FINANCING THE NEXT GENERATIONS OF INNOVATION: NEW DIMENSIONS IN THE PRIVATE EQUITY MODEL

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Financing the Next Generations of Innovation: New Dimensions in the Private Equity Model

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ABSTRACT
It is widely acknowledged that, for firms to grow, they need to regularly introduce new generations of innovation; however, this is rarely addressed in the finance or private equity literature. If the private equity investment class is structured based on the business cycle, little is known about how it fosters firms’ capacity to regenerate. This leads to the question: How can private equity support firms’ ability to repeatedly innovate? Building on the literature in innovation management and design theory, we propose complementing private equity models with new dimensions: the design of potential future products and their expected value. This model is used to analyze in-depth a longitudinal case provided by a French investment fund. We show that it is far better suited to certain investment strategies than are classical models. Among other important implications, we suggest that private equity must

1. Acknowledgement: We thank Adam Goulston, MBA, ELS, from the Edanz Group (www.edanzediting.com/ac) for editing a draft of this manuscript.
not only provide seed, venture, or buyout capital, but also support firms’ innovation portfolio regeneration.

**KEYWORDS:** Financing Innovation, Private Equity, Innovation Management, Middle-Market Firms, Design Theories, Firm Life Cycle, Value of Firm

**JEL CODES:** G320, O32

The ability to adapt to fast-paced business change has become critical for firms’ competitiveness and growth. There are several ways through which firms can occasionally increase their performance, but none is as important over the long term as the development of an ability to sustain innovation. There have been extensive research efforts to understand the drivers behind a firm’s capacity to continuously innovate, especially in the fields of innovation management and design theories. Despite this, there remains a need for research in finance to integrate these developments, especially in clarifying the correlation between repeated innovation and private equity investment, not limited to venture capital (VC) (Bertoni, 2017).

Indeed, while the innovation management literature insists on the need for firms’ regular renewal (Jelinek et al., 1993; Le Masson et al., 2010b; O'Connor, 2008), private equity support for firms’ regeneration strategies has received scant attention. Private equity consists of equity securities of non-quoted companies with high potential over the medium-to-long term (EVCA, 2007; Invest Europe, 2018). Its support of innovation has largely been linked to start-ups, which mostly sustain a first and one-off innovation. Private equity is, however, also prominent in more mature firms, through the practice of buyout, and these firms also face the challenge of regeneration, given current challenges in innovation. Despite this, the bulk of the buyout literature focuses on the impact of leveraged buyouts on portfolio companies, or the drivers of successful investment strategies, while minimizing reliance on innovation to facilitate such strategies. Overall, apart from a few recent studies linking entrepreneurship and buyouts, there remains a lack of a conceptual framework and methods by which private equity investors can foster value creation through corporate innovation in mature firms (Mazzucato, 2013).

Private equity is a funding source that public policies have used to support economic growth and that Invest Europe now presents as a way to “build better businesses”. The recent sharp increase in the amount of capital available (McKinsey, 2018) and the difficulty of ensuring high returns from financial engineering alone has led to investors’ renewed interest in entrepreneurial growth (Torres, 2015); hence the value of clarifying the role of investors in fostering corporate innovation.
The present study therefore addresses the following research question: How can the private equity mode of investment support repeated innovation, especially in mature firms?

The design theory literature insists on the crucial role of regeneration processes, not only limited to knowledge expansion but also integrating the exploration of unknown concepts. We show that current literature on private equity practices and related models has scarcely considered this approach. We conduct an exploratory case study in partnership with a French state-owned investment fund. Specifically targeting middle-market firms, the fund has been operating since 2014 and benefits from 3 billion euros in assets under management. We single out an investment toward an innovative firm which confirms that this framework explains certain innovation-based investment practices that have not yet been modeled. We build on this empirical analysis to complement the private equity approaches by modeling another mode of investment better suited to fostering repeated innovation; we call this “regeneration capital”. This investment model has distinct characteristics in terms of target selection, valuation, and post-investment strategy, resulting in various theoretical and managerial implications.

Accordingly, the paper comprises four sections. In the first section, we analyse the relevant academic literature. The second section details the case study methodology. The third section focuses on case study description and results. Finally, the fourth and fifth sections set out a discussion, implications and limitations.

**Literature Review: Private Equity Support for Corporate Innovation**

The literature on innovation has already thoroughly investigated the conditions of a sustained regeneration process. In this section, we first present the theoretical framework of our analysis that we derive from this literature on innovation management and design theory. Then, a review of private equity literature highlights the limitations of private equity models to assist such renewal. We show that this literature does not yet fully capture the variety of interesting and innovation-based practices that actual private equity funds use in their activities.
A Framework for Clarifying the Relationship between Innovation and Private Equity Investment

Innovation has become a major issue with regard to firms’ competitiveness in the light of a more fiercely competitive environment and rapidly changing markets. Over the past few decades, management researchers have devoted a great deal of attention to differentiating various innovation dynamics, and to characterizing the organizational structures and management practices that generate them.

The main empirical evidence driving this research field is that no long-term success is built on a one-off innovation. Abundant research has stressed the need for developing a capacity to repeat innovation to create sustainable long-term value. Evolutionary theories have long emphasized the role of cumulative learning relying on the development of organizational capabilities (Nelson et al., 1982; Nelson et al., 2002). Building on Penrose’s seminal work, the resource-based view of literature also insists on the crucial ability of a firm to develop strategic resources that are able to enhance a firm’s competitive advantage (Van de Ven et al., 1999; Hamel et al., 1994; Nonaka, 2000; Penrose, 1959). Research on dynamic capabilities has emphasized the need to continually extend and renew the firm’s resource base to adapt to the changing business environment and consequently sustain a competitive advantage (Cohen et al., 1990; Teece, 2007). To some authors, the quest for sustainable growth even depends directly on firms’ ability to identify and combine the microeconomic drivers of their persistent innovation; for example by systematically coupling product and process innovation (Bianchini et al., 2018; Le Bas et al., 2014).

Given that the regular renewal and management of exploratory processes are fundamental to every firm’s long-term survival in contemporary economies (Jelinek et al., 1993; Le Masson et al., 2010b; O’Connor, 2008), design theories were developed to provide systematic approaches to organizing regeneration processes, especially in mature firms (Le Masson et al., 2018). Recent advances in design theories, and concept-knowledge (C-K) theory in particular, offer an integrated framework to explore the organizations and processes required to sustain innovation capabilities (Hatchuel et al., 2006; Le Masson et al., 2017b). Their main contribution is to highlight that any innovative design process, aimed at forcing the existence of new – hence previously unknown – objects (e.g. products, services, organizations), requires not only the creation and expansion of knowledge (learning, optimizing, absorbing external knowledge), but also the regeneration of associated “imaginaries”, or concepts; i.e. the design space in which designers work on the desirable potential properties of future new objects.
This discovery entails at least one pivotal practical consequence for organizing sustainable innovation: the requirement for a concept regeneration process not limited to the acquisition of new knowledge. It has led researchers to produce an integrative framework based on the difference between two distinct “design regimes”; one based on established design rules, wherein new products and services can be described using existing and stable performance criteria, and designed using the least new knowledge possible; and an innovative design regime, wherein the identity of products and services to be designed are greatly regenerated, thus prompting the need for radically new competencies and knowledge, and renewing the imaginaries used to represent future desirable objects.

In the first design regime, the development of new competencies and products happens gradually. New objects are part of lineages sharing common attributes and emerging from the exploration of stable knowledge bases in known directions (Hage et al., 2006). In economics, ruled-based design relies on a rationale of uncertainty reduction; for example, through the usual marketing, testing and validation tools. This development phase is mostly based on already identified knowledge and competency fields; this is why we will call the design activities in this regime “K-products” (in which K means “known”).

However, the innovation-intensive economy requires companies to adopt an innovation design regime with increasing frequency (Le Masson et al., 2010a), wherein only refining existing concepts or products is not sufficient. Companies, to substantially renew their activity, must simultaneously explore unknown paths, break away from existing design rules, define new value, expand competencies, and generate new opportunities. In practice, this development relies on firms’ exploration of the unknown properties of their future products to regenerate innovation fields and performance criteria. This phase relates to fuzzy front-end (Koen et al., 2001), ideation, creativity (Le Masson et al., 2017a; Lerch et al., 2015), regeneration of imaginaries (Agogué, 2012), and expectations (Le Masson et al., 2013). Contrary to already identified knowledge fields in the first design regime, here it generates objects (e.g. ideas, concepts, technologies) aimed at expanding the firms’ competencies, and requires a transformation into actual products and services, such as through research and development steered by innovation fields. In this stage, the concept is embodied in the promise of a product to be developed; one that has specific value for the firm and which would ultimately constitute a new head of lineage (i.e. first of a product lineage). We will call this promise an “unknown product” (U-product). Substantial financial support
can be required for areas such as prototyping or acquiring key technologies or competencies.

With this vocabulary, sustaining an ability to repeatedly innovate requires not only sustaining the launch of K-products but also regularly designing U-products and consenting to related organizational efforts and development costs. In other words, merely converting U-products into K-products cannot support repeated innovation over the long term. On the investor side, sustaining U-product generation requires, in addition to the mere provision of financial resources, new competencies in terms of identification, valuation, and support.

We explore whether the literature analyzing private equity investment practices in mature innovative firms also described similar systematic approaches.

**Limits of Current Private Equity Models for Financing Mature and Innovative Firms**

The view of innovation as a life cycle has clearly strongly influenced the organization of private equity, as its asset classes are currently structured around business cycle stages, from young and innovative firms to mature companies (Berger et al., 1998; Miller et al., 1984; Quinn et al., 1983). First, equity venture funding refers to private equity investments made for the launch (seed capital), the early development, or expansions of start-ups (EVCA, 2007). Then, buyouts, in a broad definition, encompass deals usually financed through a combination of equity and debt (Berg et al., 2005; Wright et al., 1994) aimed at supporting a firm’s growth and maturity. At the end of the cycle, a third model, turnaround capital, addresses investments in distressed firms. Buyouts and VC (including seed and later stages) have attracted most of the attention in the private equity literature (Broere, 2013; Glachant et al., 2008). Researchers have characterized these distinct practices, and their relationship to innovation, which are grounded in various theoretical models.

**Buyout Investments Do Focus on Mature Firms but Value Growth Scenarios on Known Projects**

The buyout literature suggests investors neither select innovative firms nor endeavor to enhance innovation capabilities once acting as shareholders. Unlike with venture capitalists, it is well established in academic literature that buyout investors target mature and stable companies. As clearly stated in the *Harvard Business Review*, buyout investors “don’t invest in firms known
for innovation”, but rather they “are looking for companies that are dominant in a market, aren’t risky, and have a predictable and steady stream of cash to pay back debt” (Torres, 2015). That aside, studies focusing on investors’ value creation levers have historically emphasized operational and financial engineering as efficiency mechanisms to improve financial performance (Bassoulet, 2015; Gompers et al., 2016b; Holmstrom et al., 2001). Thus, buyout transactions have conventionally been associated with cross-cutting activities, short-termism, and downsizing workforce (Harris et al., 2005; Wright et al., 2001; Wright et al., 2009). These rationalization strategies depicted in the literature, although they generate strong returns for investors, are often accused of damaging research and development (R&D) efforts and, more generally, innovation capabilities (Nadant, et al., 2011). Even though some other value creation levers, such as internationalization, digitalization, and product development (Berg et al., 2005; Bruining et al., 2002), have recently been mentioned, researchers regret the scant attention devoted to strategies that would invest in innovation and enable entrepreneurial growth (Meuleman et al., 2009; Toma et al., 2017; Wright et al., 2001). Consequently, there is a call to renew the historical strategies mostly based on optimization (Baker et al., 2012; Hersh, 2018).

Empirical literature has studied correlations between buyout investment and standard indicators for corporate innovation. Researchers have looked for evidence of the fact that leveraged buyout transactions would not systematically hinder innovation capabilities. The impact on resources allocated to R&D, through measurements of amount and efficiency, has been discussed and has had mixed results. Regarding the output of innovative activity, there would be no impact on the number, originality, and genericity2 of patents, while patent portfolios would on the whole be more focused (Amess et al., 2015; Kaplan et al., 2009; Lerner et al., 2011). Such patent portfolio management seems consistent with a focus on core competencies as depicted in the resource-based view literature. Building on path dependencies, new activities are deduced from previous ones thanks to “local” exploration spaces (O’Connor, 2018), whereas substantially renewing a firm’s activity requires the exploration of unknown paths.

Current valuation methods prove consistent with low-uncertainty buyout development strategies. Despite the key role discounted cash flow methods play in firm valuation in academic finance courses, recent research has shown that buyout investors would rather rely on a gross internal rate of return, a multiple of invested capital and, to a lesser extent, comparable

2. An original patent quotes patents from various patenting classes. A generic patent is cited by several other patents from a distinct patenting class (Lerner et al., 2011, p. 453).
approaches (Gompers et al., 2016b). Compared with the discounted cash flow method, they all set aside the complex issue of discount rate choice. However, all these valuation methods share the need to assess a firm’s current and future earnings given its existing products and an extrapolation of its future developments, thus making forecasts of future profit streams (embodied by free cash flows or EBITDA) a key variable. Due diligence processes have been formalized to estimate the probability that business plans will be accurate. In practice, these methods are known to be less reliable with regard to innovative companies that have the potential to develop yet-unknown products targeting unknown markets. The comparable approach compares the firm with others possessing the same characteristics (e.g. same sector, size, region, structure). The more innovative a firm, the harder it is to find comparable activities or transactions or to extrapolate future cash flow from past activities. To sum up, the academic literature shows that buyout investors prefer to target stable companies likely to increase their revenues through low-risk development strategies (CAIA Association, 2018; Torres, 2015). Financial valuation approaches stemming from historical corporate finance models serve such targets and strategies accordingly.

The established buyout model has therefore been encouraging and valuing low-uncertainty strategies with limited consent to invest in non-productivity-oriented development costs; thus casting doubt on buyout capital’s ability to nurture new capabilities other than upgrades. The valuation process values growth scenarios on known projects, even if they are still uncertain, such as the optimization of existing activities, operational and financial engineering, or certain types of build-up. Consequently, based on our framework, we identify that buyout capital mainly fosters K-products either by optimizing already existing ones or by providing additional production capacity.

Buyout investments, although they target mature firms, prove to be limited at supporting innovation. On the contrary, entrepreneurial equity models, such as venture or seed capital, are known to be tailored to young innovative firms. We therefore investigated the related literature to identify if entrepreneurial equity models sustain U-products, and if they could help in supporting mature firms’ renewal.

**Entrepreneurial Equity Investment Models as a Potential Resource**

In the private equity asset class, entrepreneurial equity financing is distinct when considering the topic of innovation as it targets start-ups, which are known as strong drivers of disruptive innovation in the contemporary economy (Timmons et al., 1986). An extended study of the relationship
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between sources of capital and innovation is a core issue of entrepreneurial finance literature (Cumming et al., 2017; Cumming et al., 2018). During the first development stages, firms face extreme difficulties in contracting loans because of high uncertainty related to their activities, a lack of tangible assets to be used as collateral (Williamson, 1988), and substantial information asymmetry (pecking order theory, Myers, 1984). Therefore, among private debt, trade credits, initial public offerings, crowdfunding, business angels, and private equity funds, the latter two funding tools have been recognized as vital elements for young firms’ development.

Private equity intended for young firms includes all equity financing from the firm’s birth until it has commercialized its first products, got out of the Death Valley by becoming profitable, and expanded. In practice, venture capitalists share the same investment steps as those modeled by Tyebjee and Bruno (Tyebjee et al., 1984). This broad category encompasses a range of funds, investing from early (seed) to late stages (series C/third round), and ending with growth capital. Venture capitalists’ investment practices are grounded in several theoretical models.

We deduce from the literature that the late-stage VC investor role is oriented toward one-off innovation development. Investment decision-making determinants have been discussed extensively, which has led to the identification of two key variables: business characteristics (investors seek proof of technological maturity and market reality (Bhidé, 2008; Eckhardt et al., 2006)) and management teams; the latter being the most important for selection and ultimate success (Gompers et al., 2016a; Gompers et al., 2016b; Khanin et al., 2008; Knockaert et al., 2010). More precisely, it appears that VC mainly provides funding to complete development and accelerate the commercialization of creative concepts (Hellmann, et al., 2000). Several studies show that venture capitalists select innovative companies with the objective of helping them in the commercialization process, rather than to generate further innovations (Rin et al., 2013; Rin et al., 2017). As mentioned in (Rin et al., 2007): “Venture capital would therefore finance companies whose innovation strategies are already well developed, with the perspective of turning them soon into ‘cows’”.

Venture capitalists not only assume a role of scouting, selecting, and funding promising start-ups, they also provide coaching. Although some business angels are not actively involved in the invested firm, most consider their post-investment contribution to be critical (Landström et al., 2016) and provide strategic input, such as by taking positions on the venture board or by becoming consultants (Cumming et al., 2018). First, for all VC stages, researchers cite investors’ networks and brokering capabilities as assets for
start-up success, but often without linking this precisely to innovation strategy. Venture capitalists also share a model of innovation acceleration, known as the Lean Startup model (Ries, 2011), which has recently attracted a great deal of attention from researchers and practitioners (Engel, 2011). This business development methodology aims to find an appropriate market for an existing product to reach initial success by trial and error, adjustment, and development techniques. When facing a dead-end, start-ups have no other choice than to pivot. The existing research on pivoting is limited and some examples suggest a type of pivot involves altering the product—a market fit without launching a new U-product, which would also cause significantly stronger organizational issues for a mature firm.

Regarding valuation rationale, one challenge lies in the underlying pricing calculation method. At later stages, when funding marketing, product improvement, or major expansion, venture capitalists use earning or market value approaches (Gompers et al., 2016a) because an asset-based approach does not account for a firm’s future growth. However, market value approaches (comparable transaction methods) are difficult to apply, as finding comparable firms for highly innovative activities can be challenging. Theoretical finance models based on cost and revenue forecast results (the earning value approach) also lack accuracy for start-ups because of remaining uncertainties regarding future growth. Investors usually focus on estimating future revenues while paying less attention, or having difficulty assessing, the required reinvestment and operating expenses (Damodaran, 2009). Practitioners have tailored further methods, among which are convention-based (Damodaran, 2009; Meunier, 2017) or real option frameworks. The convention-based approach aims to estimate remaining development costs until the firm reaches a break-even point. It therefore circumvents the issue of precisely forecasting future revenues related to yet-unknown activities and hypothesizes that they will have adequate significance to ensure a return on investment. This strategy mostly relies on the incubation of existing projects, with the hope that they include “golden nuggets”, i.e. a portfolio strategy wherein the small percentage of successful invested-in firms should compensate for the failure of all the others and ensure the investor a financial return. These targets are expected to achieve extremely high profits; for mature firms, this would question the value of sustaining historical activities. The real option framework has then been designed as a multi-staged financing tool to aid decision-making under uncertainty. It allows the creation of an option for unblocking

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3. For example: discounted cash flow (DCF), internal rate of return, net present value, and the top-down approach (which is derived from DCF), Damodaran, A. (2009), Valuing Young, Start-Up and Growth Companies: Estimation Issues and Valuation Challenges, New York University, ibid.
financing that depends on future learning and is based on a defined decision space. In practice, few venture capitalists use real options, perhaps because of this inconsistency between the radical uncertainty faced by start-ups – even more at the early stage when dealing with U-products – and the requirement of a pre-designed decision space (Dubocage, 2006).

At the earliest stages after the ideation phase, when funding the first proof of concept, investors face both an unknown technology and an unknown market (Huang et al., 2015). Departing from frameworks on decision under uncertainty, seed investing would refer to frameworks on decision under the unknown. This could explain why a “gut feeling” is often used to describe business angels’ investment decisions (Gompers et al., 2016a). Indeed, although research on business angels identifies characteristics of the entrepreneur as key determinants for target selection, decision-making criteria remain a topic of ongoing research (Drover et al., 2017). On the whole, business angels use fewer formal contracts, control, and due diligence processes. They prefer to rely on expertise-based intuitive evaluation that has been demonstrated to lead to the selection of more successful investments (Huang et al., 2015). An empirical study focusing on business angels’ post-investment practices concludes that predictive strategies through business plans or market analysis are proven to be less efficient than non-predictive control strategies (Wiltbank et al., 2006) attained through “a means focus, affordable loss investing, pre-committed partners, and leveraging surprise” (Wiltbank et al., 2009). If start-ups obtaining seed capital work on refining their U-product, it seems investors lack a systematic approach to select and support them. Business angels usually make smaller stakes at the earliest stage of a firm’s development and expect most of their decision to be complete losses.

Finally, abundant literature has analyzed VC investment’s impact on backed start-ups’ innovation output, in a search for ex-post correlation or causality. For example, a stronger propensity to patent was found in VC-backed companies in the United States (Kortum et al., 2000), but the same did not hold true in the European context (Freeman et al., 2007). In another direction, the numbers of new products and instances of VC funding have been shown to be correlated (Peneder, 2010). Very few studies have analyzed how investors influence start-up innovation strategy by making use of advances in innovation management to characterize this.

Based on this literature review, we conclude that the dominant models of private equity investment described in the literature (seed, late-stage VC, and buyout) do not address the need to support innovative firms’ regular regeneration. The design theory framework sheds new light on the relationship between the various private equity asset classes and corporate innovation.
Buyout capital mainly fosters the launch of K-products because of optimization strategy or increased production capacities. Entrepreneurial equity is described as addressing U-product development in two different ways: seed capital sustains U-product maturation, that is, the promise of refinement, while late-stage VC supports its conversion into a K-product that generates actual turnover. The rise of development strategies such as spinoff, incubators, or corporate venture could be an attempt to adapt entrepreneurial investment strategies for mature firms. Based on a decoupling of firms’ historical and innovative activities, this suggests investors lack models to organize and value internal self-sustaining renewal.

Overall, we conclude from the literature that no existing private equity asset class would support the repeated generation of new waves of U-products. Figure 1 summarizes the main practices and models of private equity investment and their impact on corporate innovation.

**Figure 1 – Relationship between innovation regimes and investment practices of private equity investments, extracted from the academic literature**

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<tr>
<th>Seed capital</th>
<th>Late-stage venture capital</th>
<th>Buyout</th>
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<tr>
<td><strong>ENTREPRENEURIAL INNOVATION</strong></td>
<td><strong>CONCEPT DEVELOPMENT</strong></td>
<td><strong>OPTIMIZATION</strong></td>
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<td>INFORMAL AND NON-PREDICTIVE APPROACHES</td>
<td>DECISION UNDER UNCERTAINTY</td>
<td>FORMAL VALUATION METHODS</td>
</tr>
<tr>
<td>Target selection</td>
<td>Selection and scouting: young firms with high growth potential with an already defined creative concept and strong management team (Echcharch, Shane et al. 2006)</td>
<td>Stable and mature firms with growth potential (Torres 2015)</td>
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A few studies contribute to characterizing other ways for private equity to invest in innovation. Yet buyout impact as an entrepreneurship stimulator is a buyout category that has attracted scant attention (Bertoni, 2017). Some less-common avenues of research have found evidence that buyout-backed firms can promote entrepreneurial investment opportunity (Amess et al., 2016), but only if this is through management buyout (i.e. if the main investor is the management team already in place) (Bruining et al., 2013). For example, one study emphasizes new conditions of an investor mindset for a buyout operation to foster corporate innovation, owing either to incremental changes or renewal (Wright et al., 2001). Instead of controlling managers as in the traditional agency theories perspective, this entrepreneurial approach focuses on promoting innovative ones. Another study showed how a private equity investor may actively contribute to providing new organizational capabilities in the specific context of an already entrepreneurial family firm in need of structuring its governance (Di Toma et al., 2017). That work, however, presented a restrictive hypothesis: the presence of managers with an entrepreneurial mindset. At any rate, empowering managers still does not give investors clues on how to identify them and specifically impact innovation strategy when entrepreneurial managers are not already part of the firm. On the VC side, a recent original study (Rin et al., 2017) pointed out that investors urge firms to strengthen their absorptive capacity, thus their innovation strategy (Cohen et al., 1990), by favoring “make and buy” R&D. However, these isolated studies demonstrate the continued lack of a conceptual model building on original investment practices that help to support repeated innovation by addressing the selection, valuation, allocation of invested funds, and support of the firm after the investment. Overall, a research gap remains on the relationship between modes of investment and corporate innovation dynamics enabling mature firms’ renewal. Thus, in the present article, in line with the previous contributions on the relationship between investment and the firm’s innovation dynamics, we address the following research question: How can the private equity mode of investment foster the development of a firm’s capability to repeat and sustain innovation?

We assumed that some investors have developed such original investment practices. Therefore, we identified a potential candidate and conducted an exploratory case study based on a panel of its investment deals. The paper builds on one of its investment decisions which is especially illustrative. In the next section, we present the related research design.
Research Design

This research was carried out thanks to collaboration with the French state-owned investment bank that includes several private equity activities targeting mostly French start-ups, small- to medium-sized enterprises (SMEs), and middle-market companies. VC investments and mid- and large-cap teams report to distinct directors and these teams do not exchange methodology or views on any deal. As of early 2018, the investment bank had around 30 billion euros under management, with part of that already invested directly in 700 firms and indirectly in 300 private equity funds. The French public sector was responsible for 9% of private equity money raised by French funds during the first semester of 2018 (France Invest, 2018). Even if state-owned, the investment bank doctrine states that it should “behave like a prudent investor operating under market conditions to serve public interest”. To do so, all deals occur in partnership with at least one co-investor (e.g. another private equity firm, family, industrial group, or individual entrepreneur).

We chose to focus on investments in middle-market firms. The interest of private equity investors in this quite new firm category has drastically increased in recent years, creating a new asset class focused on mid-cap investments. In 2012, the investment bank created the first French fund specifically targeting middle-market firms, with 3 billion euros in assets under management. Despite the growing weight of mid-cap investments in financial markets, an investigation into related investment rationales has been overlooked. Middle-market firms are defined as being positioned between SMEs and large ventures. There is no international standard, but main definitions set limits for annual turnover and the number of employees. For example, in France, this encompasses companies with an annual turnover below 1.5 billion euros and with 250-5000 employees. These account for a significant share of job and value creation, which is why they are known as pillars of the economy in countries such as Germany (Mittelstand), the United States, and France. Middle-market firms face the challenge of continually renewing their activities through repeated innovation to sustain their competitive advantage. They combine high-uncertainty activities related to their entrepreneurial mindset (Grandclaude et al., 2014) while benefiting from a financial track record that provides a stronger ability to predict future revenues. Therefore, investigating current private equity investment rationales in European middle-market firms, which are at the crossroads of buyout and VC, should reveal other models and enrich both literatures in buyout and VC.

To deal with middle-market companies’ specific needs and issues, the French government in 2008 created a new statistical category for them and
for identified actors, including the French state-owned investment bank, to act as investors able to fully support the companies’ innovation capabilities.

**Data Collection**

We selected and analyzed a group of deals among those of the French investment bank’s multi-sector funds specializing in mid-cap investments. These funds have invested in more than 50 firms since early 2009, soon after French legislation acknowledged middle-market firms as a distinct firm category. The sampling process was designed to provide firms with contrasting types to emphasize surprises and to single out significant parameters. We faced one main constraint due to the phases of re-negotiation that can arise during the investment cycle (related, for example, to exit or reinvestment). By that time, both firms and investors are reluctant to disclose information.

This study presents one significant investment case that gathers two main characteristics. First, among the group of selected deals, it is one upon which we could assemble a full dataset despite confidentiality constraints which often restrict data collection. Then it is the most striking case regarding the difference between investor reasoning and the theoretical investment model (Siggelkow, 2007).

We followed the research setting of an exploratory case study. The theoretical framework extracted from design theories enables us to highlight new elements of investment rationales observed in the investment case that have not yet been traced in the academic literature.

One interesting characteristic with regard to our research question is that the firm we studied faced two private equity transactions, each of which had no impact on the capital structure. Each time, this only consisted of transfers of stock ownership. Consequently, the firm did not benefit from additional financial resources that could have been used to finance innovative activities.

The partnership gave us the opportunity to investigate investment strategies, owing to access to a yet-unexplored pool of data. We had unique access to contrasted data both from the investor side (interviews, due diligence, follow-up documents), and the firm side (interviews with the founder, management teams, research teams, and partners). Investors in charge of the deal have aided our understanding of the investment rationale. Meanwhile, direct access to middle-market firms has enabled better analysis of the innovation

4. Please refer to the annex for additional methodology insights.
strategies. We also triangulated these data with press articles and open-access patent databases.

**Data Analysis**

The case study focuses on an industrial company established in the 1990s which we have decided to rename NRJ. At the time of the last private equity deal, in 2015, as with 61% of middle-market companies, NRJ was employing between 250 and 999 employees (only 12% have more than 1000 employees, Bpifrance, 2015). The generated annual revenue amounted to a few hundred million euros.

The data analysis consisted first in re-enacting NRJ history through three foci: the firm’s competitive landscape, design activity, and capital structure evolution. Then we characterized the rationales of the various investors involved.

We used a specific approach regarding the analysis of NRJ design activity. Since its creation, NRJ has been well known as an innovative firm because of its ability to repeatedly design new products and processes. In the case study, the specific firm policy of systematic patenting was found to play a key role in tracking regeneration strategies. We found that 13 patent applications have been filed since its creation; on the firm’s direction and by searching in the Espacenet online patent-search platform. Patents include technical specifications, some functional requirements, use cases, as well as performance criteria of new products. An analysis of NRJ patents through the lens of the design theory framework enabled us to draw a patent family tree differentiating U-products from K-products.

The following section presents the case study. It first describes a standard reading of the case which fails to fully explain the French state-owned investment decision. Thus, we make use of the framework extracted from design theories to propose a more accurate interpretation.

**Case Description and Findings**

The empirical analysis starts with a standard reading of the firm’s ownership structure history and the issue arising because of the exit of private equity shareholders. At this stage, confronted with the current framework extracted from private equity literature, and competing funds’ offers, the investment of our French partner fund (PEFinnov) appears to have been over-invested. We then depict the firm’s historical innovation and growth dynamics, owing to
the framework extracted from the innovation management literature that unveils the distinct reasoning on U-products. This reveals the key role of the firm’s regeneration capability and enables understanding and characterization of PEFinnov’s original investment approach.

**Standard Reading of the Case: A Valuation of Existing Products and the Risks of Declining Revenues**

NRJ, established in the 1990s, manufactures and sells the core component of an energy production device. NRJ’s first product resulted from a newly patented technology that gave the firm a sustainable competitive edge. Building on this first one-off innovation, intensive R&D activity generated a range of product families and improved the manufacturing process. This resulted in a steady revenue increase followed by an exponential increase in the mid-2000s, when new products were launched at the same time as the company underwent geographical market expansion.

Around 2010, one of the two founders sold their shares to a private equity fund (hereinafter PEF0), which became the majority shareholder, thus substantially changing the historical shareholder distribution. After the average holding time of a private equity fund, 5 years, PEF0 wished to exit. Among other private equity funds, the French one with which we collaborated considered the deal.

From 2015, a decrease in unit margins was forecast, owing to the products’ obsolescence and competition. Indeed, multiple technologies coexisted on the market, the NRJ’s technology being more efficient but without an irrevocable differentiator. Besides, NRJ technology addressed a narrow pool of international clients, some of whom could choose to insource. Nevertheless, volume sales were foreseen as increasing thanks to a growing underlying market, while CAPEX was anticipated to remain stable. Therefore, free cash flows were forecast to only slowly increase during the next holding period. This analysis is consistent with the literature on innovation management: absent any regeneration strategy on the offer of products and services of the company, “K-strategies” are at risk of becoming obsolete in a rapidly changing environment. This raised the question of how the company should be valued at that time (Figure 2).

Our interviews with the company’s CEO, as well as press articles published at the time, show that, given this limited valuation potential over the following 5-year period, several private equity funds offered to purchase NRJ with the strategy of relocating production lines in lower-cost countries, and optimizing production costs. Again, consistent with the buyout model, this
strategy focuses on rationalizing existing projects with stable knowledge and is not conducive to a repeated innovation strategy.

Following a strategic exchange with NRJ’s CEO, PEFinnov agreed to purchase the company for the same price as the other funds were proposing but refused the relocation strategy and preserved the historical amount of R&D expenses and capital expenditures. Using the traditional valuation method, based on the extrapolation of previous cash flows, it appears that PEFinnov would therefore have over-invested to purchase NRJ. However, this French private equity fund is legally bound to do its utmost to ensure the best return on investment. The findings reveal that it valued something else.

**Ex-Post Analysis of the Firm’s Design History**

By the time the NRJ founder wished to exit, NRJ was already a mature firm. Working on the innovative concept of an “instant product line” (U-product), major improvements in the manufacturing process duration had been made; decreasing it from more than one hour to just a few minutes. Since then, NRJ has mainly focused on product innovation. Managers have reported that each new product had systematically been protected by a patent application, which makes patent analysis an effective tracking tool for product innovation in this specific empirical case.

In-depth analysis of NRJ patents showed that NRJ’s historical ability to continually renew its value proposition and formulate original concepts directly manifested itself in new patents, and then generated a head of lineage finally completed by related lineage extensions (K-products). The first historical product was optimized in terms of energy efficiency and improved compactness (i.e. volume and weight). NRJ also generated two new U-products (modular and easy-to-plug-in products), from which emerged two lineages.
that provided steady returns. Apart from the above, in 2010 other products based on new technologies NRJ recently patented were about to be launched. These were mature enough to enable, with low uncertainty, the quantification of remaining investments needed to finish their development, as well as related future income. This analysis of the period before PEF₀’s investment demonstrates that NRJ already had some capabilities for developing innovative design strategies.

At the beginning of the holding period, PEF₀ did launch the new products. Although capital expenditure and R&D expenses remained stable, they were allocated to capacity and productivity improvement programs. Indeed, additional production lines were built, factories were extended, and some processes improved, while no additional patents or products emerged during the entire PEF₀ holding period (K-product optimization strategies). Free cash flow increased particularly because of an underlying booming market upon which the firm was well positioned, owing to environmental regulations favoring in-house technology.

Figure 3, based on a detailed patent analysis, shows the various design spaces that have been generated over time, and the related patents and products. Each dot represents the filing of a new patent. This clearly shows that while NRJ was prolific in terms of new concepts, new products, and related patents up until 2010, it stopped when PEF₀ invested. Furthermore, the average innovation cycle duration previously observed was short enough to track certain evidence, if present, of activity renewal during the PEF₀ holding period.

Another Valuation Approach Including Promises and Continued Reinvestment in Their Renewals

On the one hand, analysis of NRJ’s design history demonstrates that PEF₀ took advantage of revenues extracted from products launched at the time of their arrival and invested to boost production capacity but that it did not pay attention to U-products’ renewal and potential. Indeed, none were launched during the holding period. Moreover, in 2015, a written report resulting from the strategic and financial audit it ordered stated that no external growth or product development were considered for valuation assessment. In line with the buyout investment model depicted in academic literature, the deal attracted attention from various private equity funds that set a price with plans to relocate NRJs activities abroad to ensure a return on investment.

On the other hand, PEFinnov, while contractually mandated to return the same benefit as the others, invested at the exact same price, but declined...
relocation strategies. In other words, this strategy is inconsistent with the buy-out optimization model depicted in the academic literature, which corroborates that the usual mode of investment and related valuation approaches are sometimes incomplete. Further analysis of PEFinnov’s pre-investment documents and post-investment strategy highlights three new findings.

First, PEFinnov detected high-potential U-products unseen by other investors. NRJ’s history showed its ability to design innovative products before the PEF₀ investment period, which notably gave birth to various patents and several successive lineages of products, although none were developed after 2010. An internal document edited specifically by PEFinnov mentions two new products under development as potential future business development streams.

Second, its post-investment strategy not only consisted of supporting K-product generation by rationalizing investments and costs on existing projects. During its holding period, it invested in R&D and capital expenditures resulting in U-product renewal. This point is crucial, as it highlights that the potential use of invested funds can differ from the buyout model.

Third, this strategy requires valuing U-products’ potential and maturation. Traditional valuation calculation cannot account for the strategy followed in the regeneration model. Indeed, the buyout model values an extrapolation of existing projects in addition to increased cost efficiency linked to the relocation strategy. To be competitive the regeneration model assumes another

Figure 3 – Patent analysis: new lineages generated and main products launched by NRJ from its creation until PEF₀ exited
type of added value. Data accumulated since 2015 show that two new patents were registered and one product was launched, prompting the hypothesis of a new lineage based on a new cycle of U-products. If this was the case, the valuation calculation for the regeneration model must include valuation of these new products. Therefore, this valuation would have been split into two parts: a usual extrapolation of revenues owing to existing products, and a premium resulting from exploration of the unknown, which the fund financed and supported. Figure 4 shows in green an example of the expected cash-flow returns following an optimization strategy and in blue the expectation of a strategy based on higher R&D and capital expenditures, with later earnings owing to new products and services.

Discussion

The Need to Account for the Renewal of Mature Companies in Finance

On the one hand, as described in the literature review and observed in the case study, standard private equity models for mature firms build on a firm’s past activity extension. Investors prefer to target stable firms and to implement optimization strategies or finance low-uncertainty projects such as additional production lines. Accordingly, valuation is based on financial forecasts extrapolated from past activities.
On the other hand, the earlier stage investment models (e.g. early stage venture capital, business angels) sustain innovative product maturation or promise regeneration but lack a description of systematic approaches.

While U-product renewal is acknowledged as a key driver of a firm’s long-term growth, none of the standard investment models account for its structured support in mature firms. The empirical case confirms the existence of some original investment practices not reflected in current tools (e.g. due diligence frameworks and valuation processes) and which do value innovation beyond traditional finance models. We contribute to supplementing the existing private equity models with an additional dimension: regeneration.

**A Theoretical Model of the “Regeneration Model”**

We aim at characterizing an investment model dedicated to mature firms and tailored to support their renewal.

To sustain a firm’s renewal, design theories show that a concept regeneration process is required. Accordingly, they provide a vocabulary to differentiate promises of products to be developed resulting from this concept regeneration process (“U-products”), from already existing activities (“K-products”). We aim to integrate these promises that have specific value for the firm in the investment model. We propose a model that considers both forecasts extrapolated from past activity and premiums related to innovative design activities.

In addition to standard extrapolation methods, a quantifiable premium ($\Pi$) can be generated owing to the ability to identify, value, and support still partially unknown concepts (U-products) and related development costs. Building on the discounted cash flow valuation or comparable methods, valuation could be mathematically expressed in valuation calculation by:

$$Valuation_{(DCF)} = \sum_{t=1}^{N} \frac{FCF_{(existing \_ products)}}{(1 + WACC)^t} + \frac{VT}{(1 + WACC)^N} + \Pi - debt$$

or

$$Valuation_{(Comparable)} = M * EBITDA_{(existing \_ products)} + \Pi - debt$$

where $\Pi$ represents the additional value owing to U-products beyond the traditional valuation methods found in existing literature. The value $\Pi$ embodies the targeted value resulting from design activities to be deployed and which cannot be reached by uncertainty reduction.
The empirical analysis shows the challenge of identifying the yet-unknown products. For example, in the case study, the specific firm policy of systematic patenting has played a key role in tracking regeneration strategies; however, patents are not always available, and they can have various relations with innovation (Laperche, 2004). While renewing innovation indicators remains an ongoing research topic (Kerr et al., 2015), evidence of innovative design efforts can already be found in individual cases by tracking patents and acquired licenses, prototypes, or the topics of external collaborations (e.g. institutional cooperation programs, inter-firm partnerships, crowdsourcing).

**Regeneration Capital: Implications for Corporate Innovation**

Integrating recent advances in innovation management and design theories with literature on private equity, we suggest variables for private equity models that better account for investors’ roles in firms’ regeneration processes. Following the three key steps – target selection, strategy, and valuation – depicted in the literature, such an investment mode would have the following characteristics and stakes, summarized in Figure 5 alongside the traditional investment models.

**Target Selection: Not Only Creative Concepts or Predictable Growth, but also Innovation Capabilities**

The regeneration capital model emphasizes U-products’ key role. Scouting and selection processes need to be updated accordingly. The literature review shows that most current due diligence processes of mature firms do not include identification of U-products or firms’ capabilities to develop and renew them.

Beyond identifying existing U-products, investors should also detect firms’ organizational capabilities to sustain development and renewal. The innovation management literature suggests various approaches that help in this regard. Notably, an organizational function called the “innovation function” has been proposed (Börjesson et al., 2014; O’Connor, 2008). This incorporates two main functions: managing an innovation portfolio and setting the firm’s capability to systematically innovate. Some specific types of external partnerships can also be tracked (Cabanès, 2017; Le Masson et al., 2010a).

In addition to reflecting regeneration capabilities, good indicators must deal with time constraints and restricted access to data, which investors often face during due diligence processes. One avenue for further research relates to how this model can also help interpret corporate VC, wherein financiers may have greater ability to identify U-products.
Valuation: Not Gut Feeling or Extrapolation of Past Performance, but Rather Concept Valuation

Investors need valuation approaches that will not only be based on pure extrapolation of past performance to avoid speculation. On the contrary, they must consider the future value and remaining design efforts linked to products still under development, as well as new U-product generation potential. These aspects are reflected in the premium valuation approach.

First, the premium incorporates two distinct scenarios regarding identified U-products. While a concept cannot be monetized per se, if there is sufficient maturity to generate a new head of lineage during the holding period, the related premium results from a quite-standard calculation. It supposes an evaluation of the turnover forecast with new products, but also of the spending that is necessary to develop from a partially unknown concept to a known lineage (e.g. salaries, cost of goods, costs of partnerships, CAPEX due to POC or pilots…). The issue then remains of how to value refinement of unknown concepts and related design efforts that would not result in the launch of a K-product during the holding period.

Then, investors who focus only on the expected value of U-products and neglect proper assessment and investment in related development costs are at risk of generating valuation bubbles by overestimating firm valuation and offering a higher price than with buyout or regeneration models. This raises the issue of expectation management (Le Masson et al., 2013) and the risk of creating valuation bubbles by over-evaluating attractive promises. Venture capitalists already face such risks when counting on rising returns while incorrectly assessing or insufficiently supporting remaining design efforts. Refining the regeneration capital valuation model thus also addresses some of venture capitalists’ concerns.

Finally, in real options, investors pay more in exchange for a right to postpone their decision based on learning accumulated in the meantime. Here, the premium embodies another role: it reflects what the investor is ready to pay to actively organize the regeneration process.

Strategy: Not Acceleration or Optimization, but Rather Concept Regeneration

Design-oriented investors not only provide additional financial resources to the invested-in firm, they also support its design strategy through both the generation of valuable new U-products and their development.

Investors need to develop post-investment strategies to support these U-products with two key variables: their involvement in the firm’s strategic orientation and the interaction between activities related to U-products and
historical ones. Regarding involvement in strategic orientation, some investors remain passive while others, as shareholders, actively back management. The latter are involved in the firm’s governance and support U-products by guiding strategic discussions on non-monetary dimensions of post-investment strategies (e.g. networks to develop, research paths to explore). Investors each have their own resources to contribute to the remaining design effort, and related premium value differs from one co-designer investor to another. Regarding interactions between different types of activities, as mentioned in the literature review, the few studies on buyouts that do not focus on rationalization strategies depict a model of an entrepreneurship stimulator (Wright, et al., 2001), (Bruining et al., 2013), in which investors free up management to concentrate on innovation (Berg et al., 2005). This is in line with the customary practice of operating a separate business plan and creating an innovation playground to isolate entrepreneurial activities, such as through labs or spinoffs. However, innovation management literature highlights the key role of interface mechanisms between major innovation management systems and the mainstream organization (e.g. interactions, knowledge reuse, networks) (O’Connor, 2008). Research on ambidexterity has also discussed balance, insulation, and interaction among exploration and exploitation activities, resulting either in incremental innovation or a more substantial renewal (Lenfle, 2008; March, 1991).

Another buyout strategy is increasingly used by practitioners: the buy-and-build, or build-up, strategy. This post-investment strategy consists of acquiring and combining several firms through additional buyout allowing for synergies to lead to value creation. Depending on the existence and nature of synergies, it can either enable U-product or K-product renewal.

**Further Theoretical and Managerial Implications**

The regeneration capital model discusses private equity segmentation according to a firm’s life-cycle stages. A firm’s life-cycle framework differentiates firms based on their age and size, ranging from newly created start-ups to aging big companies. This historical model tends to restrict the regeneration process to new firms and to hide the need for continuous innovation. Yet, over the long term, rationalization strategies usually implemented on mature firms through successive buyout investment cycles risk irreversibly damaging invested-in firms’ innovation capabilities, as product obsolescence and external competition ultimately erode firms’ financial performance and valuation. The regeneration capital model leads to another firm classification according to a firm’s needs in terms of entrepreneurial activities. Besides, this approach offers a new way of
structuring private equity. Instead of focusing on a firm’s life-cycle stage (creation, development, handover, decline), it highlights investors' strategy and competences related to U-product or K-product support.

The key focus on U-products in the regeneration capital model suggests paying close attention to their identification from a managerial point of view. This would benefit from explicit concept formulation on
the management side while, on the investors side, it requires an extension of tracking abilities and structuring of proper methods.

Additionally, the framework contributes to the study of private equity risks with regard to speculation and bubbles. It highlights the intrinsic risk of under- or over-valuing promises related to the next generation of innovations, which remain difficult to identify and characterize.

**Conclusion**

This research contributes to the VC and buyout literature that investigates the impact of private equity investment on firms’ innovation capabilities. Building on recent advances in design theories, it complements private equity models with new dimensions; namely, the design of future potential products and their expected value. By proposing an original investment model that meets firms’ need for support for repeated innovation, it initiates a renewal of private equity techniques in target selection, post-investment strategies, and valuation. The longitudinal case study validates the fact that this new model accounts much more effectively for certain investment strategies than classical models. It also confirms that a mismatch between a firm’s design regime and the private equity fund mode of investment can, in the long run, hinder firms’ innovation capabilities.

The exploratory study realizes a new model of regeneration capital that would benefit from further empirical case studies to refine its consequences and better characterize regeneration investors’ rationales and tools. Indeed, middle-market firms present a diverse category. These firms are both described as mature firms generating sound revenues, owing to their existing activities, and entrepreneurial firms facing a need to maintain their competitive advantage by continually regenerating their activities. Thus, they must continually arbitrate on capital allocation between seed and development activities, which gives the investor two distinct roles: (1) buy an existing activity and typically optimize it, and (2) fund and support regeneration strategies. Thus, this firm category should, on the whole, benefit from a regeneration capital type of investment, and studying other firms could enhance the model’s robustness. Furthermore, VC literature shows that the source of funds (e.g. bank, corporation, pension fund, government) and the market structure characteristics (bank-based or market-oriented) would influence the type of activity financed by private equity funds (Mayer, et al., 2002). Therefore, additional interesting practices and refinement of our model could be extracted from analyzing deals for other private equity firms.
Finally, the regeneration capital model raises specific challenges, such as in managing a trade-off in financial and extra-financial resource allocation between regeneration of the firm’s activity and optimizing or scaling existing activity. There is also a methodological challenge related to U-product tracking by external investors facing time constraints and limited available data. Under specific conditions, the investor could take advantage of a patent analysis, but this cannot cover all cases; for example, it does not account for process regeneration. Other indicators could be tailored, such as prototypes, establishment of external collaborations, and networking. This remains a topic for further research.

Annex – Additional Methodology Insights

This annex aims at providing more details on the data collected for the NRJ case study.

**Interviews**

<table>
<thead>
<tr>
<th>Interviewees</th>
<th>Date; duration</th>
<th>Type</th>
<th>Transcription</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior and junior investors who concluded the deal</td>
<td>May 2016; 30 minutes</td>
<td>Semi-structured</td>
<td>Note-taking during the interview</td>
</tr>
<tr>
<td>Informal lunch</td>
<td>Early June 2016</td>
<td>Unstructured</td>
<td>Written summary after the interview</td>
</tr>
<tr>
<td>Senior and junior investors who concluded the deal</td>
<td>October 2016; 30 minutes</td>
<td>Semi-structured</td>
<td>Note-taking during the interview</td>
</tr>
<tr>
<td>NRJ financial director and chief executive</td>
<td>Late June 2016; 1 hour 30 minutes</td>
<td>Semi-structured</td>
<td>Recorded and transcribed</td>
</tr>
</tbody>
</table>

Interview guides were structured in four sections. In both cases, the first one consisted of an introduction of the interview and generic questions on the interviewees.

For the investors’ interviews, the second part gathered questions on the fund’s activities and organization. A third part focused on a general understanding of NRJ activities at the time of the transaction and its developments since then. The last part aimed at scrutinizing investment practices.
Financing the Next Generations of Innovation

The interview of the NRJ executive also included questions related to the firm’s history. Then we investigated the firm development strategy with a focus on its innovation strategy. Finally, we discussed the capital structure and the various changes in capital ownership.

**Written Documents**

Three sources of written documents have been used in order to triangulate data.

Some files have been sent by the senior investor:
- Slides presented to the French private equity fund investment committee that decides whether or not to conclude the deal
- A strategic due diligence and an extended market and strategic review (conducted by two distinct external audit companies)
- Financial due diligence (conducted by an external audit company)

The following have been extracted from the fund’s digital archives:
- A large number of legal and financial documents related to the deal (e.g. legal due diligence, shareholder agreement, incorporation documents, underwriting documents)
- A written document summing up the deal provided to the investment bank’s board of directors

Public information has been collected on the Internet:
- The press release related to the closure
- 20 press articles related to the firm’s founder, the deal, or the firm in general
- Patent data extracted from the online search tool Espacenet

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