate parent and the portfolio firm.[31]

In addition to the traditional CVC model, the number of success stories with other corporate venturing mechanisms has been increasing. This is the case of the German conglomerate Siemens, whose innovation unit Technology-to-Business has run 70+ projects since 1999 and has launched 10+ new products. It is also the case of the software corporation SAP, which brought more than 1,500 early adopters to a new product's platform by creating a corporate accelerator. A third case is the US conglomerate AT&T, which worked with the start-up Intucell through its Foundry program to improve the reliability and speed of the AT&T wireless network. The speed and reliability of the service increased by 10%, while tower overloading was reduced by 30% within a few months.[32]

My corporation is better than any start-up: Firms that are successful in corporate venturing are those that regard the differences between corporations and start-ups as a source of opportunities. One organization may find a solution to its limitations in another organization. For instance, a start-up's endemic lack of resources may be compensated by it being able to share the resources of a corporation. (See **Figure 4**.)

The focused talent pool of a start-up may offset a corporation's lack of knowledge in that area. As IBM Ventures managing director Wendy Lung said, "There has to be an awareness and acceptance within senior leadership that this is an absolutely vital ecosystem that we have to have a close relationship with."[33] In other words, the weaknesses of some are the strengths of others and vice versa.

Corporate venturing will give me short-term results: First, it is important to first define both "short-term" and "results." Depending on whom you ask (e.g., a start-up or a pharmaceutical corporation), you might be told that "short-term" refers to days, weeks, months or years. For instance, the time required to launch a new product or service in the pharmaceutical industry is quite different from the time required in the tech industry. While a pharmaceutical company needs around 13.5 years from discovery of a new molecular entity to launch (preclinical, phase 1, phase 2, etc.),[34] a tech company can launch a new product in less than a year. The same happens with what is meant by "results," which executives can understand as referring to many things, such as revenues, processes, business models, mind-set, knowledge or products (e.g., when you ask a banking institution or a media company).

Figure 3 shows that mechanisms such as sharing resources, venture clients and hackathons have average time spans of less than eight months between the identification of the opportunity and the integration of value into the parent company, excluding the time required to build the mechanism.[1, 27] In conclusion, corporate venturing mechanisms are designed for mid- to long-term horizons, bearing in mind the singularities of the industry and size. Having a short-term view may destroy long-term growth opportunities for corporations.[1]

Corporate venturing is useful only for start-ups at either an early or late stage: It is a misconception that corporate venturing works only when collaborating with start-ups that are in their early-stage development or with very developed start-ups. Previous research reports that there are mechanisms for each development stage (i.e., for discoveries, start-ups and scale-ups) and there are success stories relating to each mechanism.[1] For instance, CVC is usually applied to start-ups and scale-ups, while scouting missions and hackathons are usually used for discoveries.

In summary, these are some of the most frequent misunderstandings. But has the situation always been as it is now?

1.5 How Has Corporate Venturing Arrived to This Point?

A Brief History of Corporate Venturing

In the past, corporate interest in creating venture funds tended to increase and decrease in sync with the general VC climate. The three waves of corporate venture activity in the late 1960s, mid-1980s and late 1990s corresponded with booms in VC investments and venture-backed initial public offerings (IPOs).[35]

The origins date back to 1914, when Pierre S. du Pont, president of chemical and plastics manufacturer DuPont, invested in a still-private, six-year-old automobile start-up called General Motors. During World War I, DuPont invested $25 million in the automobile company, which by 2016 had reached an annual sales growth of 56% and had over 85,000 employees.[36]

The first wave of conglomerate VC (1960–1977) involved US industry titans such as DuPont, 3M, Alcoa, Boeing, Dow, Ford, General Electric, General Dynamics, Mobil, Monsanto, Ralston Purina, Singer, W. R. Grace and Union Carbide—including the emblematic CVC program of Exxon Enterprises, which was one of the largest CVC investors of the 1970s. During those years, CVC investors employed a variety of CVC models, often at the same time. In parallel, companies also invested in internal

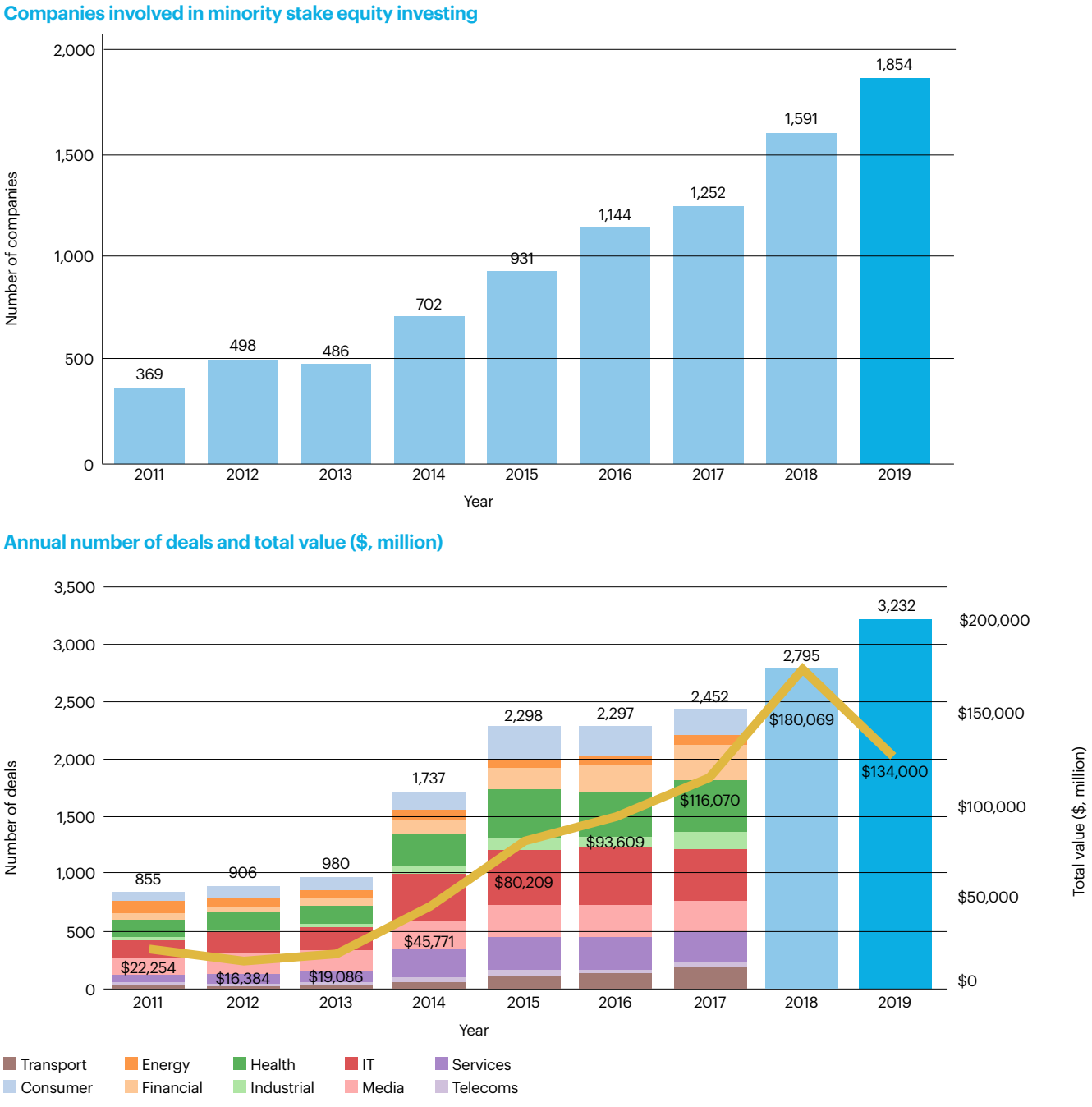
employee ventures, trying to spin out in-house technologies into new ventures.[36]

The second wave of Silicon Valley (1978–1994) was characterized by a big boost from private VC investors in 1978, when capital gains tax was significantly reduced in the United States, and then again in 1980, when capital gains tax was lowered again, incentivizing investment. Between 1977 and 1982, the amount of money dedicated to VC grew from $2.5 billion to $6.7 billion. As a consequence, this increased the pool of capital available to entrepreneurs, bolstering the creation of start-ups and creating a positive feedback loop.[36] In the late 1990s, various independent, for-profit incubators were set up, leading to the creation of new concepts and business models such as accelerators, hatcheries and greenhouses.

In the third wave of irrational exuberance (1995–2001), nearly 100 CVC investors made their first investments between 1995 and 2001. CVC continued to internationalize during this period, although the United States remained the most significant market. Between 1990 and 1999, 71% of CVC investors and 75% of CVC firms were located in the United States. This period was characterized by closer collaboration between corporate and private VC investors compared with those in previous waves.[36]

From 1998 to early 2000, the number of for-profit incubators increased substantially in parallel with a boom in VC. While most of these independent for-profit incubators have since ceased operations, corporate for-profit incubators continue to be relevant for large corporations in several sectors, such as those that are technology-intensive.

Figure 5. Historical Global Development of Corporate Venturing Capital (2011–2019)



Source: Adapted by Josemaria Siota (IESE Business School) from GCV Analytics data.

After the market correction and rapid decline of Internet and high-tech businesses beginning in early 2000, many of these independent incubators disappeared, along with VC funds. However, corporate incubators have since increased in importance. They have adapted to the rise and fall of independent incubators and have taken over some of their processes, instruments and mechanisms.[37]

Last, the current, fourth wave (starting in 2002) is characterized by the emergence of the unicorn era. While CVC fell substantially after the economic recession of the late 2000s, it didn't disappear. CVC as a percentage of total VC was halved, but CVC investment leveled out at about $2 billion* per year through the first half of the decade, and then began to increase again before dipping, along with the rest of VC investments, during the worst years of the global financial crisis. In 2009, the amount from CVC-backed deals reached only $5.1 billion. Afterwards, it took off again when Silicon Valley began to boom once more in the first half of that decade.[36]

During the last decade, CVC has grown tremendously. From 2013 to 2019, the number of companies involved quadrupled up to 1,854; the number of deals more than tripled, to 3,232; and the total amount invested in those deals grew by a multiple of seven, totaling $134 billion[i] (see **Figure 5**.) Moreover, in 2017, 75 of the Fortune 100 companies were active in corporate venturing and 41 had a dedicated CVC team. They represent a growing source of capital as well, participating in nearly a third of all US venture deals and 40% in Asia.[38]

What happened to accelerators? After the Internet crisis in 2000 and the financial crisis in 2008, VC investments not only declined but also moved to later-stage start-ups, leaving a funding gap for early-stage start-ups. This gap was partially filled by the newly emerging, noncorporate accelerator programs, which first appeared in 2005. The concept only gained widespread acceptance in 2008.[37]

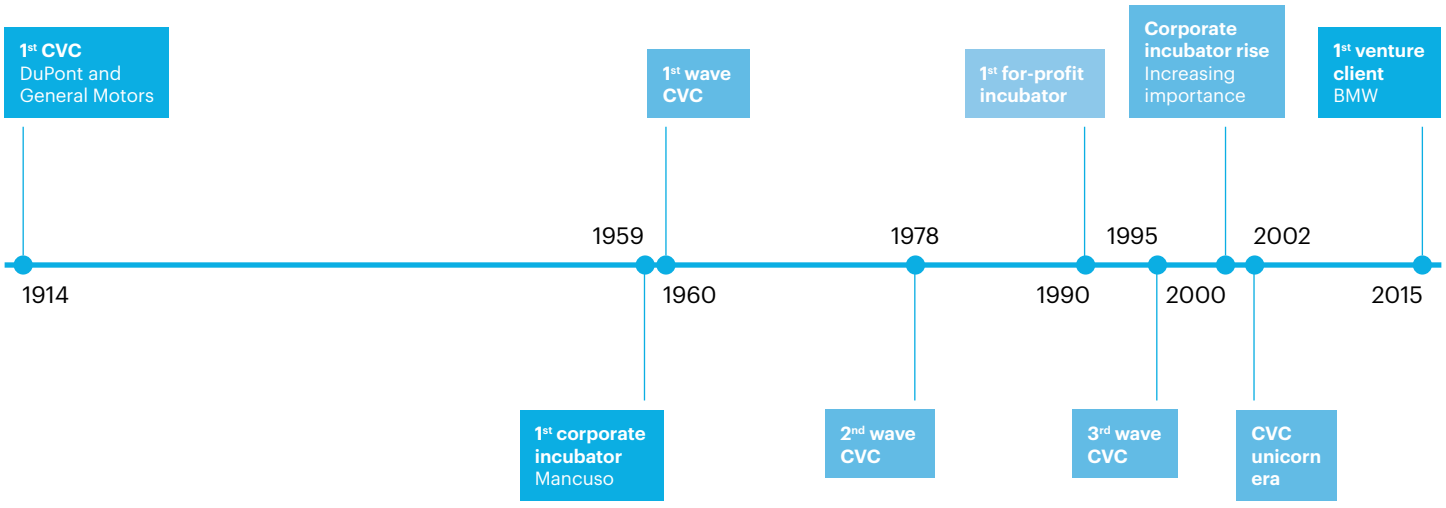
Rather than disappearing with the recovery of VC investments after each crisis, accelerators survived and established themselves as a new fixture in the funding ecosystem. This was further facilitated by advances in technology, which reduced the cost of launching new businesses and made the comparatively low investments of accelerators more attractive than in the past.

During the most recent upturn of corporate and independent VC, around 2010, corporate accelerators appeared as a new phenomenon alongside their noncorporate peers. It is speculated that this was triggered by corporate interest in being close to entrepreneurs to increase their own innovation potential. Corporate accelerators may have also been a way for firms to diversify their spending on external businesses.[39] Overall, there have been many corporate venturing mechanisms that have increasingly penetrated the market. For instance, there has been a 42% increase in top-210 companies by market capitalization using corporate accelerators, incubators and partnerships with start-ups.[1]

Globally, in 2015, two-thirds of accelerators were corporate, while in Europe one-third (32 out of 103) were run or supported by corporates. This figure continues to grow rapidly.[24]

In recent years, more sophisticated tools and mechanisms have emerged to enhance the corporate-start-up collaboration, such as hackathons, scouting missions, venture builders and venture clients. Currently, there is a extensive use of those mechanisms within corporations of different sizes around the world. (See **Figure 6.**)

Figure 6. Some Historical Milestones of the Corporate Venturing Model (Approximate Estimates)



Source: Prepared by Josemaria Siota (IESE Business School) based on a literature review and the databases Factiva, Google Scholar, Google, Ngram and Discovery.[28, 40, 41]

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Note: Please keep in mind that the time line is not exhaustive. It excludes those mechanisms without a clear starting point. Additionally, consider the data points as indicating the first time that those terms were used and tracked. However, it is possible that the mechanisms were previously used under a different name.

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* 1 billion = 1,000 million.

1.6 Recent Trends

Open innovation is becoming a leading opportunity for corporations and has proved barely affected by the recent economic climate and political uncertainty.[42]

Within the framework of open innovation, there is little estimation on which corporate venturing mechanisms will be most utilized in the future. However, there was little variation during 2019, whereas corporate accelerators diminished by 9% and acquisitions and sharing resources by 3%.[42]

In parallel, venturing mechanisms are becoming more sophisticated,[43] especially in deployment, where executives are currently able to access data on each mechanism in terms of speed, cost and process, among other factors. With these numbers, some mechanisms (e.g., corporate incubators) are starting to lose relevance in some industries.[27]

In terms of challenges, corporations are starting to encounter fewer barriers in identifying start-ups with which to collaborate. This is due to developing case studies, the tracking of experiences in current initiatives and the fact that more innovation firms are engaging in corporate venturing. However, companies are still facing challenges in integrating value into the parent company (i.e., revenues, products or services, business models, knowledge, processes and mind-set) and measuring it—ensuring a cost-effective and agile process. Some literature has recently been developed on this topic.[44]

Since more corporations are engaging in corporate venturing, there is more competition among them to find the right start-ups to collaborate with. As a consequence, corporations are looking to improve the value propositions offered in those activities. Meanwhile, start-ups in earlier stages of development (e.g., those connected to universities and research centers) are becoming more relevant to corporates than before.

Connecting corporate venturing and technology transfer is also a trend that is gaining momentum. These are two processes that can be highly complementary. Technology transfer is the process of shifting scientific findings from one organization to another for the purpose of further development and commercialization.[34, 45, 46] Companies are placing more relevance on identifying, and in some cases adopting, the discoveries that may disrupt their sectors.[32]

1.7 Corporate Venturing and Technology Transfer in Europe: A SWOT Perspective

Europe has a strong ecosystem of corporations that are increasingly willing to collaborate with and allocate resources to start-ups and that have many success stories. Schneider Electric, BMW, Airbus and Adidas are just a few examples.[31] This trend is not only affecting large corporations but also SMEs. (See section 1.4.)

The region is distinguishing itself as a flourishing start-up ecosystem. However, since there is more competition for corporations to find the best start-ups, companies are trying to figure out how to redefine their value propositions for start-ups and emerge as the chosen corporation in their sectors. In some cases, corporates are forming multi-industry partnerships with that same purpose, where they are able to increase cross-sector technical knowledge and go-to-market networks, and develop a stronger brand, among other objectives.[32] In parallel, companies such as BP, Siemens and Roche are collaborating with early-stage start-ups from European universities and research centers, which are distinguished by their strong research infrastructure and visibility in high-impact journals.[32, 47]

These trends are triggering new research and training programs in business schools, focused on corporate venturing such as the Open Innovation Conference, the Open Innovation Network and the reports developed by IESE Business School in collaboration with other institutions.[5, 32, 44] Other business schools have started to generate partnerships in this direction such as the French INSEAD with the US venture fund 500 Startups.[48]

However, this is not happening evenly across sectors. Each industry is adopting these practices at its own pace. While sectors such as high-tech, aerospace and energy are already quite advanced, others such as agriculture and some subsectors of professional services firms are still starting out.[1]

Meanwhile, not all start-ups represent an attractive prospect for large companies. Some European corporations are facing a lack of agility. They are slow to identify and adopt change, are stuck in traditional mind-sets, concentrated in some regions with a risk-averse way of thinking, and surrounded by highly regulated sectors (e.g., finance and health care) and, in some cases, are not interested in collaborating with start-ups due to imposed time contraints.[19]

Moreover, some companies are still measuring opportunities by short-term financial KPIs and, in some cases, losing long-term growth opportunities. As a consequence,

corporate venturing units are caught in the middle trying to deal with start-ups and traditional business lines, lacking the right level of autonomy (e.g., location, KPIs, reporting cycles) to maximize the level of innovation while maximizing the value integrated into the parent company.

There are also additional legal and funding challenges. The fragmented legal framework in Europe is not always helpful. Sometimes start-ups face challenges scaling up their collaborations with corporations because of the fragmentation of country-specific commercial and corporate law, such as investment-related aspects. These challenges are enhanced because of the lack of clear patterns of law, which in many cases is limited to the guidelines of commercial or corporate law.

On the other hand, while Europe has become a powerful ecosystem for start-ups, scale-ups have funding needs that in some cases are not fulfilled locally and thus trigger a flight of talent to the United States or China.[24]

Europe boasts a strong research ecosystem, which includes more than 20 of the best 100 research institutions in the world, as determined by factors such as the number of publications in academic journals, according to the Scimago Institutions Ranking of 2019. However, the region faces major challenges in relation to the commercialization of its scientific outputs.

Around 95% of the existing European patents may be dormant, while the remaining 5% of those contribute to more than 40% of the European gross domestic product, according to the European Patent Office.[49] In other words, European institutions conduct extensive research, but they are a long way from translating their inventions into tangible economic benefits to society.

Among other reasons, there is a lack of specialization in tech transfer in many research institutions across Europe, with differences within and across the same region. Some inexperience includes negotiating IP at technology transfer offices (TTOs), a low level of sharing of best practices among European countries and a fragmented regional legal framework that challenges the internationalization of start-ups. (See **Table 1**.)

Table 1. Summarized European SWOT on Corporate Venturing

Strengths	Weaknesses
Growing corporate venturing ecosystem More corporates joining efforts to seduce start-ups Local success cases of collaborations between start-ups and corporates High-growth start-ups originating locally Academic and practitioner talent with expertise in corporate venturing SMEs learning how to work with start-ups Strong infrastructure of research centers with publications in high-impact journals	Large corporates that are not agile, especially in highly regulated industries Corporate venturing units lacking the right autonomy to work with start-ups Different maturity stages of corporate venturing depending on sectors Corporate venturing performance indicators are related to short-term financial KPIs and, loosing (in some cases) long-term growth opportunities Lack of funding for scale-ups Regionally fragmented legal framework for start-ups Financial Valley of Death for science start-ups looking to cover the cost of proof of concept Research institutions that are slow, bureaucratic and distant from corporate financial goals
Opportunities	**Threats**
Open innovation is becoming a common tool among corporates New room for training, certification and advisory services on corporate venturing Some regions are more attractive than others for corporate venturing Universities profiting from commercialization of ideas Need for specialized training and certification of researchers and technology transfer officers	Possibility of a forthcoming recession Restrictive clauses in shareholder agreements can prevent involvement of corporates Lack of collaboration between corporates and university start-ups because of different performance indicators

Note: Corporate venturing is defined as the "collaboration framework that acts as a bridge between innovative and disruptive start-ups and established corporations." Please note that the list of items is not exhaustive.

Source: Prepared by Josemaria Siota (IESE Business School) based on expert insights and a literature review.

This context triggers the creation of specialized training for researchers in the technology transfer process, an avenue of education that business schools are starting to scale.

The financial Valley of Death in the building process of university spin-offs is still a challenge. At the beginning these start-ups can leverage the research funds of the affiliated institution, while at late stages they can ask for VC funds. However, in the middle, there are no effective mechanisms to finance the PoCs of those discoveries.

Companies such as BP are starting to explore new financial mechanisms in university spin-offs, such as pre-equity investments in which the corporate provides average funding ranging from €50,000 to €250,000. Then, the researchers have less than 12 months to create a PoC and validate the model. The success is measured by how many PoCs move to the next stage, which could be eligible for corporate VC funding from the same institution. In this process, while the researcher gets the required financing for testing, the corporation can recover the investment, in the form of a discount (e.g., 10%) in the next financial round of the university start-up.

Private accelerators such as 500 Startups and Y Combinator are also working in this field, getting funding from corporations to better prepare deep-tech start-ups from universities and research institutions.[27, 32]

Yet the future looks promising, with plenty of opportunities. Open innovation is becoming a common tool among corporates.[42] This is creating opportunities such as training, certification and advisory services in this arena. Since some of the mechanisms are so new, corporations are asking for advisers with experience and evidence-based knowledge who can support the deployment of specific parts of the value chain. This opportunity is greater for those mechanisms that are newer, such as with venture clients or excubators.

Furthermore, there are regions that are more attractive than others regarding corporate venturing—those with more demand, in terms of corporates looking to collaborate with those start-ups, and fewer high-growth start-ups on offer.

Within this promising future, what other aspects are relevant to take into consideration? In some investment forums, it is discussed the possibility of a forthcoming recession and an investment bubble concerning higher start-up valuations.[50] Although the higher valuations are supported with data, there is not yet a clear, evidence-based estimation of whether or when that is going to happen.

Some shareholder agreements can prevent corporates from becoming involved through the inclusion of tag-along or drag-along rights,* IP settlements, etc.—clauses that can be, in some cases, quite restricting.

Last, since venturing mechanisms can be very strategic, sometimes high-growth, innovative start-ups may not be able to collaborate with corporations because their strategic goals do not align. In other words, there may be high-growth-potential start-ups that have no corporation into which to fit. For example, in the case of university spin-offs, the spin-off may not fit with the corporate expectations, as university spin-offs usually take long-term time horizons to succeed, and have a high mortality rate.[51] Furthermore, research institutions run the risk of ending up with long-term illiquid assets because they are unable to commercialize their discoveries.[52]

In summary, there is an emerging awareness of corporate venturing in which corporations are learning how to cooperate with start-ups. This movement is creating new opportunities for start-up ecosystems.[1, 19, 32, 53, 54]

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* Tag-along rights are contractual obligations used to protect a minority shareholder, usually in a venture capital deal. If a majority shareholder sells their stake, it gives the minority shareholder the right to join the transaction and sell their minority stake in the company.

Drag-along rights are provisions designed to protect a majority shareholder. These enable a majority shareholder to force a minority shareholder to join in the sale of a company, giving to the minority shareholder the same price, terms, and conditions as any other seller.

2. Models of Interaction Between Corporations and Start-Ups: A Legal Point of View

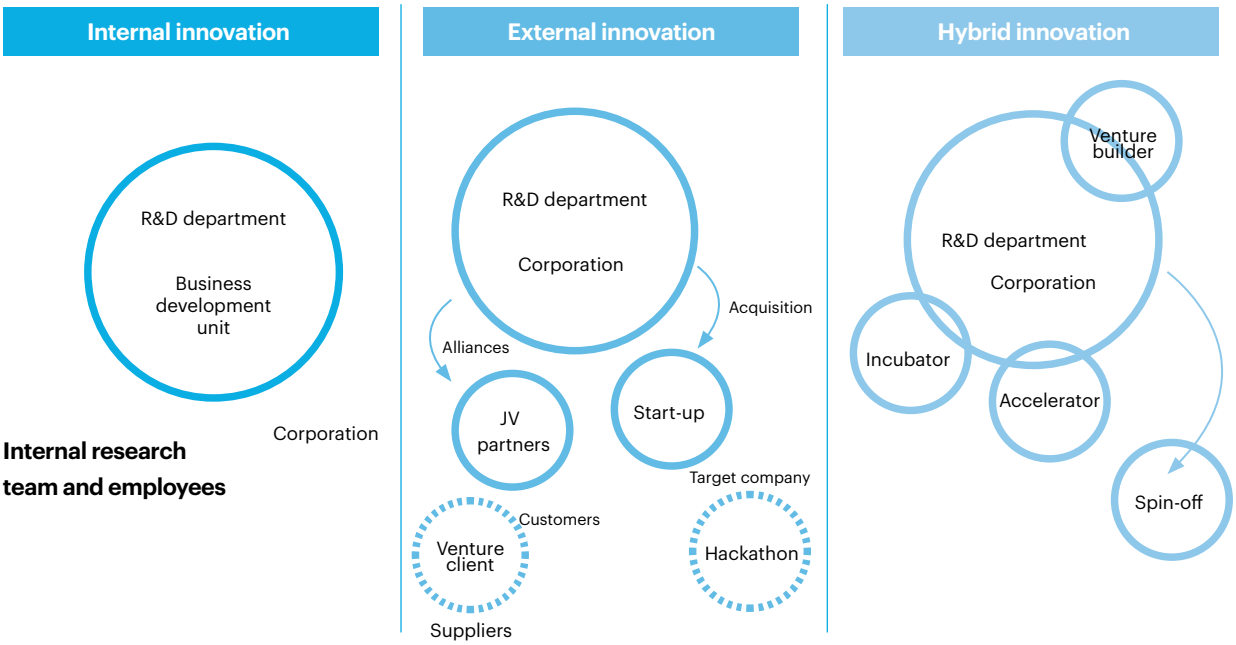
Corporate venturing is focused on innovation and is characterized by a reallocation of internal research and development resources to a new, clear target: start-ups. In addition, corporate venturing transfers traditional CVC to corporate start-up engagement as a tool for innovation, competitive advantage and business development, as well as a way of providing new solutions to complex problems.

Collaboration between start-ups and large corporates is key. Benefits are obvious for both sides. Corporates gain flexibility by developing solutions to face new needs, access to disruptive innovation and an agile and customer-oriented culture. Meanwhile, start-ups gain muscle, scalability, new distribution channels, technical knowledge and support in the search for market share and growing revenues. In terms of Schumpeter's thinking, start-ups help in the creative destruction of large corporations through reinventing themselves.[2]

Reflecting on characteristics, nature, objectives and legal considerations, we can understand the main drivers to gain scalability and capture investment. There are different means by which corporations exert influence over start-ups; the most traditional way of equity is through technology or market access. Collaboration between corporations and start-ups is not an easy path. Difficult barriers to overcome include different cultures, ways of understanding the environment, methodologies to face projects (agile versus structured methodology), aversion to risk and the generation of new realities, being locked into a business relationship and reputational issues. Understanding each other is crucial. A relevant aspect is to choosing the right model to start the relationship, clarifying expectations and objectives, finding the right team and defining responsibilities.

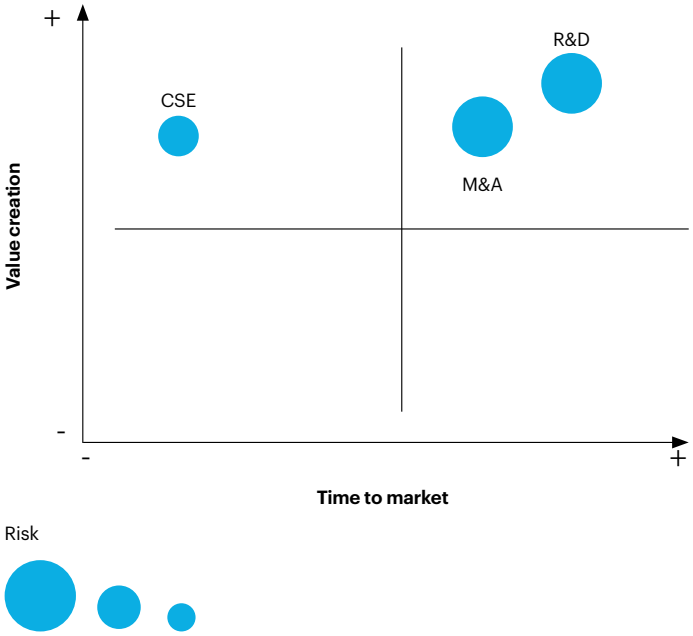
Most industries have been challenged by start-ups. Successful start-ups can achieve significant growth and are able to bypass corporations in a few years. In this context, corporations need to explore ways of gaining access to innovation, which can be done internally with traditional R&D departments, externally through acquisitions or by taking a hybrid approach via corporation-start-up engagement (CSE). (See **Figure 7**.)

Figure 7. Comparing Internal, External and Hybrid Innovation



Source: Prepared by Paola Riveros-Chacón.

Figure 8. Examples of Traditional Versus Innovative Approaches of Value Creation



Source: Prepared by Paola Riveros-Chacón.

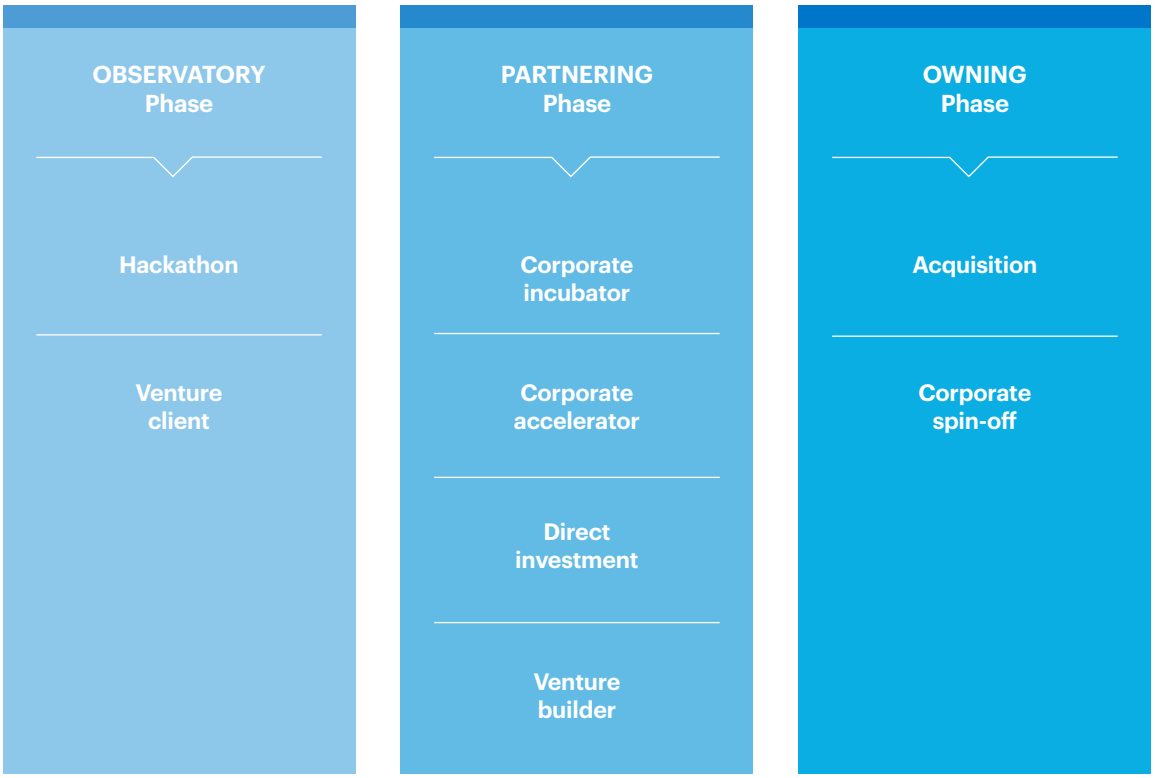
These different innovation strategies have diverse value creation results, time-to-market intervals and risk, as shown in **Figure 8**. These aspects should be considered in order to define the best fit. One way to innovate is using a CSE model, as most mature multinational enterprises recognize the need to plug into new trends, to listen for weak signals in their ecosystems and to bring in outside expertise.[55] Incumbent market leaders with the most to lose are the least likely to change, signaling the need to break through this culture to get consistent, mid-run results.[56]

A CSE ecosystem is a tool for shortening the innovation cycle, extracting value from technology, reducing risks, enhancing business capabilities, developing new capabilities quicker than big corporations and creating value.

The way in which corporations engage with start-ups is evolving constantly and can sometimes be confusing. Terms such as corporate incubators, corporate accelerators, venture builders and venture clients must be clarified in order to understand the corporate venture framework. There are several ways to analyze these mechanisms, depending on different factors.

From a legal standpoint, a clear and transparent contract ruling is basic. The field of regulatory affairs is a new core competence, essential for start-ups. It is the basis of research,

Figure 9. Corporate Venturing Models



Source: Prepared by Paola Riveros-Chacón.

development and innovation (R&D&i) legislation, reoriented from industry to entrepreneurs, labor contracting and more imaginative retribution formulas.

Determining what entity is controlling the intangible assets is what matters the most in terms of innovation. In other words, the owner of the IP and industrial property rights (such as patents, trademarks, software, domain names, utility models, know-how and business models), as well as the governance of the project and the relevant contracts, is fundamental for its development. This section focuses in particular on IP arrangements when considering corporate–start-up engagement models.

Regarding the regulation of IP rights, there is a matter common to all ways of interacting, which is engrained in the differentiation between background IP, joint IP and sideground IP. The definition of these terms may differ depending on the specific agreement. For the purpose of this analysis, "background IP" refers to any IP solely developed by a party before the agreement, "joint IP" is related to any IP jointly developed by the parties under the agreement, and "sideground IP" means IP that one party develops outside the scope of the agreement. In general terms, background IP shall remain with the party that provides it.

This section analyzes the different case scenarios, from those with the lowest level of corporate involvement to those with the highest level of engagement and, at the same time, the most traditional. This section also describes how these engagement levels mirror the control of the intangible assets and can be divided into three main stages. (See **Figure 9.**) First, the observatory phase includes mechanisms such as hackathons and corporate venture clients. Second, the partnering phase refers to accelerators, incubators and investment. Third, the owning phase involves acquisitions and spin-offs. Each case scenario also explains the financing instruments used to invest in or finance the project. Some models may share features from various phases and are not mutually exclusive. There is no contradiction if a corporation implements various models in parallel in order to achieve different objectives.

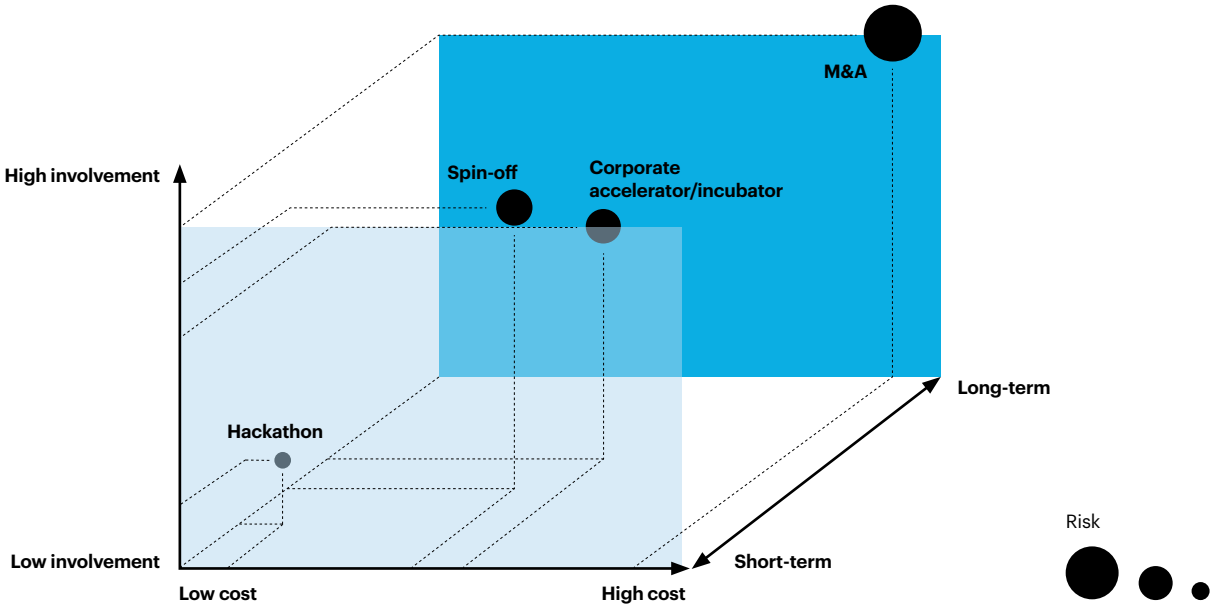
IP rights are some of the main assets from which a start-up can benefit. The appropriate use of these models plays a central role in fostering the innovation process, making start-ups more competitive and helping to bring high rates of return, enhancing their growth. As not all intangible assets are equal, a corporation must select the one that best fits its corporate strategy, considering all the potential costs associated.

There are different dimensions for categorizing coordination between corporations and start-ups in terms of required involvement, costs, time frame and risks. (See **Figure 10**.) These attributes should be considered in order to define the best corporate start-up engagement framework fit.

A complex matter to be taken into account in the partnering and owning phase models is start-up valuation—especially in the early stage—which is a highly conflictive point that must be clear to founders and investors beforehand. There are several valuation methods such as cost-to-duplicate, market multiple, discounted cash flow. Valuation may vary depending on the industry, the stage and the country. Another aspect that may benefit start-up valuation is to have a strong and settled team in place, as well as well-protected technology.

The following sections look at how to produce viable relationships, increase innovation or create jobs, and understand the differences among the corporate–start-up engagement models.

Figure 10. Some Mechanisms Classified by Involvement, Cost, Speed and Risk



Source: Prepared by Paola Riveros-Chacón.

2.1 Observatory Phase

The observatory phase is the lightest preliminary approach in terms of collaboration between corporations and start-ups. This phase is mainly oriented to the objectives of solving problems or having access to innovation but with little impact over culture, new process capabilities or financial returns. It's the first step towards a successful relationship in the long path of engagement.

The main mechanisms involved in this phase are hackathons and venture clients. The section below analyzes the main objectives, outcomes, considerations and agreements involved in these relationships.

2.1.1 Hackathon

A hackathon is an event that gathers entrepreneurs to test their ideas in solving a specific challenge over the course of a day or two. The word comes from the combination of "hack" and "marathon." "Hack" refers to the problem-solving process, and "marathon" describes the race or competition taking place during the program.

These events are aimed at instilling creativity and boosting the innovation process of the participating corporation, allowing it to connect with a dynamic and transformative environment, identify new ideas and promote entrepreneurs. (See **Figure 11**.) As described in the article "How Can Hackathons Accelerate Corporate Innovation?" (Flores et al. 2018, 167–175)[57] there are four enablers to be considered when organizing a hackathon:

"i) Strategy and leadership commitment: For cocreation events to be successful, they require: 1) an alignment with the company vision to determine strategic challenges for the event, 2) support from leadership to communicate the seriousness of the intent to potential participants, and 3) ensuring the results have the potential to grow and become real projects.

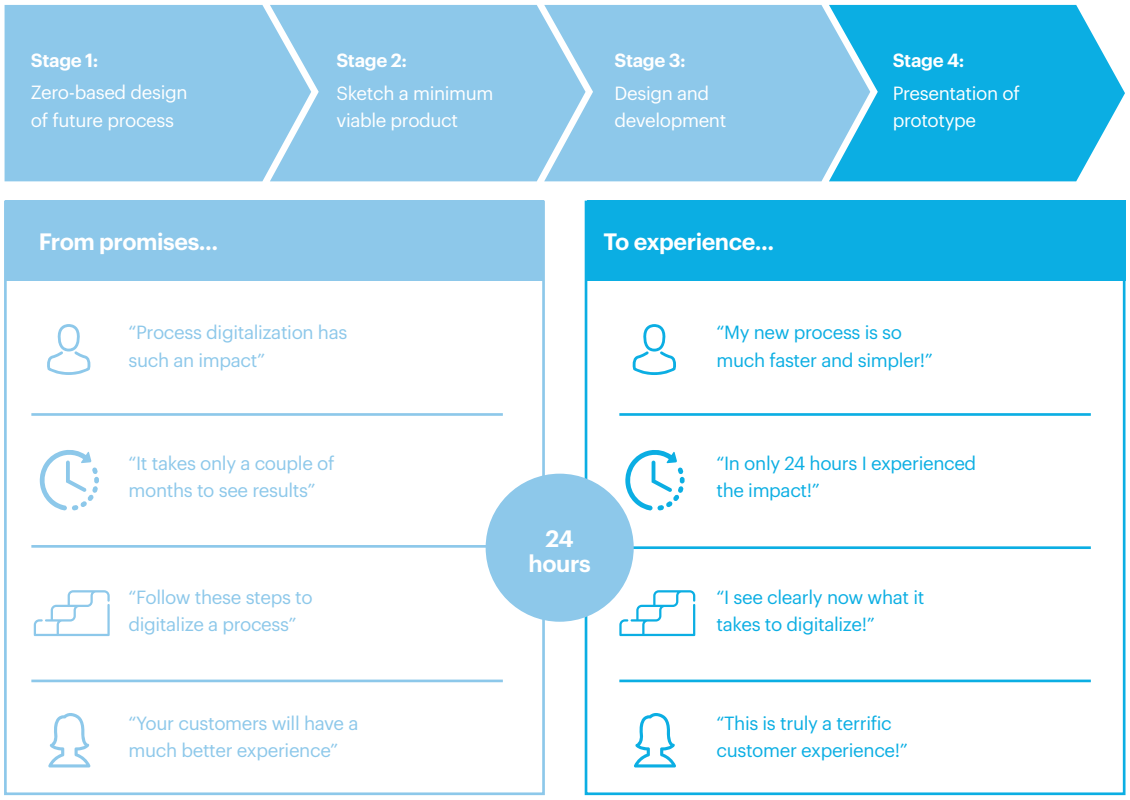
ii) Cross-functional collaboration: Experts from the same domain can only come up with ideas related to their area of expertise. Therefore, a wide diversity of participants is encouraged to ensure that out-of-the-box ideas emerge. It is key that employees interact with external participants during the cocreation events.

iii) Sustainable innovation process: To run a successful cocreation event, a simple, yet impactful innovation process is required. Commonly used methodologies for such events are: design thinking, lean startup, scrum, or a combination of these.

iv) Internal and external partnerships: Forming partnerships to organize cocreation events makes a big difference in whether the event will be a success or just another mediocre workshop."

Hackathons have mainly been developed by tech-sector companies, but lately the idea has spread to all sectors—

Figure 11. The Hackathon as an Accelerator for Digital Transformation



Source: Grijpink, Lau, and Vara, "Demystifying the Hackathon" (2015).[58]

including that of pharmaceuticals. Merck, a health-care company in the sector of life sciences, has launched several hackathons in the last few years in which participants gain access to mentoring and opportunities to network. The winners—in addition to receiving monetary prizes—are qualified to become part of Merck's incubator programs. The objectives of a hackathon are mainly oriented toward innovation, problem-solving and talent discovery. However, its short-term purpose doesn't make it a suitable tool to be close to the start-up and match its process capabilities, open new markets or improve the company's performance or financial results.

The value proposition is to get the best participants, coaches and jury talent, maximize participant experience and define the next steps for both projects and participants.

The Most Relevant Agreements Related to This Model
Participants in these programs must accept a set of terms and conditions (T&C). It is important to highlight that there are no standard terms for hackathons, except for a clause establishing that participants represent and guarantee that their work is an original work and does not infringe the IP or proprietary rights of any third party.

Regarding the intangible assets, some T&C establish that the IP or joint IP rights must be shared with or transferred to the corporation; others establish an exclusive license during a specific term or state that the IP rights over the results of the program shall remain with the participant.

The following are some examples of these kinds of clauses:

Ownership of Entries: Participant represents and warrants that the Entry does not violate any agreement or obligation to any invention assignment, proprietary information, confidentiality, non-solicitation, noncompetition or similar agreement with any employer or other person. Participant represents and warrants that the Entry is and will be Participant's own original work and does not and will not infringe the intellectual property or proprietary rights of any third party, including, without limitation, any third-party patents, copyrights or trademarks. Participant hereby agrees not to instigate, support, maintain or authorize any action, claim or lawsuit against the Sponsor, or any other person, on the grounds that any use of a Participant's Entry infringes any of Participant's rights as creator of the Entry, including, without limitation, trademark rights, copyrights and moral rights or 'droit moral.' Participant hereby assigns and transfers and agrees to assign and transfer to Sponsor all right, title, and interest in and to Participant's Entry and consequently Sponsor will have all rights to copy, edit, publicly display, publicly perform, broadcast, publish and use, in whole or in part, any Entry, in any manner without further compensation during and after the Hackathon.

At Sponsor's request and expense, Participant will assist and cooperate with Sponsor in all respects to execute documents and will take such further acts reasonably requested by Sponsor to enable Sponsor to acquire, transfer, maintain, perfect and enforce their intellectual property rights and other legal protections for the Entry. Participant hereby appoints the officers of Sponsor as Participant's attorney-in-fact to execute documents on behalf of Participant for this limited purpose. Nothing herein shall constitute an employment, joint venture, or partnership relationship between Participant and Sponsor. Participants will not receive any compensation from Sponsor in connection with any Entries. Each Participant acknowledges and agrees that Sponsor or other Participants or third parties may have developed or commissioned works which are similar to the Entry of Participant or Participant's team, or may develop something similar in the future, and each Participant waives any claims that Participant may have resulting from any similarities to the Entry of Participant or Participant's team.

Each Individual Participant confirms and undertakes that all Intellectual Property Rights resulting from, and connected to, the Product(s) created by such Individual Participant during, and in relation to, the Hackathon will be transferred unconditionally, royalty-free, irrevocably and non-exclusively, with the right to sub-license to [corporation name]. This rule on the Intellectual Property Rights will supersede any other contractual relations any Individual Participant may have with any affiliate of the [corporation name]. If, according to local laws, additional legal steps are needed to actually transfer the Intellectual Property Rights, such Individual Participant agrees to cooperate with such additional steps to arrange for the transfer.

2.1.2 Venture Client

Venture client is a new engagement strategy between start-ups and corporations that is gaining a lot of supporters. In this new model, the start-up becomes a supplier to the company. This model was first utilized when the BMW Startup Garage was founded in 2015, integrating start-ups into the innovation process.

At Munich Startup, Gregor Gimmy–the member of the BMW team behind this model–explained that they would "choose the best applicants, meaning market leaders who offer something that we at BMW and our current suppliers do not have yet. Start-ups that work with us have to be better than, say, Intel, SAP, Qualcomm or whoever might work in that specific field."

So, what's the difference between this model and other corporate venturing models? By making start-ups suppliers to corporations, this engagement agreement gives start-ups the assets they need the most: customers and a direct revenue source to finance their product development. They work together in a client-supplier relationship towards the creation of a product or service. Once the product or service is tested, the corporation could decide to invest in the start-up while simultaneously improving the success rate of this company. The venture client strategy is like a funnel, ensuring that the start-up has a high-quality team and the necessary technology. If the project becomes successful, the start-up becomes a supplier and may also get investment from the corresponding CVC unit.[59]

Additionally, this model allows the start-up to test and validate the project directly with a real client and to receive feedback in order to cover the gaps before launching the product or service. In order to make the cooperation work, the company must deal with a product that is still under development and not yet marketed or viable. The length of the program is usually 10 to 12 weeks.

BMW's program is directed at early-stage start-ups, which must be legal entities with a full-time management and development team and have at least received seed funding from an institutional investor.

Venture client objectives are mainly oriented to solving real corporate problems over the course of a long-term relationship to capture value through sales. This engagement model doesn't imply exclusivity in terms of opening new markets or sales channels and does not directly correspond to or improve financial results.

The value proposition in this model is oriented towards leveraging existing assets, making a profit for both the corporation and the start-up in a mutually beneficial relationship and, at the same time, establishing high-performance teams to develop a perfect fit to match the market. The momentum allows both parties to test the validity of their relationship to consolidate a long-term partnership in a short period of time, if everything works well. The effectiveness is direct insofar as in the products and services can be tried on real customers and, if successful, generate a new source of income for both partners.

The intensity of capital required is low and the partnership created in a client-provider relationship strengthens the integration between teams, making the venture client a perfect model that balances capital investment risks, access to innovation and a perfect team integration solution, delivering results in the short term.

The Most Relevant Agreements Related to This Model
There are two main agreements to be signed by the parties in the venture client model: a PoC and a supplier agreement, with the corresponding purchase order (PO).

The PoC allows the corporation to validate the usability, functionality and compatibility of the solution or product within its environment in no more than 10 to 15 weeks. Once validated, the parties will agree on the terms of a regular supplier agreement.

This model corresponds to a client-supplier relationship. As a consequence, the control of the project and its intangible assets remains with the start-up. Venture clients purchase a start-up's product, service or technology, not its equity. Nevertheless, if the relationship is successful, a corporate with low investment risk could enter as a shareholder once the quality of the team and the products offered are verified. These are two crucial elements in closing the best deal.

This model helps to validate the applicability of the product in a real-world-scenario.

2.2 Partnering Phase

During the partnering phase, challenging topics of collaboration arise between corporations and start-ups in terms of culture, closeness to business and exclusivity as a qualified channel. It is a maturing step in the long path of engagement needed to establish a successful relationship.

The main mechanisms involved in this phase are incubators, accelerators and venture builders. The following section analyzes the main objectives, outcomes, considerations and agreements involved in these relationships.

2.2.1 Corporate Accelerators

After observing the market, the next stage is to increase the degree of involvement with the start-up. This can be done through the corporate accelerator model, defined by Susan G. Cohen and Yael V. Hochberg (2014, 1–16) as "a fixed-term, cohort-based program, including mentorship and educational components, that culminates in a public pitch event or demo-day."[60]

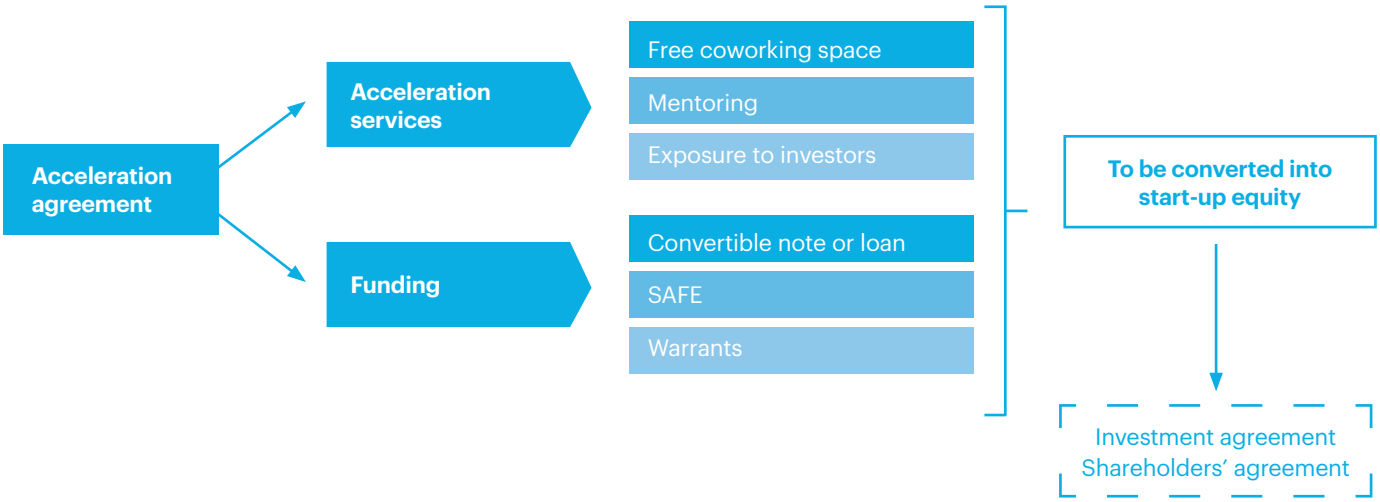
Corporate accelerator programs vary in nature, depending on different factors—such as the sector and the country. However, the program's core is always the same—to connect the corporation to external innovation. In most corporate accelerator programs, start-ups are created outside the corporation and apply to participate in the program in order to speed up the growing process and enhance their capabilities. Corporate accelerators usually offer structured mentoring and funding in exchange for equity that ranges from 5% to 10%. However, the size of the ownership stake depends on the investment, sector and stage of the start-up, among other factors.

The accelerator model objectives are mainly oriented to solving real business problems in a fixed-term program (12 to 24 weeks). The value proposition is leveraged on the existing assets that configure its suite of bundled services and a talented team, speeding up the growth of a start-up across different maturity stages (from seed to IPO), helping the start-up gain its next-stage funding. The accelerator start-up collaboration framework defines the transition from product invention to commercial product.

In this model we can differentiate between those corporations focused on achieving economic benefits through financial returns and those that achieve the results through innovation integration.

With regards to the control of IP rights and technology, these

Figure 12. Relevant Aspects of the Acceleration Agreement With Start-Ups



Source: Prepared by Paola Riveros-Chacón.

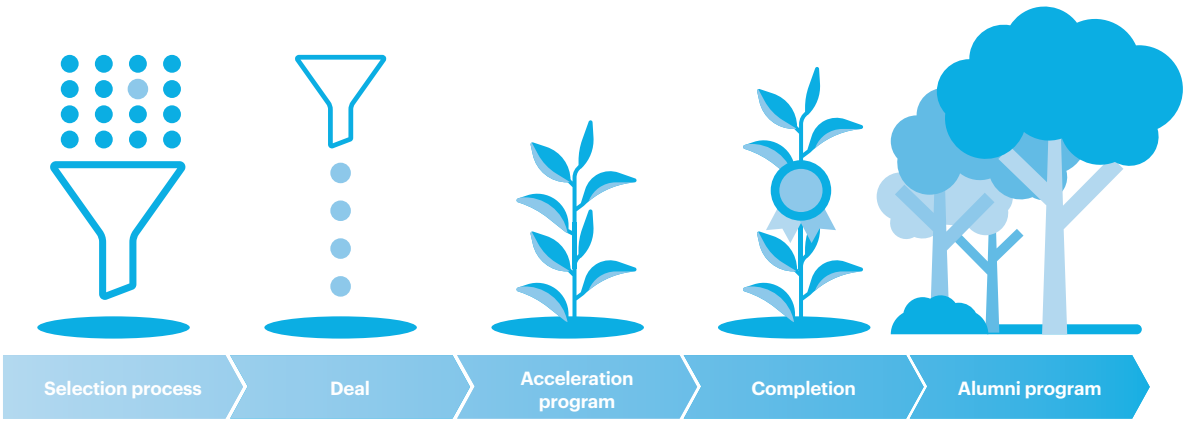
matters will be regulated in the investment and shareholders' agreements, and if there is also financing, it can be structured through a convertible loan agreement or a convertible note, as shown in **Figure 12**. This engagement model implies exclusivity in terms of opening new markets or distribution channels. Financial results are a key matter in the relationship. Accelerators create a narrowly focused pipeline of technologies and actively manage their industry connections and networking to gain traction. (See **Figure 13**.)

The Most Relevant Agreements Related to This Model

In order to participate in a corporate acceleration program, the first step is a due diligence process that is carried out by the corporation in order to confirm that start-ups entering the program comply with the corresponding corporate, tax, labor and remaining legal requirements. Once the due diligence process is finished, if satisfactory, there are two main agreements to be implemented in a framework agreement, generally known as an acceleration agreement, which regulates the acceleration process. Usually it consists of (i) money for equity, direct financing, financial support; or (ii) resources for equity, services oriented to the growth of the project or acceleration services. The financial support is frequently structured through a convertible loan agreement or a convertible note that regulates the terms and conditions under which the corporation grants a loan, which can be exchanged for shares of the start-up upon the fulfillment of certain pre-established conditions. There is also the possibility of establishing a simple agreement for future equity (SAFE) or warrants.

Loans can be issued with or without a conversion option. A convertible loan agreement can be defined as a financing instrument that mingles debt and equity. It is initially a loan that can be automatically converted into the start-up's equity in the event of qualified financing or at the discretion of the investor. The main advantage of this instrument is to avoid the issue of determining the valuation of the start-up at the disbursement of the funding, leaving this matter to be determined later in the qualified financing. Usually, investors in the convertible loan will be entitled to a stake in the start-up's shares at a previously agreed discount over the valuation (10% to 20%).

Figure 13. Stages of the Acceleration Program



Source: Deloitte, Design Principles for Building a Successful Corporate Accelerator *(2015).*[61a]

Among the most relevant terms to be included in a convertible loan are the following: conversion events, interest, discount, valuation cap and events of default.

It is also important to highlight that, despite the fact that investors are not equity holders, these agreements usually include some information rights and covenants to protect their investment. In this sense, certain decisions—like payment of dividends, mergers, acquisitions or liquidation of the company—may require the prior consent of the investor.

A SAFE[61b] is an instrument that was introduced by Y Combinator in 2013, and it is used by many start-ups—mainly for seed series fundraising. According to Y Combinator's description:

A SAFE is not a debt instrument, but is intended to be an alternative to convertible notes that is beneficial for both companies and investors.

Why: *1. Debt instruments have requirements—including regulations, interest accrual, maturity dates, the threat of insolvency and in some cases, security interests and subordination agreements. These requirements can have unintended negative consequences.*

2. A SAFE is intended to be simple for both companies and investors, with the usual path to agreement requiring the negotiation of only one item—the 'valuation cap.'

3. A simple equity security has the potential to become standardized, and a standardized form has the benefits of certainty and speed, which in turn results in lower (or zero) transaction costs for companies and investors.

When: *Most start-ups need to raise money soon after formation in order to fund operations, and the SAFE can be a vehicle for investors to fund companies at that very early stage. Unlike the sale of equity in traditional priced rounds of financing, a company can issue a SAFE quickly and efficiently, without multiple documents and the necessity of a charter amendment. As a flexible, one-document security, without numerous terms to negotiate, the SAFE should save companies and investors money and time.*

How: *The investor and the company agree on the valuation cap, mutually date and sign a SAFE and the investor sends the company the investment amount. What happens next? Nothing, until the occurrence of one of the specific events described in a SAFE. In the meantime, an outstanding SAFE would be referenced on the company's cap table like any other convertible security (such as a warrant or an option).*

Finally, in the start-up ecosystem, warrants can be defined as instruments that grant the holder the right to acquire equity (as the underlying security), for an agreed exercise price, during a specific period of time. Warrants can be exercised for common equity or preferred stock in the start-up.

On the other hand, the acceleration services usually consist of free access to coworking spaces, industry connections and support services, such as mentoring, legal, accounting and business consulting, and technical support. These services are provided in exchange for equity, granting start-ups access to key resources that will boost their growth with higher success rates.

The following sections will provide further information on the acceleration agreement and its follow-up, the investment and shareholders' agreements.

2.2.2 Corporate Incubators

Although corporate incubators have been widely analyzed in the last decade, there is no clear definition that encompasses all the aspects related to this type of mechanism. As noted by Kuratko and LaFollette (1987),[62] the task of defining an incubator has become difficult because the original concept is being adapted to fit the needs of different economic areas.

Corporate incubators are specialized corporate units that hatch new businesses by providing physical resources and support. These can either be external start-ups or internal intrapreneurs with a promising business idea or technology, which will henceforth be referred to as 'technology ventures'.[63]

As noted by Becker and Gassman (2006), for large technology-driven companies, four corporate incubator types can be distinguished: fast-profit incubators, market incubators, leveraging incubators and insourcing incubators, according to source and type of technology.[63]

The typology of corporate incubators is derived from distinguishing the mission of the corporate incubator according to its source of technology, from within or outside the corporation, and by its type of technology as a core or noncore technology. The features of each type can be summarized as follows:

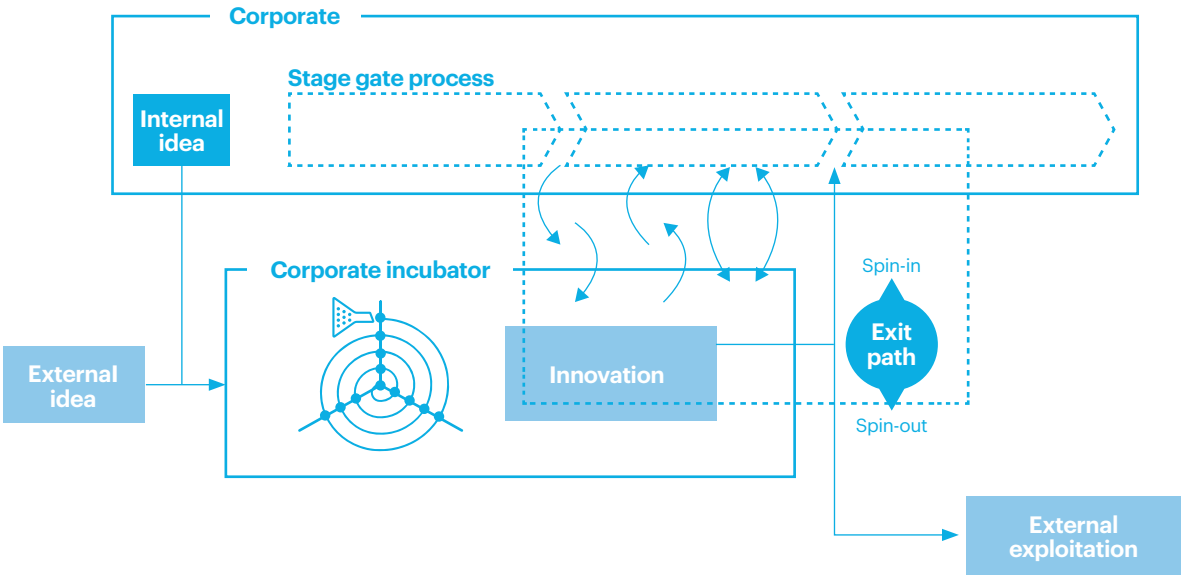
The fast-profit incubator commercializes noncore technology for a later spin-off. It utilizes internally developed technologies, such as unused patents, through setting up and funding technology ventures with the end goal of exiting through a spin-off to make a profit. Examples of fast-profit-incubators are BT Brightstar, Nokia Ventures Organization and Siemens Technology Accelerator.

The marketincubator develops a market for a complementary noncore technology to increase demand for its own technology and products. It takes a unique position in supporting the development of complementary technologies without potential acquisition goals. Examples of market incubators are Novartis Venture Fund and Siemens Mobile Acceleration.

The leveraging incubator takes advantage of internally developed technology to commercialize it for the market (inside-out innovation), thereby supporting the growth of the corporation. It strives to increase the utilization of internally developed technologies. Through matchmaking central R&D with market units, it increases the commercialization of current or future core technologies to be integrated into core businesses in the future. Lucent New Ventures Group, Reuters Incubator and Siemens Technology Accelerator are examples of the leveraging incubator.

The insourcing incubator sources emerging external technologies that might be of interest to the corporation for potential spin-in (outside-in innovation). It exits from the

Figure 14. The Corporate Incubation Process



Source: Christoph J. Selig, Tim Gasser, and Guido H. Baltes, "How Corporate Accelerators Foster Organizational Transformation: An Internal Perspective," IEEE (2018).

technology ventures through integration into the corporation, either through an existing business unit or through the formation of a new business unit. Insourcing incubators can be found at several corporations and include Bertelsmann Corporate Ventures, Motorola Ventures, Panasonic Internet Incubator and UPS Strategic Enterprise Fund, to name a few.

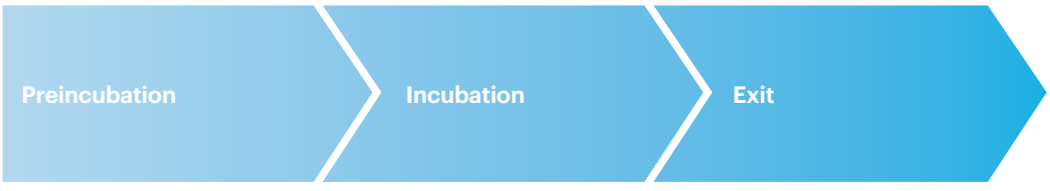
Corporate incubators represent a kind of results-oriented incubation. (See **Figure 14**.) It is important to note that some models develop and take new forms—as in the case of the aforementioned fast-profit incubator—which usually become a spin-off.

Depending on the ecosystem and the country where it develops, the incubator model may vary. In the most common incubator models, the corporations keep all related IP rights that are generated and developed inside the corporation (mainly because the company that owns the incubator has created and promoted the conditions necessary to generate business) until the new company is created as a separate legal entity (newco). At this point, the corporation usually keeps a percentage of the share capital of the newco.

Corporate incubators usually target sectors relevant to the main business of the parent company. However, there are some cases in which the sector can be completely different.

What do Nokia, Siemens, Panasonic and Novartis—large corporations from different industries—have in common? All have successfully established a corporate incubator that continues to operate despite reduced incubation activities from a downward economy. The corporate incubator can act as a knowledge hub of business-building expertise, where good ideas have a place to go as well as from which knowledge is transferred to other units in the corporation. Researchers have not yet constructed a typology of these corporate incubators nor identified the different knowledge modes.[63] The incubator-model objectives are mainly oriented to creating a self-sustaining mature business and to solving real business problems in a long-term program (on average, 33 weeks). (See **Figure 15**.) In this case, the incubator doesn't provide funding. Incubators create a pipeline of technologies.

Figure 15. The Incubation Process



- Diagnosis of needs
- Integration into the corporation
- Origin of ideas
- Selection of tenants
- Involvement of corporate employees

- Incubator program
- Resource allocation (coaching, network, business support, financing)
- Involvement of corporate employees

- Internal ideas:
  - Spin-off
  - Sale of an idea
  - Integration into the corporation
- External start-ups:
  - Acquisition
  - Purchase of shares
  - Supplier contract

Source: Rebecca Hirte, Laura Drost, and Jürgen Münch, "Incubators in Multinational Corporations: Development of a Corporate Incubator Operator Model," IEEE (2017).

The Most Relevant Agreements Related to This Model
The legal structure implemented by corporate incubators is similar to the one described for corporate accelerators, where specific services and obligations are included for an early-stage project. The term of the incubation agreement is longer than that of corporate acceleration, as incubation programs require more time and dedication. The services are mainly focused on incubating technology, project or business ideas into marketable products or services, through mentoring, professional services (accounting, legal and management) and provision of facilities.

The financial models utilized are also similar to the ones analyzed for corporate accelerators: convertible loans or notes, SAFEs and warrants, among others.

2.2.3 Venture Builders

Corporations may also cocreate a start-up to develop a particular project, idea or enter a specific sector and test its viability. This model may start in-house with an incubation process or can be outsourced by partnering with a firm or venture builder, providing capital in exchange for an equity stake in the start-up. This model helps in the creation and launch of fully operative ventures, designed from scratch with the attributes necessary to grow by themselves.

Venture builders may also engage corporations by identifying business ideas on an outside-in, disruptive innovation approach, looking for and building talented teams, finding capital, directly managing the ventures and becoming deeply involved in the day-to-day operations, providing shared services for long periods of time and employing entrepreneurial methodologies.[64]

In this sense, there are three different kinds of venture builders: in-house inside-out innovative venture builder (where a corporation owns the venture builder and the start-ups born from its efforts), venture builders working for investors (where the venture builder holds equity in the different ventures and charges fees for the services provided), and venture builders working for corporations (charging fees in exchange for their services).

All of the different models help companies to develop a pipeline and portfolio of viable ventures from the organization.

The objective is to create fully operational companies with the best team—chosen specifically for them—and to launch and accelerate the business, find funding capital to make the venture viable in the long run and proactively support the venture. (See **Figure 16**.)

The in-house venture builder tries to empower innovation, and build internal capabilities and culture to create valuable ventures to solve new customer needs. Disrupting from the inside out through a venture builder helps a corporation to develop alternatives to transform the future from within. The corporation owns the venture builder not only as an investment vehicle but also as a channel of innovation.

Venture building as a service goes through different steps. Firstly, innovation—where a multidisciplinary team explore an area or opportunity during a four-month period, applying agile or lean methodologies in order to design business concepts, customer journeys, PoCs and prototypes. Secondly, incubation—MVP and team building over the course of no more than six months, with the objective of checking the product-market fit. Lastly, commercialization—during which the main effort is focused on the growth and creation of the structures to make the venture viable.[64]

The venture builder model objectives are mainly focused on solving real business problems in a long-term, support-driven relationship, oriented to capturing value through sales. This engagement model implies exclusivity in terms of opening new markets or distribution channels and in terms of financial results. The key for venture builders is the quality of the team hired to create, launch and grow an operational company.

In this scenario, the corporation usually shares control of the project and its intangible assets with the start-up. The specific terms of governance must be established in the shareholders' agreement. In general terms, it is said that corporations will be represented by the board and will decide on high-level matters, while the team running the start-up will take care of the execution of the project. In the case of a venture builder as a service, the procurement agreement approach is ruled by the purchasing procedures.

2.2.4 Direct Investment

Start-up financing has changed significantly during the last 10 years due to a lack of trust in financial institutions, originating in the financial crisis, as well as digitalization that eases bottom-up initiatives driven by platforms in a digital circular economy approach, facilitating direct relationships between start-ups and corporate investors, without intermediaries, according to Langley and Leyshon (2016). Direct investment in start-ups is no longer just a matter of professional, qualified investors but a very sophisticated reality achieved through platform-based funding models.

This model consists of direct CVC investment in exchange for a minority stake in the start-up. This is the second-most common kind of engagement between corporations and

Figure 16. Venture Building Process

Source: Prepared by Paola Riveros-Chacón.

start-ups behind start-up partnership programs.

The corporation allocates funds through direct investments and applying alternative innovative solutions or prospective technology platforms to address unmet needs. This investment approach is directed at early-stage and higher-risk opportunities, in areas adjacent to or even beyond a corporate focus, aiming for high financial returns.

Direct investment implies that corporations take on a passive role in the chosen portfolio companies. The screening process is particularly important in this model as the high uncertainty surrounding start-ups makes these kinds of direct investments highly risky.

Equity investments can also be considered a traditional way of engaging with start-ups, given that most start-ups need resources. Start-ups attempt to attract investment from VC funds, but also from corporations. There are different forms of investment, whereby corporations can inject the funds directly into the start-up in the form of equity, or through a loan or debt. Most of the time a convertible loan will be used, with specific terms for its future conversion into equity.

Investment can also include additional services to be provided by the investor, such as customer access. This is the case of Coca-Cola, a minority investor in a 2012 financing round of Spotify. Coca-Cola added Spotify's branding to its cans, giving Spotify access to Coca-Cola's massive customer base.

In order to explain the investment process, we will divide it into two main stages that can be summarized as follows.

The first stage includes term sheets, confidentiality or nondisclosure agreements (NDAs) and due diligence processes. When dealing with early-stage start-ups, the due diligence process will be limited to the verification of the IP rights, the technology and the team. When start-ups have already received some investment, the due diligence process will also include incorporation, good standing, labor and compliance-related matters.

The second stage includes the negotiation of the main terms of the final agreements: the investment agreement and the shareholders' agreement. The founders will negotiate the economic and political rights, which depend on the outcome of the due diligence. Founders and investors must find common ground in order to establish agreements that accurately reflect their expectations.

The investment agreement regulates the way in which the existing shareholders will increase the share capital of the start-up. The investors will subscribe[ii] for the shares, as well as agree other important terms, such as the amount and disbursement of the investment, the use of proceeds of the investment, the waiver of all rights of first refusal, pre-emptive rights, notices or consents, postclosing commitments, representations and warranties.

The shareholders' agreement establishes the economic and political rights of the shareholders, including the terms and conditions that shall govern the relationship among the shareholders and between the shareholders and the start-up; the operation, governance and management of the company; the transfer of shares, the antidilution rights in case of future down rounds and the rules regulating the exit, including allocation of proceeds, among others.

In this scenario, depending on the amount of the investment or the loan, the corporation usually establishes some specific rights in order to have limited control over the intangible assets and some influence on the decisions that may affect the project.

Media for Equity

Media for equity (MfE) is another option to implement the investment, mainly used by media companies, whereby a corporation offers media advertising, coverage and related services in exchange for a start-up's shares. The first matter to be agreed on in this model is how to value a media campaign. When there is a reference market value, the parties usually settle on an amount a little below the average market value.

This alternative offers start-ups the opportunity to gain visibility and target potential clients without spending cash reserves and is usually combined with other financing alternatives.

This model is not recommended for early-stage start-ups, as the technology, service or product must be ready to bring to market. It is also important to highlight that, due to its nature, this option only works for business-to-customer services.

The direct investment model objectives are mainly oriented to obtaining a financial return or a preliminary validation of a promising, high-risk-reward start-up. This engagement model implies a passive approach to the relationship between corporations and start-ups. It is based on financial performance more than other considerations, such as sourcing of innovation or best practices.

2.3 Owning Phase

The most challenging collaboration topics between corporations and start-ups come to fruition during the owning phase in terms of culture and long-term involvement, closeness to business and exclusivity. It is the most mature step in terms of engagement and the main value capture is through equity.

The main models involved in this phase are spin-offs and acquisitions. The next section analyzes the main objectives, outcomes, considerations and agreements involved in these relationships.

2.3.1 Corporate Spin-Off

A corporate spin-off has been traditionally understood as a divestiture carried out as a corrective measure to restructure a company. It differs from the spin-offs created by universities and public institutions that opt to commercialize the results obtained through research activities. In this study, we are analyzing spin-offs based on their ability to create an innovative environment, promoted by the corporation to boost a specific internal objective and in terms of flexibility and agility—whether or not the unit is capable of developing new products or technologies. Start-ups can also benefit from a corporation's expertise, resources and management team.

Peruffo et al. (2014) commented on their importance, "The relationship between spin-offs and innovation is of particular interest and relevance. A review of the literature and an analysis of possible implications in terms of the innovative performance of the decision to spin-off reveals how spin-offs can actually encourage innovative performance."

In this scenario, the corporations usually maintain a high degree of control over the project and its intangible assets, where, in most cases, the corporation is the majority shareholder.

As an example of a spin-off followed by a spin-in operation carried out by a corporation, Cisco Systems Inc. and the start-up Insieme are a noteworthy case. Cisco funded Insieme with around $100 million, reserving the right to acquire the start-up. In reference to the operation, Cisco explained:

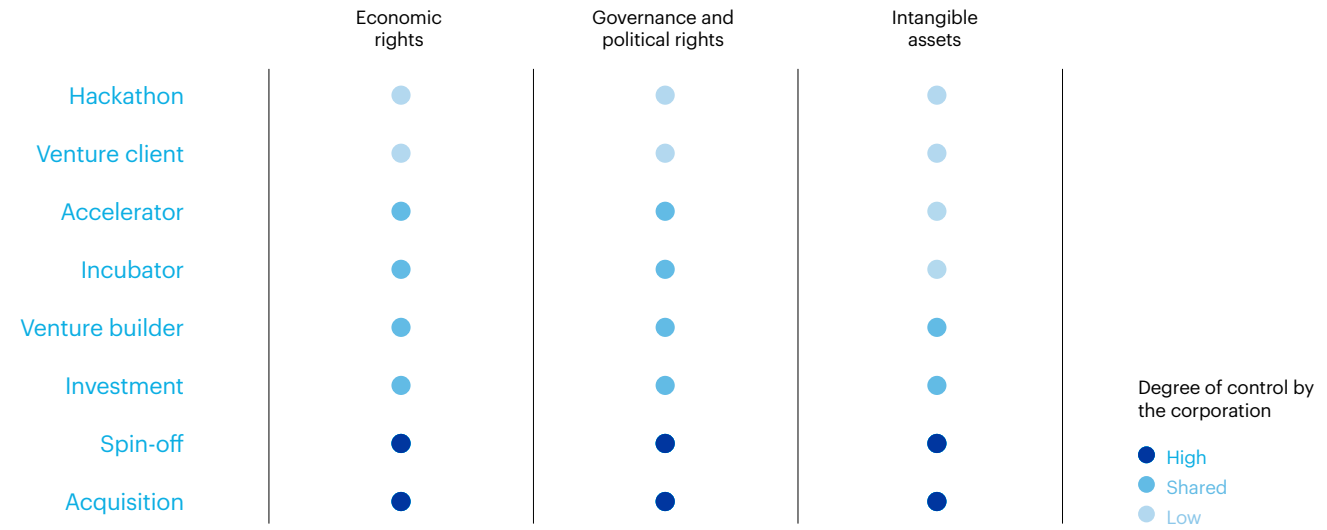
"Insieme's product development efforts are complementary to that of Cisco's current and planned internal investments. Insieme and other internal programs will be components of Cisco's broader programmability framework. These types of investments have strongly benefitted Cisco in the past, and we will continue to look for similar ways to complement our internal development capabilities."[65]

Steve Glaveski (2017) presented some reasons corporations should spin off independent companies: "They are free of the corporate bureaucracy that inhibits speed and innovation (and oftentimes, fulfilling work); they have their own resources, processes and values to help unleash entrepreneurship; they have smaller overall revenues and therefore can go after smaller and/or emerging markets, which is usually where disruptive innovation begins (such markets are often too small for large parent companies to consider); they can introduce more direct incentives, such as stock options, which compensate management of the new company, leading to improved operating performance; they have clearer accountability and responsibility, with less reporting lines and layers of approval than the parent (less time in steering committees, more time doing); they get the full attention of management, rather than being seen as non-core and an afterthought; and they become investment and/or acquisition targets and can also IPO separately."[65]

2.3.2 Acquisitions

In this scenario, the corporation acquires the start-up, gaining control of the project and its intangible assets. As mentioned previously, acquisition is a traditional method to implement outside-in innovation and access external knowledge. This is the main reason why, according to PitchBook, the top 10 buyers of

Figure 17. Degree of Corporate Control via the Corporate Venturing Mechanism



Source: Prepared by Paola Riveros-Chacón.

internet technology (IT) companies in the last 10 years are Google, Facebook, Yahoo, Oracle, IBM, Cisco, Twitter, Microsoft, Apple and Salesforce.

Acquihire

The term "acquihire" was coined by Rex Hammock as "acqhire" in 2005. It describes a way of recruitment by which the corporation acquires the start-up and establishes the obligation of the management team to continue working for the corporation. This method of talent acquisition is mostly used in the technology sector, where companies like Nokia, Google and Facebook have acquired start-ups in order to hire their teams. Founders are often a start-up's most valuable asset, and acquihiring allows corporations to gain access to know-how and entrepreneurial spirit. According to Selby and Mayer (2015): "We propose that three distinct benefits may be derived via this strategy: 1) the preservation of dynamic capabilities and tacit knowledge embedded in the start-up's team dynamics; 2) the prevention of knowledge leaks which might hasten the decay in value of the new human capital; and 3) the protection of the acquired firm's innovation potential."[66] As environmental and competitive pressures increase the regularity of hiring via acquisition, these findings may have significant implications for the understanding of how firms compete via human resources.

In this option, apart from the agreements already described for the investment process, it is important to regulate the employment relationship between the team and the corporation. The contracts with the key employees must include exclusivity and noncompete clauses; it would be also advisable to have an incentive plan to further motivate and reward them.

Having analyzed some of the ways of interaction between corporations and start-ups, **Figure 17** shows the range of control over the project and the intangible assets.

Some Aspects Impacting the Model

As can be deduced from previous sections, the model of engagement to be implemented by the corporation must be defined—depending on the objectives and the type of return expected. The following factors are among those to be considered when choosing the model (see **Figure 18**):

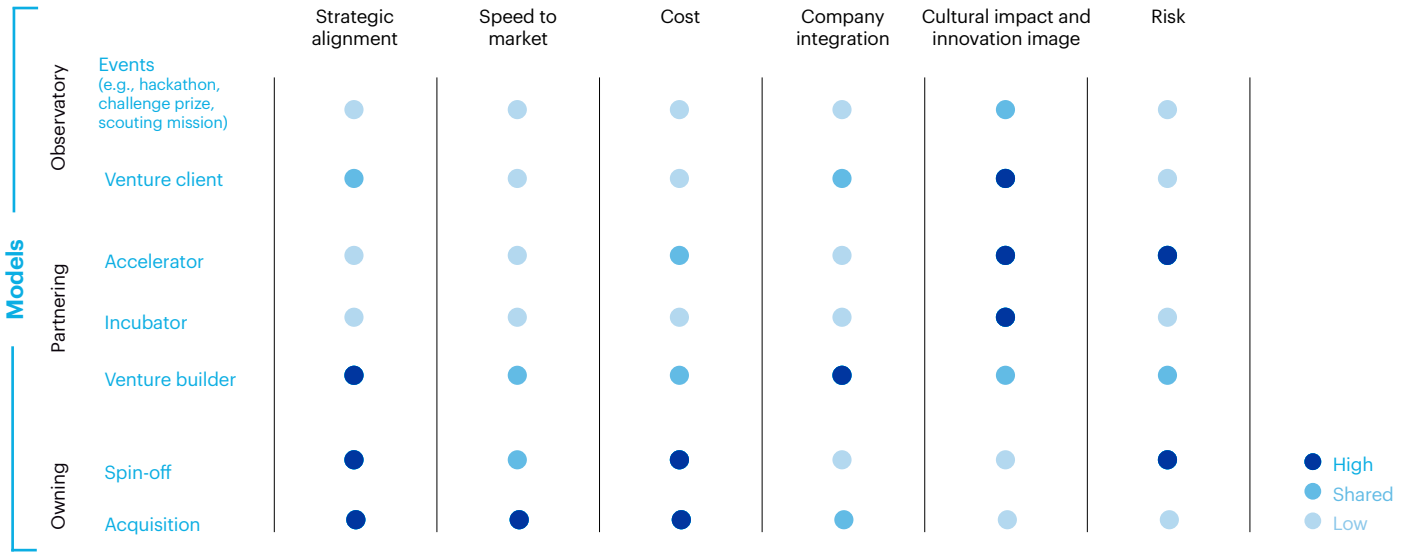
Corporate strategy: Acquisitions and investments are the most recommended models if there is a strategic rationale: for example, to explore new markets or to tackle specific challenges already identified by the corporation. Incubators, accelerators and spin-offs are most recommended when the corporation aims to foster and enhance innovation. Investment is a good way to mix a financial and a strategic return and, depending on the amount of the investment, it can generate a high degree of involvement with the start-up. Hackathons are a way to observe and connect the corporation to a challenging environment in order to explore new ways of solving problems and obtain information about the state of the art.

Objectives of the model (short-, medium- and long-term): Google, Microsoft, Novartis, Johnson & Johnson and Merck are among the companies with the highest R&D expenditure, whereas all of them are interacting in some way with start-ups—simultaneously reducing the time to market and the amount of the investment compared with the traditional acquisition model. However, each model has a different time frame required to obtain returns, and it depends on the cost of the investment or acquisition, the stage of the start-up and the sector being targeted by the corporation.

Associated internal resources (economic, human and operational): Another aspect to be considered in the implementation of the model is which internal resources are going to be dedicated to the start-up and to the project, keeping in mind that the acquisition model is usually one of the most expensive mechanisms in the short term.

Conditions affecting the start-up (legal, regulatory and corporate matters): An additional critical aspect to address when analyzing the model is the regulatory matters that can impact start-up culture. There are several examples of legal battles between new business models and legal gray areas.

Figure 18. Aspects by Mechanism: Alignment, Speed, Cost, Integration, Mind-Set and Risk



Source: Data from Byld adapted by Paola Riveros-Chacón.

2.4 Remuneration

The other important aspect to consider when analyzing the models of engagement between corporations and start-ups is remuneration. In corporate venturing, compensation is granted in a different way than for traditional VC investors. Corporate venturing uses various retribution formulas, including a variety of cash and equity from parent companies.

It is usually said that VC employees are better compensated than those from the corporate venturing world, due to the fact that some VC compensation systems are not compatible with large corporations. However, there are several ways to address these remuneration issues. Excluding hackathons and the venture client model, in which corporations do not need to incentivize the performance of the team in the long run, incentive plans can be implemented in all remaining models. In this section we will describe the most common types of incentives to be given to corporate venturing managers, founders and employees. (See **Table 2**.) Stock incentive plans have been traditionally used by companies in the United States for two primary purposes: as tools of corporate governance to align the interests of top managers and shareholders, and to motivate managers to maximize shareholder value.

Granting collaborators or key employees shares in the start-up through a stock-options plan was usually seen as a good and motivating idea. However, the transfer of shares implies rights that may affect the decision-making process and generate complex issues in the start-up.

In this scenario, phantom (or virtual) shares or stock appreciation rights are a good option to address those issues by giving economic rewards to beneficiaries, allowing the beneficiary to realize the economic value of her virtual shareholding only in the case of a liquidation event. Virtual shares will usually be distributed over time.

Table 2. Compensation Systems

	Incentive stock (IS) options	Restricted stock (RS) plan	Phantom stock (PS) plan
Description	Beneficiaries are granted options to purchase common stock at a price fixed at grant, exercisable for a defined number of years into the future.	Company stock is granted to a beneficiary, subject to forfeiture, unless vesting conditions are satisfied.	A plan that grants economic awards that are valued based on the company's common stock (virtual participations).
Type of interest	Conveys right to acquire company's equity.	Conveys right to acquire company's equity with associated restrictions that lapse in the future.	Conveys percentage of value of the company. No incidences of ownership. No political rights.
Distributions payable in	Stock.	Stock.	Stock.
Who grants the incentive?	The company to founders, key employees or collaborators.		
Out-of-pocket expenses to plan's beneficiary?	Beneficiary must pay for shares purchased at the stated exercise price, normally subject to a discount with respect to the market value, to be able to exercise his or her option and acquire the shares.	Shares awarded for no cost.	There is no disbursement by the beneficiary: the beneficiary must not pay any amount to collect the phantom shares.
Tax treatment	Depending on the member state regulation, it is usually taxed on discount at the exercise of the option. For example, in Spain there is a €12,000 exemption from income tax, if shares are held for at least three years after the purchase date and certain other requirements are met.	Depending on the member state regulation, RS is usually taxed at vesting. Taxable amount is fair market value of the shares.	Depending on the member state regulation, PS is usually taxed at payment. Taxable amount is amount of the cash payment. For example, in Spain, a reduction of 30% can be applied if certain requirements are met (tax deduction): if the generation period is greater than two years, that beneficirty has not been enjoyed in the last five years of this reduction and if the payment of the incentive is not split over more than one year.
Vesting	May condition right to exercise, establishing the completion of stated number of years of service or specific performance goals.	May condition right to exercise the completion of stated number of years of service or specific performance goals.	May condition right to exercise, establishing the completion of stated number of years of service or specific performance goals.
Payment triggers	At the date agreed for the exercise of the option, the holder may acquire the corresponding shares by payment of the agreed price.	At fulfillment of the vesting conditions.	The liquidation event triggers the payment obligation (i.e., the sale of the company, the distribution of dividends or an IPO).

Source: Prepared by Paola Riveros-Chacón.

2.5 Tax Impact

This section addresses the impact on taxes from a pragmatic standpoint. Founders try to get the highest valuation possible in order to attract the maximum financial contribution from investors during the investment process, whilst maintaining the highest possible percentage of ownership.

However, considering that the founders' contribution is mainly based on the initial idea, their own workforce and some intangible assets (e.g., patents, software developments or other soft assets), there is an evident asymmetry between founders' and investors' contributions, with evident implications in terms of founders' taxes.

There are other types of corporate activities that can have an impact in terms of the taxes levied on founders such as uncovered assets and gift taxes due to dilution. The CVC investor should try to bear this in mind in order to cover these pitfalls and help the founders with their tax planning and with the provisioning of funds to face all these duties. There is a tendency to reduce tax risks for the founders in favor of the corporate investor, especially in liquidation or capital preferences.

At the same time, it is important to consider which tax incentives are available that help to foster investments in start-ups, and that act as an enabler to increase overall productivity and job creation.

Income or capital taxes could have a huge impact, when analyzing the risks of investing in start-ups, and tax policies have a determining role in supporting these growing and innovative businesses by increasing their supply of capital.

The best practices in taxing corporate start-up engagement models should consider the following ways of reducing tax quotas: capital gains tax exemption(s), loss relief to eligible investors rather than the baseline tax system, up-front tax benefits to eligible investors, relief on income generated over the lifetime of the investment, relief on gains realized upon disposal of the investment, tax credits as an instrument to incentivize corporate investors to buy equity in a start-up, tax deductions to incentivize certain kinds of activities to expand the productivity or rate of job creation, and tax deferrals that postpone taxation for small businesses until future liquidity events.[67]

These benefits are granted based on selection criteria such as business age, size and specific sector focus in order to target start-ups. There are certain conditions related to maximum investment values and minimum holding periods.

Generally, it is recommended to benefit equity investment. Meanwhile, debt investment operations shouldn't be eligible for these incentives.

All of these incentives are typically calculated over the following tax bases: invested income in qualified equity, capital gains on disposal of investments in qualified equity, dividends, and capital losses on disposal.

In summary, this chapter has described some of the most popular mechanisms of collaboration between established corporations and innovative start-ups, deep diving into some of their characteristics.

3. Corporate Venturing Group Roles and Current Trends

3.1 The Differing Roles of Corporate Venturing Groups

3.1.1 The Value and Benefits of Corporate Venturing to Large Industrial Firms

It has often been proposed that the primary purposes of CVC units are information acquisition, through learning from entrepreneurial start-up firms, and the assessment of potential targets for acquisition. Given the development timescales of new products, R&D project costs and patenting practices vary widely among different industries—as do corporate venturing practices. This section reviews some of the literature on the purposes of CVC activities (i.e., the benefits to the parent firms). It considers how the conclusions from this work fit with current practices in the pharmaceutical and biotechnological industries and variations in practices across industries. Consideration of the life sciences and medical technology industries is merited due to their economic importance, the strength of these sectors in Europe and the long-established CVC tradition in these fields. Corporate venturing practices in these fields differ in some respects from those that are commonly applied in other domains. This fact highlights how CVC practices need to reflect industry characteristics (e.g., development time lines and economics) in order to add value to the parent firm.

Technology Awareness

A number of authors have investigated the idea that learning is a key objective of CVC activities, as well as one of the principal strategic purposes of a large corporation that maintains these units.[18, 68–71] The broad concept of learning comprises a number of notably different information-gathering and landscape-assessment activities that the firm may wish to conduct. Over the last 20 years, academic studies have investigated a number of aspects of these processes and clarified how firms may seek to gather information to fulfill a number of subtly different objectives.

Dushnitsky and Lenox (2005) conducted one of the few studies to examine industry characteristics that affect corporate VC and the variation of approaches adopted across different fields.[68] These authors suggested that "corporate venture capital programs may be instrumental in harvesting innovations from entrepreneurial ventures and this may be an important part of a firm's overall innovation strategy," that "an increase in a firm's innovation rate may result from an increase in the stock of a firm's knowledge, allowing novel combinations of existing knowledge to be formed" and that these programs facilitated "exposure to new technologies and practices," acting to "increase the firm's absorptive capacity."

The authors analyzed a large number of firms over a 20-year period and found that CVC activities correlated with an increase in citation-weighted patenting, which was used as a proxy for innovative output. Firms with greater absorptive capacity (i.e., the technical capabilities and the staffing capacity to assimilate the received information) appeared to derive greater benefits from CVC programs—as long as the knowledge bases of the parent and the portfolio firm were not too close, in which case the benefits were diminished.

It is critical for the parent firm to have adequate technical understanding in a field and sufficient resources allocated to its interactions in order to assimilate the information that is available through CVC activities. Academic studies frequently discuss the rather broad concept of absorptive capacity. Equally, it is important for the flows of information within the organization to be effective and structured in order for key groups to access the information. In one example, Yang et al. (2009) reviewed the literature on critical characteristics that affect the knowledge flow to the corporate parent.[72] They concluded that these included adequate and robust interorganizational knowledge flows,[73] in addition to sufficient absorptive capacity of the knowledge receivers.[74]

Key challenges exist in organizing and structuring CVC units, and different studies have investigated characteristics such as incentive schemes, degrees of autonomy from the parent, knowledge flows to the parent from portfolio companies, knowledge flows to the portfolio company and the innovativeness of the parent. These issues are very real in many corporate venturing contexts: Can a CVC head be paid more (if successful) than the company CEO? If all CVC group

employees receive standard corporate compensation (e.g., salary and bonus), how can a suitable financial performance incentive be applied? A VC-style compensation scheme (with CVC staff retaining a share of profits) increased portfolio company performance when compared with a standard salary-plus-bonus corporate pay scheme, but such measures may negatively affect corporate innovativeness.[75, 76] The relationship between autonomy and a number of performance variables was positive, suggesting that the freedom to invest with minimal supervision by the corporate parent allowed the CVC groups greater freedom to explore new domains and to share the awareness of these new fields with the corporate firm.

As noted above, a number of studies have investigated the issue of technical proximity: How close should technologies be to those of the CVC parent firm? Perhaps unsurprisingly, the emerging view is that a middle degree of technical distance is optimal in order to allow the parent firm to assimilate lessons while ensuring that a new and differentiated flow of information is provided.[77, 78] Social capital and knowledge relatedness have an impact on the extent of knowledge that is transferred and on the efficiency of the transfer process. The concept of relational fit combines these two attributes.[79] A high degree of relational fit is found to improve knowledge transfer, knowledge creation and the performance of portfolio companies. It was proposed that, for effective knowledge transfer, the fit between the knowledge base of the portfolio firm and the parent should be aligned but not identical, as a parent firm has to have some domain knowledge in order to assimilate new practices and approaches—even if it is seeking new sources of information.[79]

Variation in Practices Across Industries

The issue of so-called patent thickets in computing, electronics and IT domains is well known. These industries utilize a large number of patents to protect a single product, where litigation, threatened litigation and cross-licensing is common. In contrast, billions of dollars in sales of a pharmaceutical product may be supported by a single composition of matter (i.e., chemistry) patent.

The issue of the effect of the IP regime on CVC practices has been an active topic of debate in the academic community for many years, and a variety of views have been expressed. In practice, it appears that there are differences in approaches to CVC activity between life sciences and the information and communications technology (ICT) fields. Pharmaceutical and biotechnology firms engage only rarely in collaborations with companies that the parent firm's VC arm has invested in, whereas this practice is common in the electronics and computing fields and may even be a condition of investment.

Some academic studies support the idea that weak IP regimes are favorable for CVC activity.[18] These concluded that CVC learning benefits were limited to information and devices sectors in the ICT domain, which "are characterized by relatively weak intellectual property regimes," and that there was no indication that firms in the chemical, automobile or pharmaceutical sectors, "where the IP regime is stronger", gained any benefit from CVC activities.[18] Dushnitsky and Lenox (2006)asked the question that "if CVC investment has positive innovative benefits only in industries with weak IP regimes, why do firms in industries with strong IP regimes invest in corporate venture capital?" and noted that, "interviews with CVC fund managers at pharmaceutical firms reveal that these firms often pursue CVC as a vehicle for identifying future alliance partners and takeover targets."[18]

Basu et al. (2011) examined why firms participate in CVC activities, examining 477 firms across industries and concluding that the greatest users of such approaches tend to be firms in industries with "rapid technological change, high-competitive intensity and weak appropriability."[70] It was also found that firms "that possess strong technological and marketing resources and resources developed from diverse venturing experience engaged in greater CVC activity."

"Appropriability" is defined as "the extent to which economically valuable knowledge produced by a firm can be protected from spilling over to competitors."[80] Weak appropriability is associated with less effective protection being provided by formal IP, such as patents and copyrights, and with increased knowledge diffusion between firms. It was suggested that the conclusion regarding weak appropriability is linked to rapidity of technological change: if firms cannot generate returns through protecting innovations by means of patents and other forms of IP protection, rates of knowledge transfer in an industry will be high and there will be a corresponding need to innovate rapidly in order to maintain market position.

Given the long development cycles of drug products, the strength of IP protection is regarded by many authors as a necessary condition for firms to make the investments of over $1 billion per compound.[81] In such circumstances, Basu et al. suggested that firms might be more willing to commit to lengthy and expensive internal development programs, due to the relative security that effective patent protection can provide.[70] Yet the pharmaceutical industry has a history of CVC that dates back to the mid-1980s. It has contributed to a substantial portion of overall VC investment in this field, and was critically important in the period following the 2007 economic crash. Consequently, it appears that CVC activity is perceived by many firms to be valuable in industries that have strong IP regimes, and that, notwithstanding the studies that are noted above, such approaches can have value in industries with different levels of appropriability and IP protection. Acquisition, as is discussed below, is at best only part of the motivation; logically, firms in this industry that operate CVC groups must have a rationale that lies outside direct knowledge appropriation or straightforward firm acquisition.

Selection of Companies for Acquisition

Obtaining knowledge on potential acquisition targets with an explicit aim of using CVC as a means of identifying innovative firms to acquire is an objective that has long been attributed to CVC.[68, 82] Although some academic studies have found that, across industries, a significant number of firms that large corporates invest in are later acquired, this view is not wholly supported by both recent studies on the pharmaceutical and biotechnology industries and information from market participants. It seems clear that information is a primary goal and that this may lead to acquisition in time, yet recent data do not wholly support pipeline-feeding as a prime purpose of

biotechnology CVC investments. The best conclusion from the data seems to be that, while acquisition is a potential outcome from an investment, the information-gathering processes operate at a subtle level, and the prime objective of firms is to obtain information about emerging new fields—especially regarding new therapeutic modalities such as messenger RNA (mRNA) and small interfering RNA (siRNA) approaches.

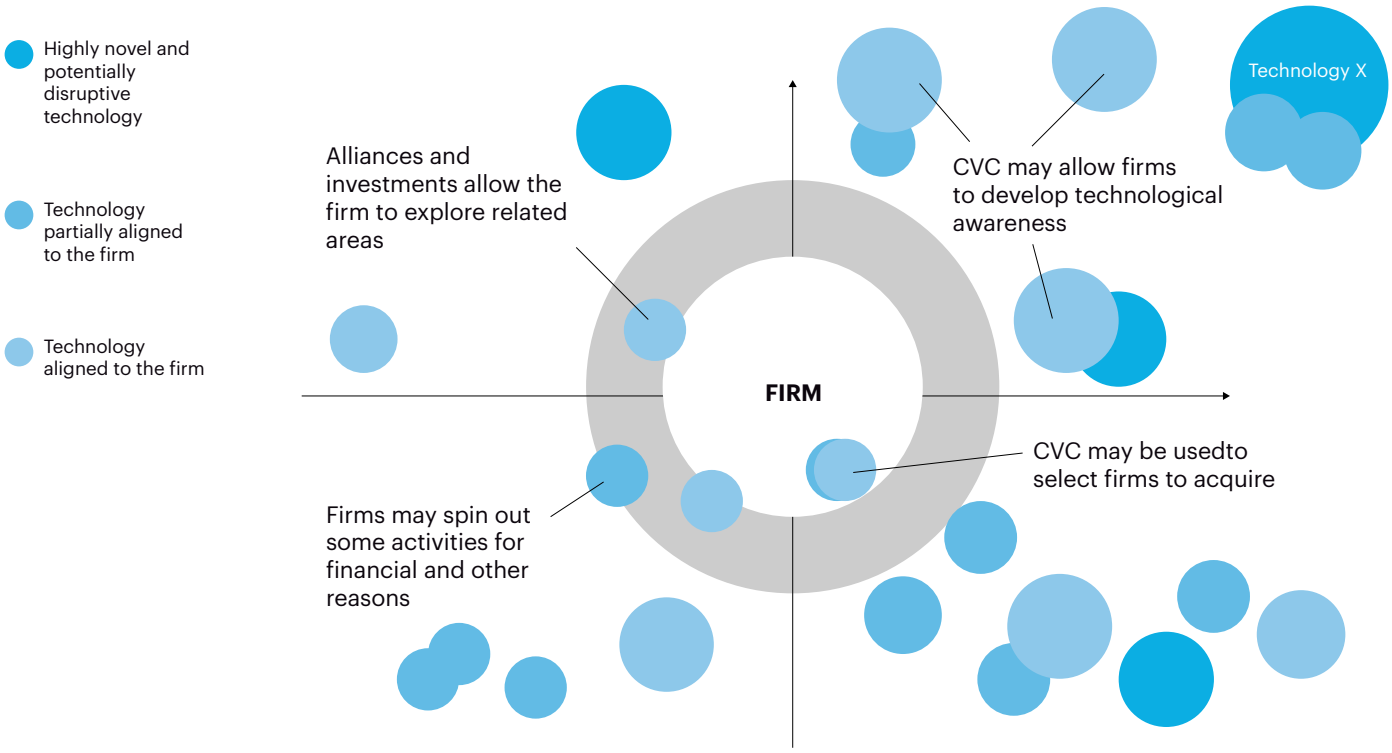
Benson and Ziedonis stated that 20% of all start-up firms purchased by corporations that routinely employ CVC approaches are CVC-backed firms, having analyzed data from 1987 to 2003 across several industries.[83] However, in the pharmaceutical industry, practitioner comments suggest that acquisition rates may be much lower. For example, GlaxoSmithKline (GSK), has acquired very few of the firms that have received investment from its VC group, SR One, which was established in the mid-1980s.

Awareness of Emerging Novel Technologies: Technological Discontinuities

In the 1990s, Maula, Keil and Zahra analyzed the appearance of references to the Internet and to wireless technologies in company documents (Securities and Exchange Commission [SEC] filings, annual reports and similar formal materials).[84] In a statistical analysis of text references, those companies that had connections with independent venture capitalists of high reputational standing—through corporate venture activities—were found to have noted the emergence of these technologies substantially earlier than companies that did not have such links. The authors suggested that this finding implies that a role of corporate VC units can be to direct senior management's attention to discontinuous technological changes, and that this function is enabled by the reputation of the independent venture capitalists. The existence of a CVC unit allows for regular contact with these individuals, who are in external positions and can monitor trends in the industry. The respect that is engendered by their high reputational standing ensures that news of highly novel technologies is met with respect, and the routine contact that occurs in deal-syndication and similar discussions allows for trust to be developed. Discussions by the managers of the CVC group with the large industrial firm's senior management are regular and enable these senior corporate firm managers to direct their attention to industry trends in a meaningful discussion on a regular basis, so allowing for periodic consideration of these novel technologies and their potential impact on the firm and industry. Maula et al. suggested that CVC managers act as trusted intermediaries between the corporate environment and the CVC world and are useful as agents who can operate in either domain, allowing permeability of the organization's boundaries to technology information.

CVC may be used to spin out activities for financial reasons, to select firms to acquire, or to develop an awareness of new technologies. The nature of the technologies in question may be similar or different from the domains of activity of the parent firm, and there is an interaction between alliance activities and CVC programs. In **Figure 19**, bubble size reflects the value of the opportunity and color represents the technological distance from the activities of the firm.

Figure 19. Schematic Diagram Showing Different Purposes of CVC



Source: Prepared by Mark Wilson.

Forms of CVC Activity

Perhaps as a consequence of this widespread use of alliances, the term "corporate venture capital," within the pharmaceutical and biotechnology industries, refers predominantly to the acquisition of equity stakes in entrepreneurial start-ups, in conjunction with independent (financial) venture capitalists. While this form may be dominant in this particular context, across industries a variety of forms of externally focused activity may take place and may be considered to be forms of CVC. Hill and Birkinshaw (2008) noted four types, as follows:[85]

1. Internal explorer units invest in opportunities that arise inside the parent firm and actively nurture and develop these so that, over time, they become sources of growth for the firm.

2. Internal exploiter units attempt to monetize the existing assets (such as patents, technologies raw ideas and managerial talents) of the parent firm within a short time frame, frequently by spinning these out as new businesses.

3. External explorer units invest in external companies (typically independent start-ups) predicted to have growth potential in domains anticipated to be of future strategic importance to the parent firm.

4. External exploiter units invest in external companies with a view to generating financial returns through leveraging the existing assets of the parent firm.

In recent years, the prevalence of asset out-licensing and divestment in the pharmaceutical industry has increased, and in parallel with this trend, large firms are increasingly creating small entrepreneurial firms, using compound assets or other technologies. Although equity investment may be a very important form of CVC, it is important to note that the term encompasses a variety of groups with different, specific functions and roles.

3.1.2 Perspectives on Technology Acquisition Approaches and Alliance Practices

While several high-technology industries have been cited as examples of open innovation and have seen firms develop networks of connections, the choices among the various options are complex and firm-specific. Increasingly, the literature has noted the complexity of the choices of form of external engagement, including different types of CVC. The life sciences sector provides one example of the development of an increasingly complex set of external networks and interfirm contracting arrangements.

The number of and degree of connectivity among pharmaceutical and biotechnology company alliances appear to have grown rapidly over the last 20 years, so that an industry that was once characterized by a handful of major interfirm collaborations and university links now supports an industrial infrastructure of interorganizational cooperation and codevelopment. This trend was documented by Roijakkers and Hagedoorn (2006), who provided a network analysis of alliance activity, assessing the number of alliances from major firms and the degree of connection among network clusters, and who showed that the total number of industry alliances grew from fewer than 50 in 1975 to more than 500 in 1999.[86]

The authors state that this "research indicates an overall growth in the number of annually, newly established R&D partnerships where research partners consistently prefer contractual partnerships to equity-based alliances. In the networks that develop through these R&D partnerships, small, entrepreneurial biotechnological companies take a leading role during the 1980s when biotechnology first became relevant for the pharmaceutical industry. The 1990s, however, show a different pattern with established, large pharmaceutical companies becoming more dominant, acting as nodal players, with multiple partnerships with a variety of companies."

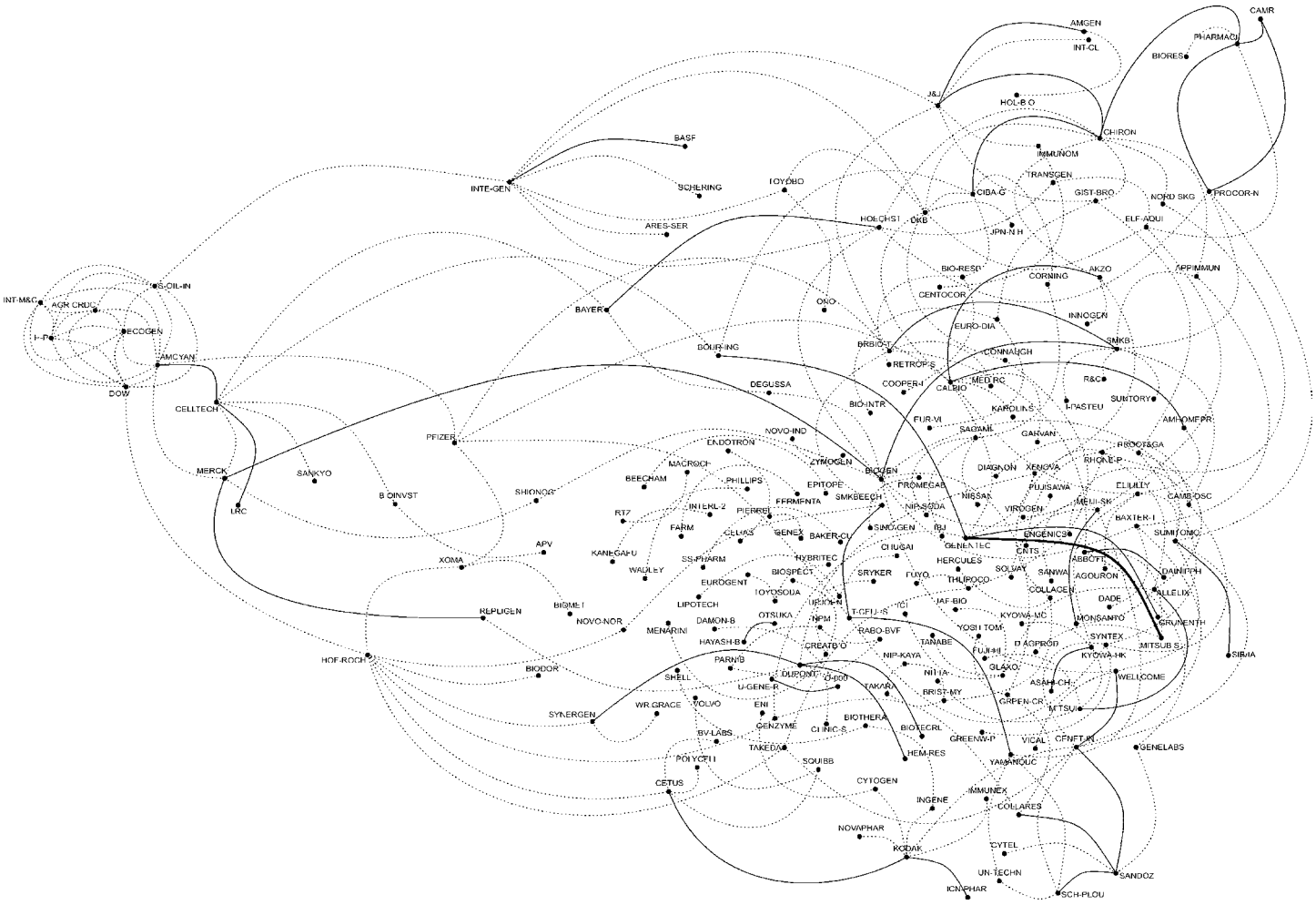
The alliance activity during the 1980s is shown in **Figure 20**, and **Figure 21** shows the differing pattern in the 1990s.

The academic concept of absorptive capacity, which may sometimes be perceived as a broad or diffused characteristic, can be highly specialized. While one firm may have expertise in an area such as leading-edge techniques in mammalian cell culture, another may not, and would need to develop a different alliance strategy to develop competences in the domain before implementing fresh arrangements in order to access cutting-edge techniques. These issues are illustrated by a practical real-world set of examples in a study by Mittra (2007), who conducted an analysis of how pharmaceutical company alliances were changing and on the merger, acquisition and strategic alliance behavior of large firms, based on interviews with senior managers at a number of firms.[87] The study is notable for the variation in response expressed by many of the quoted respondents, and for the variation in firm technical capability, organizational structure and therapeutic focus that the investigation highlighted. Mittra noted that "a perception of innovation deficit has induced large firms to exploit various strategic options for capturing both incremental innovations and new disruptive technologies," and that "the relative value of these activities is firm-specific," as capabilities across a large range of specialized technical activities vary substantially across firms.

The last 10 years have seen an increasing level of specialization by major pharmaceutical firms within therapeutic areas and within approaches such as key biologics or small molecule fields. Within the biologics field, firms have made clear strategic choices within certain specialized modalities (e.g., mRNA, siRNA). This effect was noted in the Mittra study (2007), which concluded that increased specialization within the industry was occurring, noting that: "Strategic differences at the firm-level suggest that it may no longer be appropriate to homogenize big pharma. Strategic decision-making is problematized by changing externalities and 'bounded rationality,' so the individual firm's distinct situational context is crucial to analysis and understanding of strategic decision-making and sectoral restructuring."

The study also concluded that the larger firms have maintained a dominant force in pharmaceutical R&D and, therefore, "largely dictate the strategies of smaller firms." A large firm gains an information advantage over rivals when it enters into an alliance; however, commitment of resources to

Figure 20. A Network Diagram Representing Alliance Activity in the Pharmaceutical and Biotechnology Industries (1985–1989)



Source: Roijakkers and Hagedoorn (2006).[86]

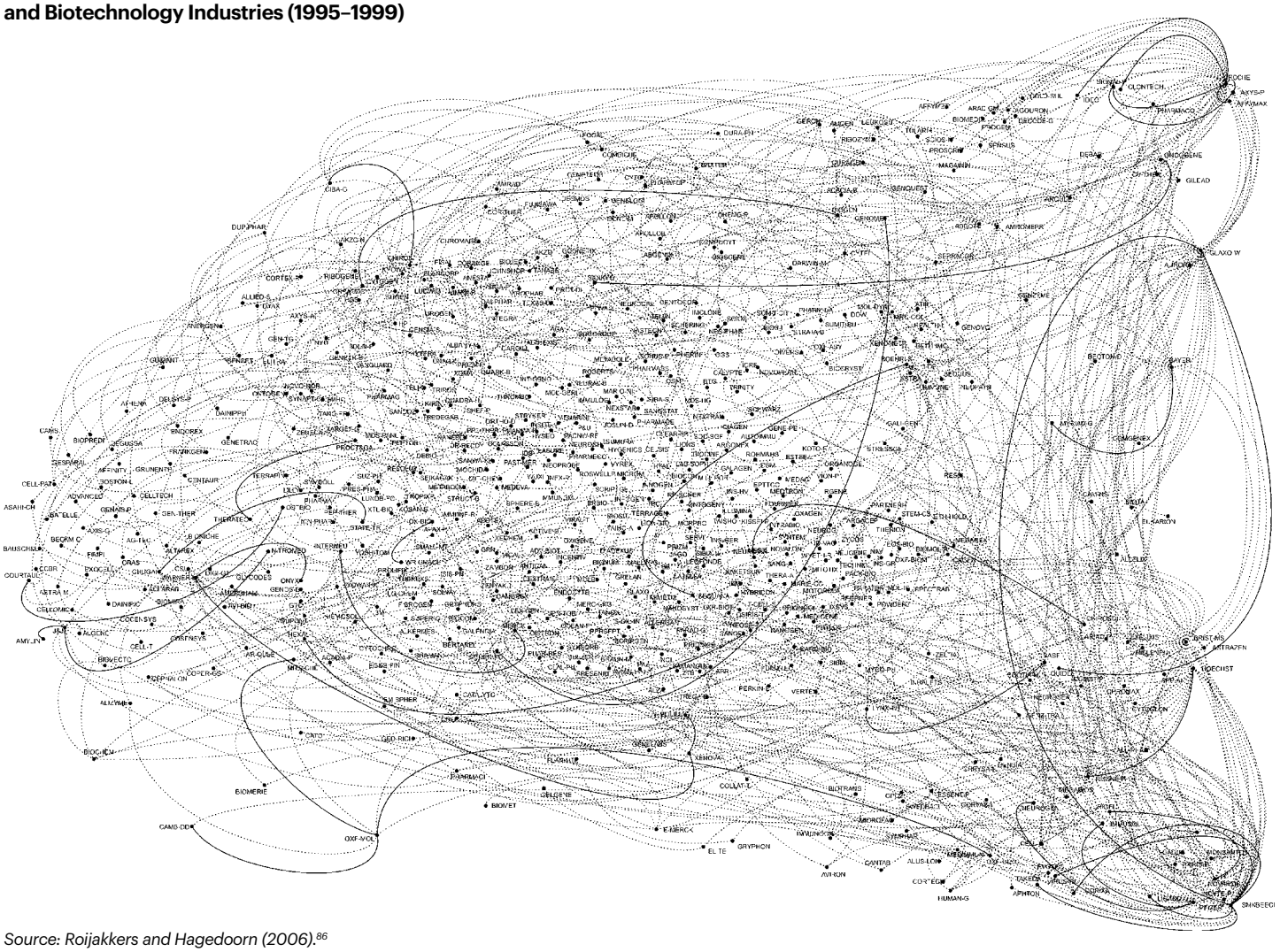
a major alliance is a significant choice within a portfolio of R&D projects, and this cost of commitment is not taken lightly. Industry alliance managers attest to the strong incentive to maintain a reputation as a decent alliance partner, as a result of reputational pressures. Pharmaceutical firms are ranked annually by major consultancy firms on alliance management competence, and by this and other means, experiences of alliance partners spread across the industry. To forfeit a positive reputation would deter future potential collaborators and weaken the pool of opportunities available to the firm.

There is some academic evidence to support the assertion that familiarity with a target company through an alliance allows an information advantage. To cite example, Higgins and Rodriguez (2006) studied the "outsourcing of R&D through acquisitions in the pharmaceutical industry" and concluded that during the period from 1994 to 2001 acquirers realized significant positive returns.[88]

This finding is in opposition to a large body of literature in the corporate finance field, which states that companies that purchase smaller organizations typically realize no net benefit and that the majority of the gain from the transaction flows to the shareholders of the company that is bought. Higgins and Rodriguez also found that the returns to acquiring companies have a positive correlation with prior access to information about the target firms, which the authors attribute to facilitating a superior negotiating position compared with other situations. There are many recent examples of acquisition of an alliance partner, including at scale, such as GSK's 2012 acquisition of Human Genome Sciences after a partnership of over a decade.

In line with financial economics theory, small drug discovery firms (biotechs) may obtain a significant benefit by signaling their quality to the broad market (and future alliance partners and acquirers) from a collaboration with a large firm; given the extensive capabilities of the large firm to conduct extensive assessments on the small firm's technology, unconnected firms may consider an alliance with a larger firm to be a mark of technical quality. This theory is supported by some academic studies. Nicholson, Danzon and McCullough (2005) investigated the discount at which small firms provided access to larger firms (in a sample of deals from 1991 to 2000) when forming their first alliances, and concluded that a significant discount was provided.[89] The reduction on the first two alliances was found to be of a similar level of magnitude (47% and 28%), but these authors concluded that this discount was recovered in substantially higher firm valuations from

Figure 21. A Network Diagram Representing Alliance Activity in the Pharmaceutical and Biotechnology Industries (1995–1999)



Source: Roijakkers and Hagedoorn (2006).[86]

venture capitalist and the public equity markets in subsequent financing activities.

As a consequence of these activities, the pharmaceutical industry has developed a set of alliance practices over the last 30 years, including the development of well-defined collaboration forms and career paths for staff who are responsible for these matters. For example, most firms operate specialist groups to develop and to maintain collaborations with academic groups, regarding these activities as being specialized and different from the conduct of comparable activities with industrial firms. The formation of collaborations of a variety of types is one of the key characteristics of open innovation, as firms seek opportunities that are outside the boundaries of the firm. Clearly, other industries make widespread use of collaborations and alliances. However, the degree to which deal forms have become standardized, roles have been stratified and practices have been refined is perhaps unusual in comparison to other sectors.

Trends in Deal Structures

Within the pharmaceutical and biotechnology industry, practices continue to evolve, and the use of options-based deals became widespread after 2000, with GSK utilizing this approach with considerable frequency. In this structure, a license is not concluded for a single early-stage compound, but rather for a set of options to a series of compounds that the smaller company has in development. The larger partner may have a series of options to acquire an individual compound, with the value of the terms increasing as the compound progresses through development. Agreements of this type typically allow for the pharmaceutical company to hand back the asset to the smaller company and provide options for later reacquisition. These arrangements provide funding to small discovery companies and allow the potential for substantial future returns—if compounds progress in development—while these deals offer a cap on pricing to the larger company. Naturally, these arrangements are only concluded if the smaller company's scientific expertise, and hence its potential pipeline, is considered to be attractive by the larger partner.

Many acquisitions agreements now make use of contingent value rights, whereby the price of the company is determined up to several years after the acquisition—dependent on the progression of the development pipeline. The establishment of ViiV, the organization for the treatment of human immunodeficiency virus (HIV), which pooled assets from Pfizer, Shionogi and GSK,[90] was a notable and early example of this type of agreement, which has since become widespread.

3.2 Current Trends and the Potential Future

3.2.1 Novel Structures and Venturing Forms

In response to the challenges faced by industry and the changing opportunities of the business environment, new practices in the field of corporate venturing will continue to emerge. The key emerging trends of the past few years provide valuable insight into possible developments. Significant changes have occurred in both the range of funding structures that are employed and the nature of the venturing activities of large firms. These trends are likely to develop in scale and scope in the coming years.

University-Sector Developments

In the context of technology transfer, an interesting trend is the increased funding of early-stage technology development by groups that are linked to institutions and universities. Given the high level of scientific uncertainty that is inherent in licensing IP related to early-stage technologies, it is difficult for licensor and licensee to assess specific uncertainties and, consequently, to formulate and agree on transactional arrangements to deal with these issues. In this context, one challenging but rational resolution of these difficulties is for the institution to continue to fund the development and to decrease the risk for the potential licensee. Although this requires substantial expenditure, it enables institutions to offer assets at a later stage of development, to create an offer that is more akin to that of a start-up or biotech company and to reduce transactional difficulties.

The creation of the novel UK-based drug discovery and development fund Apollo Therapeutics was made possible with joint funding from Johnson & Johnson, GSK and AstraZeneca, in collaboration with Imperial College, University College London (UCL) and Cambridge University. The case of Apollo Therapeutics can be viewed as a vehicle for this type of forward-integration activity. The cofunded and comanaged investment vehicle "aims to share the risk and accelerate the development of important new treatments, while also reducing the cost" and is a novel collaborative arrangement between multiple firms and major universities.[91] A press release explains the structure and parameters of the arrangement:

"Each of the three industry partner companies (AstraZeneca UK Limited, Glaxo Group Limited and Johnson & Johnson Innovation-JJDC, Inc.) will contribute £10 million over 6 years to the venture. The technology transfer offices (TTOs) of the three university partners—Imperial Innovations Group plc, Cambridge Enterprise Limited and UCL Business plc—will each contribute a further £3.3 million.* The aim of Apollo is to advance academic preclinical research from these universities to a stage at which it can either be taken forward by one of the industry partners following an internal bidding process or be out-licensed. The three industry partners will also provide R&D expertise and additional resources to assist with the commercial evaluation and development of projects."[91]

University-Linked Venture Funds

A related trend is the continued development of sizable venture funds with university ties. Although this trend first developed in the United States, the approach is now well-established in the UK and is emerging in other countries. This field of university venturing has rarely been commented on in academic literature to date. In essence, the approach relies on a combination of external capital to develop university-developed IP, and a variety of contract arrangements and organizational forms appear to have been deployed in different situations. All of these structures allow the institution to retain some of the commercial benefits of exploitation of late-stage technologies, allowing potentially greater returns to be generated.

A recent report from Global Corporate Venturing, written by Gregg Bayes-Brown "... identifies 187 UVF-linked [university venture fund-linked] worldwide, with just under $15 billion worth of UVF funding available. Of these UVF-linked funds, 35 are based in [the] UK and their $4.96 billion in assets represent almost a third of the total. These include a diverse group: seed, proof of concept, early-stage venture funds, patient capital funds focused on universities and venture funds backed by universities and institutional investors." [92, 93]

A number of notable funds have developed in the UK, such as Epidarex, which in 2014 launched a £47.5 million ($79.5 million) fund focused on British life science start-ups. University investors include King's College London, Glasgow University, Edinburgh University and Aberdeen University, in addition to the pharmaceutical company Eli Lilly, the European Investment Fund, Scottish Enterprise and Strathclyde Pension Fund.[94]

In another example, UCL in London has strong links with an independent VC fund, Syncona, which allows funding to be provided for certain spin-off ventures. In 2013, the Wellcome Trust set up a £200 million investment fund,[95] Syncona, which in 2016 was merged with funds from the cancer charities BACIT and CRT Pioneer Fund to create a group with £1 billion in assets.** [96] This group has close collaborative links with UCL. Syncona has been a leading investor in UCL spin-outs the university noted in 2016, and "UCL spin-out companies will be at the heart of a new £1 billion life sciences company which has been created by three major investors in cancer research and other biotech fields."[97]

A number of universities have granted bundles of technology transfer rights to specialist companies, such as the grant of company formation rights to IP Group in the UK by a number of major UK universities. This development attracted much attention, as it constituted a decision by several major universities to eliminate a core function of internal technology transfer groups—at least in respect of certain disciplines. The overall benefits and drawbacks of this approach are clear from an organizational perspective: decreased internal complexity and access to skilled, external resources. However, there is a challenge in pricing rights to IP that has yet to be developed, which is the essence of this type of transaction. IP Group was

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* In 2020, the value of £10 million is €11.73 million, and the value of £3.3 million is €3.87 million.

** In 2020, the value of £200 million is €235 million, and the value of £1 billion is €1.17 billion.

formed as IP2IPO and signed its first agreement with Oxford University in 2000/2001, agreeing to fund some new buildings for the School of Chemistry in return for a 50% share of royalty revenue generated by spin-offs for a period of 15 years. Agreements with the universities of Southampton and York, and King's College, followed in subsequent years. The group floated in 2003 and later took over Fusion IP, which had arrangements with the universities of Sheffield and Cardiff.[98]

Imperial College in London developed a number of companies from different technology sectors, using internally developed IP, through its internal group (Imperial Innovations). This group had a stock market IPO in 2006,[99] and later expanded its investments to include companies formed from innovations developed at UCL, Oxford and Cambridge, before rebranding as Touchstone Innovations (in order to reflect this diversified set of interactions) in 2017. Of note, an unusual event took place in this sector in 2017, when IP Group acquired Touchstone Innovations in a hostile takeover.[100] From a finance theory perspective, these investment vehicles need not be publicly quoted. However, a public quotation allows fund managers who have broad investment discretion but who are mandated to invest in public stocks to access these vehicles.[101]

Consolidation of Technology Transfer Groups

From an industrial perspective, one interesting trend is the development of consolidated TTOs that represent multiple institutions. While there are not many examples of this type of organizational development, there are notable groups in both France and Germany: Inserm Transfert in France represents a number of constituent institutions from a technology transfer perspective, and Ascenion in Germany provides a service to multiple bodies. Inserm Transfert's scale has allowed it to enter into specialist collaborative agreements, such as a 2012 agreement with a UK clinical research organization, Covance.[102] Ascenion acts on behalf of a number of German institutions and a best-practice case study from a pan-European technology transfer body (ASTP 2016) describes the structure as follows:

"Founded in 2001 as a wholly owned subsidiary of the LifeScience Foundation for the Promotion of Science and Research, Ascenion is a technology transfer company focusing on the field of life sciences. Ascenion currently serves a total of 23 research institutes and university hospitals all over Germany. [...] A particular focus of Ascenion is spin-off coaching and equity management. Many staff members have life-science backgrounds—in some cases combined with MBAs—and several years' industry experience and good connections in the sector."[103]

The consolidation approach raises challenges, in that local contacts and relationships must be maintained with all of the key departments in the participating institutions. Nonetheless, it allows activities to be developed on a notable scale, which allows for the specialization of skills and expertise in terms of technical background among the staff, for increased levels of engagement with key industrial groups (as potential licensees) and for a substantial flow of license opportunities to be developed, providing live data on current market rates and emerging trends and preferences. This structure can be seen as mimicking a large company's business development organization: a few specialists are based in central locations, with work responsibility in a certain (fairly narrow) technical space. Specialization is considered to be more important than the maintenance of a local presence. Universities are not businesses, and so this model may work only in certain situations. Nonetheless, these groups have created interesting precedents.

Technology Transfer Issues and Challenges

Venture groups invest in firms that may deliver returns many times the amount of the initial investment, allowing the potential for a few firms to provide a tenfold or greater return on funds invested. This requirement for high growth potential is an element in the high-risk and high-return venture model and precludes investment in firms that have valuable and commercially positive or socially beneficial technologies in development but which cannot offer this level of potential return. Consequently, many firms that have commercially and socially valuable technologies cannot be funded through venture approaches. Some of these firms may be able to bootstrap themselves through early sales, but this can be difficult if significant development expenditure (and time) is required. The provision of nondilutive funding through a collaboration with a larger firm may ease funding difficulties, and this route is valuable for many companies. However, firms with promising technologies that cannot offer high returns to investors due to variables such as a moderate market size experience real funding challenges. It is important to note that venture funding is appropriate only in certain situations, given that this financing model is predicated on the provision of achieving a significant rate of return of capital to investors.

From a technology-transfer perspective, a valid question is whether a technology of this type should be placed into a new company or licensed to a preexisting or larger firm. While many stakeholders might prefer to see the creation of a new company, on certain occasions this can lead to the slower and relatively inefficient development of technology and result in a substantial period during which a valuable innovation cannot reach the market. Consequently, careful assessment by highly trained technology-transfer staff is required in assessing spin-out possibilities.

Creation of Public-Good IP Pools

In another innovative approach, some large companies have permitted access to intangible IP assets and to tangible compound libraries in order to allow the payment-free development of compounds for diseases throughout the developing world. GSK established a novel patent pool that later became the basis for the Re:Search scheme administered by the World Intellectual Property Organization (WIPO).[104] AstraZeneca has granted access to a set of clinical and preclinical assets for similar purposes.[105]

New Models for Technology Development

Another notable trend has been the emergence of groups that are wholly or partially funded by philanthropic bodies, which are

implementing new approaches to technology assessment and progression in areas that have major societal impact, such as in environmental technology, health care and life sciences.

FasterCures is a center of the Milken Institute, a major nonpartisan think tank founded by the US bond-trading billionaire Mike Milken, which aims to improve global prosperity.[106] Historically, the group organized annual brokering events in New York, where over 1,000 US-based small charities and grant-giving philanthropic bodies met with a set of small companies seeking funding for drug development. In the development of this initiative, the body now organizes a large-scale online brokering platform. Typically, many organizations that take part in such programs are addressing "orphan" diseases—those that affect small populations and are not attractive as target markets for most of the pharmaceutical industry. In addition to its venture philanthropy brokering activity, the FasterCures organization also engages on policy matters.[107]

In the UK, Saint George Street Capital was founded in 2017 on a philanthropic basis and aims to coordinate funding for drug development, focusing its efforts on drug molecules that are not being actively progressed by industrial firms and that may have significant patient benefits.[108] In a similar vein, some other groups have led discussions to try to coordinate and to deliver greater value from philanthropic funding of pharmaceutical projects by small charities.

Different definitions have been applied to the terms "venture philanthropy" and "impact investing."[109, 110] However, the essence of these approaches is to apply financial-sector VC approaches to the development of companies that can deliver solutions to critical societal challenges, with respect to issues such as the environment or health care.

They aim to relax some of the constraints (such as the level of expected return) so that, while investment and management disciplines are retained, companies that would not meet strict financial-sector criteria can be funded. In this respect, the models that are applied in this sector sit between pure philanthropy, or grant-giving, on the one hand, and pure financial investment, on the other.

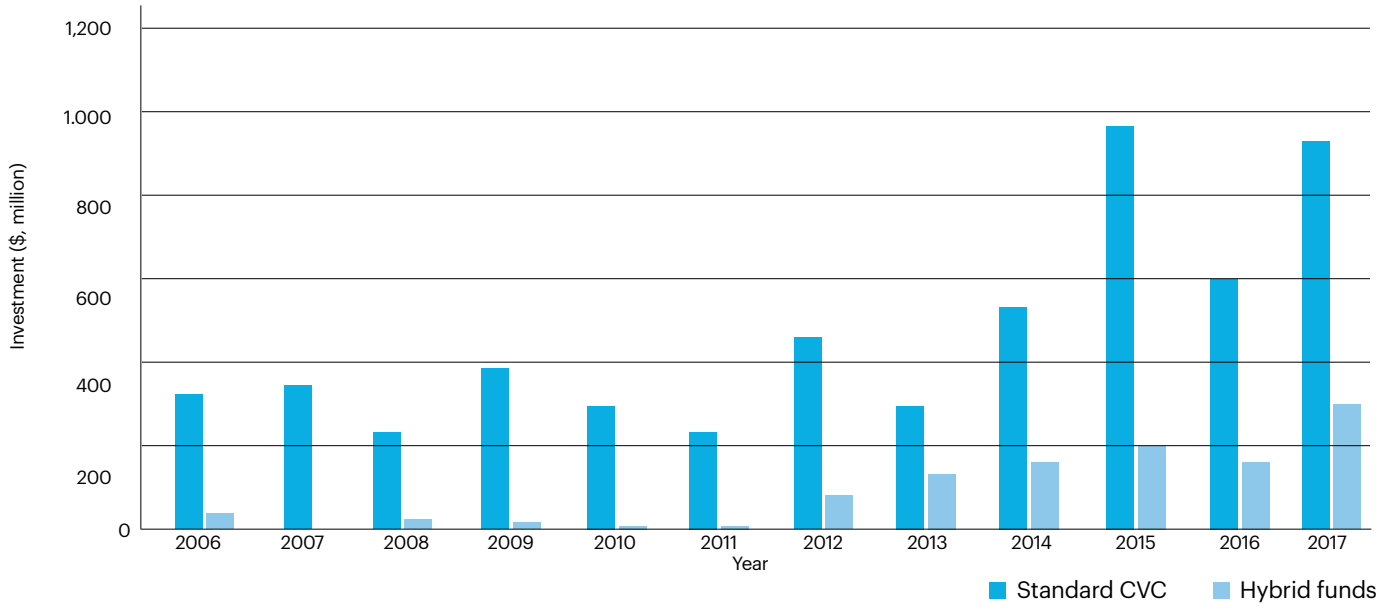
Although this sector is dominated by activities in the United States, a number of European funds have been established that are applying innovative models. In one example, the Global Health Innovation Fund was established in London as a $108 million social impact investment fund with a first-loss tranche of $20 million provided by the Gates Foundation.[111] This investment allowed a number of other organizations to invest in the fund and secure in the knowledge that any losses would be minimized. This sector has grown notably in recent years and—given Europe's strong legal systems, deep financial expertise and excellent science and engineering capabilities—it is a domain in which European groups could play a major role in coming years.

Hybrid CVC Funds in the Life Science Industries

With regard to novel fund structures, there is initial evidence that innovative CVC structures are being employed as a new form of externally focused R&D. In contrast to prior practice, these new structures are characterized by the involvement of one or more industry investors in the management of the fund (e.g., through representatives on the scientific advisory board that is pivotal in making investment decisions) or investors with an option to acquire the portfolio company or with insider access to coinvestment opportunities. In this regard, there is a blurring of the previously separate roles of the limited partner (LP), who provides finance, and the general partner (GP), who operates the fund.

Investments made by hybrid fund structures that combine elements of independent VC and corporate R&D approaches constituted a substantial share of total VC investment made by CVC groups of the 25 largest pharmaceutical companies worldwide by 2016–2017, and were broadly at the level of total

Figure 22. Total Hybrid Fund Investment in Small Companies and Standard CVC Investment ($, million) in the Pharmaceutical and Biotechnology Industries (2006–2017)



Source: Wilson and Minshall (2018).[112]

CVC investment by these companies during the period 2006–2011.[112] (See **Figure 22**.) The number of funds that can be regarded as having some elements of this hybrid model approach is also significant, as is the strength of the industry reputation of the independent funds that have developed such structures (which can be measured using proxy variables, such as total funds invested by the firm and the total number of companies invested in). A significant number of funds have been created during the last seven to eight years, and the total declared capital raised by these funds is substantial, relative to CVC expenditures made by large pharmaceutical companies.

A key consideration is to establish to what extent these new hybrid funds have replaced the traditional split between LP and GP roles with arrangements that fuse both the investor and fund manager roles. Consequently, a critical question is to establish the degree of influence that the corporate obtains and any preferential legal rights (e.g., acquisition options) that are granted. In the case of the Index and Medicxi funds, the scientific advisory board has been structured to allow the corporate partner substantial influence in the investment process, with four of nine board members being very senior members of the corporate groups' R&D organizations (such as the head of R&D). In both the cases of the Index/Medicxi[113] and Atlas funds,[114] final investment control remains with the LPs. However, Atlas has made it clear that the links with the corporate investors are strong and that these partners can influence fund decision-making in a number of ways:[114]

"The intent of these relationships is to provide Amgen and Novartis with strategic proximity to Atlas Venture's start-up formation activities around innovative, potentially high impact medicines, and catalyze future collaborations around translational research across Atlas Venture's early stage portfolio... through the mutual commitment of team bandwidth and dedicated liaisons/'EIRs' [entrepreneurs in residence] from our CSPs [corporate strategic partners], we anticipate finding a set of opportunities for working together."

In other instances, option rights have been granted to the pharmaceutical investor on an exclusive basis. This was the case when the option that was granted to GSK as part of the Avalon X fund arrangements.[115] In some hybrid fund structures, the corporate investor has no direct control over investment decisions but gains privileged insider access to early-stage opportunities and the chance to engage in discussions with the GPs on specific investment possibilities and provide scientific expertise to the fund. The Flagship/Merck cooperation appears to be structured on this basis.[116]

3.2.2 Industrial Developments in Innovation Practices

Case Study: The Pharmaceutical Industry

Although the trends will not map perfectly across all industries, recent developments in the pharmaceutical and biotechnology industries in the United States and Europe provide practical examples of how firms have adopted open innovation approaches and indicate trends that, as is noted in this report, can be observed in many other sectors.

Internal Restructuring With Adoption of Start-Up Practices

Within the pharmaceutical industry, a number of companies have adopted approaches that aim to construct an R&D organization from small groups of scientists and, to an extent, mimic the nature of small drug discovery companies. In the 2000s, GSK implemented an approach that was based on the discovery performance units of 20 to 60 scientists, who focused on a single disease condition or metabolic pathway. The groups were funded for no longer than three years, and a board of internal and external experts (including external venture capitalists) determined the continuation or termination of funding.[117] Although discovery was organized into these small groups, the later phases of drug development were dealt with by a single central function. Pfizer appears to have adopted a broadly similar approach with regard to the disaggregation of a large discovery organization into smaller focused groups.

Increased Early-Stage Collaboration

The pharmaceutical industry has a history of licensing externally developed products that have been progressed to Phase II or beyond. As a potential development of this culture and industry practice, some authors have proposed that pharmaceutical companies should: (i) focus more on external sourcing of the strategic assets of the industry, such as promising drug candidates, through acquisition from small discovery companies; and (ii) put less effort into internal research and development.[118] Many large companies now source 40% to 60% of assets through a variety of external relationships,[119] and DiMasi et al. (2010) note a slightly higher probability of clinical success for externally sourced assets compared with internally discovered ones.[120]

Yet there are limits to the extent to which external is viable. In an auction dynamic, prices of late-phase compound assets increase dramatically, with a consequent minimization or elimination of gains to the acquirer. In an attempt to balance price and risk, a number of deal forms and alliance structures have been employed. Roijakkers and Hagedoorn (2006) demonstrated that there has been a rapid and consistent growth in the number of pharmaceutical company alliances with small companies over a long period, and that the network density within these sets of connections has increased markedly in recent decades.[86] Munos and Chin (2009) argued that such networks facilitate innovation, especially when supplemented by many weak links as opposed to strong links (i.e., trust- and contract-enabled connections).[121] CVC is one form of governance mode that large companies in the sector employ to manage external relationships.

Over the last 10 years, the industry has moved to license more early-stage assets, including preclinical assets in addition to Phase I compounds.[122] As academics and practitioners have come to talk of open innovation over the last 15 to 20 years, pharmaceutical companies have refined prior models of collaborative development and licensing that can be considered as long-standing examples of open-innovation approaches.

A Greater Interest in Early-Stage Technology Licensing

As part of these developments, a number of approaches have been utilized to enable companies to build strong, collaborative relationships with universities and with specific research groups, in order to make the university-industry licensing process more effective and less adversarial. One example of this approach is GSK's Discovery Partnerships with Academia (DPAc) program. In this arrangement, licensing terms are prenegotiated with a

university technology transfer group, and GSK commits to conduct certain tests if molecules show promise (based on prespecified criteria).[123, 124] Critically, the company works with a specific research group, often led by a single academic, initiating the partnership before licensable assets have been identified. Clearly this approach does not suit all research or academic institutions, but it provides an innovative model that can speed asset progression, minimize transactional discussions and facilitate effective collaboration.

A similar collaboration is AstraZeneca's with the Medical Research Council Technology (MRCT) group in the UK, in which both organizations pooled compound libraries to enable screening of targets for oncology, inflammation and diabetes.[125] This arrangement followed a highly novel 2011 agreement to enable academic researchers, through the MRCT, to access 22 of AstraZeneca's discontinued clinical and preclinical compounds in order to allow research for the repurposing of these compounds (i.e., in order to treat other target disease conditions than those for which the compounds were developed).[105]

In a similar vein, AstraZeneca reached an agreement with a US-led academic group that resembles GSK's DPAc in a number of respects. The Academic Drug Discovery Consortium (ADDC) was founded by five major academic centers with expertise in drug discovery in the United States: Johns Hopkins, University of North Carolina, University of California San Francisco, Harvard and Vanderbilt.[122] Under the terms of the collaboration, access was provided to AstraZeneca's extensive compound libraries, to enable screening of targets, and AstraZeneca received the option to license any candidate molecules that emerged from these activities.[126]

In Europe, the broad Innovative Medicines Initiative (IMI) has brought small discovery companies and large pharmaceutical firms together in a series of focused codevelopment projects. With origins in a 2005 European Union (EU) collaboration with the pharmaceutical industry, the IMI program was formally initiated in 2008 and had a budget of €2 billion over a five-year period, funded jointly by the European Commission and the major European pharmaceutical industry body the European Federation of Pharmaceutical Industries and Associations (EFPIA). A second multiyear program was initiated in 2014, set to operate until 2020 with a budget of €3.2 billion.[127]

Increased Use of Different Forms of Corporate Incubator Approaches

The pharmaceutical industry has expanded its use of physical incubators and of incubation schemes in recent years. In 2010, Pfizer established a novel codevelopment initiative with a set of academic institutions, which the Rockefeller University of New York joined in 2011. Under the Centers for Therapeutic Innovation program, the arrangements had a number of characteristics that appeared to have been designed to mimic a VC-funded biotechnology start-up model. Pfizer offered "equitable intellectual property and ownership rights to support continued experimentation and exploration" for funded preclinical and clinical development programs and in return received commercialization license rights.[128] An important aspect of this model is the fact that Pfizer initiated the colocation of some in-house discovery laboratories close or adjacent to the academic partner sites (e.g., one, in the case of the Rockefeller collaboration, is "on the East Side of Manhattan with close proximity to NYU Medical Center, as well as the Mount Sinai School of Medicine, Weill Cornell Medical College, Memorial Sloan-Kettering Cancer Center").[129]

GSK has been a major partner in the establishment of the Stevenage Bioscience Catalyst at one of its two key R&D sites, in Stevenage, in the southeast of the UK. This incubator has been developed over several years, and now hosts 31 companies, offering both wet lab space and office locations for virtual companies. Notably, the UK's new Cell and Gene Therapy Catapult, a government-sponsored industrial/academic development initiative, partially modeled on Germany's Fraunhofer institutes, is now located at this site.[130]

Johnson & Johnson has adopted a significant and unusual framework for early-stage companies to access the group of individual companies that are contained within its structure. The company now provides incubator space to selected companies that operate in areas of interest on a long-term basis at a set of 12 locations across three continents (in the United States and Canada, Belgium and China). The first site was founded in San Diego in 2012, and Johnson & Johnson has since expanded this incubator approach to multiple locations and made it a core part of the group's search activities. The company has stated that incubators have hosted over 330 companies in total, which have raised over $9.4 billion in growth capital.[131] This scale of activity is unusual in the pharmaceutical industry, given the fact that most major companies have largely focused exploration activities on maintaining small, early-stage search and licensing teams within their business development functions. It is possible that the more distributed nature of the Johnson & Johnson group (when compared with most large pharmaceutical competitors) may make this structure more valuable, as it offers external firms a pathway to locate the key contacts and key companies within a large group that undertakes many different activities.

More recently, some smaller firms have also begun to use of incubators. Zambon, a moderately sized, integrated Italian pharmaceutical company with a history in the respiratory medicine field, opened its Zcube Open Accelerator program in 2018.[132] The initial version of this program featured approximately 30 companies and provided entrepreneurship, technology development and licensing training. The program was based in Zambon's headquarters in Milan and allowed the start-up company staff to engage directly with leading venture capitalists from across Europe, with particularly strong engagement from the Italian life-science VC community.

In some programs of this type, the benefit may be access to new opportunities and a chance to assess (or to help shape) promising technologies while at an early stage. For larger organizations, the benefits may be partly derived from access to opportunities and also from the effect of incubation activities on the company culture of the sponsoring firm. In the case of the Stevenage Bioscience Catalyst, a set of sophisticated early-stage entrepreneurs now share coffee bars and restaurants with GSK staff, and these developments may have an effect on the culture of the host sites.[130] GSK's head of R&D Patrick

Vallance commented on these interactions in 2017: "The proximity to GSK's UK Science Hub and access to our capabilities has already made a tangible difference to a broad range of biotech companies as they pursue their novel programs... It is clear that GSK scientists value these interactions and relish the opportunity to be involved with the SBC scientists so that they can contribute to these emerging areas of science whilst developing their own skills and networks."[133]

This physical opening up of sites and the encouragement to start-up businesses to colocate with established large company R&D activities is a trend that spans industries. A famous example, which is widely cited in the innovation literature, is the transformation of the Phillips campus in Eindhoven, between 1999 and 2007. Various changes were made to transform the site physically, as the company moved from a largely internal R&D focus to a more distributed and collaborative (open) approach.[134, 135]

GE has adopted a related approach at an incubator in Finland. Instead of targeting companies for acquisition, it operates an incubator, the GE Health Village, and develops engagement with a set of companies that are selected for their areas of activity and the relevance of these to GE health-care interests. The smaller companies benefit from coaching, access to a network of experts and some of the resources of the larger firm. In return, GE obtains new understanding of emerging developments in key areas of interest.[136]

The Use of Option-Based Terms and Contingent Value Rights in Deals

The important issue for large firms is to make decisions on technology acquisition or codevelopment that optimize the firm's position in the marketplace. This requires the evaluation of a large number of factors, such as the culture of a potential collaborating firm—not all of which are amenable to numerical analysis. Clearly, the key issues are both the price of acquiring access to the technology (whatever the specific approach that is employed) and the risk of the technology in question. Assessing these issues is a complex matter—as is managing them to obtain suitable technological inputs that offer an economic benefit after risk is taken fully into account.

In the early 2000s, the pharmaceutical industry adopted a new form of deal structure—the so-called "option-based deals." This structure appears to have been used on a number of occasions when a small drug discovery company had developed an approach that was assessed by a large pharmaceutical firm as consisting of highly promising science and yet lacked a lead molecule that had advanced beyond the preclinical stage.

In a move that can be construed as an attempt to balance price and risk to the large company on the one hand and return and risk to the smaller one on the other, agreed-upon deals contained a set of options. The large company could license and develop the first, second or later (specific) molecule of the small company's emerging pipeline and could then decide to continue to develop or hand back the IP rights to the small company at a later stage (e.g., at the end of Phase I). Various royalty rates and license milestones were prespecified, depending on the scenario.

Many deal structures contained complicated possible scenarios, such as licensing by the large company (e.g., at a preclinical stage), discontinuation (e.g., at the end of Phase I), and further development by the small company and relicensing by the large one (e.g., at the end of Phase II). These deal structures appear to have been designed to allow large companies to access strategic assets at an acceptable risk-adjusted price, avoiding the auction dynamics (and the winner's curse) of single-asset licensing processes, and to provide acceptable returns to small companies at a relatively early stage of development (i.e., prior to the progression of a lead molecule into the clinic). These deals also provided validation of an unproven technology (from a clinical perspective) to other potential future licensees; academic studies have suggested that the value of this market signaling may be very substantial.[89]

A subsequent trend in the industry was the utilization of contingent value rights (CVRs) in acquisition transactions. In this deal structure, the final price to the acquirer is determined by the outcome of various clinical or sales activities, and the final payments are made some months or years after deal closing. An early example of this approach was the establishment of the HIV-treatment organization ViiV, which pooled assets from Pfizer, Shionogi and GSK.[90] This approach has since become widespread, as exemplified by the significant conversion ratio (CVR) in the proposed acquisition of Celgene by BMS. In its 2019 offer for Celgene, BMS offered $50 and one BMS share for each Celgene share, plus a CVR that was dependent on regulatory approval for three Celgene drugs in development: ozanimod for multiple sclerosis, and chimeric antigen receptor T-cell (CAR-T) therapy molecules JCAR017 and bb2121.[137] Both the option-based deal approach and the use of CVRs can be considered to be novel approaches within the industry to the issue of balancing price and risk, in an industry that is characterized by substantial technical development risk throughout the R&D process.

The Extension of Existing Open-Innovation Systems and Approaches

The extent of in-licensing and collaborative activity in the pharmaceutical industry, over decades, led to the development of a broad and deep so-called open-innovation system, prior to the coining of this particular term. This system was both broad, in the sense that it spanned almost all companies in the industry, to a greater or lesser extent, and deep, in that systems, processes, expectation and standardization emerged. For example, standard expectations of agreements, job roles and career pathways developed. For example, alliance management emerged as a recognized discipline to a substantial degree through the activities of firms in two key industries: information and communications technology (ICT) and pharmaceuticals/biotechnology. In the pharmaceutical industry, specific deal practices emerged regarding the involvement of the intended manager of an alliance in the transactional deal negotiations (with the default being to brief the alliance manager but to keep that individual away from the face-to-face negotiations, so as to avoid any potential rancor from the commercial discussions affecting the future relationship). One indicator of this trend was the membership composition of a major organization for alliance managers, the Association of Strategic Alliance Professionals

(ASAP), which for many years was dominated by individuals and firms from these two industries.

Within the pharmaceutical industry, certain career pathways became highly standardized. For example, it became unusual for an alliance manager to move into a transactional deal negotiation role. Although this happens on occasion, the general belief appears to be that the characteristics that are required of the two roles are so different that it would be unusual for an individual to be able to perform well in two fields that are dissimilar, even if both job functions are intimately involved in managing external collaborations for a large firm.

The phenomenon of open innovation has attracted a great deal of attention from both academics and industrialists, as revealing a change in the orientation of industrial development activity, from a largely inward focus to one that is highly externally directed (see, for example, Chesborough et al. 2006 and 2017).[138, 139] This phenomenon has been observed in a number of industries and situations. The experience of the pharmaceutical and biotechnology industries is revealing as it shows the same trend toward increasing openness in the sourcing of innovations and technologies that has occurred in many other industries, even in a context of extensive preexisting collaborative networks and a large degree of inward licensing by major companies.

3.3 Issues and Challenges: The Industrial Context

Given the widespread use of incubators and accelerators, the in-licensing of IP and the collaborative development of new technologies, why do some companies make notably greater use of some of these approaches than others? How do companies choose which approaches to employ, and how are these activities shaped by internal research and development programs? At a European level, would it be advantageous for companies to be more open to external science and technology? What lessons can be learned from this discussion of open-innovation approaches and corporate venturing, from the perspective of national and European policy makers?

Europe has an extensive science base in both academia and industry, and many large European companies employ a number of open-innovation approaches. In particular, many large companies have a classical corporate venture group, which makes equity investments in early-stage start-up firms. This approach is well established in industry, yet companies, as noted in this report, appear to be increasingly adopting a range of methods of interacting with early-stage high-technology firms and of assessing and sourcing new technologies. A key issue for large corporations is how to manage a complex set of interconnected operations, and this challenge becomes magnified when a large network of highly variable, external interactions becomes a critical element of its technology strategy.

Technology Management in Firms: The Corporate Venturing Context

How a company develops its new products is a fundamental issue for management. In high-technology fields, openness to external approaches is common. The methods by which these must be blended with internal activities is a core focus of technology strategy and management; the company's senior management must choose the strategic objectives, the goals for product development and the fields of activity (for a discussion of these topics see Tushman and Anderson 2004[140]). How best to accomplish these objectives is the responsibility of R&D management, and it is typical for multiple external inputs to feed into a core group of internal

development programs. A company requires an optimal balance of internal and externally focused activities, and the best arrangements will depend on the quality, cost, difficulty of access and stage of development of the internally developed and externally available inputs.

A broad academic literature describes approaches to the field of technology management. Fundamentally though, this domain is one of practice and applied management within the specific situation and culture of the particular firm in question. Approaches such as technology road mapping can enable development teams in large firms working on multiyear projects "to see the wood for the trees" and to retain a focus on strategic technology goals.[141] In these frameworks, a time line runs on a diagram from left to right, and a small number of horizontal layers run from top to bottom, representing different technical levels of aggregation, from the product goal, through key technical capabilities and subsystems that must be developed, down to specific current projects. (See **Figure 23**.) This type of diagrammatic representation makes clear that multiple technical inputs are involved in the development of most high-technology industrial products. Naturally, these inputs may be sourced externally or internally. When a firm obtains external inputs, these are typically at the lower levels of the road map, as IP licenses or collaborative projects aimed at meeting specific goals and developing subsystems.

In the high-technology domain, small firms face very similar needs to large firms, as the relevant managers plan and organize the assembly of different elements of technology into new products or novel technology platforms.

The Conflicting Objectives of CVC Groups

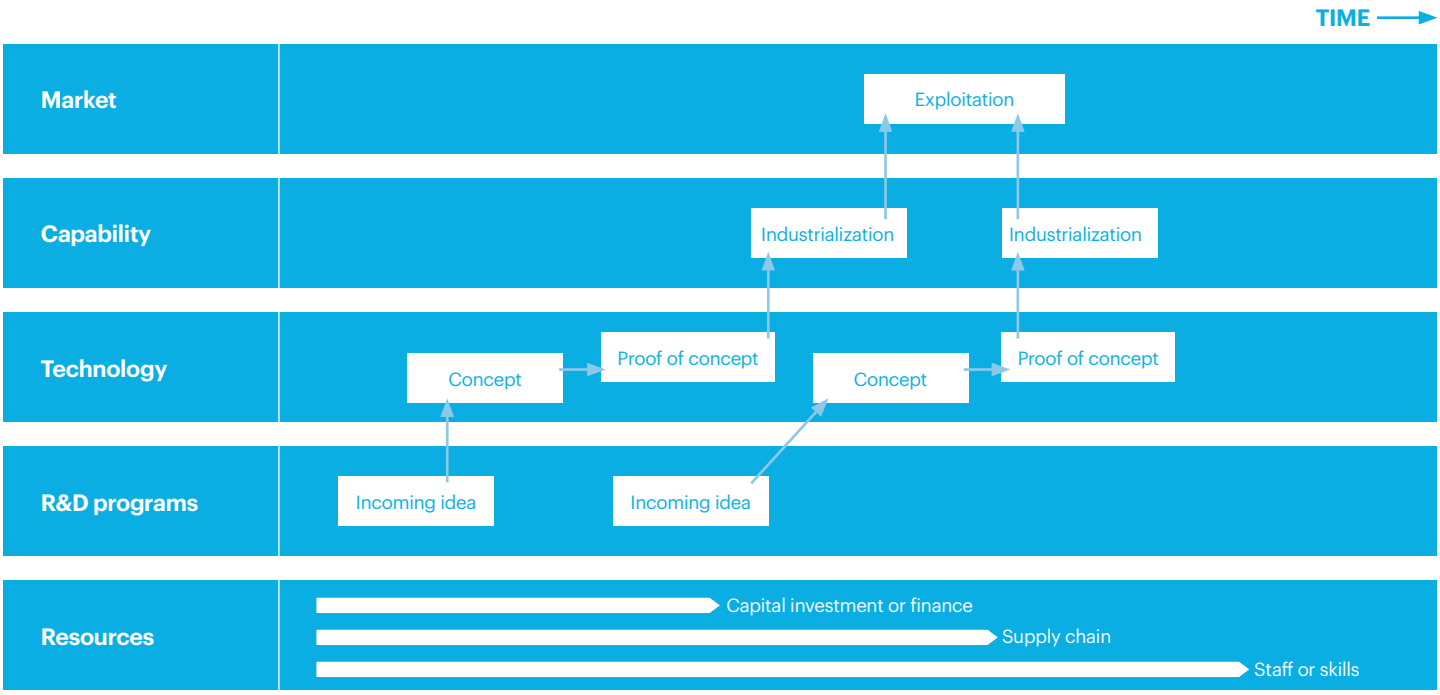
In the context of the need for company mangers to make a complex set of evaluations and decisions, there are specific issues that affect CVC groups. Vanhaverbeke and Peeters (2005) described the challenges of operating of a CVC unit: a key aim is to explore beyond the confines of the parent corporation, while operating within those boundaries.[142] The nature of CVC groups means that their staff must be adept at dealing with internal and external domains, and handling differing concerns, priorities and business environments. These authors noted:

"'New business development' units are almost by definition peripheral in a company where the majority of managers at all levels are preoccupied with incremental innovations, operational efficiency, cost cuts and narrow market share competition. Nurturing radical innovation and exploring attractive business opportunities for the future growth of the company is at odds with the dominant logic within the firm."

The Organization and Incentives of CVC Groups

Hill et al. (2009) considered the "transferability of the venture capital model to the corporate context" and evaluated to what extent it is possible or desirable to replicate management structures and incentives of a financially motivated, independent VC firm within the corporate environment.[75] Using a longitudinal study based on data collected at three main time points over a period of several years from 2001, they attempted to discern which practices should be adopted and the impact on the survival of the CVC unit. These authors concluded that adopting

Figure 23. Schematic Representation of a Technology Road Map



Source: Based on Phaal et al. (2010)[141]

many of the practices of independent VCs ("carried interest compensation, vertical autonomy, VC syndicate size, and investment in an industrial domain that is relatively related to that of the parent" [ibid.]) improved the financial performance of CVC groups. However, while the case can be made that CVC groups should adopt the practices of independent venture capitalists, as these have been successful for many VC firms, it is possible that these practices do not translate effectively to a corporate setting where strategic objectives may be as important as or more important than financial returns.

Ambidexterity and Organizational Challenges

Hill and Birkinshaw (2014) presented the concept of ambidexterity and developed an argument that this characteristic is critical to the survival of CVC units.[143] The authors defined ambidexterity as being "the capacity to capitalize on an existing set of resources while at the same time developing new combinations of resources to meet future needs" (Ibid.). This study suggested that the concept of ambidexterity should be seen as being central to a CVC group's balancing of relationships with internal senior management, external venture capitalists and business unit managers in the firm. The authors proposed that exploration and exploitation should be seen as a continuum, rather than as polar extremes. Hill and Birkinshaw proposed that CVC groups should, in order to survive, avoid focusing entirely on exploration or exploitation, but seek to address both potential goals of CVC activity to some degree.

As the authors noted, given the fact that VC funds typically require at least seven to eight years to demonstrate profitable returns, and the fact that corporate executives typically have a tenure that is less than this time span, there is a significant danger that CVC groups that would be profitable if continued could be terminated before profitability had been attained. The resources of the firm, as other authors have noted, provide assets that independent firms cannot replicate, and hence provide a source of advantage for CVC units. Equally, the constraint that may exist on operating in areas that are close to those of the parent firm may impose costly restrictions on the CVC group. Although the issues mentioned above were first raised in connection with equity-investing corporate venture groups, similar challenges are faced by internal groups operating other external-facing activities and programs, as is the case with accelerators and incubators.

Acquisition and Integration Issues

In some firms, one of the purposes of accelerators and incubators is to identify technologies that may be suitable for acquisition by the sponsor firm. Sometimes, the gain of rights may be through a license (whether or not linked to a collaborative development project), but on other occasions, the larger firm may acquire the smaller one outright. The importance of identifying of acquisition targets appears to vary across industries. Obtaining knowledge on potential acquisition targets with an explicit aim of using CVC as a means of identifying innovative firms to acquire is an objective that has been attributed to CVC.[68, 82] However, some authors note that acquisitions are not necessarily value-adding[83] and, based on the academic literature[84] and practitioner comment, there appear to be multiple rationales for firms to operate corporate venture groups (and, by extension, the same rationales, accelerators and incubators). It is an interesting question as to whether or not the increasing use of accelerator-type approaches has increased the importance of acquisition target identification for sponsor firms.

Integration of the activities of a small firm into a larger one is a task that is often fraught with difficulties. One of the motivations for acquisition is often to employ and to retain the team that successfully initiated development of the selected technology and who know this approach in great detail. However, individuals who flourished in a small company environment may be reluctant to remain with a larger firm, and there are practical limits to contractual approaches to the retention of key employees. One approach, at the cost of additional complexity, is to allow the smaller firms to operate on an independent site (as GSK did following its acquisition of Cellzome).[144] In general, best practice appears to be to acknowledge both the issues involved in integration and the practical limits of mitigating measures, and to plan for integration as part of the acquisition process.

3.4 Conclusions

Companies use formal VC groups and related venturing approaches, such as company-sponsored incubators and accelerators, for a variety of purposes. The specific focus of venture activities varies greatly, and there is evidence that company practices vary across industries. While a broad aim of CVC is to gain awareness of novel technologies, firms may specifically seek: to develop a broad awareness of market developments; to identify companies for potential acquisition or technologies for potential licensing; or to develop mechanisms that alert the firm to emerging technological discontinuities (i.e., major technical changes, such as the advent of epigenetics in the pharmaceutical field).

A number of trends have been observed in this domain in recent years. In the university domain, these include the funding of the development of technologies to a later stage by institutions and associated funds, and the emergence of a university venturing sector, particularly in the United States and the UK. Financial investment models are increasingly applied, albeit on a small scale, to the development of socially beneficial technologies (e.g., in the environmental or health-care domains). A small venture philanthropy and impact investing community has developed, occupying a space that sits between financially oriented investment and pure philanthropy (i.e., grant giving). Industrial attitudes to externally sourced technologies appear to have changed in the last 15 years, and an increased openness is apparent. This is evident in an increase in the licensing of early-stage technologies, a substantially increased use of incubator and accelerator schemes, and the use of novel structures that are option-based or that make extensive use of contingent value rights. The pharmaceutical sector has seen the development of novel forms of hybrid VC groups that combine practices of independent (i.e., financially oriented) VC firms and CVC groups.

Firms face major challenges and significant complexity in sourcing and assimilating appropriate external technologies. Assessing the risk of early-stage technologies is a critical issue, and firms in high-risk industries (e.g., pharmaceuticals) must carefully evaluate the risk-adjusted cost of any potential technology acquisition. In addition to facing traditional technology management issues, venture groups are challenged to find and to develop novel and innovative solutions in an operating company context that is typically characterized by a culture of incremental improvement and systematized processes. Consequently, these groups often need to carefully manage and to balance the interests of multiple key internal stakeholder groups.

Companies operating in Europe appear to demonstrate many good practices in terms of corporate venturing, collaboration and the external sourcing of technologies. However, there are a number of areas within the overall academic-industrial ecosystem that cause difficulties and challenges for organizations, and efforts to address these areas would be beneficial. In addition, there are a number of emerging trends that could be fostered and supported at a European level, to deliver economic and social benefits.

The EU and its constituent bodies could consider taking action in the following areas that are connected to corporate venturing, with the aims of maintaining and improving European economic competitiveness:

Encourage industrial, open-innovation activities in Europe in high-technology sectors. The EU and its constituent bodies should monitor the activities of large and mid-sized firms to engage with providers of early-stage technologies through the use of accelerators, incubators and VC schemes. From a European perspective, these activities are of vital importance to the health of key high-technology industries, in which Europe has a strong position, and it is important that a clear picture is developed of European activities in this domain and that, where appropriate, action is taken to further foster the development of open early-stage technology development activities. A key concern should be to ensure that industry in Europe is participating fully in emerging trends and that major gaps, compared with activities of firms in North America or Asia, do not develop.

Encourage the development of a European venture philanthropy sector. North American groups are the leaders and pioneered venture philanthropy and impact investing. The EU and its constituent bodies should encourage the development of this sector in Europe, given the potential social benefits of these fields and European strengths in financial and legal sectors in addition to extensive expertise in high-technology science and engineering. In particular, it may be possible to facilitate the emergence of pan-European platforms and networks through the EU bodies' power to convene the leading actors in this domain and to encourage the development of guidelines and the dissemination of best practice.

Encourage the development of the university-venturing sector. The EU should monitor and, with care, encourage the development of the university-venturing sector in Europe. In this sector, the dissemination of best practice could be of significant benefit, given the vital importance of appropriate governance in the development and management of these investment funds.

Improve the overall effectiveness of university-sector technology-transfer activities. While some institutions possess excellent technology-transfer groups, there is a wide range of capabilities among groups across Europe, and cultural challenges remain, such as negative attitudes to commercialization in certain regions. The EU and its bodies could play a role in improving European effectiveness in this area. In addition to facilitating the spread of best practice, consideration should be given to encouraging new structural models, such as consolidation of TTOs, as part of this activity.

Develop regional connections to key clusters. There are certain key high-technology clusters (for different sectors) across Europe, and in order to maintain global competitiveness, it is important that the strength of these clusters is retained. In terms of the goal of enabling economic development of regions outside of these clusters, one valuable approach would be to foster a degree of connectedness of these regions to the key high-technology clusters, in order to provide an infusion of knowledge and connections to regions outside of the key technology centers.

4. The Impact of CVC on the Technology Transfer Field: The Developing Role of University TTOs

4.1 Introduction

In today's classic European innovation ecosystem, university TTOs seek to raise investment from the private sector to progress research spin-offs, moving IP to market. Corporates look for innovation-based investment opportunities that match their corporate strategy activities. This seems like a perfect match in university-industry collaborations. However, looking at the drivers that motivate this relationship, it is possible to observe that universities and corporates have different perspectives on common-ground issues affecting their relationship. These differences become apparent when a government grant for a research project runs out but the researcher has yet to secure external funding from private investors. Without further investment, research that may later be socially and economically useful, but is not yet commercially viable, can stall. This lack of funding in the early-stage development of a research project, known as the Valley of Death, is the center of this section's discussion.

The problem is as follows. By definition, "Valley of Death" refers to the period of time spanning from when a start-up firm receives an initial financial contribution to when it begins generating revenue. The so-called Valley of Death is therefore a metaphor, often used in VC to describe the gap between university research and its commercialization.[145] It arises when the private sector or investors will not pick up a scientific marketable idea because it is too risky—as it has not been fully applied and its TRL is too low—generating a financial gap that impedes the commercialization progress of this idea. Therefore, this increases the difficulty of covering the negative cash flow in the early stages of a start-up before the new product or service can bring in revenue from real customers.

It's not surprising, therefore, that university start-ups in an early stage of development very often encounter a financial gap that limits their ability both to innovate and to commercialize their products or services, ending up in the Valley of Death.[146] Yet, for these new companies, limited human capital, high uncertainty in terms of product and market, a volatile development process and weak partnership ties are the utmost impediments for successful development.[147]

For the purpose of this section, the level of analysis focuses on the venture/investment level between corporate venture capitalists and university TTOs.

In this scenario, CVCs are valuable contributors to university start-ups in both filling the financial gap and in providing value-added services, such as financial, technological, managerial support and contacts.[148] Hence, CVC funding can trigger company growth and product development, inspire entrepreneurship and enhance the competitiveness of a start-up,[149] bringing key factors for its future development to every stage of the start-up project (prototyping, launch, refinancing and project output).[150]

In return, CVC funding also brings terrific advantages to its parent companies, as they benefit from an opportunity to invest in a diversified portfolio, which makes it possible to reduce the risk of innovation while keeping a certain control over a start-up or an option of repurchase on the innovation once it has gone beyond the stage of emergence. According to Weber and Weber (2007), empirical analysis of German CVC units and their innovative portfolio companies shows that the success of the latter has dual significance for the corporation: high returns for the CVC unit and strategic potential for radical innovation.[79] This confirms that CVC funding is a model for big companies to continue to develop in high-tech sectors.

The only risk in measuring the impact of CVC on the technology transfer field is that, if CVC activities have a positive effect on a firm's long-term economic benefits, these strategic gains are often not evident because a short time span is normally considered when evaluating CVC benefits.

The impact of CVC on the developing role of university TTOs in the technology transfer field remains predominantly characterized by the sharing-of-resources mechanism. Other mechanisms are certainly contemplated by universities but mostly via separate collaboration between university business schools and industry. The fact that prominent TTOs predominantly use the resource-sharing mechanism for corporate venturing is also due to the fact that the parent university can afford to support extensive research activity with its own university research budget.

In the case of the University of Oxford, the research carried out across all subjects is mostly financed by the university itself (with an annual university research budget now close to £580 million)*.[151] In addition, the university also supports its TTO, which relies on the entrepreneurial culture of the university and its entourage (at the national, regional and local level) to put in place other corporate venturing mechanisms in an effort to expand its technology transfer operations to activities supporting specific industry partners, creating closer connections to the corporate sector. More specifically, these interconnections happen when the TTO shares the IP early filing information with corporates in order to open up prospective collaboration to develop both the technology and the business model of the new invention.

Regarding other mechanisms, the University of Oxford considers some activities that evolve in parallel with the TTO and develop within the Oxford ecosystem, such as the development of spin-off company business plans, which is often done in collaboration with the university's Saïd Business School; or via the creation of a university-based technology business incubator (The Foundry), through which the university also provides a permanent coworking space. All this, in turn, enables the university to explore other corporate venturing mechanisms, including hackathons, soap boxes (scouting teams), excubators and challenge prizes. Moreover, the entrepreneurial Oxford ecosystem also provides the university TTO with tight interconnections with the science parks and seed and venture funds to further strengthen the TTO-CVC collaboration framework to act as a bridge between innovative and disruptive start-ups and established corporations.

In an attempt to measure the impact that CVC units have on the technology transfer field, the case of the University of Oxford TTO is considered a good example to illustrate how the sharing-of-resources mechanism works in practice. The CVC-TTO collaboration in Oxford develops either on a direct-external or indirect-external basis, depending on the partnering corporation's approach. In the case of direct-external, the partnering corporation—without using a dedicated new venture fund—acquires or takes an equity position in an external venture, in this case launched by the TTO. For example, this happens when the corporate invests in the formation of a spin-off, taking a minority position along with the university and the management team, securing the possibility of growing a new business that may well have a direct benefit on the corporate financial results. In the case of the indirect-external approach, the partnering corporation instead invests in a VC fund that targets external ventures (university spin-offs) in specific industries or technology sectors, thereby indirectly gaining access to and participation in new business that can be absorbed in the corporation via M&A. On the university side, the impact emerges when the IP portfolio is licensed and duly developed into start-ups to then be commercialized with the CVC unit as an investor, regardless of the approach used.

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* The value of £580 million is €689 million.

4.2 Issues Affecting CVC Impact on Technology Transfer

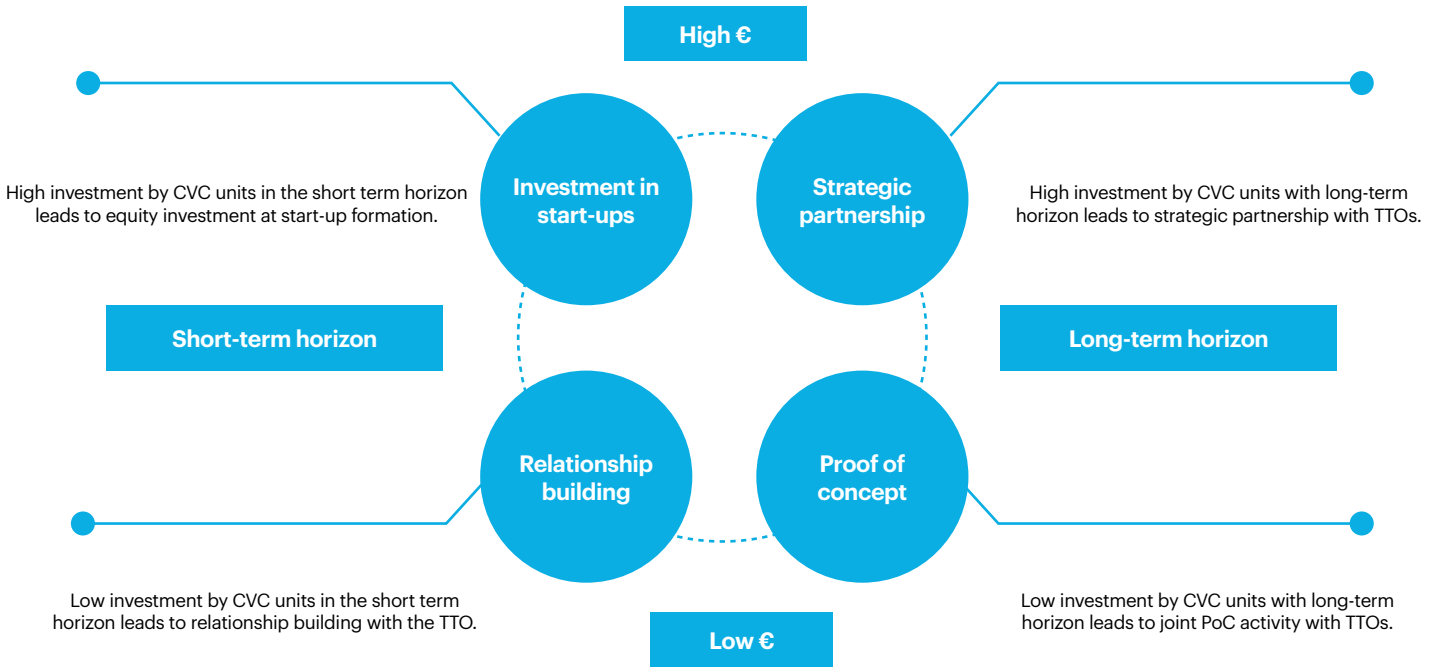
In the light of the above, a question emerges: If CVC funding is a perfect catalyst for start-ups to overcome the Valley of Death and start-ups are a great source of innovation for big companies, why is the lack of early-stage funding (by CVC units) still resulting in a high mortality rate among a great number of university start-ups?

To find an answer, we may need to look at issues affecting this relationship. Drawing on research that looks at the fundamental matters that afflict university-industry collaborations, some researchers have repeatedly pointed to the different time horizons in which university and corporates operate, invest and plan their activities. They found that the academic research focus on long-term challenges is often in conflict with the short-term focus on financial objectives of CVC programs. The latter, in turn, may prohibit counting CVC units' long-term strategic benefits from external innovation when collaborating with universities.[152] As a result, corporates sometimes find universities too slow and too bureaucratic to be good partners[153] and show persistent reluctance to invest in university projects, as holding an equity stake in a start-up is a high-risk investment that often leads to a long-term illiquid asset.[53]

Others look at the different expectations that universities and industry devise for project collaboration, particularly for those publicly funded universities that aim to further develop the research findings from earlier collaborations. A review of current literature on the subject suggests that university-driven research, though riskier, allows for unexpected fruitful scientific and technological achievements, with a lot of spillover into other fields. In contrast, industrial-driven projects result in more modest achievements but are more likely to be adopted for use by firms that invest in knowledge transfer through several channels, in particular labor mobility.[154]

Figure 24 identifies the emerging collaborations between CVC units and TTOs according to time-horizon and quantity of money invested by CVC units. It clearly shows that classic investment from CVC units tends to favor the types of collaboration that evolve in the short term horizon, in contrast to the university's goal reinforcing this relation with the CVC unit for long-term activities, including PoC and strategic partnership ventures for successful collaboration.

Figure 24. Emerging Collaboration Between CVC Units and TTOs—Taking Into Account Time Horizon and Money



Source: Prepared by the authors.

4.3 A Cross-Cutting Approach Is Needed to Align Different Perspectives

It would be easy to think that collaborating CVC units and TTOs are kept or abandoned merely based on performance, but it's not that simple. Corporate VC units are often motivated by their strategic benefits, which are much harder to assess than pure financial returns.[155] This uncertainty makes the focus on intangible benefits important. That is to say, aside from the firm's need to assess its willingness and ability to commit to it, a CVC unit must invest regularly enough so that its managers accrue expertise and self-confidence, reducing their natural propensity to blindly follow the crowd when it comes to decisions on whether to play a strategic role in keeping up with the disruptions in the business and ensuring business longevity.

The identified issues reveal that, given the potentially broad impact that CVC funding can have on technology transfer, it is important to take a cross-cutting approach to address them under joint programs, where CVC units and TTOs are able to communicate their needs and align their perspectives in order to ensure that these two worlds and individuals from these two sides can cooperate as well as possible.

In order to succeed, it is important to bear in mind what the university and industry drivers for collaboration are and where they differ. From a corporate venturing point of view, the main aspirations for investing have a stronger focus on corporate strategic objectives, determined by their increasing need for additional growth in business propelled by innovation. From a TTO's perspective, the first step to success is typically to form a partnership with either a corporate or a start-up, where the TTO builds the bridge between research and revenue, sometimes with an academic in the center. Whether that means conducting market research, providing incubator space, funding the PoC experiments or registering patents, the TTO has to create a strategy that will lead the research to market and make money for the institution.

In order to generate a CVC-TTO common list of objectives and then prioritize the ones that are most important in each circumstance, it is important to understand that fruitful cooperation entails a change of mind-set that consequently will have an impact on the time horizons and strategic objectives both entities use to operate and invest together. For example, a corporation's short-term focus on financial objectives may need to be gradually adjusted according to the benefits from external innovation it expects to receive when collaborating with universities to grow business propelled by innovation. Universities operating in this increasingly diversified and rapidly changing landscape of innovation will clearly require a major capacity-building effort to equip technology transfer players with the necessary skills and resources to ensure success.

Looking at the experience of prominent university TTOs and their best practices in encouraging university–industry collaborations, some solutions to address the existing issues can be foreseen. A suggested solution is that businesses structure their relationships with universities in ways that make them much more valuable. In fact, this kind of suggestion has been recognized for some time to address the prevailing casual nature of this relationship.[153] Note that in the overall technology transfer landscape, when university TTOs and corporate venturing units interact, too often corporates pursue collaboration with university researchers in an ad hoc, piecemeal manner. Given better chances to understand each other, both universities and corporates can achieve better results from working together.

The following section discusses three approaches that have been successfully adopted by prominent universities to promote effective relationships between TTOs and CVC units.

4.4 Finding Common Ground to Collaborate Effectively in the Long Term (Five+ Years)

Industry and university collaborations aren't always effective. To make them work, each side must overcome the cultural and communications divide that tends to impair collaborations of all types and undercut their potential. For a collaboration to be effective, it has to be a long-lasting relationship between these two types of organizations. A successful relationship is usually a combination of culture, effort, talent and resources.

The challenge is to find ways in which TTOs and CVC units can communicate their needs in order to find common ground. The following set of selected strategies has been identified as instrumental in prolonging the life span of collaborations.

4.4.1 Effective Staffing Choices

According to Gaba (2017), specific staffing choices and high investment levels can prolong the life span of CVC units.[155]

Since CVC has become a crucial tool for big corporations under pressure to push innovation, effective collaboration with TTOs gives them a window into new technologies and a way to access novel ideas, especially those likely to cause disruption to the industry. For this to happen though, CVCs need to stay on course to reap the benefits. This is not always noticeable to firms, and despite the obvious benefits, CVC units tend to have a short life span. Between 1980 and 2006, the life cycle of a corporate venturing program was estimated to be about four years, while strategic investment programs' financial goals based on return on investment should always be positioned as long-term (five+ years).[156]

Corporates that want to sustain their unit over the long term should think carefully about the implementation choices they make, in particular staffing, as they may be inadvertently sowing the seeds of abandonment.[157] For instance, after controlling for multiple variables, including the dotcom collapse of 2000, Gaba and Dokko (2016) found that hiring at least one team member with prior VC experience makes corporates less likely to abandon their CVC unit. Here abandonment is defined as the absence of VC investments for at least four years.

University TTOs operating in this increasingly diversified and rapidly changing landscape of innovation will also clearly require major capacity-building efforts to equip technology transfer managers with the necessary skills and resources to interact with corporates and overcome misunderstandings and misperceptions on common issues. It had been theorized that qualified technology transfer managers (TTMs) bring deep practice knowledge and that a TTO would have a higher chance of success if it were staffed with people intimately familiar with the inherent ability to integrate start-up technologies and manage top management expectations. It turns out that having a qualified team of TTMs with VC experience on board brings deep practice knowledge, providing a better handle on how to look for new ideas, how to evaluate early-stage start-ups and create contracts, etc. Without the full know-how and mind-set, teams lacking experience with VC tended to adapt the VC practices in unhelpful ways.

4.4.2 Effective Trade-Off Evaluation

As mentioned earlier, it is naive to think that practices are kept or abandoned simply based on performance. Corporate VC units should pay attention when evaluating their strategic benefits, which are much harder to assess than pure financial returns. Apart from ensuring that VC investments are done right, team members with VC experience are more likely to emphasize financial returns. If the firm cares about strategic returns, hiring people with real VC experience is essential to accrue expertise and self-confidence, reducing their natural propensity to blindly follow the crowd.

Corporate VC programs can play a strategic role in keeping up with the disruptions in the business and ensuring its longevity. Specifically, CVC units that made a higher number than the median number of investments conducted by corporates were less likely to be abandoned, even after accounting for negative social pressure. We theorized that more investments allow managers to hone their experience and increase their self-confidence, dulling their instinct to follow the crowd.

4.4.3 Effective Teamwork to Serve Common Interests

For industry, universities provide the earliest look at where the next big idea will come from. In fact, corporates that are aligned with early-stage research see early signs of what's going to be the next big opportunity, and they get a head start on the competition. Corporates also benefit from access to a network of faculty, key opinion leaders and lead scientists, and the ability to team up with other companies interested in the same research. Finally, collaborating with universities allows corporations to derisk their research and provide research cost avoidance, saving them money even as they funnel dollars to universities.

For universities, understanding how to develop and maximize corporate collaborations in this uncertain funding environment is critical. Industrial collaborations can tell academics where the current challenges lie, and mutually beneficial partnerships can produce groundbreaking research and innovation that solve complex problems, drive economic growth and create a more skilled workforce. This also helps university researchers/inventors build their research based on a real-world experience. Moreover, while universities and industry enjoy a symbiotic relationship, society will also benefit from economic growth driven by innovation and a trained workforce.

4.4.4 Effective Choice of Mechanisms

In order to choose the appropriate mechanism of collaboration, corporates should consider questions such as: What can these university TTOs do better or differently than we

can? In fact, some big companies invest in university partnerships in areas where it does not yet make business sense for the company to build extensive technology capability. In its place, a TTO director could consider adopting the sharing-resources mechanism to help address these questions. Such a mechanism would enable both the university and corporate partners to meet periodically to discuss selected IP disclosures in specific fields that are strategic to the corporation but in which CVC units may lack internal know-how. These constitute a primary reason why engaging with the TTO as a legitimate partner to start up a new venture would be opportune for a corporation.

A strategic alliance can also be considered as a mechanism to facilitate the provision of innovation funding to a TTO via a joint university-corporate PoC program. Such a program can be structured around the development phase of the university research until the delivery of a working PoC in order to validate the potential for commercialization through pilot tests, which ideally would grow into a profitable business. To achieve effective screening of those opportunities, a joint team must set appropriate evaluation criteria, define common areas of interest and include personnel with relevant technical and market experience in the screening committee. The commercialization phase often entails significant investment risks and therefore the emphasis on validation via PoC would further reduce technical and market uncertainties by gaining early customer feedback, and in turn, make a well-informed judgment on the likelihood of commercial success.[158]

According to Elmuti, Abebe and Nicolosi (2005), the major advantages for the academic community and for industry in making strategic alliances is to lower research and development costs and increase technology transfer opportunities that boost competitiveness.[159] The drawbacks may include the different working cultures and values of the partners. University-industry alliances, therefore, must be supported by continuous learning and restructuring processes to overcome these differences.

4.5 Training to Align Perspectives and Best Cooperate

To understand what meaningful cooperation involves, a change of mind-set is required to align the time horizon and strategic objectives that corporates and TTOs use to operate and invest together. This change may be eased with common training to create a buffer against the gap found between CVC units and TTOs in terms of language, perspective and expectations. Essentially, training technology transfer managers from university TTOs will provide them with the necessary skills to understand and negotiate intellectual property rights (IPRs) with corporations, while corporations will gain insightful understanding of the novelty and opportunities that university spin-offs imply for their financial objectives as a benefit of external innovation.

A literature review suggests that universities and industry have a different perception of their usual cultural barriers to collaboration.[160] Through training, the chances of experiencing an institutional convergence may provide a shared cultural space for knowledge exchange and communication in joint CVC-TTO projects, bridging perceived institutional gaps.

This is confirmed by Bruneel, D'Este and Salter (2010), who found that obstacles to collaborations between universities and industry are affected by the collaboration experience, breadth of interaction and interorganizational trust.[161] In particular, prior experience of collaborative research lowers orientation-related barriers and greater levels of trust reduce both orientation-related and transaction-related barriers. These authors also indicate that breadth of interaction diminishes the orientation-related barriers but increases transaction-related barriers. Interorganizational trust is therefore one of the strongest mechanisms for lowering the barriers to interaction between universities and industry. For this reason, the traditional system of informal reciprocity and exchange, which dominated CVC-TTO interaction, should be an important aspect to take into account in the attempt to support and build enduring collaborations.

Looking at the nature and impact of universities and other higher education institutions (HEIs) on firms' innovation and growth, Howells, Ramlogan and Cheng (2012) found that collaborations vary significantly between the type of firm involved and its location, and that much of the nature and effects of such collaborations are counterintuitive.[162] Industrial researchers who have little experience of interacting with universities are more likely to report high barriers to collaboration (i.e., different frameworks and the difficulty of identifying, locating and accessing university knowledge). However, industrial researchers, who are more experienced at collaborating and networking with university researchers and at scanning and searching academic publications to inform their industrial R&D activities, see fewer barriers. Moreover, industrial researchers who have been intensively involved in patenting and in interacting with universities through TTOs often emphasize concerns about IPR ownership issues or high management costs.

CVC-TTO collaboration training should be designed for three different audiences: (i) TTOs only , (ii) corporate ventures, and (iii) joint training for both TTOs and corporate ventures. The curriculum should cover the following topics: IPRs, licensing agreement negotiations and IP development plans. The training should be given by relevant governmental institutions, universities and practitioners' associations (such as AUTM in the United States, ASTP-Proton in the EU and PraxisAuril in the UK). The training should start with a teaching-friendly format (classroom learning, e-learning tutorials and locally and/or regionally based training) that can be reinforced with internships and mentoring to help build sustained working relationships as well as career prospects.

4.6 Proof of Concept (PoC) to Help Cross the Valley of Death

University spin-offs often develop early-stage technologies characterized by long development paths and uncertain commercial potential. Preseed schemes aim to reduce the organizational uncertainty and make the nascent venture attractive to investors. The seed funding initiatives seek to improve the supply of funding, while there seems to be an increasing number of preseed and PoC schemes seeking to bridge the financing gap from the demand side by increasing the attractiveness of the spin-offs for investors.[163]

On the one hand, seed funding schemes provide early-stage equity financing. On the other, CVC has experienced tremendous growth over the past decade. A peak in CVC funding was observed in 2015, with more than $28 billion injected in young companies by CVC players around the world. With such large amounts, CVC definitely deserves attention, notably in Europe where CVC is still in a ramp-up phase.[164]

Financially focused CVCs can be leveraged for the brand, while strategic-focused CVCs will drive PoC and pilots, where PoC is defined as a basic demonstration that showcases an idea in order to illustrate its scalability and profit potential.

4.6.1 PoC as an Instrumental Link Between Creation, Entrepreneurship and Economic Growth

By exploring the relationship between knowledge creation, entrepreneurship and economic growth in the United States over the last 150 years, Audretsch et al. (2006) found out why new growth theory (that is, investments in knowledge and human capital generating economic growth via spillovers of knowledge) does not explain how or why spillovers occur, or why large investments in R&D do not always result in economic growth. The missing links were identified as "the knowledge filter" (the distinction between general knowledge and economically useful knowledge) and the entrepreneurship mechanism that converts economically relevant knowledge into economic activity.

Vass (2008) describes how the unprecedented increase in R&D spending in the United States during and after World War II was converted into economic activity by the operation of many tech transfer PoC centers.[165] From this exceptional experience, Vass notes that an effective PoC center must be able to find: a combination of an administrative team and advisers who are pivots in the local technology-industry network; a knowledgeable TTO staff, who may actually be more useful in accelerating the commercialization of university technology than the seed funding; and a strong social network, if there is a community surrounding the center, that includes advisers, angel investors, venture capitalists and interested firms for grantees to partner with.

4.6.2 When Is a PoC Valuable for a Start-Up?

The PoC stage is one of the most valuable milestones for a start-up. Whether the PoC process involves developing a prototype, building an algorithm or assessing market demand, the PoC stage proves to the start-up founders and potential investors whether or not there is a market for their product in the first place.

The PoC stage is not just a matter of taking an idea and bringing it to life—it shows potential, particularly to investors considering backing a project, by showing that prospective users can actually be interested in using and enjoying the product. Running a successful PoC gives validation that such a need exists and that the product can provide the solution. Confirming a start-up's value to the market gives different teams throughout the company the boost they need to expand the influence of their innovative technology.

Start-ups gain many advantages from prototyping, including the ability to adjust to change, think creatively and bootstrap ideas. This is crucial when there is a short time line to prove success. Start-ups can use the momentum of a successful PoC to keep running forward. Moreover, for early-stage start-ups, showcasing the results from a successful PoC may increase their valuation and help their efforts in securing future investment rounds. For start-ups currently in or about to launch an investment round, a successful PoC can not only increase their value but also convince on-the-fence investors that the product has a clear product-market fit.

Since the PoC process is a complex one, when working on a demo the process must be made reliable and innovation-friendly. This is when CVC-TTO joint support becomes instrumental, as it may compensate for the start-up's inability to reach the right person, whether through lack of connections, funds or time on the start-up's part, which often blocks start-ups and hinders their ability to integrate their solution into an enterprise. In addition, start-ups' timely connection to enterprises at such a critical point in their R&D stage means they are able to take the benefits of such collaboration to all future funding rounds.

PoC also addresses the common issue that arises when the private sector/investors will not pick up a scientific marketable idea because it is too risky (as it has not been fully applied yet and its TRL is too low), generating a financial gap that impedes the progress of the idea's commercialization. PoC here offers an effective joint activity that can be promoted by TTOs and CVC units together to help start-ups cross the Valley of Death.

4.6.3 PoC as a Key TTO Feature to Attract CVC Collaboration

A feature that characterizes prominent TTOs is the principle of not starting the commercialization phase too early, in order to avoid promoting an IP portfolio that is not adequately developed.[165] For this reason, Oxford University Innovation (the University of Oxford TTO) often deploys PoC as a key IP commercialization mechanism to plug this gap. This mechanism could be jointly adopted by a CVC unit and TTO (on a 50-50 basis) to financially support PoC of university IP in specific research fields of interest to both corporate and university researchers.

There, another feature of PoC funding is that its model has evolved around two essential features: (i) a percentage of the income stream from the commercialization of innovations is allocated to the PoC for further investments and, (ii) the PoC fund has increasingly become financially self-sustaining from this allocation of income and other related income-generating services.

In other words, the PoC offers the CVC-TTO collaboration an approach where both gain the benefits of the increased chances of successful commercialization o fthe university's scientific discoveries.

4.6.4 Recommendations

While the challenges and opportunities for university-industry collaboration examined here were identified and put forward, the impact of CVC on the technology transfer field will greatly depend on the key interventions that both innovation policy makers and corporate leaders can champion. To do this, CVC units could actively embrace universities, using the differences between industry and academia to their advantage, while policy makers should also understand the impact that this university-industry interaction will have by itself in increasing innovation and economic growth.

Effective cooperation between TTOs and CVCs units also requires a long-lasting relationship between these two types of organization to combine culture, effort, talent and resources. Taking this into account, the impact of CVC on the evolving role of HEIs and public research organizations (PROs) in the technology transfer field can be amplified.

Since industry and university collaboration isn't always effective, to make it work the challenge is to find common ground where TTOs and CVC units can communicate their needs. Each side must overcome the cultural and communications divide that tends to impair industry and university partnerships and undercut their potential. To do this, prominent European institutions can reinforce the knowledge triangle (business, higher education and technology research), relying on experts and practitioners who have firsthand experience to lead collaboration programs and annual events where experts, practitioners and decision-makers share their successful experiences and best practices.

Promoting joint training programs is an approach that should be designed to equip technology transfer players with the necessary skills and resources to ensure success. In practice, capacity building needs to encompass not only training to shape the right skills but also interaction between different cultures (academic and business) and learning through experience. On this point, policy makers should promote the technology transfer manager (TTM) career as part of business school curricula; for example, in order to build up consensus around the idea of launching a certification scheme to build trust in the TTM role among all the players concerned.

Joint university-corporation training to address common issues may result in improving the chances of finding mutual language and achieving better results when working together. Giving better chances to understand each other may also increase the expectations of CVC units and TTOs that these two worlds can cooperate as well as possible.

In order to address the question "What can university centers do better or differently than corporates can?" from a social perspective, policy makers should consider the option of promoting excubators. This will present a twofold advantage in relation to the growing need for support in technology transfer where, despite the rapid growth in university incubators and accelerators over the past few years, the number of researchers (within and beyond universities) seeking help far exceeds the supply of support from TTOs. For instance, getting accepted into a university incubator or accelerator can be difficult; inventors accepted in accelerator programs and those chosen to receive valuable resources are normally a fraction of those applying, but the thousands rejected often do not know where to go for help.

An IP excubator, for example, is a new kind of mechanism that has emerged to jump-start start-ups. This type of excubator, unlike an accelerator that typically lasts for just three months of the year, would support start-ups from the very beginning with ideation and IP protection to the very end of what it is hoped will be a successful exit. Moreover, this mechanism has the advantage that, although standing outside the universities and corporates, it can still help grow the IP-based start-up ecosystem and provide the public with the benefits from innovation.

The impact of CVC on the evolving role of HEIs and PROs in the technology transfer field can be further amplified by putting in place a PoC mechanism that secures a reliable pipeline to early-stage investors for a growing innovation-led ecosystem. PoC is a powerful instrument that provides transparent, secure and noncompetitive funding to develop the prototypes, practical demonstrations and crucial experiments required to translate patents or IP elements into marketable products.

As prominent TTOs suggest, universities should adopt mechanisms such as PoC that shorten the time needed for commercialization of a research project. However, they also express the persistent need for early-stage funding to support the IP development in a timely and effective manner before it becomes obsolete. Addressing the Valley of Death through PoC requires, therefore, best practices that can be shared within and outside the university to prototype as a way to avoid marketing IPs that are not ready for commercialization. It is also necessary to rethink models and instruments that the EU Commission uses to deploy investments in the Valley of Death area. Data from successful experiences collected in the last 15 years at prominent European universities show that PoC programs can be very effective in bringing more innovation to the market.

Considering the case of the University of Oxford TTO, it can be noted that much of the collaboration focus with CVC units is already on PoC, as it is crucial to shape the pipeline of future CVC investment opportunities while increasing the chances of progressing university IP portfolios to the market successfully. In this sense, the area of technology transfer can be seen by corporates as a business space. This confirms that, from the corporate venture point of view, the main aspirations when investing in technology transfers are determined by the corporate's increasing need for additional growth in business propelled by innovation.

The PoC mechanism should always be managed independently (bearing in mind its financial sustainability: e.g., operated as a revolving fund) in order to invest money in inventors' ideas while ensuring that they receive a share of the proceeds if the future business venture is successful. A joint PoC program between CVCs units and TTOs ideally should be managed by the TTO, with direct reporting to the company during a 12-month support period given to each PoC project.

5. Recommendations for European Leaders in Government, University and Industry

These recommendations address some of the main challenges in the process of technology transfer: the limited amount of external guidance and support that is available during the whole process, the lack of financing during the Valley of Death and the issue of existing financial mechanisms not being adapted to technology transfer needs.

Although categorical recommendations cannot be provided, given the constraints of the current analysis, these suggestions provide some initial thoughts and considerations to aid in the development of policies: enhancing technology transfer, cooperating in corporate venturing and utilizing more sophisticated investment mechanisms. These recommendations have been developed based on a literature review, experience in the field and interviews with other experts.

Promote Coinvestment Mechanisms for PoC Projects

1. Connect specialized investors by:
Supporting existing sectorial gatherings of investors (e.g., business angels, VC, CVC and family offices) who are involved in early-stage venture development in deep technologies. These individuals can help develop networks, identify opportunities and syndicate investments.

2. Enhance cooperation among corporate funds by:
Fostering coinvestments by corporates (e.g., through a joint CVC challenge fund) in early-stage commercial development, focusing on shared challenges. This type of collaboration could be used to launch challenge prizes, utilizing the communication capabilities and resources of several corporations, in order to attract the best entrepreneurial scientists. This mechanism could be supported by the coinvestment fund (described in the previous paragraph).

3. Establish a technology transfer fund by:
Creating a new financial mechanism to coinvest in PoC projects for European researchers. This fund should be managed not solely according to financial metrics (such as by the European Investment Fund) but also according to specialized impact metrics—for example, within the European Innovation Council. The performance indicators of the fund should be long-term (e.g., 15 years) and should consider the potential long-term revenues generated by the project, especially in connection with enabling technologies. In principle, this fund should coinvest in PoC projects with the research institution or with university-linked venture funds in exchange for shares in those spin-off companies that are developed from these investments. The fund structure and the process of selecting institutions should be developed carefully, using the expertise of bodies such as the European Investment Fund, to avoid market deformation.

4. Promote philanthropic and impact investment funds by:
Supporting the creation of social funds that address European social goals. It may be possible to facilitate the emergence of pan-European platforms and networks through European bodies, convening the leading actors in this domain and encouraging the development of guidelines and the dissemination of best practice.

Tailor Existing Investment Mechanisms for Technology Transfer

5. Adapt existing financial mechanisms by:
Adapting the initial phase of the SME-instrument, which supports the funding of start-ups, to fund PoC projects in a start-up incubator. The incubator should be in either a research institution or in a private incubator that has a linked investment fund.

6. Validate policies with experimentation by:
Using a more evidence-based approach to policy making with regard to corporate venturing and technology transfer. As some aspects of the corporate venturing phenomenon are quite new, it is sometimes difficult to develop evidence-

based policies due to the limited availability of historical data. By conducting small experiments in selected regions (sandboxes) to gather data, prototype policies could be developed and validated in an effective and efficient way.

7. Monitor corporate pre-equity investment performance by: Conducting further research on corporates that are increasingly financing PoC projects and evaluate the effectiveness of such schemes. In these cases, corporates typically invest from €50,000 to €250,000, and the entrepreneurial scientist has less than 12 months to validate the model. Success is measured by how many PoC studies are progressed to the next stage and by other milestones related to the development of IP.

Further Support to the European Technology Transfer Process

8. Develop a more unified regulatory framework by: In the longer term, authorities should seek to define a more simple, agile and unified legal framework to assist start-ups in development and growth (e.g., creating a start-up, recruiting international experts and cross-regional investment in VC). Currently, each region has its own rules for start-ups and investors. When a start-up (or a research spin-off) wants to scale in Europe, there is a barrier to entering each market, due to varying rules and regulations.

9. Professionalize the field by: Enhancing and enriching master's degree-level programs in technology transfer management. Although there are some certifications, there are currently few bachelor's and master's degrees in this field. In some cases, these include courses on IP matters but exclude other subjects that are crucial for technology transfer.

Encouraging the widespread adoption of existing certifications and qualifications. There are relevant certifications available to technology transfer staff in Europe, such as Registered Technology Transfer Professional and Certified Licensing Professional certifications. Building on prior EU-funded initiatives, support could be provided to enable more widespread use of such certifications.

Providing targeted funding to support the recruitment of professional practitioners (e.g., industry experts or investors) who can mentor researchers on venture development and market entry. There is a need to enhance the level of industrial experience that is available within many TTOs, especially for smaller offices that are located outside industrial clusters.

10. Support training and industry engagement by: Providing funding for technology transfer staff to attend suitable training courses and go on short-term placements in industry. Key needs for the university sector are to support small TTOs and to develop staff awareness of industrial perspectives. Existing pan-European bodies in the technology transfer field are well-placed to lead such initiatives. One way would be to reinitiate the European ENTENTE program that enabled university licensing staff to devote time to short-term placements in corporations.

11. Share lessons from successful cases by: Inspiring the technology transfer field through giving visibility to success stories. This can be achieved by giving greater visibility to entrepreneurial researchers who are showcased in existing rankings, including those who have successfully worked with industry to introduce their discoveries to the market.

Providing funding to include in existing training and development events for technology transfer officers—not only experienced professionals but also those who are new to the discipline. Such an approach would enhance the flow of knowledge among individuals and among regions.

6. Appendixes

6.1 Methodology

This study was set up to provide an overview of topics related to corporate venturing, covering the main characteristics of the most popular models, the historical development of the phenomenon, current trends and the impact of corporate venturing on technology transfer.

To achieve this objective, the authors complemented their existing knowledge with a literature review and consultations with additional experts. Subsequently, several independent experts reviewed the rigor of the process and the quality of the results obtained.

The authors acknowledge that, given the broad scope of the analysis, the conclusions only provide some initial thoughts and considerations to aid in the development of policies. Further studies in forthcoming white papers will be welcome to provide guidance on additional questions, such as how companies are conducting pre-equity investments in entrepreneurial scientists, further details on how to structure a financial mechanism to cover the Valley of Death in university start-ups, a theoretical study mapping how the definition of corporate venturing has evolved over the years, [23,167-171] and potential incentives to encourage researchers to commercialize their discoveries.

6.2 Acronyms

CEO	Chief executive officer
CIO	Chief innovation officer
CSE	Corporate start-up engagement
CSP	Corporate strategic partner
CVC	Corporate venture capital
CVR	Contingent value right
EU	European Union
FTE	Full time equivalent
GP	General partner
HEI	Higher education institution
HIV	Human immunodeficiency virus
IP	Intellectual property
IPR	Intellectual property right
ITC	Information, technology and computing
KPI	Key performance indicator
LP	Limited partner
M&A	Mergers and acquisitions
MfE	Media for equity
MVP	Minimum viable product
PO	Purchase order
PoC	Proof of concept
PRO	Public research organization
R&D&i	Research and development and innovation
SAFE	Simple agreement for future equity
SME	Small and medium-sized enterprise
TRL	Technology readiness level
TTM	Technology transfer manager
TTO	Technology transfer office
UK	The United Kingdom
VC	Venture capital

6.3 Additional Concepts

6.3.1 Scouting Mission

A scouting mission is a mission undertaken by professionals from an industry in which a company is interested. The professionals are tasked with holding meetings with start-ups, inventors or university researchers. They look for interesting innovations that are aligned with the company's strategy. Companies gain insights and valuable information from leading innovation hubs around the world. Start-ups are exposed to potential financing opportunities and business deals.

The company objective is gaining insight into leading innovations.

6.3.2 Hackathon

A hackathon is a focused, intense workshop in which software developers collaborate, either individually or in teams, to find technological solutions to a corporate innovation challenge within a restricted time. Start-ups solve specific technical problems for companies or produce a particular piece of code in a short period of time and, in return, they get access to new segments, markets and financing opportunities.

The company objective is finding technological solutions to a corporate challenge.

6.3.3 Sharing Resources

Sharing resources is the simplest form of collaboration between corporations and start-ups. It allows companies to improve corporate branding, attract and keep talent, and gain visibility. Meanwhile, start-ups get access to cost-effective or free corporate resources, increase their visibility and are able to network with other similar ventures.

The company objective is getting closer to the ecosystem to understand its composition and needs.

6.3.4 Challenge Prize

A challenge prize is an open competition that focuses on a specific issue. It gives innovators an incentive to provide new solutions based on new opportunities and technological trends to foster internal learning. Companies get to adopt external opportunities, improve corporate branding and gain visibility, while start-ups get access to new segments, markets and financing opportunities.

The company objective is obtaining new solutions based on new technological trends.

6.3.5 Corporate Accelerator

A corporate accelerator is a program that provides intensive short- or medium-term support to cohorts of rapid-growth start-ups via mentoring, training, physical working space and company-specific resources. These resources can include money invested in a start-up, normally in exchange for a variable share of equity. Through corporate accelerators, firms and start-ups get benefits similar to those of a corporate incubator.

The company objective is supporting start-ups with a structured program.

6.3.6 Corporate Venture Capital

In the case of CVC, corporations target equity investment at start-ups that are of strategic interest beyond a purely financial return. Companies become more diversified and get access to products, services and technology, while start-ups get access to financial resources, know-how and advice from experienced corporations.

The company objective is getting fast-track access to innovations, strengthening internal research or accessing new distribution channels.

6.3.7 Venture Builder (or Excubator, if Outsourced)

Corporations aim to fast-track the growth of start-ups through a combination of several tools. In practice, an excubator functions as those for a company. While start-ups develop tailor-made prototypes to solve a problem for a corporation, entrepreneurs gain access to facilities, expertise and technical support, including skilled mentorship, which increases their chances of getting access to funding.

The company objective is getting a minimum viable product (MVP) outside the regular structure.

6.3.8 Corporate Incubator

Corporate incubators provide mentoring services (centralized legal or marketing support) and working spaces to build viable opportunities and business models ready to go to market in exchange for a share of equity. Corporations get a cost-effective and outsourced R&D function, while start-ups get access to facilities, expertise and technical support.
The company objective is providing viability to promising innovation and its commercialization.

6.3.9 Strategic Partnership

A strategic partnership is an alliance between corporations and start-ups to enable them to define, develop and pilot innovative solutions together. It allows both sides to build a relationship and synergies.
The company objective is defining, developing and piloting innovative solutions with an existing company.

6.3.10 Venture Client (or Client Accelerator)

A venture client involves a specific type of strategic partnership and a highly integrated tool that companies can use to purchase the first unit of a start-up's product, service or technology when the start-up is not yet mature enough to become a client. While corporations get access to start-ups with a ready MVP, start-ups get revenue and a consolidated company as their client.

The company objective is fostering a client relationship to insource external innovation.

6.3.11 Acquisition

Acquisitions involve the purchase of start-ups by companies to access the start-ups' commercially ready products, complementary technology or capabilities that solve specific business problems, or to enter new markets. The buyer benefits from the acquisition of talent, skills and knowledge, while the start-up receives monetary rewards and a reputational advantage.

The company objective is accessing commercially ready products, complementary technology or capabilities.

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