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Financement des start-ups par les fonds de capital-investissement d'entreprises en santé: analyse stratégique et étude d'impact sur la période 2009-2016

Etienne Daher

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UNIVERSITÉ GRENOBLE ALPES

UFR DE PHARMACIE DE GRENOBLE

Année : 2018

FINANCEMENT DES START-UPS PAR LES FONDS DE CAPITAL-INVESTISSEMENT D'ENTREPRISES
EN SANTE. ANALYSE STRATEGIQUE ET ETUDE D'IMPACT SUR LA PERIODE 2009-2016

THÈSE
PRÉSENTÉE POUR L'OBTENTION DU TITRE DE DOCTEUR EN PHARMACIE
DIPLOME D'ÉTAT

Etienne DAHER

[Données à caractère personnel]

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 CRI : Centre de Recherche INSERM
 CNRS : Centre National de Recherche Scientifique
 DCE : Doctorants Contractuels Enseignement
 DPM : Département de Pharmacochimie Moléculaire et de Cognition et Ontogenèse »
 HP2 : Hypoxie Physiopathologie Respiratoire et Cardiovasculaire
 IAB : Institut Albert Bonniot,
 IBS : Institut de Biologie Structurale
 LAPM : Laboratoire Adaptation et Pathogenèse des Microorganismes
 LBFA : Laboratoire Bioénergétique Fondamentale et Appliquée
 LCBM : Laboratoire Chimie et Biologie des Métaux
 LCIB : Laboratoire de Chimie Inorganique et Biologie
 LECA : Laboratoire d'Ecologie Alpine
 LR : Laboratoire des Radio pharmaceutiques
 MAST : Maître de Conférences Associé à Temps Partiel
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 PAST : Professeur Associé à Temps Partiel
 PRAG : Professeur Agrégé
 PRCE : Professeur certifié affecté dans l'enseignement
 PU : Professeur des Universités
 PU-PH : Professeur des Universités et Praticiens Hospitaliers
 SyMMES : Systèmes Moléculaires et nanoMatériaux pour l'Energie et la Santé
 TIMC-IMAG : Laboratoire Technique de l'Imagerie, de la Modélisation
 UMR : Unité Mixte de Recherche
 UVHCI : Unit of Virus Host Cell Interactions

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List of abbreviations/Liste des abréviations

CVC : Corporate venture capital

IPO : Initial Public Offering

Glossaire/Glossary

Français

Capital-risque : activité de financement d'une jeune entreprise réalisée par un fonds d'investissement dit institutionnel.

Capital-investissement d'entreprise : activité de financement d'une entreprise et réalisée par le biais d'un fonds d'investissement dépendant d'une entreprise établie.

Capital-risque d'entreprise : synonyme de Capital-investissement d'entreprise

Série (A,B,C,D,E, etc.) : Tour d'investissement réalisé par une start-up auprès de financeurs. Une lettre suivant le mot Série (A, B, C, D, E, etc.) permet de classifier chronologiquement le tour d'investissement vis à vis d'autres tours.

English

Investee: firm receiving funding

Series (A, B, C, D, E, etc.): Given investment round of a start-up from defined financiers. A letter following the word Series (A, B, C, D, E, etc.) allows to chronologically classify the given investment round.

Introduction (Français)

Le capital-investissement d'entreprise a été utilisé comme un des outils de l'innovation par les compagnies établies et ce, depuis des décennies, au delà de l'industrie pharmaceutique. Toutefois, jusqu'à ce jour, on retrouve peu de littérature vis à vis de l'impact des fonds de capital-investissement d'entreprise sur les start-ups dans lesquelles ils investissent en termes de résultats pour ces dernières.

Dans cette thèse nous chercherons d'abord à comprendre les différents moyens à disposition d'une entreprise établie cherchant à soutenir sa croissance ainsi que les possibilités de financement pour les start-ups.

Par la suite, une revue de l'histoire du capital-investissement d'entreprise nous aidera à considérer l'industrie pharmaceutique dans ce cadre et à effectuer une revue de littérature sur l'état de la recherche sur le capital investissement d'entreprise afin de mieux comprendre les motivations, attentes et bénéfices pour ces acteurs.

Considérant spécifiquement l'industrie de la santé, nous souhaiterions mettre en avant les pratiques d'investissement de ces fonds de capital-investissement d'entreprise dans l'industrie pharmaceutique et comprendre comment ceux-ci s'intègrent dans la stratégie globale d'une firme pharmaceutique.

Ainsi, comme nous supposons un effet positif de l'implication de fonds de capital-investissement d'entreprise sur la croissance des start-ups, notamment du fait de l'accès à des ressources spécifiques et à une expertise, clés dans un secteur tel que celui de la pharmacie, nous réaliserons une étude d'impact visant à tester cette hypothèse vis à vis d'autres financeurs non reliés à une entreprise établie.

Introduction (English)

Corporate venture capital (CVC) has been used as part of the innovation tool-kit of established companies for decades, be it in the pharmaceutical industry or not, yet little investigation has been performed with regards to the impact of corporate ventures arms on the start-ups they invest in, in terms of outcomes.

In this thesis we first want to understand the different tools at hands for a firm seeking to sustain its growth and the financing means a start-up can use.

Then, looking at the history of corporate venture capital will help us to narrow down on the healthcare industry and to confidently approach a literature review regarding corporations' motivations and expectations in that endeavor.

Specifically looking at the healthcare industry, we would like to outline specific investment practices of corporate venture arms depending from healthcare companies and understand how they integrate in the wider corporate strategy of pharmaceutical corporations.

Hence, as we might suppose a positive impact for the growth of start-ups having access to specific resources and expertise of healthcare corporate investors we would like to perform an impact analysis aiming at testing this hypothesis compared to financing received from institutional investors.

Résumé détaillé (Français)

1. Construire, Emprunter ou Acheter

La quête d'une croissance durable pour toute entreprise établie dans le secteur de la santé, et dans d'autres industries, s'avère clé afin de maintenir un avantage compétitif dans son secteur.

Les moyens pour saisir cette croissance peuvent se résumer sous trois termes qui sont : construire, emprunter ou acheter. Sous chacun de ces termes se trouve un ensemble d'outils qui doivent s'utiliser en fonction des ressources de l'entreprise, de ses manques potentiels et des conditions de marché.

Il est important de comprendre que la combinaison de plusieurs modes de croissance s'avère primordiale afin d'éviter une dépendance à une seule option qui peut se traduire par des difficultés pour l'entreprise. Par exemple, une sur-utilisation de croissance interne peut se traduire par une lenteur d'acquisition de nouvelles connaissances pouvant s'avérer clés dans un secteur comme celui de la recherche pharmaceutique. De la même façon, une trop grande croissance externe peut fragiliser l'entreprise en terme d'organisation.

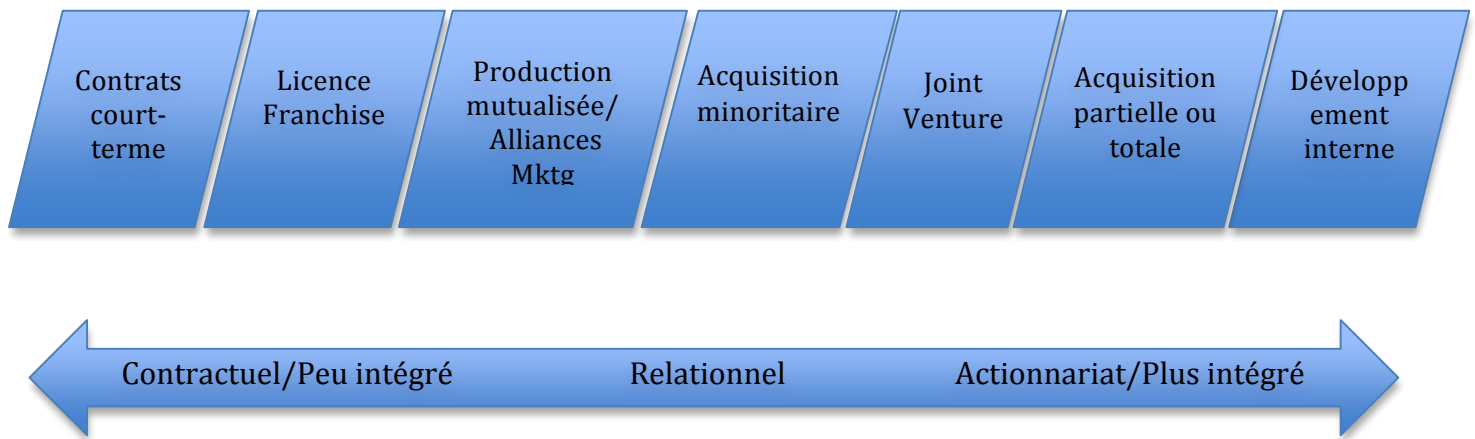


Figure 1 - adapté du cours Strategic Growth Management - Professeur Ha Hoang - ESSEC Business School - 2016

Concernant spécifiquement l'activité d'acquisition dans l'industrie pharmaceutique, Higgins et Rodriguez (2006)¹ ont trouvé un bénéfice plus important de cette politique d'acquisition en cas d'accès préalable à la compagnie visée par l'acquisition. Cet accès se faisant notamment par le biais d'alliances ou de coopération sur différents plans. Nous pouvons ainsi comprendre l'intérêt pour les firmes pharmaceutiques établies d'établir des liens, aussi par le biais d'activité de capital-investissement d'entreprise, avec des partenaires externes innovants. Cette activité d'investissement par le biais de fonds dédiés apparaît pour les entreprises pharmaceutiques être un moyen équilibré pour compléter une stratégie d'innovation à la fois interne et externe.

2. Moyens de financement d'une start-up

Une start-up dispose de différents moyens financiers pour financer sa croissance qui sont entre autres :

- des fonds de capital-risque dits institutionnels, comme Orbimed ou Sofinnova Partners, investisseurs en sciences de la vie. Ces entités disposent de véhicules d'investissement financés par des levées de fonds auprès de différents acteurs du

monde financier. Ces véhicules ont une durée de vie définie et sont gérés selon des critères définis par les dirigeants de ces mêmes fonds.

- des fonds de capital-investissements d'entreprises, comme M Ventures, fonds d'investissement dépendant de l'entreprise Merck KgaA. Ces fonds peuvent être des entités légales séparées de la maison mère et tirent la plupart du temps leur capacité d'investissement d'engagements financiers pris par la direction de l'entreprise. Les bénéfices tirés d'éventuelles reventes de participations dans des entreprises sont le plus souvent réinvestis afin de prendre de nouvelles participations.

3. Histoire du capital-investissement d'entreprise :

On peut retracer l'histoire du capital-investissement d'entreprise par le biais de vagues successives, étroitement liées aux conjonctures économiques évolutives dans l'histoire de ces dernières décennies. Celles-ci ont entre autres été détaillées par Dushnitsky (2012)² et dans un rapport du site d'analyse de données financières CB Insights (2016)³.

La première vague, datée entre 1960 et 1977 suit la Grande Dépression en Amérique, poussant les industriels à chercher des nouvelles opportunités commerciales. Un des premiers programmes en ce sens fut initié par la compagnie 3M, aujourd'hui également active dans le domaine de la santé. Cette première vague se conclut par une diminution sensible de l'activité d'investissement notamment du fait d'une augmentation des taxes sur les gains de capitaux et de la situation économique tendue à la fin des années 70.

La seconde vague, de 1978 à 1994, fut lancée par l'avènement de l'ordinateur et de l'emballage que celui-ci a créé, de concert avec la popularité croissante de la Silicon

Valley et de ses succès. Suivant une baisse des taxes aux Etats-Unis d'Amérique en 1980, l'investissement réalisé par le biais de programmes de capital-investissement d'entreprise reprit, sous diverses formes. De fait, les entreprises décidaient alors 1) d'investir dans des fonds institutionnels classiques et indépendants, 2) d'établir un fonds d'investissement dédié avec un management externe débauché auprès de fonds classiques ou 3) d'établir un fonds de capital-investissement géré par du personnel interne à l'entreprise.

C'est lors de cette vague que Lubrizol, compagnie spécialisée en chimie, investit dans Genentech, menant à une sortie fructueuse pour l'entreprise après une valorisation en bourse à hauteur de 10 milliards d'euros en 1999.

Le crash financier de 1987 amena un tiers des programmes de capital-investissement d'entreprise à terminer leur activité et marqua la fin de cette vague.

La troisième vague, de 1995 à 2001, stimulée par les succès de compagnies dans le domaine de l'internet amena un nombre important d'entreprises à reprendre ou commencer un programme de capital-investissement. Durant cette période et du fait de l'augmentation des dépenses de recherche et développement, les entreprises pharmaceutiques représentèrent une partie importante de cette activité de capital-investissement, leur permettant une plus grande agilité. Cette vague fut terminée par le crash boursier de 2000, impactant principalement les compagnies technologiques mais épargnant relativement les compagnies pharmaceutiques.

La quatrième vague, de 2002 à 2016, vit les investissements repartir progressivement de 2 milliards de dollars en 2003 jusqu'à près de 28.4 milliards en 2015. La majorité de ces investissements fut réalisée dans le domaine Mobile/Internet et celui de la Santé. La peur d'une disruption technologique externe, la bonne trésorerie des compagnies et les taux d'intérêts historiquement bas stimulent aujourd'hui une activité soutenue en capital-investissement d'entreprise.

4. Revue de littérature

4.1 Motivations d'un capital-investisseur d'entreprise

Une structure de capital-investissement d'entreprise peut poursuivre différents buts, souvent regroupés comme étant financiers, stratégiques ou analytiques (combinaison des deux premiers). La littérature précise à plusieurs reprises que les entreprises cherchent la plupart du temps un équilibre et tendent à avoir une approche analytique^{4 5}⁶. On retrouve effectivement le retour sur investissement comme objectif clé affiché mais également l'exposition à de nouveaux marchés et nouvelles technologies⁷. De la même façon le potentiel d'acquisition de nouvelles entreprises est également une motivation citée. Ce dernier objectif reste toutefois nuancé par une vue critique sur le double rôle d'investisseur contribuant à la croissance de l'entreprise et d'acquéreur, plus tard dans le développement de la start-up, pouvant être perçu comme une limitation à un seul potentiel acquéreur⁸.

Considérant ce dernier aspect, il apparaît toutefois que la proportion de start-ups finalement acquises par la maison mère des investisseurs soit relativement faible, autour de 5%⁹.

4.2 Résultats du fonds de capital-investissement

Considérant que les résultats se mesurent tant en termes de gains financiers que de bénéfices stratégiques, ceux-ci s'avèrent particulièrement délicats à mesurer. On retrouve toutefois dans la littérature une satisfaction particulière vis à vis de l'accès donné par le fonds d'investissement dépendant de l'entreprise à de nouveaux marchés⁷. Il est intéressant de noter que les fonds de capital-investissement

d'entreprise ayant d'emblée une visée stratégique quant à leurs investissements ont de meilleurs résultats financiers¹⁰ et une plus longue durée de vie¹¹.

Il a également été rapporté un effet positif de la syndication sur les start-ups investies¹².

Il s'agit du processus par lequel plusieurs investisseurs, institutionnels et de capital-investissement d'entreprises se réunissent pour investir au sein d'une même start-up.

4.3 Impact sur la maison mère

S'agissant de l'innovation, la littérature met en avant une augmentation des activités de recherche et développement¹³ et de dépôt de brevet¹⁴ au sein de l'entreprise ayant créée une unité de capital-investissement, quelques années après sa création.

Il est possible que cet effet soit à l'origine d'une certaine hésitation de la part de certains dirigeants de start-ups à partager avec des fonds de capital-investissement d'entreprises leurs trouvailles scientifiques, de peur de perte de propriété intellectuelle.

Il a également été retrouvé qu'il s'agit d'un outil important pour anticiper les changements de marchés et les évolutions technologiques et scientifiques¹⁵, élément clé pour les entreprises établies dans l'industrie pharmaceutique.

Concernant la performance financière de la maison mère, il a été retrouvé un apport nul à positif selon les études^{16 17}.

4.4 Impact sur les start-ups investies

L'accès à des ressources spécifiques, internes aux entreprises ayant établi des fonds de capital-investissement apparaît clé comme atout bénéficiant aux start-ups investies^{18 19 20}. Cet atout peut se révéler particulièrement important dans une industrie comme celle de la santé, disposant entre autres de parcours commerciaux bien précis et d'une

expertise scientifique nécessairement pointue. L'avantage d'une crédibilité accrue vis à vis de tierces parties apparaît également comme un avantage primordial dans la croissance de ces start-ups²¹.

On retrouve dans la littérature la même probabilité de succès jusqu'à une introduction en bourse entre entreprises soutenues par des fonds de capital-risque institutionnels et celles soutenues par des fonds de capital-investissement d'entreprises. Cette probabilité de succès se voit toutefois renforcée lorsqu'il existe une adéquation stratégique entre le capital-investisseur d'entreprise et la start-up¹¹.

Concernant la valorisation de l'entreprise au moment de cette introduction en bourse, on retrouve dans la littérature une corrélation entre l'adéquation stratégique entre la start-up et le capital-investisseur d'entreprise et une plus haute valorisation de marché²².

5. Analyse stratégique de fonds de capital-investissement dans la santé

Henderson (2007)²³ utilise une classification relative aux investissements stratégiques réalisés par des entreprises de la santé par le biais de leur fonds de capital-investissement.

Celle-ci met en avant trois différents objectifs pour une prise de participation par un capital-investisseur d'entreprise pharmaceutique qui sont :

- la mise à profit d'activités existantes : investissement en rapport direct avec le focus commercial et de recherche et développement actuel de l'entreprise
- l'amélioration d'activités existantes : investissement visant à simplifier, accélérer le développement d'un médicament ou à baisser son coût.

- se réserver un droit d'accès : investissement dans des compétences différentes, que ce soit en termes de processus de fabrication, d'aire thérapeutique ou de technologie mise en œuvre et ayant un potentiel disruptif.

Nous avons utilisé cette classification afin d'analyser la stratégie d'investissement de trois fonds de capital-investissement qui dépendent de trois grandes entreprises pharmaceutiques : Novartis, Eli Lilly & Co et Merck & Co (MSD en France).

Il en résulte des stratégies différentes selon les entreprises et une filiarisation de certains de ces fonds d'investissement en entités distinctes avec des objectifs propres.

Les investissements en capital-risque réalisés par Eli Lilly sont faits par le biais de deux véhicules, l'un basé en Asie, Lilly Asia Ventures et l'autre basé aux Etats-Unis, Lilly Ventures. Ces investissements sont pour les deux véhicules majoritairement en ligne avec le focus de l'entreprise, principalement dans le secteur de l'oncologie. Lilly Asia Ventures a également réalisé un nombre important d'investissements lui permettant de se réserver un droit d'accès potentiel sur des nouvelles technologies et aires thérapeutiques, notamment sur des dispositifs médicaux complémentaires des aires thérapeutiques servies par des médicaments de la maison mère.

Les investissements en capital-risque réalisés par Novartis se font par le biais de Novartis Venture Fund, créée en 1996 et ayant sous gestion à ce jour environ 800 millions de dollars de participations. Sur les 116 investissements que nous avons recensés, une majorité d'entre eux, environ 60%, se réalisent afin de mettre à profit des activités existantes. Environ 30% de ses investissements ont été réalisés dans le but de dénicher un potentiel d'accès à des technologies disruptives ou dans des aires thérapeutiques autres que celles visées par Novartis au moment de l'investissement.

Les 10% restants tombent dans la catégorie visant à améliorer les activités existantes, avec un effet sur le processus de création du médicament.

Merck & Co a créé en 2010 le fonds d'investissement Merck Global Health Innovation Fund et Merck Research Venture Fund en 2011, renommé MRL venture fund. Le premier a pour objectif de prendre des participations dans de jeunes entreprises centrées sur la santé digitale. Ainsi, on retrouve principalement pour ce fonds des prises de participation dans la catégorie visant à ouvrir un potentiel d'accès à de nouvelles technologies ou aires thérapeutiques pour Merck & Co. En effet, le but affiché de ce fonds est de permettre de compléter l'offre médicamenteuse de Merck & Co en allant toucher le patient dans l'entièreté de son parcours.

Quant à MRL venture fund, il a principalement pris à ce jour des participations dans des sociétés centrées sur l'oncologie, en ligne avec le focus de Merck & Co. Il a également pris des participations dans des fonds de capital-risque institutionnels comme Flagship Pioneering lui permettant un accès indirect à de l'innovation externe au delà de ses propres prises de participation.

Il est donc intéressant ici de voir la diversité des approches prises par ces trois entreprises majeures de la santé afin de compléter stratégiquement leurs activités en utilisant le potentiel des fonds de capital-investissement d'entreprise. Si Novartis et Eli Lilly centrent la majeure partie de leurs investissements sur des entreprises en lien avec leur focus, Merck & Co prend une approche différente en allant surtout au delà du médicament en tant que tel et en investissant dans des technologies nouvelles pour un acteur pharmaceutique, avec parfois un potentiel disruptif sur son marché actuel.

Une des limitations de notre étude et de notre exercice de classification peut ici venir du fait que les jeunes entreprises sur lesquelles nous avons pu effectuer des recherches

ne communiquent pas forcément publiquement sur l'état actuel de leurs recherches dans certaines aires thérapeutiques et il est par conséquent possible que nous ayons pu classer certains investissements dans des catégories ne reflétant pas la volonté réelle de l'entreprise pharmaceutique vis à vis du but de l'investissement.

6. Etude de cas - financement de la santé digitale

La santé digitale englobe un nombre important de sous-secteurs pour lesquels l'Organisation Mondiale de la Santé (O.M.S) propose une taxonomie, centrée sur les solutions à destination du patient, du professionnel de santé, des systèmes de santé et des services liés à l'utilisation de données de santé²⁴.

En voyant la diversité de cette classification, on comprend mieux la quantité d'approches que peut prendre une entreprise pharmaceutique établie afin de développer, d'acquérir ou de prendre des participations dans des solutions qui peuvent lui permettre de digitaliser son processus de recherche, ses efforts marketing ou bien encore ses essais cliniques.

Au sein de ce large secteur, nous avons choisi de considérer les thérapies digitales, développées sous la forme de programmes disponibles sur mobile, tablette, ordinateur et autres plateformes digitales.

Ces thérapies digitales ont pour but d'être de réels traitements et alternatives médicamenteuses cliniquement éprouvées vis à vis d'échelles de référence.

Du fait de la présence importante d'applications de bien-être, dites de "santé", disponibles pour le grand public, il est intéressant de noter l'approche plus médicale à laquelle nous nous intéressons ici. Celle-ci permet notamment de voir certaines

solutions ayant une utilité cliniquement démontrée passer sous prescription médicale, et, pour quelques unes de demander l'accès à un remboursement de la part des financeurs du système de santé.

On peut prendre l'exemple de Pear Therapeutics, qui est devenue la première thérapie digitale sur prescription, centrée sur l'abus de substance en 2017. Il s'agit là d'une application mobile, engageant le patient à rapporter des informations le concernant et lui permettant de suivre ses progrès. En Avril 2018, la société a annoncé une collaboration mondiale avec Sandoz, filiale de Novartis, afin de développer des solutions similaires concernant la sclérose en plaque et la schizophrénie. Quelques mois auparavant, Novartis avait pris une participation minoritaire au capital de l'entreprise.

D'autres exemples nous permettent d'illustrer la variété des approches prises par les entreprises établies afin de nouer des relations avec ces jeunes entreprises positionnées sur une approche nouvelle.

7. Etude d'impact

Après avoir considéré la littérature concernant notamment l'impact potentiel pour une jeune entreprise d'avoir à ses côtés un investisseur venant du domaine pharmaceutique, nous avons décidé de réaliser une étude d'impact de cette prise de participation sur les résultats de la croissance de la start-up.

Pour ce faire, nous avons considéré deux indicateurs qui sont 1) le temps écoulé entre un tour d'investissement et la réalisation d'une entrée en bourse et 2) la valorisation de l'entreprise au moment d'une entrée en bourse.

Nous avons construit un jeu de données comportant des informations sur des tours d'investissements réalisés par des jeunes entreprises en santé auprès d'investisseurs institutionnels classiques et auprès de fonds de capital-investissement d'entreprises en

santé entre 2009 et 2016. Celui-ci a été tiré de la base de données CB Insights et nettoyé manuellement.

Nous avons classifié les fonds de capital-investissement d'entreprises en santé selon leur objectif déclaré de rentabilité financière, stratégique ou combinant les deux afin d'avoir également une vue sur l'impact potentiel de la motivation de l'investisseur sur le résultat des start-ups investies.

Nous avons également pris en compte la présence de plusieurs capital-investisseurs d'entreprises afin de voir un éventuel effet synergique de leur présence sur la croissance de la start-up.

Nous avons également évalué la pertinence statistique de nos résultats par le biais d'outils d'analyse de données et de tests paramétriques et non-paramétriques selon la normalité de nos échantillons.

Concernant le temps passé entre un tour d'investissement donné et une entrée en bourse pour une start-up en santé, nous avons trouvé un temps plus court entre une Série A, Série B, Série C et l'introduction en bourse pour les jeunes entreprises en santé considérées. Cette différence s'est toutefois avérée non statistiquement significative.

Concernant la valorisation de la jeune entreprise au moment de l'introduction en bourse, nous avons retrouvé des résultats en faveur d'une implication de capital-investisseurs d'entreprises en santé, avec une valorisation moyenne plus élevée que les start-ups soutenues par des fonds institutionnels de capital-risque. Toutefois, à nouveau, cette différence s'est avérée statistiquement non significative.

Une des limites de cette étude vient de la partie manuelle de traitement des données et des erreurs potentielles que celle-ci a pu générer. Nous aurions également pu bénéficier d'un échantillon plus large d'entreprises pour l'indicateur du temps entre un

tour de financement et l'introduction en bourse, qui nous a mené à considérer uniquement les années 2015 et 2016 du fait de la nécessité d'un traitement manuel. Cet indicateur de temps n'est pas facilement retrouvé dans la littérature.

Une autre limite provient du classement subjectif réalisé de notre part concernant la motivation du capital-investisseur. Entre une volonté affichée d'un investisseur et son comportement réel une fois l'investissement réalisé, il existe des différences qui peuvent amener à reclasser certains des fonds de capital-investissement d'entreprises en santé, chose difficile à réaliser dans le cadre de notre analyse.

Nous pouvons également mettre en avant l'hypothèse selon laquelle les fonds de capital-risque institutionnels spécialisés en santé bénéficient d'un réseau important de partenaires et experts du domaine de la santé et que cette expertise peut s'avérer suffisante quant au développement de la jeune entreprise en santé jusqu'à un certain point où les bénéfices d'avoir un capital-investisseurs dépendant d'une entreprise pharmaceutique établie peuvent éventuellement entrer en jeu.

Comme il a pu être fait dans la littérature, nous aurions pu suivre l'évolution du prix des actions des entreprises en santé nouvellement cotées mais avons décidé de nous focaliser sur les start-ups et avons donc considéré qu'au delà de l'entrée en bourse, la jeune entreprise en santé n'était plus dans ce cadre de start-up.

Conceptual part

1. Build/Borrow/Buy

When considering any company aiming at sustaining its position in an evolving economy, be it in the healthcare space or not, one must look at the perpetual quest for growth associated with a firm's business activity.

Envisioning the adequate way to grow, companies have to consider different alternatives in order to seize the adequate vehicle leading to prolonged success of their businesses.

One can summarize as either Building, Borrowing or Buying the 3 tools to achieve sustained growth. Under each of these three umbrella words, one will find different options allowing a company to achieve sustained growth depending on its own resources, potential gaps identified within the firm as well as market conditions.

Capron & Mitchell (2012)²⁵ proposed a framework outlining the different options a company can follow after having clearly identified a strategic resource gap connected to a strategic goal of the company.

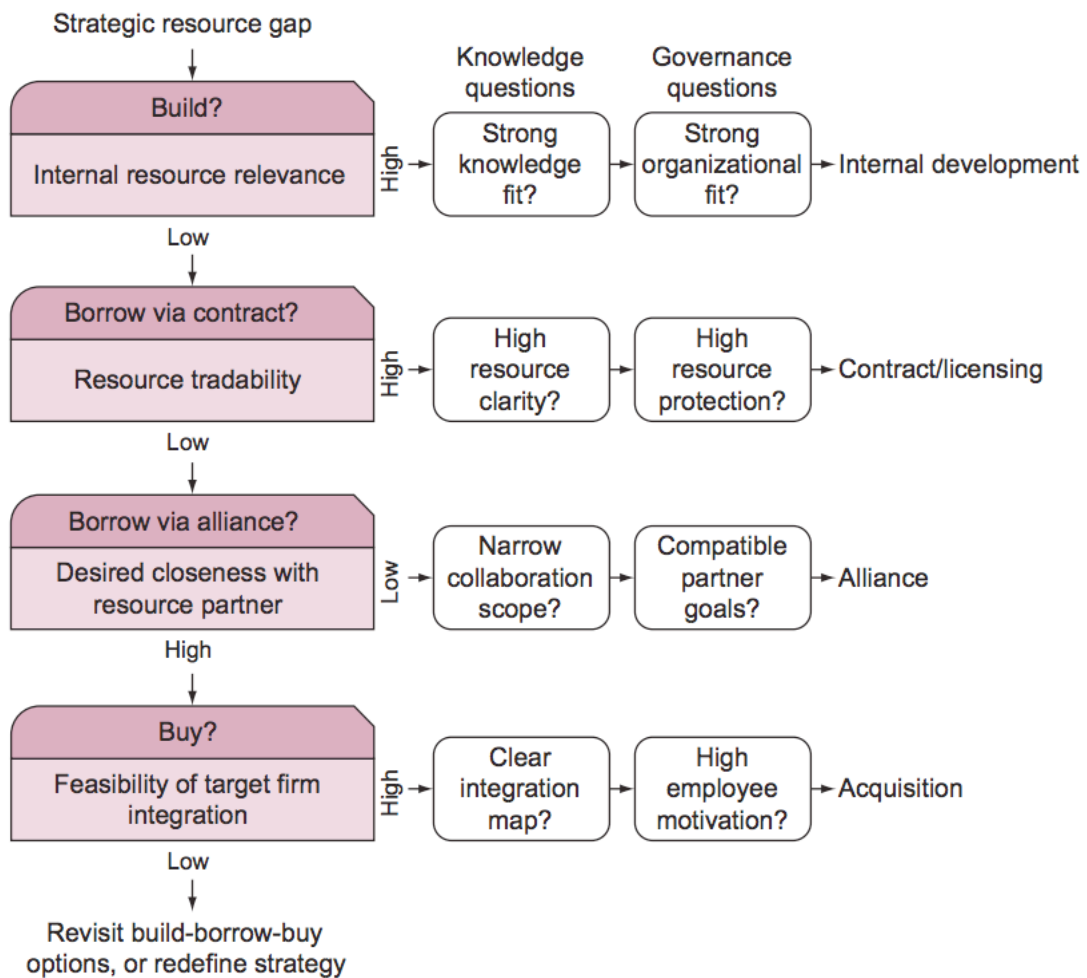


Figure 2 - strategic growth tool-kit - Capron & Mitchell (2012)

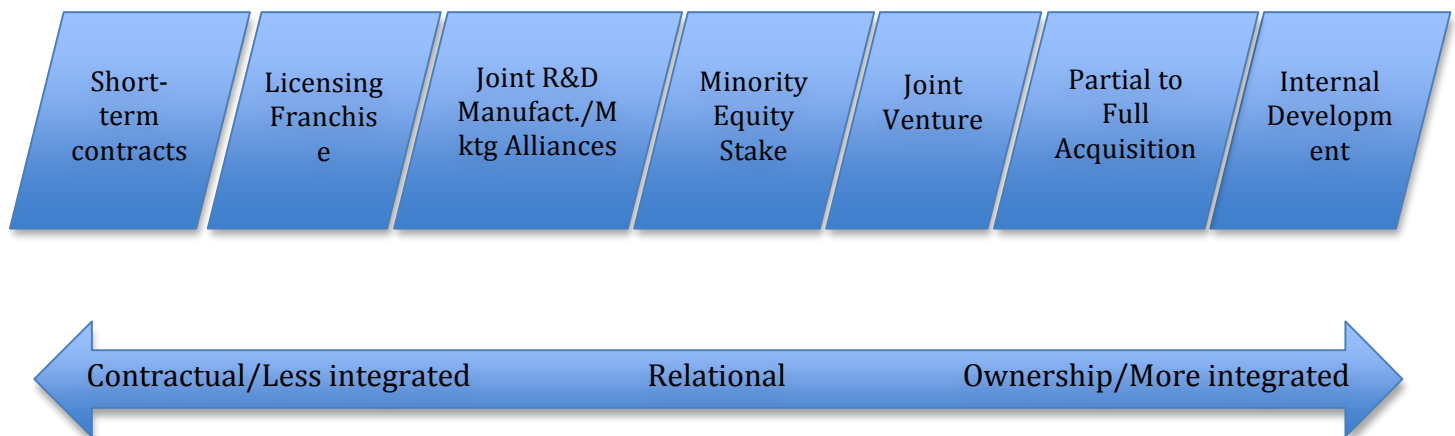
Relying on a single growth mode without considering the full range of available options and selecting the one that best fit the market conditions and their resource constraints will make the company prone to losing value in the mid-long run.

As an example, over-reliance on internal growth can translate into a slower acquisition of new resources needed to survive in a fast moving environment for the company.

On the other hand, acquiring too much outside in a short period of time can lead to incoherence in terms of organization. As to borrowing, being too dependent on licenses, contracts and to can make the firm vulnerable priorities changes' from the

partner's perspective. Developing a right blend of options will help the company to take advantage of emerging opportunities while optimizing costs doing so.

Looking closer at the different end options and their relative basis of control for the company will allow us to narrow down on minority equity stake acquisition, hence on venture capital as a means of growth for a corporation.



*Figure 3 - adapted from Strategic Growth Management course - Professor Ha Hoang
- ESSEC Business School - 2016*

Regarding acquisitions and focusing on the pharmaceutical industry, this means of growth for an established company can definitely be seen as a way to externalize research and development efforts.

History and research have consistently shown if not break-even results from mergers and acquisitions endeavors, generally negative returns on investment.

Interestingly, analyzing this specific growth mode in the pharmaceutical industry, Higgins and Rodriguez (2006)¹ found that it can be beneficial for a firm to supplement its internal research and development and research and development focused alliances with targeted acquisitions. Even more interesting is that the same study

outlined a greater success of such a policy when the acquirer had access to information before the acquisition.

Gathering of information was performed either by the acquiring company forming alliances with the target before acquiring it, be it manufacturing, research, co-development, distribution or by having prior internal efforts in the same therapeutic area as the target company.

It allows the firms to avoid three major pitfalls being overbidding for acquisition of the target firm, selecting an inadequate target and failing at the post-acquisition integration process.

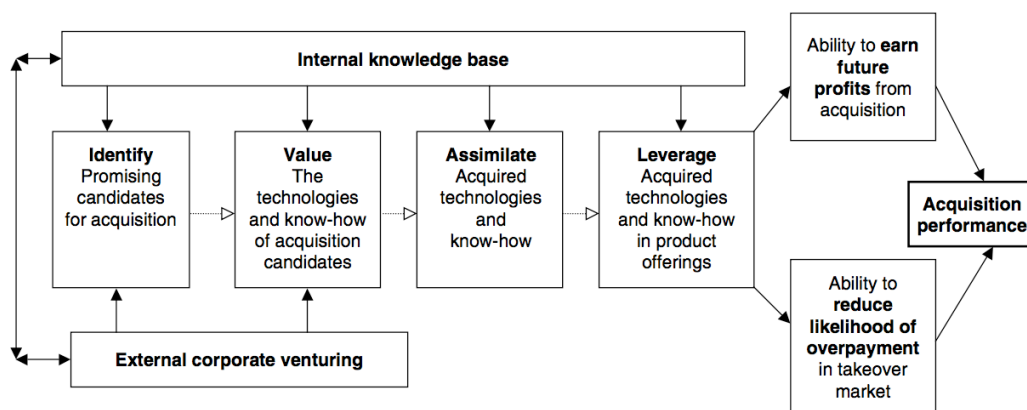


Figure 4 - Conceptualization of Acquirer knowledge base and firm performance when acquiring start-ups - Benson and Ziedonis (2005) - Corporate Venture Capital as a Window on New Technologies

From this, one can understand the interest for established pharmaceutical corporations to derive information with previous alliances as well as investing through corporate venture activities, which would allow the firm to gain access early-on to valuable knowledge.

Hence, specifically looking at the minority equity stake option as a strategic growth tool for a company, venture capital investing appears as an intermediate mean and complementary tool to any well-balanced growth strategy.

It provides a certain level of ownership in a start-up and fills potential internal knowledge gaps with regards to a technology. As a matter of fact it can also provide important windows on new markets we will elaborate further on when looking at motivations of initiating a corporate venture program and investors' outcomes following establishment of such a program.

2. Start-up definition

While there is no official definition as to what a start-up is, some people have been trying to put boundaries around the concept of a start-up. Stanford professor Steve Blank mentions that it's "an organization formed to search for a repeatable and scalable business model"²⁶. Warby Parker co-CEO told Forbes that "A startup is a company working to solve a problem where the solution is not obvious and success is not guaranteed"²⁷.

Regarding the status of a start-up as to our considerations and not looking at the start-up mindset but at sound metrics, it is agreed that the start-up, depending on its stage of financing, is experiencing a potential of rapid growth after being created few months or years ago.

As to its profitability it's often the case that the start-up is yet to be profitable and to scale its businesses' activities.

When considering venture capital investing as a whole, the stage at which an investor will act as a source of capital for the start-up will depend on its investment strategy and scope.

3. Financing means/stages

Going from bootstrapping only involving founders' savings at the beginning of a venture to raising millions through an Initial Public Offering at a later stage, companies can use several means to finance their activities and growth.

As financing needs vary throughout the life cycle of a company, a business entity at a certain point in its development stage can seek different sources of capital.

As we focus on start-ups in this thesis, we detail hereafter various financing means for young businesses.

3.1 Venture Capital

The European Private Equity and Venture Capital Association (EVCA) defines Venture Capital as "strictly speaking, a subset of private equity and refers to equity investments made for the launch, early development, or expansion of a business. It has a particular emphasis on entrepreneurial undertakings rather than on mature businesses."²⁸ There is, however, no widely accepted definition of Venture Capital and it can certainly vary depending on the considered geography. The National Venture Capital Association in the US defines Venture Capital as "professional, institutional managers of risk capital that enable and support the most innovative and promising companies. This money funds new ideas that could not be financed with traditional bank financing, that threaten established products and services in a corporation, and that typically require five to eight years to be launched."²⁹

Venture capitalists usually take equity in the company through issuance of new shares (preferred shares) with a price per share setting the new valuation of the company.

There is more than money behind the commitment of Venture Capital firms into start-ups. Depending on the investment strategy of the fund, Venture Capitalists can also provide hands-on support, advices and help in shaping the strategy of the business as part of companies' boards in order to build value in the best interest for the company and eventually lead to a meaningful exit for the fund.

This exit can be obtained through selling of the shares to other financial investors willing to invest into the company, through an Initial Public Offering or a sale to an established company.

As we speak about Venture Capital as a whole, we can differentiate Institutional Venture Capital funds from Corporate Venture Capital funds.

3.1.1 Institutional Venture Capital

Institutional Venture Capital firms are investment firms relying on Limited Partners to form investment vehicles dedicated to a specific type of investments being sought in a determined geography, at a specified stage, in a specific industry.

One can take the example of Orbimed Advisors, investing in North America, Asia, Europe and Israel at different stages of development in life sciences, be it biopharmaceuticals, medical devices or healthcare services.

Sofinnova partners is a France based healthcare investor. It focuses on investments in biopharmaceuticals, medical devices and industrial biotechnology, typically originating from academia and spin-offs from large corporations. It prefers to invest in

Europe and takes an active role at the board of companies.

Usually, those investments vehicles have a finite life, with the first years dedicated to the actual investments into companies. When reaching the maximum amount the fund can invest by the means of this specific investment vehicle, activity in that fund will move progressively to managing the portfolio companies. In certain cases the fund will still commit money into follow-on rounds to sustain growth of the company and keep ownership but without any further additional investment into new opportunities until exit and return of capital to investors being limited partners (LP) of the fund.

Those limited partners can be individuals, funds of funds, family offices or any other type of financial institution.

3.1.2 Corporate Venture Capital

Corporate venture capital encompasses various investment practices coordinated by corporations and has been used as an umbrella term extensively. Hence, it is useful to define what we will consider here as corporate venture capital.

Corporate venture capital is a minority equity investment made by an established corporation into a private entrepreneurial venture². One can then differentiate between direct and indirect investments. Investments can be made through a separate legal entity fully owned by the parent corporation acting as the only LP, namely a corporate venture fund, or directly by the corporation.

M Ventures is one example of a corporate venture fund set up by Merck KgaA. a leading technology and science company. The fund is fully owned by the company but operates as an independent legal entity and clearly states its "chinese wall" in with regards to the firm in terms of information flow. It invests in 4 different areas. 3 of them being related to the existing businesses of Merck, namely Healthcare,

Performance Materials and Life Sciences and the fourth one investing in cross-divisional and blue sky opportunities.

An established company can also invest as Limited Partner into a structure managed by an institutional venture capital management, which is indirect investment.

One can find many examples in that space such as GSK being a LP of one of Sanderling Ventures' funds or Amgen being a LP of one of Atlas Ventures' funds.

It serves the purpose of exposing the corporation both to financial and strategic returns without committing a dedicated team and structure.

It is important to differentiate corporate venture capital from corporate venturing activities. The latter encompasses activities such as internal special projects new to the company's activities or incubators. It can eventually lead to spin-offs of the internal project into a separate entity from the company, should this activity be somehow misaligned with the internal strategy and have a better potential for value creation outside of the firm.

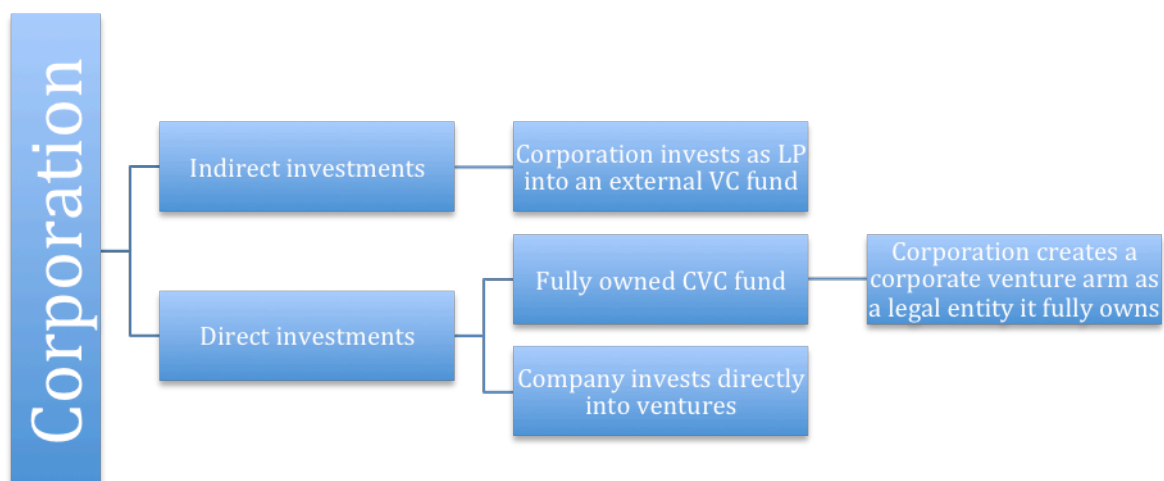


Figure 5 - Corporate venture structures

Similarly, strategic alliances or joint ventures between companies are distinguished here from corporate venture capital initiatives.

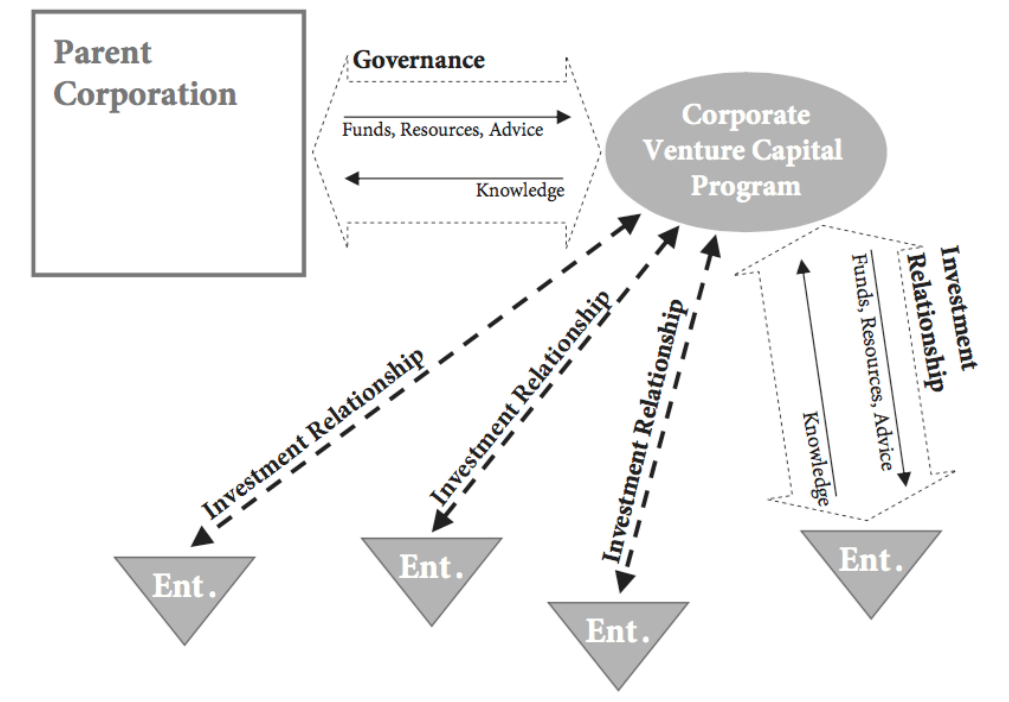


Figure 6 - fully owned CVC fund structure - Dushnitsky (2012)²

3.2 Crowdfunding

Crowdfunding relies on individuals investing money in exchange either for equity in the company or early access to products, exclusive content, etc. This source of financing has been gaining momentum in the past few years and now represents an important source of capital for start-ups.

Poietis, a French biotechnology company developing tissue bioprinting with

applications for drug and cosmetic testing as well as in regenerative medicine raised two different financing rounds using a crowdfunding equity platform. It both served the company in terms of financing and visibility.

Overall crowdfunding (P2P Lending, Reward and Donation and Equity) represented \$34bn in 2015³⁰. While it can be argued that Peer to Peer lending should be included in this crowdfunding statistics (71% of the 34bn figure), the amount raised through crowdfunding is still significant and steadily progressing year after year.

Equity crowdfunding allowing individuals to own equity in start-ups has doubled each year to reach an overall \$4bn in 2016.³¹

3.3 Initial Token Offerings

Initial Token Offerings (ITOs) are a new way for businesses to finance themselves. Relying on a specific blockchain architecture, a new token is issued by the company and can serve as a way to buy products or services within the company's ecosystem or simply act as a share in a company, without any equity ownership being involved.

ITOs have been gaining momentum in the past two years and in 2017 represented more than \$3bn of funding³². Due to unclear regulation at the moment, it is to be seen if ITOs are going to stay a viable source of funding for start-ups and more mature companies.

Some companies in the healthcare space, such as Iryo.io, developing a blockchain based solution to give patients ownership of their health data, started to use this as a sound means of financing and launched an ITO aiming at raising between \$8 and \$26m.

Some of those companies use this means of financing to accelerate the launch of a specific product or solution, along with other means of financing, while other start-up

founders clearly mentioned to us they're using initial token offerings to avoid using other means of financing and subsequent rounds of financing. Hence, they mentioned closing a bigger investment round initially would lead them to focus on the development path rather than on how to raise future financing rounds.

This view can be challenged if we think that the value of the start-up has to evolve over time in line with development of the company and that initial token offerings do not specify an intrinsic value of the start-up as they do not usually represent legal ownership of the company.

3.4 Business Angels

Business Angels are usually high net worth individuals or group of individuals committing capital to fund start-ups in their early stages of development.

They tend to invest at a stage where the company is at very high risk of failure compared to later financing stages and usually divest at the point where Venture Capital actors start to get involved. A key consideration is that Business Angels do not usually follow on in subsequent rounds of financing mainly because the financial commitment becomes too important. When reaching later stages of financing, Business Angels usually divest from the start-up.

Angels Santé is one example of a French business angels group specializing in healthcare investments. Its members come from different horizons be it pharmaceutical industry, health consulting or insurance. The group already invested €10m in 50 different start-ups.

3.5 Venture debt

Venture debt is also part of the financing means a company can use to sustain its growth. Either provided by banks, funds or finance companies, venture debt consists

of a loan specifically targeting the needs of a young company which may either want to acquire equipment or just finance its growth without any pre-specified purpose for the loan. In case of an equipment-financing loan, the equipment purchased by the company will be used to secure the loan. In case of a corporate growth loan, assets from the company and/or IP will be used.

If used properly, this tool can reduce dilution, accelerate growth of the company or extend its runway. As an example, Poxel, a french listed biotech company developing new drugs for metabolic diseases relied on venture debt to grow the company to a subsequent stage of development. The company is notably developing an orally-available anti-diabetes drug candidate focusing on the mitochondrial dysfunction.

It also allows equity investors to reserve additional capital for next rounds and avoid dilution from new investors by reducing size of the round or helping to reach milestones to increase valuation of the company.

Regarding concerns it might raise; because venture debt is senior to preferred equity, debt will have to be repaid first in case things don't work out. Also, an investor might worry about losing control of the company if a default is called.

4. History of Corporate Venture Capital

4.1 Origins

One can trace the origin of corporate venture capital back to when the US chemical and plastics manufacturer DuPont invested into General Motors (GM) just before World War I. GM was at that time a private company manufacturing cars with merely 6-years of existence. Dushnitsky (2012)² and a report produced by the financial data analysis company CBInsights (2016)³ went into details on corporate venture capital history.

Following end of the war, DuPont wisely decided to invest more money into GM, not only speeding the growth of the car manufacturer company but also increasing demand for its own products it was supplying to the car industry and to GM.

Concretizing this first investment into GM, DuPont envisioned strategic and financial returns, two main motives for corporate venture arms we will come back to later. Following DuPont's involvement into relatively early investments in private companies, other big companies decided to follow this path and created their corporate investments programs.

4.1.1 First Wave: 1960-1977

A push in the US for diversification following the Great Depression and a quite strict anti-trust enforcement led big corporations to look for investments in new business opportunities through corporate venture investments into different industries than the ones they were already active in. The emergence of corporate venture activities was also paved by the first successes of the venture capital investing model into the nascent technology industry and the willingness of big US conglomerates to make

use of their unused cash.

Corporate venture programs at that time did not only encompass external financing of ventures but as well investment into internal projects and spin-offs. One of the most successful companies to run a CVC program in that first wave was 3M whose program notably led to the famous Post-it notes.

The Oil and Gas company Exxon was also one of the biggest corporate venture investor at that time and sought diversification through various investments into computer related technologies. It led the company to release a personal computer. Exxon's push for its companies in which he held some shares to refocus according to its own plan in the computer industry eventually led to major failures as conflicts with companies' management team arose.

This first wave of corporate venture capital investments slowly declined from 1973 to 1977 partly due to the economic declining situation and stagflation crises, which resulted in drying cash resources from big companies involved in CVC programs. Another reason that contributed to the end of this first notable CVC investments' wave was an increase in taxes from capital gains.

4.1.2 Second Wave: 1978-1994

The advent of computer and the hype surrounding it together with the Silicon Valley becoming popular and success stories in this new technology industry led this new wave of corporate venture investments. At the same time, it also encouraged students across the US starting their own businesses with entrepreneurship courses flourishing in major business schools and fueling start-up creations.

Following an important reduction of taxes on capital gains in 1980, institutional venture capital was starting to grow quickly alongside corporate venture capital,

following the movement and lead initiated from those VC players. Corporations willing to invest in external ventures in the beginning of the 80's pursued various approaches detailed hereafter:

- Investments into already existing independent institutional VC funds handling the investing part.
- Investments through a dedicated VC fund which an external fund manager managed.
- Investments through internally managed CVC funds.

As it was the case with the first wave of CVC investments, main drivers for companies to invest externally were the possibility to access cutting edge technologies either to enhance existing offerings within the firm or for the seek of diversification sometimes to protect against emerging technologies that could threaten existing ones. The latter motive effectively conducted to some difficult situations between the investing CVC and start-ups, where the corporate would decide to abandon some technologies for internal strategy alignment, often leaving some start-ups powerless.

Technology wasn't the only focus at that time and investments started to emerge coming from chemical firms. A famous investment in that sector was the one from Lubrizol Corporation, a chemical company, which invested in Genentech, a biotechnology company, leading to a successful exit through an IPO with valuation at more than \$10bn in 1999.

At the same time during that second wave, companies outside the US started to initiate CVC programs, be it from Japan or European countries to invest in US companies. An opposite movement with companies such as Apple or 3M started at

the same time with the aim of investing in European start-ups.

One of the first CVC programs, which was thought to be as similar as possible to an institutional VC model, came from Xerox. It organized its CVC fund with a relative independency in financing decisions and a VC-like compensation scheme fostering risk-taking. The company wanted to exploit at best the technologies it developed internally and decided to spin-out numerous inside projects and allowing them to seek external financing at some point. The outcome of this was a very successful return for Xerox's fund with an IRR of more than 55% over 8 years, way more than institutional VCs during the same period.

Internal tensions at Xerox rose quickly regarding the compensation scheme in the fund, which was not aligned with Xerox's internal policies and eventually led to the termination of this fund in its VC-like structure.

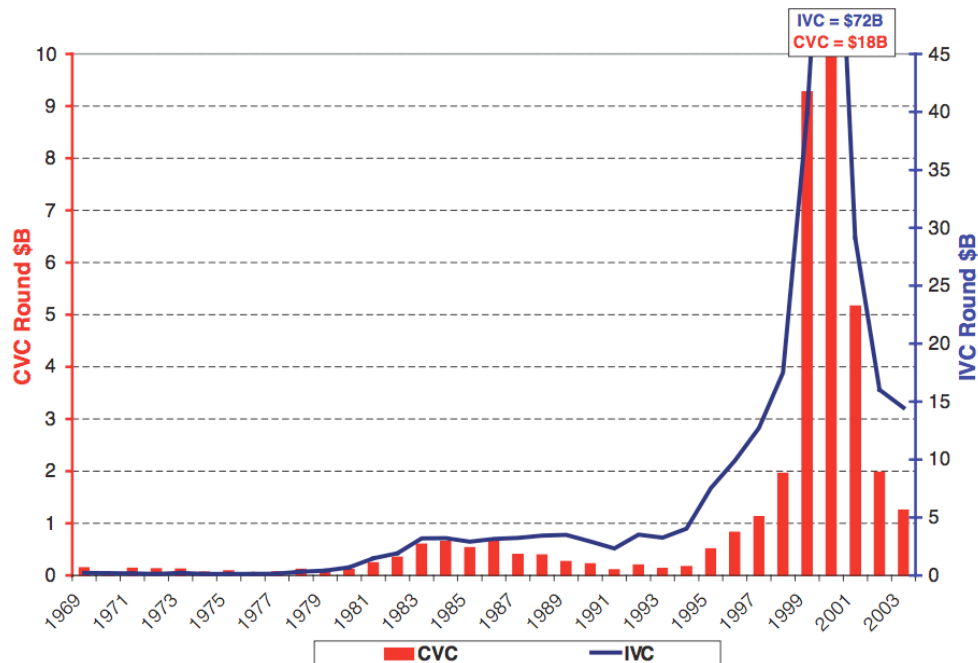
Quick turnarounds and endings of CVC programs were not unusual at that time with an average lifetime of 2.5 years, almost three times less than institutional VC funds.

1987 and the stock market crash which occurred that year led to a significant decrease in the number of CVC programs among companies. A third of the existing programs were shut down between 1987 and 1992. The same trend was observed with regards to the amounts invested by companies into indirect CVC programs through funding of VC funds.

4.1.3 Third Wave: 1995-2001

Following Internet breakthrough and success stories such as Netscape's one after its IPO in 1995, this third CVC wave started to rise with nearly 100 CVCs making their first investments between 1995 and 2001.

In terms of amounts, this new investment wave also saw way bigger amounts than before being committed with \$18bn invested in the year 2000, representing around 25% of the total funding in companies backed by institutional VCs.



IVC (Independent Venture Capital) scale on right
 CVC (Corporate Venture Capital) scale on left

* Data derived from Venture Economics, amounts in 2004 dollars.

Figure 7 - Investment rounds total amounts IVC-CVC

- Dushnitsky and Lenox (2005)

While the US was still the most important part of the world where venture investments were made, internationalization either started through foreign corporations sending executives in the US to create CVC units or US companies investing abroad to access foreign markets and technologies.

As start-ups R&D investments' share was gaining importance in the total R&D spending of all companies, CVC was used as a means to do R&D with more agility. Hence, pharmaceutical and tech companies represented an important part of all CVC programs rolled out during that period.

While this wave was seeing unseen amounts committed to CVC programs, it also reinforced some of the inherent contradictions of this type of programs compared to institutional VC structures. Compensation was one of the factors leading an important number of CVC executives to join institutional VC firms, hence leaving CVC funds with high turnover rates and key people to replace frequently.

As the number of VC funds was rising, competition did as well. One-way to differentiate for institutional VC firms was to partner with large corporations, nurturing collaboration like never before in Venture Capital. This wave of CVC investments also saw corporations seek creation of an ecosystem around their products through investments from their venture arm. Intel Capital is a very good example of this strategy with investments made for fueling the company products' use and demand.

This third CVC financing wave ended with the tech bubble bursting in 2000, leaving the Nasdaq down by 40% and CVC programs to be shut down by many players like Amazon, Microsoft or AT&T which had to write-off substantial venture related losses from their balance sheet. As tech corporations suffered, other industries like biotechnology still continued their CVC programs.

CVC reputation suffered from this episode as corporations were again seen as unreliable partners in the long run and as questionable programs from shareholders seeing those driving down financial results.

As enough data was starting to be available due to increases in investments from corporate venture funds, research and analysis in the segment grew as well. It was agreed from most of the research at that time that a lack of strategic focus and clearly defined objectives were the main issues of some CVC funds.

Mainly fueled by the hype around Silicon Valley and the desire to imitate large companies having a CVC program in place, many corporations launched a CVC

program without any clear stated intention. It led to unreasonable investments in some start-ups and substantial losses when the tech bubble burst.

4.1.4 Fourth Wave: 2002 - 2016

The tech bubble did not completely wipe CVC off the investing scene. After falling to a total of \$2bn invested in 2003, corporate venture investments rose steadily again with a slight decline during the worst years of the global financial crisis. 2014 saw corporate investments reaching again levels seen before the tech bubble at more than \$16bn. Following this trend, 2015 was an unprecedented year for corporate investors who committed \$28.4bn globally.

As this unique corporate financing increase in the past few years was even faster than the increase of investments from institutional VC investors, it is to be mentioned that this full picture also takes into account direct investments from corporations outside of a corporate venture fund structure. Those investments in terms of number of deals per year became more important than investment out of CVC funds since 2015.

Most CVC investments of this wave were done in Internet/Mobile and Healthcare segments with increased activity from corporate investors partially explained by the amount of available cash those companies sit on.

Another explanation as to why corporations regained interest for investing could come from success stories such as Microsoft's investment into Facebook and Google's decision to launch Google Ventures in 2008.

Hype, press coverage of new technologies and a certain fear for disruption also represent a significant contribution to the excitement around CVC investing.

As the current economic situation for companies involves historically low interest

rates and high cash-on-hand, they can consider going for a longer-term vision and avoid past behaviors of seeking quick returns out of IPOs. Hence it also allows for CVC players to be seen as more reliable partners by other parties and to exhibit track records improving credibility in the eyes of institutional VCs. CVC investors being more mature than before, they still look for the mix of financial and strategic objectives when considering investments with some of them diversifying through both investments as LP of institutional VC funds and the launch of dedicated CVC arms.

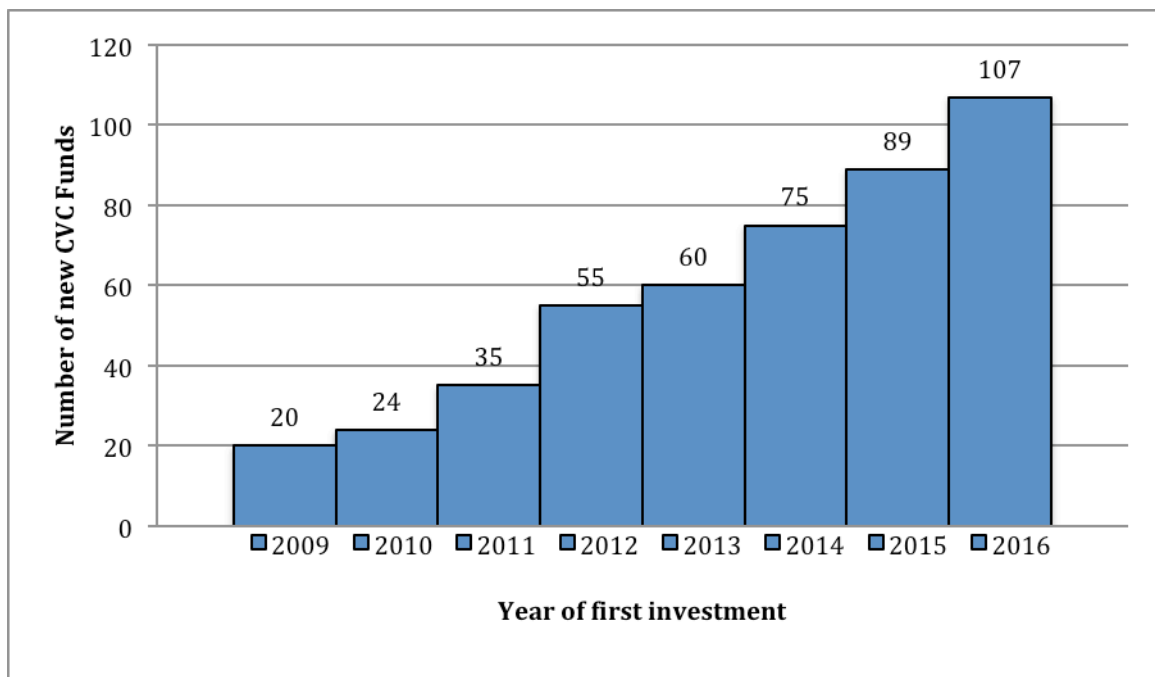


Figure 8 - Number of new CVC funds between 2009 and 2016 - CB Insights

Looking at the number of new corporate venture capital groups, CB Insights reports a steady growth year after year since 2009.

5. Motives of a CVC

A CVC arm can be set up with the aim of pursuing different strategies with a specific scope. As such, investments' objectives of CVC arms are usually painted out either as financial, like institutional venture capitalists, strategic or both. An in-depth description of those objectives is done extensively in recent literature on corporate venture capital. A firm can certainly seek financial gains out of its CVC structure, as a viable business, but research shows that most of them are looking to balance this financial aspect with a strategic endeavor associated with the fund's activity^{4 5 6}.

Going through literature on this specific topic, one will find various results of studies pinpointing in more details the reasons and end goal of pursuing a corporate venture program. Siegel et al. (1998)⁷ highlighted the most important objective for CVC groups out of one of the first surveys focusing on this matter being "return on investment". This finding is balanced by the fact that respondents also emphasized on different strategic objectives along with this financial aim. Out of those strategic objectives, "exposure to new technologies and markets" is the highest one, followed by "potential to manufacture or market new products", "potential to acquire companies" and "potential to improve manufacturing processes".

Out of another study by Winters and Murfin (1988)³³, one can find two other important strategic objectives. As corporate venture groups often offer the possibility for corporations to invest in companies out of their current business activities and geographies, those investments can translate into strategic opportunities for the mother company to expand abroad through licensing technologies and products and eventually marketing them, often beyond its current businesses. Another interesting outcome of this study is the critical view of authors with regards to the potential

facilitating role of CVCs when it comes to acquisition of the venture by the mother company. As a matter of fact, they stress that simultaneously serving as existing investor and acting as potential acquirer would likely trigger tensions.

This last finding regarding a negative environment that could be created by a corporate venture investor acting as potential acquirer of the venture was also pointed out by Sykes (1990)¹⁰, looking at strategically driven corporate venture programs and outlining that other investors and entrepreneurs don't want to be tied to this restricted exit option to the corporate investor.

Sykes (1990)¹⁰ also found through this study and surveying of 31 major corporations running CVC programs that "identifying new opportunities" and "developing business relationships" were major strategic objectives. "Find potential acquisitions" was still the following stated strategic objective in terms of importance, followed by "learning how to do venture capital" and "change corporate culture".

As commercial databases tracking venture capital investment started to emerge during the third CVC wave, it allowed studies to be made on actual investment behaviors from corporations instead of looking only at stated intentions. In addition, collected data on CVC investments also permitted to compare firms investing through CVC programs to firms which decided not to pursue any investment program.

McNally (1997)³⁴ specifically points out motives for corporations not engaged in a CVC program, be it through direct investments or through institutional VC firms. He reveals that the underlying motivation not to pursue a CVC program is tied to the lack of resources or to the appeal for solutions offering better control such as internal research and development or M&A. The study also highlights that a motivation for those corporations to eventually invest in young companies would be to gain access/knowledge to a specific technology.

Ernst & Young (2002)³⁵ surveyed forty major corporations running CVC programs and found that 56% of them declare strategic objectives, 33% mentioned to be financially driven when investing and 11% pursuing both. Among the companies, which declared to be driven by strategic objectives, having a "window on technology developments" was their principal aim. This last finding is coherent with previous studies mentioned earlier. Other strategic objectives as stated by companies included "importing innovation with existing business units", "leveraging internal technological developments"

It is interesting to note some of the changes out of a similar survey conducted by Ernst & Young (2009)⁶ and involving thirty-seven investing corporations. 97% of them declared to be strategically driven with many of the corporate investors balancing this strategic goal with financial aspirations. Only 3% of the corporate venture capital groups stated to be only financially driven.

The report "Inside the minds of corporate venture capitalists" published on the commercial venture database CB Insights in 2015 and co authored by Samir Kaji from First Republic Bank and Jessica Peltz-Zatulove from kbs+ Ventures analyzed thirty-four of the most active CVCs and surveyed them with regards to their motivation in investing into ventures³⁶. Consistent with the overall trend among corporate venture groups, 79% of the surveyed stated strategic value as a key driver with 76% mentioning financial returns as a core objective still.

As to the relation between a corporation investing into ventures and corporation's activities, Dushnitsky and Lenox (2005a)³⁷ reported a positive relationship between annual equity investments out of a CVC program and internal cash flow of the parent company, similar to McNally's (1997)³⁴ study results.

Looking at sectors of interest within CVC groups, Dushnitsky and Lenox (2005a)³⁷

also found that corporations evolving in a dynamic technology industry are more incline to go for venture capital investments. They also report that corporate venture capital is mainly directed towards ventures in industries with a weak IP and to some extent in industries in which complementary distribution capabilities are of importance.

This observation that corporate venture capital is sensitive to the mother company and venture industry characteristics suggests that CVC is a type of external research and development and it might be one motive for a corporation to set up a CVC program.

Looking at the characteristics of parent companies' industry, Basu et al. (2010)³⁸ further validates previous findings regarding a greater proportion of corporate venture arms being set up in industries where corporations experiment intense technological developments and an important patent regime. Interestingly, the authors also found heterogeneity with regards to investments behaviors within a same industry setting.

Coming back to one of the initial objectives of corporate venture programs stated in a number of declarative surveys and interviews of executives at corporate venture funds being a potential to acquire companies; it appears that the proportion of companies that first received a venture investment and then got acquired by the investing corporation is relatively small. Guo et al. (2011)⁹ outlined a 5% figure, consistent with other findings in literature according to the author.

6. Investors' outcomes

6.1 CVC Unit

Considering the outcome of corporate venture investments for a CVC unit relates to the performance of the initiative in term of strategic and financial benefits, which can prove challenging to assess. Especially since there is no pre-agreed list of strategic benefits onto which programs are measured.

Looking at literature on this specific topic, one will find two sets of studies either using surveys and accounting for a broad set of strategic and financial returns or considering large-samples' analyses and then focusing on a narrow set of performance measures.

Siegel et al. (1998)⁷ survey-based study outlined the fact that corporate venture capitalists satisfaction towards the exposure to new technologies and markets is the highest. Programs enjoying a high degree of autonomy with regards to the parent company reported higher satisfaction in achieving both financial and strategic objectives compared to CVC programs, which are highly dependent on corporate approval and capital commitment.

Sykes (1990)¹⁰ survey-based study among strategically driven CVC programs reports 40 percent of them experienced very high value creation compared to 24 percent declaring no or negative value creation. It's to be noted that programs with a high strategic value creation are also associated with better financial returns than their counterpart.

McNally (1997)³⁴ looked at the relationship between the structure of a CVC program and its performance. Considering termination of activity, the author found that

around half of the indirect CVC programs, playing the role of a LP in a VC structure ended their investment activity. This structure of investment for CVC programs is mainly seeking to learn venture capital investing and to experience capital gains. On the other hand, 39 percent of CVC programs directly investing into young ventures terminated their investment activity. Regarding this other form of corporate venture investing, CVC funds reported again a high degree of satisfaction regarding exposure to new technologies and to new markets as well as to business relationships' development.

Gompers and Lerner (1998)¹¹ also looked at termination of CVC programs through empirical evidence in a large-scale study. Assuming that the duration of a CVC program accounts for its success, at the time of the study CVC units had a mean longevity of 2.5 years compared to 7.1 years for institutional VC funds. It's to be noted that strategically aligned programs to the parent corporation had longer longevity than their unaligned counterparts.

Looking at syndication Hill et al. (2009)¹² report a positive effect of syndication with institutional VC funds with regards to perceived strategic value and lower termination of portfolio companies' activities.

In the same study, they also found a positive relationship between the alignment of compensation of CVC structures to institutional VC structures and the greater longevity of CVC arms. Dushnitsky and Shapira (2010)³⁹ also exhibited a greater number of liquidity events for portfolio companies of CVC units compared to the ones of VC funds when performance pay is implemented into the CVC structure.

Out of this literature review, we observe some consistent results with regards to the overall financial performance of CVC programs, which are strategically aligned in terms of portfolio with regards to their parent company. Still, assessing the

performance of a CVC unit beyond its financial performance stays a key challenge.

6.1.2 Parent Company

Another challenge is posed by the study of CVC investment's activity on the parent company. Measurement of this effect is challenging in that there is possibility of experiencing both long-term developments coming from certain strategic objectives of the CVC tied to technology access out of a venture investment and short-term developments tied to investment made by the CVC and aiming at improving demand for products of the parent company.

Innovation

Looking at research and development activities in 270 corporations prior and immediately after setting up a CVC unit between 1980 and 2000, Chesbrough and Tucci (2004)¹³ found that having a CVC program is significantly associated with an increase in research and development at the parent firm. They conclude that corporate venture capital hence supplements internal R&D efforts and exhibits strategic value for the parent company.

Maula et al. (2003)¹⁵ found that corporate investors syndication, along with network creation associated with it, is beneficial for the corporate investor as it is able to spot potential discontinuation in technologies quicker than other firms lacking those established connections with other corporate investors. Hence CVC investment is a tool to anticipate market changes and technological threats.

Dushnitsky and Lenox (2005b)¹⁴ found that the impact of CVC investments on a panel of public firms between 1975 and 1995 was positively associated with an

increase of patenting at the parent company. This observed effect on a firm's innovativeness is greater in firms with weak IP regimes and is consistent with viewing CVC as a tool allowing to capture innovation from young ventures. That's certainly a factor explaining why in those industries entrepreneurs are reluctant to discuss about their inventions and CVC might be seen as a way for the corporation to better understand a technology while undergoing due diligence and joining board meetings. In that regard, between 1989 and 1999 and focusing on the telecommunications industry, Wadhwa and Kotha (2006)⁴⁰ found that there is a clear relationship between the number of investments in ventures done by a CVC and the number of applied patents at the parent corporation the following year. They also found that this association is correlated to the involvement of the CVC into the investees. When a CVC is actively involved at the board of ventures or tied specific alliances between the parent company and the start-up, the degree of patenting rise is even greater in the following years.

Financial performance

Looking at equity investments of information technology firms between 1990 and 2002, Allen and Hevert (2007)¹⁶ report that CVC arms experience on average negative internal rate of return (IRR). In the meantime this study exhibits the clustered nature of this result with 39 percent of the CVC units exhibiting high IRRs while the rest experience almost null to negative IRRs partially explained because of funds launching their activities during the dot-com bubble.

Dushnitsky and Lenox (2006)⁴¹ explored value creation both from financial returns on the CVC investments' angle and from long-term strategic benefits provided to the company using the Tobin's Q ratio. This ratio is composed of the market value of a

firm regarding its assets value. Studying a panel of public firms either investing into ventures or not investing between 1990 and 1999 they found out that the creation of value at the firm is associated with CVC programs, especially strategically driven ones. But, they also mention that this relationship depends on the sector of activity, with greatest value in information and devices sectors.

Out of this literature review regarding outcomes for the parent company out of CVC investing, one can definitely outline CVC investments' role in value creation for the investing corporation especially when the CVC arm is strategically driven. Still, one must tie this value creation to industry-level factors.

7. Investees' outcomes

Considering advantages an entrepreneurial venture can expect from being backed by a corporate venture arm, one can first look at the services provided by a corporation behind a CVC unit. Block and MacMillan (1993)⁴ outlined that those services are similar to the ones at a quality VC fund.

Secondly, those services can be unique as the corporation can provide access to specific internal resources such as research and development equipment or existing distribution channels and even facilitate connections with clients or suppliers.^{18 19 20}

Thinking of the pharmaceuticals industry, this can definitely be key for a start-up as it can rely on expertise, specific know-how and potential key connections from the investing corporation in a quite closed industry.

Thirdly, in addition to key insights regarding a specific industry, a corporation also acts as an endorsement vis-a-vis third parties.²¹

Key benefits for the investee outlined in McNally (1997)³⁴ include by order of

importance:

- short-term problem solving
- access to management of the parent company
- technical expertise
- access to marketing resources and distribution channels

70 percent of the financed ventures also reported a credibility advantage by having the CVC as investor into their company.

Looking at financial metrics, Gompers and Lerner (1998)¹¹ looking at 30.000 rounds of investment in the 1983-1994 period found that CVC backed ventures have the same probability of succeeding through an IPO or an exit at a high valuation than their VC-backed counterparts. This likelihood of exit is increased when there is a strategic fit between corporations' activities and the venture.

In the same study, authors also found that corporate venture arms invest at a premium compared to venture funds, without any correlation with regards to the strategic fit between investors and investees.

Focusing on the valuation of IT ventures when going through an IPO between 1998 and 1999, Maula and Murray (2001)⁴² found that CVC-backed companies experienced higher valuation than their VC-backed counterparts only financed by institutional VC funds. Interestingly, companies financed by multiple CVC investors exhibit highest valuations.

Ivanov and Xie (2010)²² published results of an IPO prospectus and performance analysis considering 1510 companies that got listed between 1981 and 2000. They found that a valuation premium is experienced for corporate venture-backed companies only when they show a strategic fit with the parent company. A key point

to consider in this study is that the author included in their sample only CVC-backed IPOs with the corporate venture arm still involved when the venture went public. They do so because they believe CVC are unlikely to impact IPO performance if they have ended their involvement within the venture.

Maula et al. (2009)⁴³ highlights interesting findings with regards to impact of corporate investors on investees. Out of a survey of 91 CVC-backed firms, they outline both benefits and drawbacks of collaboration with a CVC. The corporation can provide learning gains on market knowledge, technical know-how and insights on competition. In the meantime, a venture can sometimes experience loss of intellectual property to the parent company and a delayed growth due to corporate processes' bureaucracy. The use of safeguards effectively decreases the probability of adverse impact from the corporation but it will also limit learning benefits. This last point is effectively a key question, especially in the healthcare space, where a team leading a drug-development program at a given start-up can definitely fear sharing information with corporate venture firms at the board of the company.

Quality of the investing corporate venture firm team should ensure that no sensible information will be shared with the parent company and that any conflict of interest will be dealt with immediately with provisions such as stepping out of board discussions on a specific matter for example.

Guo et al. (2011)⁹ analysis on 4801 start-ups between 1968 and 2008 outlined that CVC funds invest 25% more than IVC funds and a positive correlation, yet not statistically significant, between CVC investment in a given start-up and likelihood of an IPO exit compared to an IVC investment.

8. Do investment motives of CVCs impact the valuation they experience when acquiring equity in a venture?

As previously outlined in literature, CVC can provide a range of advantages to start-ups, hence some research was performed in the past years to determine if CVCs experience higher purchase prices than their VC counterpart when acquiring equity in a venture or not.

Gompers and Lerner (1998)¹¹ found empirical evidence that corporate venture units experience significantly higher start-up valuations than institutional Venture funds, hence demonstrating that CVCs pay a certain premium related to their strategic angle. Interestingly, when looking further into the considered CVCs, they found that corporate units which saw their portfolio companies tying relationships with the parent company at a given point in time experienced lower valuation when investing than their peers.

Masulis and Nahata (2009)⁴⁴ found empirical evidence that CVCs investing in start-ups with complementary products of the parent company, as opposed to CVCs investing in start-ups with potentially competitive products than ones of the parent company, experienced lower purchase prices.

Röhm et al. (2017)⁴⁵ looked at the impact of corporate venture capital investors' motivations on startup valuation. Authors categorized CVC units on their motivations using computer-aided text analysis (CATA) and cluster analysis in order to determine levels of strategic and financial investment motivation. Analyzing 52 corporate venture units' mission statements and going through 147 start-up valuations between 2009 and 2016 they found that strategically driven CVCs assign lower valuations than CVCs with an analytical motivation that have moderate levels of both financial and strategic dimension.

This finding suggests that strategically driven CVC can experience lower valuation when negotiating a deal with a venture because of their value-add compared to institutional VCs.

In the same study is also outlined the fact that CVCs with an unfocused investment motivation do have to pay significantly higher purchase prices, supporting the hypothesis that they would have a liability of vacillation.

Then, considering financially driven CVC units, authors found out that they experience almost the same valuation when investing compared to analytic corporate venture units.

9. Corporate venture units in healthcare - Strategic analysis

Specifically looking at corporate venture capital in biotechnology and outlining literature findings previously mentioned to this specific industry, Henderson (2007)²³ distinguishes three different buckets into which pharmaceutical corporate venture funds investments strategies fall. Connected to a growing threat of profit margins due to various factors notably encompassing an increased level of research complexity eventually leading to a loss of patent-protected market time and payers pressure, a number of pharmaceutical companies did launch corporate venture programs with strategic objectives in mind Henderson classifies as either:

Leveraging the core: consistent with research and development focus of the pharmaceutical company.

Upgrading the core: not involving direct drug development of a candidate but acting on its process, whether by simplifying it, accelerating it or lowering its cost.

Reserving the right to play: different competencies, be it in the disease area or

process, than those of the pharmaceutical company as well as a new technology involved with a disruptive potential.

From this classification, Henderson mapped out five different pharmaceutical corporate venture funds, outlining their effective focus depending on their realized investments as of 2007. Updating this work, we mapped out as of 2017 the corporate venture funds of Novartis, Merck & Co and Eli Lilly & Co and compared those to stated objectives of the funds gathered from websites, interviews of key executives and other relevant sources to assess consistency in the investment behavior of those firms relative to their strategies.

We used the website crunchbase.com in order to obtain a list of investments from the funds since their inception. As the official websites of the funds usually display the active portfolio companies and successful exits, leaving out some unfruitful investments, which are still part of the investment behavior of the corporate venture arm, we needed this additional source of information from external sources to cross-check.

We also used the website web.archive.org in order to obtain access to websites of the investor and the investees at the time of the investment. As the focus of companies change over time due to shift in strategies, management teams and external growth through acquisitions, it definitely is of importance to map the investment behavior of a given investment in a given year with the therapeutic focus of the investor at the same time.

9.1 Eli Lilly and Co

Lilly business areas as of 2018 mainly encompass oncology, diabetes and

immunology. It still markets historic products notably in the treatment of mental and cardiovascular disorders.

Its pipeline includes programs at different development stages. Pain related drug programs are at an advanced stage, with galcanezumab for migraine prevention in regulatory review as of May 2018.

Phase 3 programs encompass two other compounds for pain management, namely Tanezumab in new indications and Lasmiditan. A number of programs are also in the pipeline at the same stage for diabetes mainly for new indications of already marketed molecules, various new indications for oncology drugs such as Ramucirumab in bladder cancer and ongoing clinical trials in neurodegeneration such as Lanabecestat in Alzheimer's.

Phase 2 programs encompass some new molecules in oncology such as Merestinib being tested in biliary tract cancer and non-small cell lung cancer. One can also find immunology programs like Mirikizumab for the treatment of psoriasis and a type 2 diabetes trial carried out with a GIP/GLP-1 co-agonist peptide.

Phase 1 programs notably encompass an antibody treatment for Alzheimer's disease, an IDO1 inhibitor for cancer and an IL-21 Monoclonal antibody for the treatment of autoimmune diseases.

This overview both of marketed products and trials at their different stages gives us a good outlook of the current focus of the company for our analysis.

Founded in 2001, Lilly Ventures spun-out from its parent company in 2009 in an effort to align compensation of its venture team to independent venture capital structures, thus, enabling higher talent retention. Its stated goal is to "facilitate the success of companies in {our} areas of focus."⁴⁶

Our analysis of Lilly Ventures' investments outlines a large majority of investments

into companies in line with the research and development focus of the company at time of the investment. Most of those investments falling into the "leveraging the core" bucket are actually made in oncology start-ups. As to the investments aiming at "upgrading the core", one can find here investment in companies such as Numerate, in the drug-design powered by artificial intelligence sector. As to the few investments out of the direct business lines and clinical efforts of Lilly, one will for example find Remon Medical, acquired by Boston Scientific since Lilly Ventures invested in the company in 2004. It developed a medical device aiming at monitoring vital cardiac parameters. Even though medical devices are not in the realm of Eli Lilly, the potential applications for such a device are still in its cardiovascular business ecosystem and patient journey.

Interestingly, Henderson, as of 2007, outlined an emphasis on investments into the "upgrading the core" category, which is effectively the most important part of classification we came up with as well for investments between the inception of the fund and 2007, year of Henderson's study. Since then, a significant number of investments were performed in order to leverage the core focus of Lilly's activities.

Responding to specific challenges of the Asian market and predominantly investing in China, the pharmaceutical company also launched Lilly Asia Ventures in 2008 with significant fund closes of several hundred millions of dollars. Completely spun-out from Lilly in 2011, Lilly Asia started to raise capital from other entities than Lilly⁴⁷ even though Eli Lilly still is the largest LP of Lilly Asia Ventures. Its stated investment strategy as of June 2018⁴⁸ is quite broad, encompassing human therapeutics, medical technologies, healthcare services, animal health, industrial biotechnology and even agricultural technologies. It intends to back companies mainly at growth stage.

Out of our analysis of Lilly Asia Ventures' investments referenced both from its website as of June 2018 and crunchbase's website at the same date, we definitely see it being focused on leveraging its core activities with many investments into biotechnology companies, targeting the same therapeutics areas as the ones of Eli Lilly be it in oncology, immuno-oncology or diabetes.

Furthermore, a significant number of investments in the "reserving the right to play" category are made into new technologies and devices aiming at complementing drug treatments in Lilly's focus areas. One can mention Microtech Medical, developing insulin pumps and blood glucose monitoring devices for the Chinese market. One can also mention knee joint and prosthetic hips replacement company Ketai Medical, complementing the patient journey of osteoporosis treated patients, which is a disease Eli Lilly is proposing a treatment for, namely teriparatide.

9.2 Novartis

Novartis' focus activities as of 2018 are divided into 6 different sectors being:

- Oncology: breast cancer, lung cancer, kidney cancer, melanoma and hematology.
- Neuroscience: multiple sclerosis, migraine, Parkinson's disease, Alzheimer's disease, ADHD.
- Cardiology: hypertension, hypercholesterolemia
- Immunology & dermatology: psoriasis, transplantation immunosuppressive agents, chronic idiopathic urticaria
- Ophthalmology: open-angle glaucoma, age-related macular degeneration, uveitis
- Respiratory: COPD

Novartis also owns 3 subsidiaries, namely Alcon, being active in ophthalmology, Sandoz, focused on generics and Advanced Accelerator Applications, specialized in

molecular nuclear medicine. Novartis announced in June 2018 its intention to spin-off Alcon in a move to refocus the company on prescription drugs⁴⁹.

Out of a \$49.1bn turnover in 2017, \$33bn was represented by innovative medicines, namely Novartis without its subsidiaries Alcon and Sandoz. Cosentyx[®](secukinumab), which is prescribed for plaque psoriasis and psoriatic arthritis, represented \$2.1bn of sales. Gilenya[®] (fingolimod), an immunomodulator acting on the sphingosine 1-phosphate receptor, relevant for multiple sclerosis treatment represented sales of \$3.2bn by itself⁵⁰.

Novartis' pipeline exhibits 90 programs at different stages. Out of those, 38 are new molecules and 35 are new indications for existing molecules. Looking closer at those 38 new molecules being developed, 12 of those are in oncology with 7 of those in Phase III. One can name Asciminib, a BCR-ABL inhibitor, in clinical trial for chronic myeloid leukemia as 3rd line of treatment or Capmatinib, a c-MET inhibitor being investigated for non-small cell lung cancer.

In the Neuroscience area, 7 programs are being carried out, with 2 of them in Phase III. One of those programs in Phase III is siponimod, a sphingosine-1-phosphate receptor modulator for multiple sclerosis, with clinical trials read out scheduled for this year. Two programs are carried out for Alzheimer's disease in Phase II, one of those being amilomotide, a virus-like particle of bacteriophage W-beta coat protein coupled to multiple copies of human beta-amyloid peptide fragment, designed to activate antibodies production targeted against beta-amyloid plaque formation.

In the Immunology area, 8 programs are being carried out at different stages, one of which, emricasan, a pan-caspase inhibitor, is in Phase II for non-alcoholic steatohepatitis (NASH), a disease area that recently attracted significant media coverage and increase prevalence in developed countries.

Novartis Venture Fund (NVF) was founded in 1996 and currently manages around \$800mln. Its investment focus is on the development of novel therapeutics and platforms. NVF notably looks for unmet needs and clinical impact as well as proprietary science⁵¹. It invests globally and is stage agnostic, typically playing a lead or co-lead role with an active role on companies' boards.

Out of our analysis of the 116 investments we recorded from Novartis Venture Fund, we outlined that around 60% of them are made to leverage core competencies at the mother company, 30% to reserve the firm a right to play in a different disease area/therapeutic solution than its existing ones at the time of investment and the remaining 10% are intended to facilitate, accelerate or lower the cost of the drug development process. Going into further details, we can outline the likes of Enterprise Therapeutics, developing sodium and chloride ions modulator, ENaC and TMEM16A in epithelial lung cells, facilitating hydration and effective mucus clearance, which is lacking in Cystic Fibrosis. The company also works on an anti-mucus production agent, by targeting the goblet cells, which are playing a key role, overproducing mucus, in COPD. As Novartis markets treatments in both these diseases, we understand the strategic focus of investing early on in the development of potential treatments in the same disease area.

Similarly, Aerpio is developing VE-PTP (Vascular Endothelial - Protein Tyrosine Phosphatase) inhibitors, as it competitively fixes on Tie2, an Ang-1 receptor in the eye blood vessels supposed to maintain blood vessel integrity. This target could prove useful in a range of eye diseases, such as diabetic retinopathies and age-related macular degeneration (AMD). As Novartis has a clear focus on ophthalmology, with one of its best selling drug, Lucentis[®] (ranibizumab) having indications in diabetic macular edema and AMD it was a strong strategic focus to invest in such a young venture.

9.3 Merck & Co

Merck & Co businesses as of 2018 encompass a wide range of activities sub-divided into prescription medicines, vaccines and oncology. As part of its prescription medicines unit, Merck & Co markets drugs for cardiovascular, infectious and respiratory diseases and in endocrinology, immunology, neurology, ophthalmology, and urology as well as drugs for women's health. It is also active in animal health with its Merck Animal Health division.

Out of a \$40bn turnover in 2017, \$35bn was represented by pharmaceuticals, Sitagliptin (Januvia[®]) being the best seller of the company, representing almost \$6bn by itself. Then comes lambrolizumab (Keytruda[®]) with an annual sales figure of \$3.8bn. The third best seller for the company in 2017 is its type 6, 11, 16 and 18 human papillomavirus vaccine (Gardasil[®]), which amounted to \$2.3bn⁵².

Its pipeline encompasses 3 different drugs under review by regulatory agencies, namely doravirine, a non-nucleoside reverse transcriptase inhibitor (NNRTI) for HIV, which showed efficacy against most common mutations of NNRTI resistance. A combination pill with lamivudine and tenofovir disoproxil fumarate is also under review as well as a pediatric hexavalent vaccine against diphtheria, tetanus, whooping cough, polio and hepatitis B in the US after its approval under the name Vaxelis[®] in EU. Several phase III programs are carried out at the moment, mainly for lambrolizumab's (Keytruda[®]) new indications in oncology for this anti programmed cell death 1 receptor (PD-1) as well as for a PARP inhibitor Olaparib (Lynparza[®]) in collaboration with AstraZeneca. This molecule is already marketed for ovarian cancer in multiple lines of treatment. One can also outline a phase III trial for Vericiguat, a soluble guanylate cyclase stimulator for patients with chronic heart failure and preserved ejection fraction in worsening condition.

Phase II programs mainly encompass pembrolizumab (Keytruda[®]) in several indications and investigational drugs for HIV and Schizophrenia.

Merck & Co created Merck Global Health Innovation fund in 2010 and initially committed \$250m for investments through this structure. As of 2018, the commitment has been revised to \$500m with William Taranto, head of the structure, mentioning in June 2015 that half of this amount has already been invested⁵³. This fund is dedicated to investments in digital health opportunities. Its goal is to "have an impact broadly around healthcare, where, again, the pill only supplies one piece of it."⁵³

Stated investment areas are⁵⁴:

- Care Management: ensuring improved outcomes, lower costs and improved patient satisfaction.
- Health Analytics and Artificial Intelligence: transforming big data into real world evidence.
- eClinical Trials: improving site selection and trial subject recruitment.
- Therapy Planning: ensuring delivery of the right treatment to the right patient at the right time.

The fund's investment thesis is summarized in the following picture, sourced from their website.

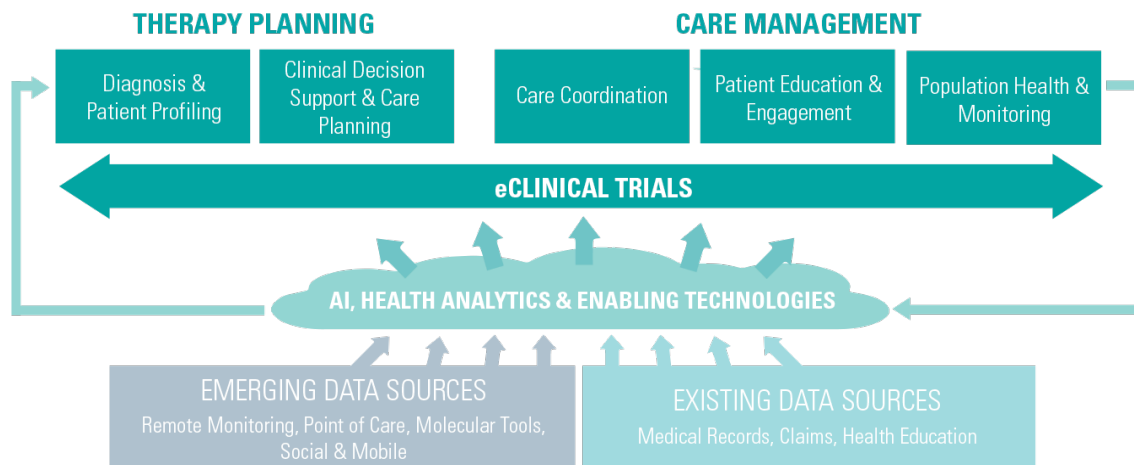


Figure 9 - "Data will be the currency of healthcare" - Merck Global Health Innovation Fund's website - June 2018

Unsurprisingly, the fund invested in companies falling in the "upgrading the core" bucket with solutions allowing for a better connection of patients to relevant clinical trials, such as Antidote.me or Syapse. Most of its investments would though fall into the "reserving the right to play" bucket as they're targeting, consistent with the investment thesis of the fund:

1/ Diagnosis, with technologies in relevant therapeutic areas of Merck, such as oncology or cardiology developed by the like of Aviiir or GenomeDx respectively working at the time of Merck's investment on diagnostics for cardiovascular diseases and genomic tests for prostate and urologic cancers.

2/ Physician support, with solutions such as the one of Aptus Health connecting physicians in an online community or Physicians Interactive.

3/ Care coordination in important business areas for Merck such as Navigating Cancer in the field of oncology, proposing a patient care coordination platform or

PatientSafe developing a mobile solution for hospital care management.

4/ Patient engagement with companies like Livongo Health or Welldoc, acting on diabetes patient behavior surrounding its drug intake.

5/ Monitoring with solution like Preventice offering a remote monitoring device in cardiology.

Through these examples we eventually notice that data is at the center of almost each of Merck Global Health Innovation Fund investment and that it is aiming at playing a role in each of the patient health touch point with regards to its disease.

Be it,

1) with patients' data analyzed in such a way that it allows for better/quicker diagnosis of a disease, eventually funneling them to better health interventions.

2) with patients' data coming from monitoring devices and patient engagement solutions allowing the firm to have real life insights of specific diseases in the end and sound measurable outcomes; leading to an easier, different or new way of developing treatments for the pharmaceutical company.

3) with patients' data analyzed in such a way that it allows for better clinical trials recruitment, allowing for a matching of patients with adequate solutions quicker than usual and potentially for a quicker time to market, or group recruitment for the pharmaceutical company.

4) with patients' data digested and communicated in such a way that it allows physicians and health professionals to make easier informed decisions for the patient.

Thinking of Merck Global Health Innovation Fund's strategy as a whole outlines a new set of companies using digital technologies applied to healthcare topics and

gaining interest from established pharmaceutical players since, especially in the last decade. Focusing on that sector, we will try to map out and explain in the next section the financing of digital health in the last decade.

Merck & Co also created Merck Research Venture Fund in 2011, renamed MRL venture fund, with the objective of investing both into existing life-sciences funds and into strategic biotech companies with the aim of "harvesting downstream through partnerships or acquisitions" as mentioned by Reid Leonard, in charge of the fund at its inception⁵⁵. As a result, MRL effectively invested as a Limited Partner of a Flagship Pioneering fund in 2012 and in a couple of other undisclosed funds until they started to invest directly into biotech companies in 2014.

Our analysis of those investments is unsurprisingly that investments coming from MRL venture fund are made into companies leveraging inside competencies at Merck & Co, with a focus on oncology for many of them such as Carisma Therapeutics, developing CAR-Macrophages to target solid tumors. One can also find investments into companies, already exited, like Miragen therapeutics, focusing on cardiovascular diseases through microRNA based therapeutics.

Throughout this study on three major corporate investment funds and their strategies toward making those commitments useful for the mother company, be it strategically or financially, we understand the variety of the approaches they use as part of their overall innovative strategy.

A limitation in our study could be that new ventures, especially in the biotechnology field are sometimes quite opaque regarding their research efforts and a stated specific area of research might not encompass all the different programs being developed internally by the start-up. Similarly, an investment fund might have access to confidential information about the future potential of a specific technology, beyond

the current research and development efforts being carried out by the start-up. Hence, we might have classified in the "reserving the right to play" bucket a number of investments which were done with the intent to leverage core competencies at the investing corporation, thus, falling in the "leveraging the core" bucket.

10. Financing of Digital Health

Digital health definitely saw a humongous interest increase in the past years from pharmaceutical corporations. Under many different perspectives we will be trying to address in this section, corporations are looking at digital innovations under the pharmaceutical scope as ways to either complement their existing businesses or address new business opportunities.

Let's first define digital health and what sub-sectors are encompassed under this umbrella term. The World Health Organization proposes a taxonomy encompassing four different buckets in order to classify different digital interventions, those being *"different ways in which digital and mobile technologies are being used to support health system needs."*²⁴



Figure 10 - Digital health intervention aimed at Clients - WHO Taxonomy²⁴



2.0 HEALTHCARE PROVIDERS

2.1	CLIENT IDENTIFICATION AND REGISTRATION	2.5	HEALTHCARE PROVIDER COMMUNICATION	2.8	HEALTHCARE PROVIDER TRAINING
2.1.1	Verify client unique identity	2.5.1	Communication from healthcare provider(s) to supervisor	2.8.1	Provide training content to healthcare provider(s)
2.1.2	Enrol client for health services/clinical care plan	2.5.2	Communication and performance feedback to healthcare provider(s)	2.8.2	Assess capacity of healthcare provider(s)
2.2	CLIENT HEALTH RECORDS	2.5.3	Transmit routine news and workflow notifications to healthcare provider(s)	2.9	PRESCRIPTION AND MEDICATION MANAGEMENT
2.2.1	Longitudinal tracking of clients' health status and services	2.5.4	Transmit non-routine health event alerts to healthcare provider(s)	2.9.1	Transmit or track prescription orders
2.2.2	Manage client's structured clinical records	2.5.5	Peer group for healthcare providers	2.9.2	Track client's medication consumption
2.2.3	Manage client's unstructured clinical records	2.6	REFERRAL COORDINATION	2.9.3	Report adverse drug events
2.2.4	Routine health indicator data collection and management	2.6.1	Coordinate emergency response and transport	2.10	LABORATORY AND DIAGNOSTICS IMAGING MANAGEMENT
2.3	HEALTHCARE PROVIDER DECISION SUPPORT	2.6.2	Manage referrals between points of service within health sector	2.10.1	Transmit diagnostic result to healthcare provider
2.3.1	Provide prompts and alerts based according to protocol	2.6.3	Manage referrals between health and other sectors	2.10.2	Transmit and track diagnostic orders
2.3.2	Provide checklist according to protocol	2.7	HEALTH WORKER ACTIVITY PLANNING AND SCHEDULING	2.10.3	Capture diagnostic results from digital devices
2.3.3	Screen clients by risk or other health status	2.7.1	Identify client(s) in need of services	2.10.4	Track biological specimens
2.4	TELEMEDICINE	2.7.2	Schedule healthcare provider's activities		
2.4.1	Consultations between remote client and healthcare provider				
2.4.2	Remote monitoring of client health or diagnostic data by provider				
2.4.3	Transmission of medical data to healthcare provider				
2.4.4	Consultations for case management between healthcare provider(s)				

Figure 11 - Digital health intervention aimed at Healthcare providers - WHO

Taxonomy²⁴



3.0 HEALTH SYSTEM MANAGERS

3.1 HUMAN RESOURCE MANAGEMENT		3.3 PUBLIC HEALTH EVENT NOTIFICATION		3.6 EQUIPMENT AND ASSET MANAGEMENT	
3.1.1	List health workforce cadres and related identification information	3.3.1	Notification of public health events from point of diagnosis	3.6.1	Monitor status of health equipment
3.1.2	Monitor performance of healthcare provider(s)	3.4 CIVIL REGISTRATION AND VITAL STATISTIC		3.6.2	Track regulation and licensing of medical equipment
3.1.3	Manage certification/ registration of healthcare provider(s)	3.4.1	Notify birth event	3.7 FACILITY MANAGEMENT	
3.1.4	Record training credentials of healthcare provider(s)	3.4.2	Register birth event	3.7.1	List health facilities and related information
3.2 SUPPLY CHAIN MANAGEMENT		3.4.3	Certify birth event	3.7.2	Assess health facilities
3.2.1	Manage inventory and distribution of health commodities	3.4.4	Notify death event		
3.2.2	Notify stock levels of health commodities	3.4.5	Register death event		
3.2.3	Monitor cold-chain sensitive commodities	3.4.6	Certify death event		
3.2.4	Register licensed drugs and health commodities	3.5 HEALTH FINANCING			
3.2.5	Manage procurement of commodities	3.5.1	Register and verify client insurance membership		
3.2.6	Report counterfeit or substandard drugs by clients	3.5.2	Track insurance billing and claims submission		
		3.5.3	Track and manage insurance reimbursement		
		3.5.4	Transmit routine payroll payment to healthcare provider(s)		
		3.5.5	Transmit or manage incentives to healthcare provider(s)		
		3.5.6	Manage budget and expenditures		

Figure 12 - Digital health intervention aimed at Healthcare Systems Managers - WHO

Taxonomy²⁴



4.0 DATA SERVICES

4.1 DATA COLLECTION, MANAGEMENT, AND USE		4.2 DATA CODING		4.3 LOCATION MAPPING	
4.1.1	Non-routine data collection and management	4.2.1	Parse unstructured data into structured data	4.3.1	Map location of health facilities/structures
4.1.2	Data storage and aggregation	4.2.2	Merge, de-duplicate, and curate coded datasets or terminologies	4.3.2	Map location of health events
4.1.3	Data synthesis and visualization	4.2.3	Classify disease codes or cause of mortality	4.3.3	Map location of clients and households
4.1.4	Automated analysis of data to generate new information or predictions on future events			4.3.4	Map location of healthcare providers
				4.4 DATA EXCHANGE AND INTEROPERABILITY	
				4.4.1	Data exchange across systems

Figure 13 - Digital health intervention as Data Services - WHO Taxonomy²⁴

From this classification, we understand the number of angles a corporation can consider when looking at developing, licensing or acquiring solutions to digitalize either part of its production process, its marketing and information efforts towards patients and/or physicians, its clinical trial recruitment and design process and so on. On the data angle, we can also outline artificial intelligence solutions aiming at facilitating or improving part of the drug discovery process, which are not really featured in the WHO classification.

In this broad field we can also point out digital therapies, through the means of carefully designed mobile or computer-based software. These digital experiences are seeking or already having some clinical validation with regards to specific diseases.

The key for these digital interventions is to have measurable outcomes from gold standard scales, depending on the target disease, which can be assessed in a clinical trial as conventional drugs are doing now. This will lead to wider recognition both by healthcare professionals and drug regulatory agencies.

Still, not every digital therapy aiming at proving its impact on human health will be able to prove its clinical-usefulness through existing standards and regulations. This is why regulatory bodies such as the FDA are trying to work together with experts and companies in the field in order to define the best way to assess some of these new solutions.

As the number of consumer-oriented digital interventions in the form of mobile or computer apps is getting bigger and bigger, it's a strategic play to take the clinical road and position a digital intervention as a real therapy based on clinically proven and measurable patients' outcomes.

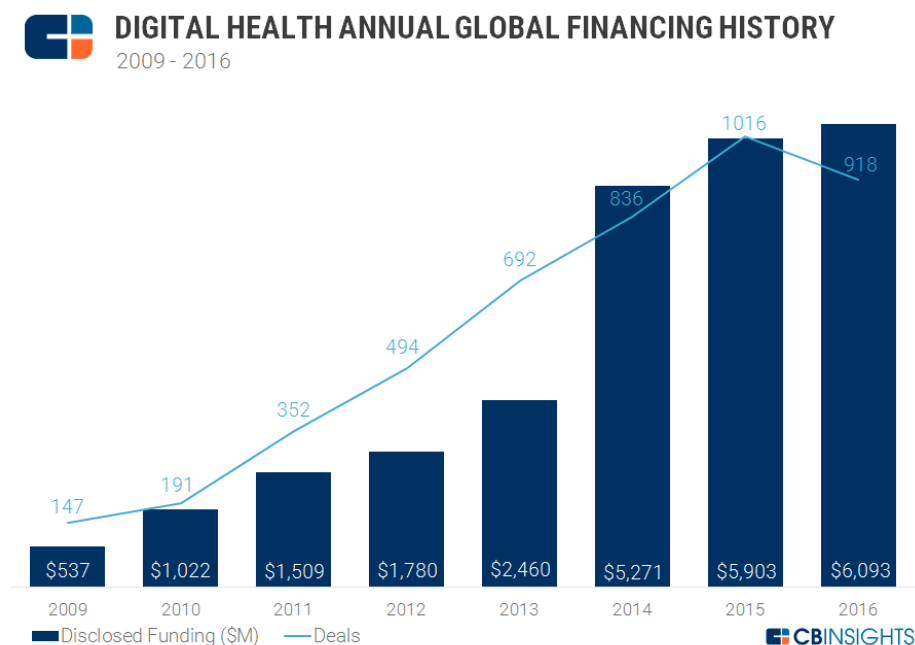


Figure 14 - Digital health annual global financing history - CB Insights⁵⁶

Overall, the digital health sector raked more than \$7bn of investments in 2017 from institutional and corporate investors in a growing financing trend progressing steadily year after year.⁵⁷

As we could have guessed from our analysis in the previous section, Merck & Co is leading the corporate venture investing table amongst pharmaceutical firms with a dedicated vehicle specifically investing in this sector. Other active corporate investors in that field include GSK with its venture arm named SR One, GE Ventures, venture arm of General Electric as well as Google Ventures, mainly centered around genetics, gene editing and health data use.

reSET

Report Your Status

Have you used today? Yes No

How strong is your craving right now?

6

What triggers are affecting this craving?

HUNGRY n/a 4

ANGRY n/a 2

LONELY n/a 3

TIRED n/a 0

SOCIAL PRESSURE n/a 3

PAIN n/a 10

OTHER n/a 6

SUBMIT

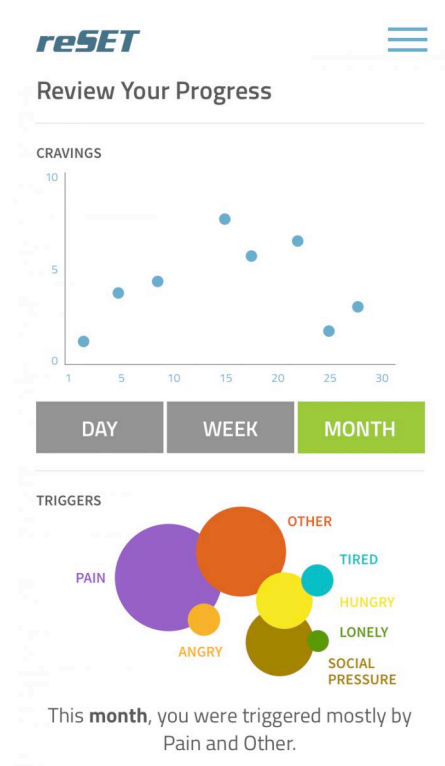


Figure 15 and 16 : Screenshots from Pear Therapeutics reSET mobile application

Pear Therapeutics became the first FDA-approved prescription digital therapeutic focused on substance use disorder in 2017. It works as a mobile-application companion and can be used based on a physician prescription.

Pear Therapeutics announced in April 2018 its collaboration with Sandoz Pharmaceuticals, a division of Novartis, to commercialize its existing digital therapies⁵⁸ for substance abuse and to develop new ones with Novartis, specifically targeting multiple sclerosis and schizophrenia.

Few months prior to this collaboration announcement, Novartis took a minor equity ownership in the \$50.000.000 Series B of Pear Therapeutics.

Tilak Healthcare is another example at the angle digital therapeutics can take in order to improve diagnosis and monitoring of specific diseases. The aim of Tilak is to develop a mobile-based videogame intended in the long run both to diagnose retinopathies and monitor eye parameters in that context. This will deliver health professionals key insights and improve treatment management for patients using the mobile app.

Another company working on a prescription-based digital therapy is Akili Interactive Labs. It is a US-based spin-off of Puretech Health and started to develop a clinically validated digital game intended to treat ADHD, a disease classically treated with drugs such as Ritalin (Methylphenidate) exhibiting a number of misuses and side effects.

The company completed a pivotal clinical trial for this indication and is working with the FDA for a clearing.

Akili Interactive Labs received interest from pharmaceutical companies and an investment from M Ventures, venture capital arm of Merck KgaA. and Amgen Ventures, venture capital arm of Amgen in a \$42m Series B.

Digital treatments might exhibit a number of advantages over the current trend observed for conventional therapies such as reduced development and production costs, which is clearly a rising issue for traditional drug and development. Digital therapeutics might as well exhibit a quicker time to market and have the potential to be safer to deliver to patients.

Those two examples also clearly highlight the convergence of technologies into the healthcare space. Akili started with the idea neuroscientists joined by game development specialists and Tilak Healthcare is led by an experienced Studio Director from Gameloft joined by a seasoned medical team in order to bring both digital therapies forward.

Looking back at the different ways for corporations to seek growth from the less to the most integrated, the digital therapeutics sector acts as a perfect showcase example with licensing happening in the case of Pear Therapeutics and minority equity ownership in the case of Akili Interactive Labs.

We see that pharmaceutical corporations are not yet developing their own digital therapies but testing the waters at small cost, isolating their exposure in case of a failure of the whole segment while benefiting from an early access in case of promising results.

If digital therapies are to be prescribed widely in the near future, they might also directly tackle the adherence monitoring issue for conventional drugs which are, as of now for digital companions, mainly relying on declarative behaviors from the patient.

Providing the patient complies to its data being monitored by its physician, healthcare professionals could easily be presented with adherence data coming straight out of the digital therapy usage.

One drawback coming from this new flow of relevant health data is that it must be presented in a way that saves time to healthcare professionals rather than adding to current workflow, which will also be a barrier for healthcare providers alike.

Looking at another barrier to adoption for those solutions, one can consider the angles being distinguishing digital therapeutics from the well-being and fitness app market. A key solution in that case would be to use on-prescription apps.

Benefiting from a huge existing market penetration of various smartphones, tablets and computers, digital therapies will definitely have to showcase efficacy on what are for them different technological vehicles to deliver their treatment.

Impact Analysis

Having reviewed at length literature regarding motives for a corporation to launch a CVC program as well as the impact of CVC involvement in a start-up compared to the impact of institutional VC on their portfolio companies, we will focus in this part on analyzing different types of outcomes in a specific timeframe and set of sub-industries.

As we also pointed out interesting findings with regards to outcomes' differences among CVC backed companies depending on the underlying motive of the CVC arm, we will try to cluster a number of healthcare-related CVC programs depending on their objectives and find any difference in terms of outcomes for portfolio companies.

As to the timeframe we will look at for the purpose of this analysis, it will be between 2009 and 2016 as it represents the fourth wave of corporate venture capital and immediately follows the global financial crisis. This timeframe will avoid taking into account this exceptional economical event as part of our overall analysis.

As to the sector we will consider when performing this analysis, we will narrow down on sub-industries considered under the Healthcare umbrella. Healthcare represents a broad industry encompassing several sub-industries of interest.

From drug development to biotechnology, medical devices or medical services, one can see a broad range of activities relying on various capabilities and input resources required to make such ventures grow.

1. Performance metrics

The first metric we will look at will be the market valuation of companies at the time of Initial Public Offerings. By looking at this metric we formulate the hypothesis that CVC backed companies experience a greater valuation when undergoing IPOs as they created more value in the years preceding the introduction on the public market.

A second metric we will use to look at differences in terms of outcomes between CVC and VC backed companies and among CVC backed companies depending on the motive of the corporate investor will be the time between the first involvement of the investor and the actual Initial Public Offering of the company. We formulate the hypothesis that CVC backed companies are likely to benefit from the expertise and resources of corporations and that this will result in a shorter time to the value inflexion point of undergoing an IPO for the investee.

2. Methods

2.1 CB Insights

A number of commercial databases have emerged in the past decade with regards to deal and companies' financials tracking and specifically focusing on the private market. It facilitated the transition from survey-based analysis to data-based analysis in venture capital and corporate venture capital research.

For this analysis we will use data coming from the commercial database CB Insights and use it as a base to pull relevant information for our study.

CB Insights' database was founded in 2008 and tracks private company financing rounds and angel investments. It counts as clients most of the world's largest financial institutions.

CB Insights relies on web data-crunching from more than 100.000 sources every day and provides access to a database organized in five different buckets under the advanced research section being "Deal Search", "Company Search", "Investor-Acquirer Search", "People Search" and "Board Search". For the purpose of our analysis, we will rely on "Deal Search", "Company Search" and "Investor-Acquirer Search" to look for relevant data.

2.2 Dataset construction

The first step was to define appropriate filters in order to build an exportable dataset with relevant information for us to analyze in the Excel 2016 software of the Microsoft Office Suite.

We considered first the Company Search and applied filter related to the industry we are considering, being "Healthcare". This industry label on CB Insights encompasses the following sub industries:

- Alternative Medicine
- Biotechnology
- Disease Diagnosis
- Drug Delivery

- Drug Development
- Drug Discovery
- Drug Manufacturing
- Elective & Aesthetic Medicine
- Healthcare Plans
- Medical Devices & Equipment
- Medical Equipment & Supplies
- Medical Facilities & Services
- Medical Information
- Medical Product Distribution
- Pharmaceutical Distribution & Wholesale
- Pharmaceuticals / Drugs

As we did not specify a specific geography, considering investments around the world, the next filter we applied was "Exit Round" being "IPO" to narrow down our search to IPOs only for this specific subset of companies. We chose the timeframe of the considered IPOs being from the 1st of January 2009 to the 31st of December 2016 under the filter "Exit date". We then chose to apply the "Backing" filter to "Only show VC-backed companies". This filter will allow us to display a blend of only VC backed companies and both VC and CVC backed companies. Using the filter "Only show non-VC backed companies" did not exhibit any IPOs involving CVCs in the last funding round without involvement of a VC. Therefore we did not consider this additional dataset as useful for our analysis.

The displayed results were refined to show in additional columns last funding investors before the IPO, the maximum valuation of the company at the time of the considered exit and the date of the exit.

We chose to display only last funding investors and not all investors as we believe, as previously outlined in literature, that the impact of an investor is significant when it is still involved being a shareholder in the company. Hence, applying this additional filter allows us to avoid considering investors who exited the company way before the time of the IPO.

As to the maximum valuation of the company, it is displayed to show the market valuation of the company at time of the IPO. As this filter does not consider other financing rounds beyond the considered IPO, we consider it to be the best way to display an exportable version of the valuation at the time of the IPO.

The dataset in its current state exhibited 342 exit rounds in companies with relevant information to use for our analysis. Exporting this dataset to Excel, we then took out irrelevant rounds not being IPOs but Mergers or Reverse Mergers. We also took out exit rounds that did not specify any market valuation, as we needed this information to perform our analysis. We eventually ended up with a dataset of 213 exits rounds with valuation at IPO ranging from 13.97m Eur. to 1.87bn Eur.

Most represented sub-industries were Biotechnology (71 IPOs), Drug Development (56 IPOs), Pharmaceuticals (30 IPOs) and Medical Device (29 IPOs).

As we needed to classify deals depending on the involvement or not of a CVC in the round, we proceeded to use the "Investor-Acquired Search" engine of CB Insights.

For this search we used "Investor Info" and selected "Corporate Venture" as "Investor Type". We then proceeded to use the Healthcare industry in company attributes and looked for portfolio exits during the same time period we previously considered for our analysis being from beginning of 2009 to end of 2016.

We obtained a list of 49 corporate venture investors which exited healthcare companies, be it through IPOs or not, during that specific time period.

Analyzing this data, we therefore decided to take out 15 investors who appeared to be misclassified as CVCs.

As a next step and using a matching formula in Excel, we spotted deals in our dataset in which those investors were involved. We took out 9 corporate investors from the list that did not appear to be involved in any of the considered IPOs. We hypothesize that those 9 investors exited companies through mergers or private acquisitions, explaining their presence in CB Insights' list.

We then ended up with a list of 25 corporate venture investors we used as a basis to differentiate between our VC-backed companies at time of IPO and CVC-backed companies at time of IPO.

As we have an interest in analyzing the impact of CVC investment motives on start-up outcomes compared both to overall CVC impact and to VC impact on those outcomes, we had to cluster the 25 CVCs.

Relying on previous literature, we defined 3 different groups being Financial CVCs, Strategic CVCs and Analytical CVCs.

We define as Financial CVCs corporate venture arms having for main purpose to generate financial returns to its mother company.

We define as Strategic CVCs corporate venture arms having for main purpose to generate strategic returns for their mother company. This strategic return as discussed in the first part of this thesis can either be knowledge acquisition from the start-up, early access to technologies, development of the investors' businesses be it by improving its sales of existing products or fueling innovation and launch of new

products. Other strategic returns are detailed extensively in literature and referenced in the first part of this thesis.

We define as Analytical CVCs, corporate venture arms having for main purpose to generate both strategic and financial returns for their parent company.

In order to assign our list of corporate venture investors to one of these 3 three groups, we performed a manual text analysis of the investors websites looking for investment thesis, investment strategies, interviews of key management people at the CVC.

We manually performed the analysis based on keywords and specific sentences stating the underlying motive for setting up the corporate venture arm.

As examples, we used as qualifiers the following sentences for each of the categories:

Strategic CVCs

"(...) we look for companies which have potential to become (...) collaboration partners in R&D through our investment activities"

"(...) invests in companies with innovative technologies, products, and therapies that have the ability to accelerate growth for the company."

" (...) primarily seeks to invest in areas of strategic interest"

Financial CVCs

"To ensure that (...) obtains a competitive return from (...) companies and financial assets in which (...) invests.

" We make investments in (...) companies aiming to create value by fostering innovation, guiding successful businesses and generating financial return (...)."

"We focus on financial returns."

Analytical CVCs

"Overall, we look for investments that can provide attractive financial returns and significant strategic value."

"(...) is focused on pursuing strategic investments that enable and accelerate (...) growth while adding value to our portfolio companies."

We further refined our analysis by having inputs from executives of two venture funds in order to confirm or invalidate some of our classification work.

In the end, we classified 10 CVCs as Analytical, 7 CVCs as Financial and 8 CVCs as Strategic.

Using a matching formula in Excel, we assigned IPOs to one or more of these groups depending on the investors involved upon the public offering of the company.

We also outlined the number of CVCs involved in the companies who went through an IPO in order to analyze the potential impact of one or more CVCs on market valuation.

We previously mentioned that we filtered only for IPO deals with CVCs/VCs involved in the last round of financing prior to the IPO to account for the impact of the investor on shaping the strategy of the company. That said, we spotted a number of

immediate investments prior to the IPO being done by corporations or institutional funds taking equity few weeks before the actual IPO, hence showing only their name in the "Last funding investors" section. As this does not represent the actual last round of financing in such a case, it would be unfair to not consider VC/CVCs involved for years and still involved upon the IPO because of this round of financing. We went manually through the different lines in the database of CB Insights and changed where needed in Excel for additional investors effectively involved in the last "real" funding round of the company.

As we wanted to look at the impact of CVC and VC involvement on the actual time needed for start-ups to develop the company until a point where they could consider doing an IPO, we had to build another dataset in order to access relevant information to perform this analysis.

Relying on the existing dataset of 213 exit rounds through IPOs, we decided to focus on the year 2015 and 2016 in order to perform a thorough manual research on each round of financing prior to the IPO for each company and the investors involved.

Using CB Insights, we accessed profile page of each company that IPOed between the 1st of January 2015 and the 31st of December 2016 and that was featured in our Excel dataset with relevant qualifying information such as an available market valuation at IPO.

From each profile page we took information regarding each Series of financing the company went through prior to the IPO and reported the information into the Excel dataset. We outlined in the dataset the exact date of the IPO, the exact date of each round of financing prior to that IPO and the first involvement of a VC or a CVC in one of those round. We consider a qualifying round of financing for our analysis a round with a date of completion and involving at least a VC or a CVC investor for the first

time in the company. We considered as qualifying round of financing a round involving equity in the company and subsequently took out the rounds not corresponding to this criterion.

We then computed the difference between the date of the IPO and each qualifying round of financing to obtain a number of days between the date of completion of a Series and the date of the IPO.

Going through each company profile page allowed us to spot mistakes in classification and edit some of our data points. We had to take out IPOs lines in our dataset that did not disclose any or only partial information with regards to previous rounds of financing.

Following this, we obtained the following number of relevant data points:

Number of days between any first round of involvement to IPO:

VC Investors: 43 data points

CVC Investors: 26 data points

Number of days between a specific round of involvement to IPO:

Series A - VC: 41 data points

Series A - CVC: 11 data points

Series B - VC: 39 data points

Series B - CVC: 10 data points

Series C - VC: 25 data points

Series C - CVC: 7 points

The number of data points for Series D and beyond was too small on the CVC side to be used in this analysis and those data points were therefore not taken into account.

As to a first description of our dataset, out of the perimeter of the parameters we are looking at further on, it's still worthwhile to outline that the vast majority of the deals we consider are based in the US. As a matter of fact, 80% of the 69 deals we consider for the time to IPO analysis are from the US, 19% in Europe and the remaining 1% in Asia.

As to the analysis on the market valuation at time of IPO, out of the 213 exit rounds considered, 79% are from North America (USA and Canada), 17% from Europe and 4% from Asia.

2.3 Statistical analysis

Regarding both our analysis of the market valuation at IPO and number of days to IPO we had to assess the distribution of our data and its normality. To do so, we used the data analysis tool of Excel and its "descriptive statistics" function.

As the values for asymmetry and kurtosis between -2 and +2 are considered acceptable in order to prove normal univariate distribution⁵⁹, we used those for our samples.

Skewness involves the symmetry of the distribution. Skewness that is normal involves a perfectly symmetric distribution. A positively skewed distribution has scores clustered to the left, with the tail extending to the right. A negatively skewed distribution has scores clustered to the right, with the tail extending to the left. Skewness is 0 in a normal distribution, so the farther away from 0, the more non-normal the distribution. In a similar way to the concept of skewness, kurtosis is a descriptor of the shape of a probability distribution.

In case of normal distribution we subsequently used parametric testing, namely the F-Test of equality of variances. It is a test for the null hypothesis that two normal

populations have same variances. Any F-test can be regarded as a comparison of two variances, but the specific case used here is that of two populations, where the test statistic used is the ratio of two sample variances in order to determine equal or unequal variances between our two unpaired populations.

Based on F-Test results we chose either between a T-test assuming equal or unequal variances for two samples.

As the T-test allows us to compare two averages and tells us, using a certain degree of confidence, if those differences are significant enough to reject the hypothesis that there is no difference between our two averages.

As for the non-normally distributed samples, we subsequently performed Mann-Whitney U test as it is a non parametric test stating a null hypothesis that it is equally likely that a randomly selected value from one sample will be less than or greater than a randomly selected value from a second sample.

We performed this test through a dedicated external macro as add-on to Excel 2011 software.

The test involves the calculation of a statistic, called U, whose distribution under the null hypothesis is known. In the case of small samples, the distribution is tabulated, but for samples' sizes above >20, approximation of normal distribution is widely used. The macro also allows taking ties into account and subsequently changes variance's formula. As some of the IPO deals and a certain number of financing rounds might be common to some of our samples' population, this tool was used.

For all the analysis we performed, we assumed an alpha = 0,05.

3. Results

3.1 Time to IPO

We first present below descriptive statistics results for each of our sample of interest in the overall analysis of difference between time to IPO from first involvement of an institutional venture fund on one hand and time to IPO from first involvement from a corporate venture fund on the other hand.

We first look at overall time to IPO from different series of financing encompassing Seed to Series E

<i>First Involvement Round</i>		<i>First Involvement Round</i>	
<i>to IPO (CVC) - Days</i>		<i>to IPO (No CVC) - Days</i>	
Mean	2260,34	Mean	2191,53
Standard Error	257,7	Standard Error	211,6
Median	2320	Median	2044
Mode	#N/A	Mode	1480
Standard		Standard	
Deviation	1314,44	Deviation	1388,07
Sample		Sample	
Variance	1727769,75	Variance	1926750,15
Kurtosis	-0,4930	Kurtosis	0,7156
Skewness	0,3833	Skewness	0,7362

Range	4771	Range	6315
Minimum	223	Minimum	143
Maximum	4994	Maximum	6458
Sum	58769	Sum	94236
Count	26	Count	43

As our samples' distributions are normal, we then ran a F-test for equality of variances with H0 our hypothesis that there is no difference between our populations' variances.

F-Test Two-Samples for equality of
Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	2191,53	2260,34
Variance	1926750,15	1727769,75
Observations	43	26
df	42	25
F	1,1151	
P(F<=f) one-tail	0,3931	
F Critical one-tail	1,8648	

As $F < F_{\text{Critical}}$ and $P(F \leq f) > 0,05$, we cannot reject H0, hence, there is no statistically significant difference between our two samples' variances.

We then performed the appropriate T-Test for unpaired samples assuming two equal variances with the H0 hypothesis that our samples averages are equal:

t-Test: Two-Sample Assuming Equal Variances

	VC	CVC
Mean	2191,53	2260,34
Variance	1926750,15	1727769,75
Observations	43	26
Pooled Variance	1852503,74	
Hypothesized Mean		
Difference	0	
df	67	
t Stat	-0,2035	
P(T<=t) one-tail	0,4196	
t Critical one-tail	1,6679	
P(T<=t) two-tail	0,8393	
t Critical two-tail	1,9960	

As $-t_{critical\ two-tail} < t\ Stat < +t_{critical\ two-tail}$ and $P(T \leq t) > 0,05$, we cannot reject the H0 hypothesis, hence there is no significant difference between our two averages in the number of days to IPO for these two samples considering VC investors on one hand and CVC investors on the other hand.

Having a chart look at the difference in the number of days to reach IPO for companies with CVC and VC involvement from a specific financing round, we see a

clear difference in favor of CVC involvement as CVC-backed companies exhibit shorter number of days on average from involvement of the corporate venture investor to IPO compared to involvement from an institutional venture investor.

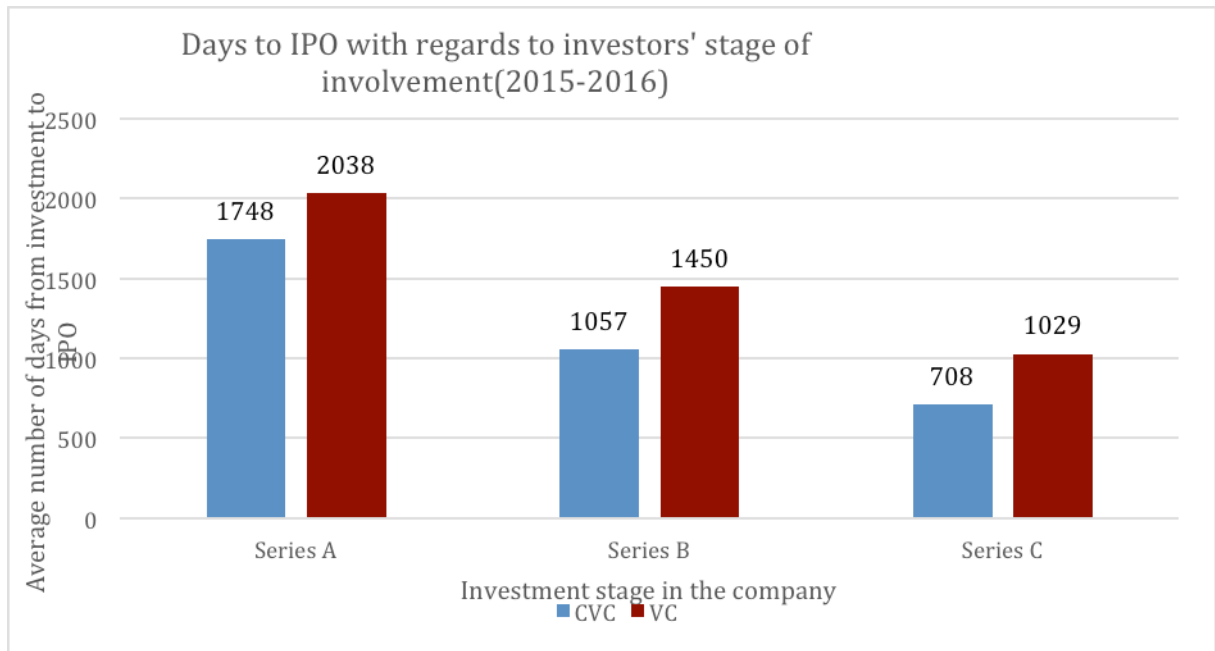


Figure 17 - Days to IPO for VC and CVC backed companies depending on financing round of the company

As this chart view does not account for statistical analysis of the real significance of those differences, we perform the same set of statistical analysis as previously on our data samples

<i>Series A - IPO (CVC)</i>		<i>Series A - IPO (VC)</i>	
Mean	1747,63	Mean	2038
Standard Error	360,14	Standard Error	180,32
Median	1891	Median	2044
Mode	#N/A	Mode	#N/A
Standard		Standard	
Deviation	1194,46	Deviation	1209,67
Sample		Sample	
Variance	1426752,25	Variance	1463310,63
Kurtosis	-0,7660	Kurtosis	-0,9129
Skewness	0,3603	Skewness	0,2137
Range	3747	Range	4710
Minimum	223	Minimum	143
Maximum	3970	Maximum	4853
Sum	19224	Sum	91710
Count	11	Count	41

<i>Series B - IPO (CVC)</i>		<i>Series B - IPO (VC)</i>	
Mean	1057,31	Mean	1450,46
Standard Error	240,40	Standard Error	214,92
Median	851,5	Median	1170
Mode	#N/A	Mode	248
Standard		Standard	
Deviation	760,2195662	Deviation	1342,177058
Sample		Sample	
Variance	577933,7889	Variance	1801439,255
Kurtosis	-1,5356	Kurtosis	3,5848
Skewness	0,4089	Skewness	1,5521
Range	2115	Range	6395
Minimum	180	Minimum	63
Maximum	2295	Maximum	6458
Sum	10573	Sum	56568
Count	10	Count	39

<i>Series C - IPO (CVC)</i>		<i>Series C - IPO (VC)</i>	
Mean	708,14	Mean	1028,6
Standard Error	231,78	Standard Error	189,12
Median	398	Median	506
Mode	#N/A	Mode	#N/A
Standard		Standard	
Deviation	613,2545498	Deviation	945,6061548
Sample		Sample	
Variance	376081,1429	Variance	894171
Kurtosis	0,5797	Kurtosis	-0,6922
Skewness	1,1103	Skewness	0,7293
Range	1719	Range	3102
Minimum	113	Minimum	27
Maximum	1832	Maximum	3129
Sum	4957	Sum	25715
Count	7	Count	25

Looking at those descriptive results we observe an overall normal distribution of our samples' data except for the Series B with VC involvement. For this specific population we have a relatively high Kurtosis. Hence, for this sample analysis together with its CVC counterpart, we will perform a Mann-Whitney U test, which is suited for non normal distributions.

We then first consider the analysis as previously done with normally distributed samples of Series A average number of days to IPO between institutional VC and CVC investors and then of Series C average number of days to IPO between institutional VC and CVC investors.

Series A Analysis:

We define H0 our hypothesis for F-Test that there is no difference between the two samples' variances.

We define H0 our hypothesis for the T-Test that there is no difference between our samples' averages number of days between the date of the Series A and the date of the IPO.

F-Test Two-Samples for equality of Variances		
	VC	CVC
Mean	2038	1747,63
Variance	1463310	1426752
Observations	45	11
df	44	10
F	1,0256	
P(F<=f) one-tail	0,521689	749
F Critical one-tail	2,650117	708

T-Test: Two-Samples Assuming Equal Variances		
	VC	CVC
Mean	2038	1747,63
Variance	1463310	1426752
Observations	45	11
Pooled Variance	1456540	
Hypothesized Mean Difference	0	
df	54	
t Stat	0,7153	
P(T<=t) one-tail	0,2388	
t Critical one-tail	1,6736	
P(T<=t) two-tail	0,4775	
t Critical two-tail	2,0048	

As we observe $F < F_{\text{Critical}}$ and $P(F \leq f) > 0,05$, we cannot reject H_0 in this test and cannot account for a significant difference between the two samples' variances.

We then perform the T-test for two unpaired samples assuming equal variances and find that $-T_{\text{Critical}} < T_{\text{Stat}} < +T_{\text{Critical}}$ with $P(T \leq) > 0,05$. Hence, we cannot reject H_0 and assume no statistically significant differences between our two samples' averages.

Series B analysis:

In order to perform manually the Mann-Whitney U Test in Excel for our two samples we first need to consider our samples' sizes. As one of our samples' sizes is >20 , we will have to approximate a normal distribution in order to run the test.

We define as our H_0 hypothesis no difference between our observations in our two populations, being number of days to IPO from Series B with VC backing and CVC backing.

	one tail	two tail
alpha	0,05	
U	172	
mean	195	
std dev	40,3112	
	-	
z-score	0,570559779	
effect r	0,08150854	
U-crit	128,1938	115,4919
p-value	0,2841	0,5682
sig	no	no

As the obtained p-value $> 0,05$ we cannot reject H_0 and there is therefore no significant difference between our two samples with regards to the number of days to IPO from Series B involvement under both a CVC or VC backing.

Series C analysis:

We define H0 our hypothesis for F-Test that there is no difference between the two samples' variances.

We define H0 our hypothesis for the T-Test that there is no difference between our samples' averages number of days between the date of the Series C and the date of the IPO.

F-Test Two-Sample for equality of
Variances

	VC	CVC
Mean	1028,6	708,14
Variance	894171	376081
Observations	25	7
df	24	6
F	2,3776	
P(F<=f) one-tail	0,1420	
F Critical one-tail	3,8415	

t-Test: Two-Samples Assuming Equal
Variances

	CVC	VC
Mean	708,14	1028,6
Variance	376081	894171
Observations	7	25
Pooled Variance	790553	
Hypothesized Mean Difference	0	
df	30	
t Stat	-0,8428	
P(T<=t) one-tail	0,2030	
t Critical one-tail	1,6973	
P(T<=t) two-tail	0,4060	
t Critical two-tail	2,0423	

As we observe $F < F_{\text{Critical}}$ and $P(F \leq f) > 0,05$, we cannot reject H_0 in this test and cannot account for a significant difference between the two samples' variances.

We then perform the T-test for two unpaired samples assuming equal variances and find that $-T_{\text{Critical}} < T_{\text{Stat}} < +T_{\text{Critical}}$ with $P(T \leq) > 0,05$. Hence, we cannot reject H_0 and assume no statistically significant differences between our two samples' averages.

3.2 Valuation at IPO analysis

A second metric we decided to look at in this analysis is the market valuation of Healthcare companies in our data set at the time of IPO.

Based on previous studies referenced in the first part of this thesis as well as analysis of key advantages from having a corporate venture investor on board we formulate the hypothesis that companies backed by corporate venture funds would experience higher valuations at IPO compared to their VC counterparts.

As a corporation can provide substantial resources and expertise, especially in an industry like Healthcare with specific inputs, processes and knowledge, we might expect this backing to translate into an increase in valuation at IPO compared to non-CVC backed companies.

We feature below descriptive statistics of each of our considered populations from Excel data analysis tool. This first step is for us to assess normality of distribution for every sample we will use.

We subsequently built sub-samples of:

- VC backed companies

- CVC backed companies
- CVC backed companies with 1 CVC involved
- CVC backed companies with 2 CVCs involved
- CVC backed companies with a Strategic CVC involved
- CVC backed companies with a Financial CVC involved
- CVC backed companies with an Analytical CVC involved

<i>CVC</i>		<i>NO CVC</i>	
Mean	311,1329	Mean	274,6145
Standard Error	37,3080	Standard Error	22,6081
Median	227,05	Median	191,455
Mode	#N/A	Mode	#N/A
Standard Deviation	300,7872	Standard Deviation	275,0404
Sample Variance	90472,9664	Sample Variance	75647,2326
Kurtosis	10,2241	Kurtosis	11,9017
Skewness	2,8582	Skewness	3,0325
Range	1777,52	Range	1856,56
Minimum	41,36	Minimum	13,97
Maximum	1818,88	Maximum	1870,53
Sum	20223,64	Sum	40642,95
Count	65	Count	148

<i>1 CVC</i>		<i>2 CVC</i>	
Mean	311,0311	Mean	332,38
Standard Error	40,1676	Standard Error	93,38480577
Median	238,53	Median	194,025
Mode	#N/A	Mode	#N/A
Standard		Standard	
Deviation	266,4421	Deviation	396,1981765
Sample		Sample	
Variance	70991,4441	Variance	156972,9951
Kurtosis	3,1017	Kurtosis	13,0614
Skewness	1,8335	Skewness	3,4501
Range	1130,11	Range	1713,88
Minimum	41,36	Minimum	105
Maximum	1171,47	Maximum	1818,88
Sum	13685,37	Sum	5982,84
Count	44	Count	18

<i>Strategic CVC</i>		<i>Analytical CVC</i>	
Mean	345,9634	Mean	273,6803
Standard Error	77,7805	Standard Error	59,9880
Median	210,015	Median	191,7
Mode	#N/A	Mode	#N/A
Standard		Standard	
Deviation	396,6046	Deviation	323,0457336
Sample		Sample	
Variance	157295,2238	Variance	104358,546
Kurtosis	7,3159	Kurtosis	19,9370
Skewness	2,5855	Skewness	4,2208
Range	1777,52	Range	1749,46
Minimum	41,36	Minimum	69,42
Maximum	1818,88	Maximum	1818,88
Sum	8995,05	Sum	7936,73
Count	26	Count	29

<i>Financial CVC</i>	
Mean	326,9972
Standard Error	47,7303
Median	284,5
Mode	#N/A
Standard	
Deviation	238,6517
Sample	
Variance	56954,6697
Kurtosis	5,6962
Skewness	2,1270
Range	1096,47
Minimum	75
Maximum	1171,47
Sum	8174,93
Count	25

Using the same standards of Kurtosis and Skewness as previously explained ranging from -2 to +2 in order to determine normal distribution of our samples, we can see that none of our samples exhibits a normal distribution.

Therefore we will pair-test each of them following a Mann-Whitney U-Test adjusting for ties and approximating normal distribution as our all our samples but one have more than 20 usable market valuations.

We formulate the hypothesis H0 for each test that there is no difference between the two considered populations in terms of market valuation at IPO with a two-tailed analysis to consider a resulting difference in both directions.

For clarity, we summarize Mann-Whitney test results in the following tables with p-values at an alpha = 0,05.

	CVC	NO CVC	1 CVC	2 CVCs	STRAT. CVC	ANALYT. CVC	FINANC. CVC
CVC	-	0,2119	0,9865	0,8313	0,6336	0,5206	0,2784
NO CVC	0,2119	-	0,2749	0,3252	0,6738	0,7230	0,0680
1 CVC	0,9865	0,2749	-	0,8595	0,6655	0,5590	0,3398
2 CVCs	0,8313	0,3252	0,8595	-	0,5923	0,4830	0,5395
STRAT. CVC	0,6336	0,6738	0,6655	0,5923	-	0,9696	0,2004
ANALYT. CVC	0,5206	0,7230	0,5590	0,4830	0,9696	-	0,1171
FINANC. CVC	0,2784	0,0680	0,3398	0,5395	0,2004	0,1171	-

From this set of tests, we can see that none of the pairs shows a significant statistical difference with all p-values > 0,05.

4. Discussion

For the time to IPO analysis, one key limitation comes from the manual processing of the data, as we needed to go through each company profile, we might have generated errors while putting data relative to each Series back into Excel.

We might also have benefited from observing a larger sample of companies as the manual process of data pulling led us to focus only on 2015 and 2016. As our observations without statistical analysis looked to be in favor of a CVC involvement, we might have benefited from using larger samples to see if this CVC effect was confirmed statistically, as this larger dataset would have allowed us to have a better representativeness. The time to IPO metric is not extensively covered in literature for CVC backed companies in order to see any effect of CVC involvement on speed of development of a start-up.

Regarding the analysis of companies' valuation at IPO, one key limitation comes from the subjective assignment of CVC investment motivations based on websites of those corporate venture arms and online interviews.

This clustering work based on stated motivations might also not always be representative of the true investment behavior of a CVC arm. Investment practices might differ from publicly stated objectives of the fund.

Another limitation when clustering CVCs as strategically, financially or analytically driven comes down to management and key people behaviors at corporate venture firms. As individuals of CVCs acting as board members of start-ups might behave slightly differently from one to the other, they might drive the investment of the corporate venture fund more strategically or financially, hence slightly changing the

investment behavior of the CVC from its original and publicly stated investment motive.

We can as well highlight that companies might decide to go for an IPO after having reached a certain development in time. In a very structured development timeline like in the Healthcare industry with clear value inflexion gates such as preclinical or human trials successes or even regulatory approval, we might hypothesize that companies, being VC or CVC backed, might seek public market financing at approximately the same development time. Hence it would make sense, as we did, to look at the difference in terms of time to reach this stage of undergoing an IPO still considering the limitations previously exposed for this study.

We can also mention as potential explanation for our results that some Venture Capitalists might benefit from existing high-quality networks to guide healthcare start-ups at their early-stage of development. It can be argued that this expertise, when a company still does not need to scale up industrially and commercially, which is often the case for healthcare companies undergoing IPOs, could be sufficient for a start-up to develop until that stage without a statistically significant difference in terms of valuation. We could hypothesize that other key corporations' advantages might kick-in and potentially add value or accelerate development of a venture later on.

As Gompers and Lerner (1998)¹¹ did in their study, we could have tracked the market share price evolution of companies being either VC or CVC backed as a way to assess impact of CVC involvement on companies' outcomes. As we wanted to focus on companies still in their early stages of development we decided to look at early metrics and not going beyond the IPO.

5. Conclusion (Anglais)

In this thesis, we first defined the key tools at hand for a corporation to sustain its growth and saw that to diversify the use of those tools is key to competitively navigate an industry. With the aim of narrowing down on corporate venture capital in the healthcare sector, we mapped out waves of corporate venture capital investing and performed a literature review aiming at pointing out different investment motives for corporate investors, mainly centered on expectations of strategic and/or financial benefits out of their portfolio companies. In this review we clearly outlined an overall positive effect of corporate venture investing on the investing corporations' innovation rates and financial performance.

Regarding investees' outcomes, we found results in literature outlining same outcomes between venture capital backed and corporate venture backed companies with regards to market valuation at the time of initial public offering for the investee. We also found studies' results pointing out valuation premiums for companies being backed by corporate venture funds compared to their venture capital backed counterparts. Investees also experience key benefits from expertise of the corporation as well as endorsement effects, which are key especially in the healthcare industry. We also outlined potential drawbacks being loss of intellectual property and delayed growth due to corporations' bureaucracy.

Specifically focusing on the investment practices of three major healthcare corporate venture arms, we outlined the diversity of their investment strategies to realize the stated goals from their mother company through a classification of their investees.

Picking a specific healthcare sub-industry, namely digital health, helped us to navigate a sector of growing interest for pharmaceutical corporations in the light of real investment examples in the past few years.

Moving to the impact analysis and focusing on the healthcare industry we found patterns showing a shorter time to IPO for corporate venture backed companies, suggesting an accelerated development effect coming from the corporate investor on board but this finding was not statistically significant. We then looked at market valuation of companies that went through an initial public offering. In that regard we both considered an intra-group view among corporate ventures arms depending on their underlying investment motives we assessed subjectively as well as an inter-group view comparing venture backed companies and their corporate venture backed counterparts. We found no statistically significant difference even after observing an interesting pattern with higher average and median valuation at IPO for corporate venture backed companies compared to non-corporate venture backed companies.

We proceeded to discuss our results focusing on explaining potential limitations of our study and proposed areas of improvement in terms of design and sizing of our samples.

6. Conclusion (Français)

THÈSE SOUTENUE PAR : Etienne DAHER

TITRE :

FINANCEMENT DES START-UPS PAR LES FONDS DE CAPITAL-INVESTISSEMENT D'ENTREPRISES EN SANTE. ANALYSE STRATEGIQUE ET ETUDE D'IMPACT SUR LA PERIODE 2009-2016

CONCLUSION :

Dans cette thèse, nous avons tout d'abord défini les outils clés dont dispose une entreprise établie, dans le domaine de la santé et au delà, afin de soutenir sa croissance et avons donc vu que la diversification était primordiale afin de rester agile dans une industrie en perpétuelle évolution.

Avec pour objectif de mieux naviguer le monde du capital-investissement d'entreprises en santé, nous avons répertorié les différentes vagues successives de sa réalisation et réalisé une revue de littérature ayant pour but de comprendre les différentes motivations que peut avoir une entreprise pour investir.

Celles-ci se sont principalement avérées centrées autour de bénéfices stratégiques et/ou financiers venant des compagnies en portefeuille pour leurs investisseurs. Au sein de cette même revue, nous avons mis en évidence un effet positif global de l'activité de capital-investissement d'entreprise sur le taux d'innovation et la performance financière de la corporation investisseuse. Concernant l'évolution des compagnies investies, nous avons trouvé dans la littérature des résultats similaires en terme de valorisation de marché au moment d'une introduction en bourse pour ce qui est des compagnies investies par des fonds de capital-risque institutionnels et des compagnies investies par des fonds de capital-investissement d'entreprise.

Nous avons toutefois aussi retrouvé des résultats dans la littérature mettant en avant un premium de valorisation qu'expérimentent les compagnies soutenues par des fonds de capital-investissement d'entreprise comparativement à celles soutenues par des fonds institutionnels de capital-risque.

Les compagnies investies expérimentent également des bénéfices clés liés à l'expertise de la corporation investisseuse ainsi qu'un "effet d'approbation" vis à vis de tierces parties. Nous avons également mis en évidence de potentiels désavantages comme la perte potentielle de propriété intellectuelle et une croissance retardée due à une bureaucratie provenant de la compagnie investisseuse.

Considérant spécifiquement les pratiques d'investissement de trois fonds majeurs de capital-investissement d'entreprises en santé, nous avons mis en évidence la diversité de leurs stratégies d'investissements, mises en œuvre afin de réaliser les objectifs fixés par la compagnie investisseuse, et ce, par le biais d'une classification des compagnies dans lesquelles ils sont investisseurs.

Choisissant la santé digitale en tant que secteur d'investissement en santé, nous avons mis en lumière les dynamiques de ce secteur vis à vis d'entreprises pharmaceutiques établies, et ce, au travers de cas réels d'investissements et partenariats par des entreprises en santé.

Concernant l'étude d'impact centrée spécifiquement sur l'industrie de la santé, nous avons trouvé des résultats mettant en avant un temps plus court jusqu'à l'introduction en bourse pour les compagnies investies par des fonds de capital-investissement d'entreprise. Cette trouvaille suggérant un temps accéléré de développement venant de l'appui de la compagnie investisseuse en santé n'a pas été confirmé statistiquement parlant.

De même, en considérant le deuxième indicateur qui est la valorisation des compagnies au moment de l'introduction en bourse, nous avons retrouvé une valorisation plus élevée en moyenne et en médiane au sein des sous groupes soutenus par des fonds de capital-investissement d'entreprises en santé vis à vis des sous groupes de compagnies soutenues par des fonds de capital-risque institutionnels. Ce résultat ne s'est pas avéré statistiquement significatif.

Nous avons ensuite procédé à la discussion de nos résultats et aux limitations de notre étude, provenant notamment du design et de la taille de nos échantillons.


VU ET PERMIS D'IMPRIMER
Grenoble, le :

LE DOYEN



Pr. Michel SÈVE

LE PRÉSIDENT DE LA THÈSE



Pr. Christophe RIBUOT

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Serment de Galien



« Je jure en présence des Maîtres de la Faculté, des Conseillers de l'Ordre des Pharmaciens et de mes condisciples :

D'honorer ceux qui m'ont instruit(e) dans les préceptes de mon art et de leur témoigner ma reconnaissance en restant fidèle à leur enseignement.

D'exercer, dans l'intérêt de la santé publique, ma profession avec conscience et de respecter non seulement la législation en vigueur, mais aussi les règles de l'honneur, de la probité et du désintéressement.

De ne jamais oublier ma responsabilité et mes devoirs envers le malade et sa dignité humaine ; en aucun cas, je ne consentirai à utiliser mes connaissances et mon état pour corrompre les mœurs et favoriser des actes criminels.

Que les hommes m'accordent leur estime si je suis fidèle à mes promesses. Que je sois couvert(e) d'opprobre et méprisé(e) de mes confrères si j'y manque ».

Etienne DAHER

FINANCEMENT DES START-UPS PAR LES FONDS DE CAPITAL-INVESTISSEMENT D'ENTREPRISES
EN SANTE. ANALYSE STRATEGIQUE ET ETUDE D'IMPACT SUR LA PERIODE 2009-2016

RÉSUMÉ :

Le financement de l'innovation en santé est notamment permis par l'activité de capital-risque d'entreprise sous la forme d'investissements réalisés par le biais de fonds créés par de nombreux laboratoires pharmaceutiques. Cette action, évoluant cycliquement à travers l'histoire selon la conjoncture économique, a pour but d'apporter un bénéfice stratégique et/ou financier à l'entreprise investisseuse tout en soutenant au mieux la croissance des start-ups investies. La littérature sur le sujet nous permet d'éclaircir les motivations principales des entreprises ayant établi de tels véhicules et de trouver un bénéfice du côté de la jeune entreprise financée, notamment du fait d'une expertise et de ressources accessibles au sein du laboratoire pharmaceutique financeur. Une étude de cas sur l'activité de trois fonds d'investissement dépendant de trois laboratoires pharmaceutiques majeurs nous permet de distinguer la variété des stratégies de prise de participations effectivement mises en œuvre par ces sociétés.

Nous réalisons par la suite une étude d'impact centrée sur deux indicateurs quantifiables qui sont le temps passé entre un tour de financement donné d'une jeune entreprise en santé et une introduction en bourse de celle-ci ainsi que la valorisation au moment de l'introduction en bourse de l'entreprise investie. Ces deux indicateurs nous aident à objectiver un potentiel effet bénéfique du capital-risqueur d'entreprise comparativement au financeur institutionnel.

MOTS CLÉS : Capital-risque d'entreprise - Financement - Innovation - Stratégie - Corporate Venture Capital - Start-up

FILIÈRE : Pharmacie industrielle