

# Chapter 12<sup>1</sup>

## IP-backed finance

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### Introduction

Over the last years intangible assets have become increasingly important as value drivers for companies operating in highly competitive environments (Lev, 2001; Levitas and McFadyen, 2009). The strategic relevance of intellectual property rights, and more specifically of patents, has lead companies to identify additional ways of extracting value from them. One of these ways relates to the use of patents to strengthen the company's position when obtaining external finance. This chapter discusses the emerging field of IP financing, analysing how technology-based companies can leverage their patent portfolios to access equity investments and debt. We summarize the findings of more recent academic research on such issues and provide several examples of IP deals in the United States and Europe, in order to highlight how a proper valuation of patents is fundamental when they are used as financial tools by IP holders and as investment assets by financial institutions and venture capitalists.

The rest of the chapter is organized as follows. We will first discuss the main problems associated to financing innovative enterprises and the signaling value of patents for external investors. We will then focus on equity financing by Venture Capital (VC) firms, to clarify how the ownership of patents can facilitate VC investments and the valuation methods adopted by such types of investors. Finally, we will present the main patent backed financial instruments (patent loans, patent securitization, patent sale and lease-back), describing their characteristics, the attributes of potential users, the risks involved and the success factors.

### 1. Financing innovation: key issues and the role of patents

Innovative companies typically face severe difficulties in attracting external financing because investments in R&D and new technologies are difficult to measure, evaluate and manage (Litan and Wallison, 2003). In particular, the main problems associated with

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<sup>1</sup> In Munari, F., Oriani, R. "The Economic Valuation of Patents. Methods and Applications", Cheltenham, Edward Elgar.

financing innovative activities by both new and established companies are: (a) the high levels of tacit knowledge embedded in innovation; (b) the presence of information asymmetries between insiders and external parties; (c) the high degrees of uncertainty surrounding innovations; and (d) the limited availability of collateral to minimize investors' risks (Hall, 2005; Murray and Lott, 1995; Berger and Udell, 1998). Indeed, the most important output deriving from investments in technologies is an intangible asset that represents the *knowledge* base of the firm. This knowledge is generally complex, intertwined and embedded in the human capital of the firm and, thus, it is tacit and difficult to codify (Barney, 1991; Nonaka, 1994; Kogut and Zander, 1992). In this context, the correct assessment of the technical feasibility and market potential of early-stage technologies becomes extremely difficult and risky for external investors.

The common scenario which occurs in R&D investments is that entrepreneurs and investors make decisions under different information conditions. thus, creating the potential for significant agency problems.. Indeed, on one hand, investors typically lack the distinctive competences necessary to evaluate the technology. On the other hand, entrepreneurs tend to be reluctant to reveal full information about their technologies and their market potential, in order to exploit their superior knowledge to obtain larger resource commitment. Due to the presence of these information asymmetries, the market for financing innovation has many characteristics typical of "lemons market", where it is difficult to recognize the quality of the firms and disentangle good investments from bad ones (Akerlof, 1970; Leland and Pyle, 1977).

Furthermore, innovation is by definition a risky activity characterized by high levels of *uncertainty*, both from the technical, commercial and competitive side, which increase the variability of the expected returns deriving from innovative investments. In addition to that, even if external finance was available, it would result extremely expensive because of the risk of opportunistic behaviors due to an imperfect alignment of the interests pursued by the entrepreneur and the VC investor (Carpenter and Petersen, 2002).

All these deterrents in financing newly established, innovative companies are amplified when firm's assets have low *collateral* value, as in the typical case of new technology-based companies which mainly possess intangible and firm specific assets, with little salvage value in case of failure. The absence of collaterals, as pledged assets, does not allow financial institutions to provide capital to technology-based firms under lower levels of moral hazard and adverse selection. Furthermore collaterals would reduce the cost of intermediation

because the evaluation of pledged assets by financial institutions has lower costs in respect to the case of uncertain businesses (Berger and Udell, 1998; Carpenter and Petersen, 2002).

The scenario that derives from these considerations is that many young, innovative companies fail to attract external financial resources, giving rise to a “funding gap” which is particularly critical in the early stages of development.

Patents can play a fundamental role in order to address and partially solve this gap, by acting as “quality signals” available to companies to communicate their largely unobservable value and commercial potential to external investors. First, *patents* can act as “a tangible signal about the firm’s ability to transform research investments into new and potentially valuable knowledge” (Levitas and McFadyen, 2009). Indeed, in a context where intangible assets are the main source of competitive advantage, patents decrease the information gap between investors and firms seeking for external financing as they represent *tangible* outputs of the firm’s invention process and, thus, provide robust signals of the *effectiveness* of a firm’s abilities to recombine different types of knowledge and develop not obvious, useful, valuable and industrially applicable technologies (Griliches, 1990). Thus, patents may act as signal to investors of the reputation of the company, as a measure of the company’s ability to innovate and as an external validation of the quality of the technology developed by the company.

Furthermore, patents are recognized as one of the main tools which firms can use to protect their technologies and create a monopoly to exploit the rents deriving from their technologies. In addition to that, they can be leveraged to facilitate the licensing of technology to third-parties, thus ameliorating the funding prospects of the new venture (Gans et al. 2002; Kulatilaka and Lin, 2006). Finally, IP assets can be used as collateral by technology-based firms that have few tangible assets to offer as security for the raise of financing (Bezant, 1998).

In line with the abovementioned considerations, firms are increasingly exploiting their patent portfolios as a means of accessing external sources of financing. Patents are important in enabling young, innovative firms to attract venture capital investments, and they are also being more frequently used as assets for more traditional financial markets via bank loans and securities markets. In the remaining part of the chapter we will first discuss the relevance of patents for VC financing, and then present a set of patent backed financial instruments, such as patent loan, patent securitization and patent sale and lease back.

In order to understand which options might be most attractive and realistically available to a company it is useful to first highlight some major differences between these modes of financing. Venture capital is a typical example of equity financing, based on an exchange of

money for a share of business ownership. On the other hand, patent loan, patent securitization and patent sale/lease back represent forms of debt financing, that means borrowing money that is to be repaid over a period of time, usually with interest. In this form of financing, the lender (i.e. the bank) does not gain an ownership interest in the business and the company's obligations are limited to repaying the loan.

The type of financing that firms need and receive varies according to the different stages of their *financial growth cycle* (Berger and Udell, 1998). Indeed, firms may be analyzed through a lifecycle (defined by different stages of development – seed, start-up, early stage, growth and maturity) in which financial needs and options change as the business grows, gains experience, and becomes less “informationally opaque” (Berger and Udell, 1998). Proceeding along this cycle, in the early phases the value of an innovative, small and young company is generally represented by its intangible assets such as technologies and patents which are characterized by high levels of risk and uncertainty. After an initial phase in which financing typically derives from insiders (start-up team, family, and friends), innovative firms may seek to access to intermediated finance on the equity side such as the VC market. Indeed, at the early stages, debt finance may be unsuitable because of the limited income flows and assets that can be used as collateral. In addition, for young companies with growth potential, equity financing provides the advantage of strengthening their balance sheet and unlocking their access to bank loan for subsequent phases. Finally, VC can also provide innovators with complementary resources such as management, financial and market development skills which are critical in the initial steps of any business lifecycle.

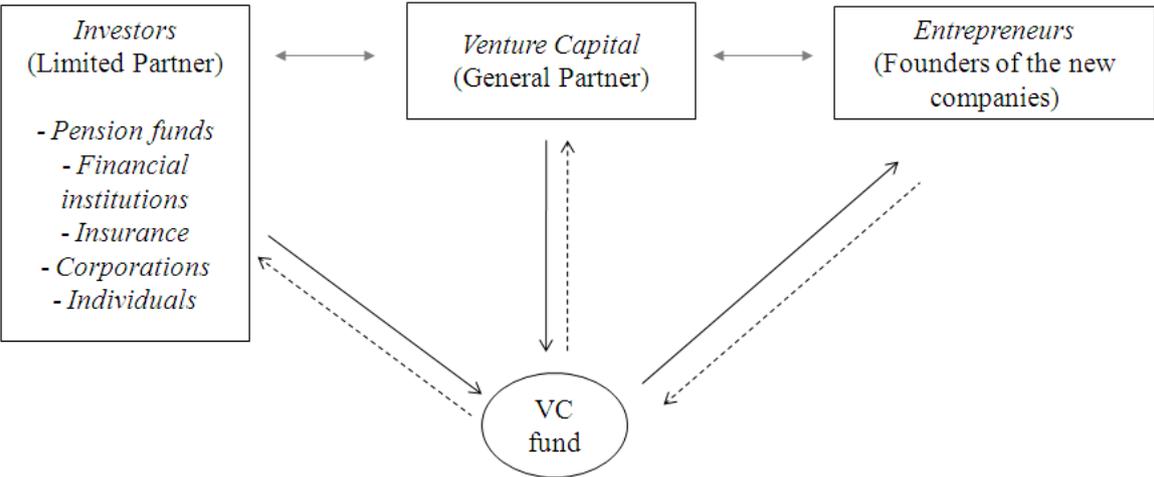
Conversely, when the firm is more developed and its value derives from both tangible and intangible assets, the use of debt-financing could substitute equity financing. Indeed, in the later phases of their growth cycles, firms generally consider the exposure to risk as reduced and, thus, they may look to protect their holdings from dilution and begin to gain access to debt markets to finance their business activities (Bezant, 1998). For such reasons, patent loans and patent sale/lease back can be attractive for companies already entered in the growth stage, whereas patent securitization, for its complexity, might result more appropriate for established companies, as we will discuss in more detail in the remaining parts of the Chapter.

## **2. Venture capital and innovation financing: the role of patents**

### **2.1. How do VC funds operate?**

According to the National Venture Capital Association, *Venture Capital* (VC) can be defined as “[...] money provided by professionals who invest alongside management in young, rapidly growing companies that have the potential to develop into significant economic contributors”<sup>2</sup>.

In essence, VC is a financial intermediary, that raises equity capital from different types of investors (pension funds, financial institutions, corporations and individuals) and invests it directly in a portfolio of private companies. A VC fund is typically organized as a limited partnership, where the venture capitalist acts as the general partner of the fund and the other investors as limited partners (see Figure 12.1). A VC is not a mere financial intermediary that only provides capital to the company, but it is also an active investors that monitor and supports the company’s growth through strategic and managerial support. To do this, VCs generally take a seat in the board of the companies to give advice and help at the highest level of the organization and also takes an important role in the professionalization of the companies (Hellmann and Puri, 2002). Finally, A VC has the primary goal to maximize its financial returns by exiting investments after a certain period of time. The VC sells its stake in the portfolio company through different mechanisms like a sale or an initial public offering (IPO), returns the money to its limited partners and then starts the same process with a different company.

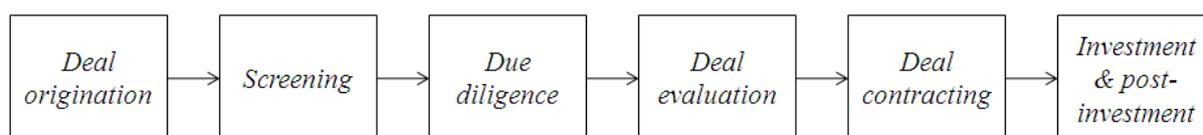


**Figure 12.1 – The VC structure (adapted by Bygrave and Timmons, 1992)**

<sup>2</sup>The European Venture Capital Association defines private equity as all the forms of “provision of equity capital by financial investors to non-quoted companies with high growth potential. VC is a subset of private equity and refers to equity investments made for the launch, early development, or expansion of a business”. For the sake of simplicity, in the rest of the chapter we will use the term venture capital with reference to those equity investments made in companies at an early stage of their development (i.e. launch, early development or expansion of a business). We will not refer to later-stage development activities or management buy-outs which, on the contrary, tend to refer to more established and mature companies.

To respond to the risk embedded in innovative investments and deal with the agency problems arising between entrepreneurs and investors, VC firms usually adopt different solutions to manage their investment activities (Gompers and Lerner, 2001): (a) a thorough screening and due diligence process, preceding the decision to invest, to reduce information asymmetries and check investment proposals with the highest growth potential; b) staged financing, contributing the financial support to investee companies in several stages, with the aim to gather additional information and monitor the progress of firms step by step maintaining the option to periodically abandon projects; c) syndication of investments, the process whereby different VCs co-invest by putting in a portion of the amount of money needed to finance a company, thus, limiting the risk of failure; d) use of compensation contract, covenants and restrictions, to align investors' and entrepreneurs' incentives; e) the inclusion of VC managers in the investees' boards of directors, to limit the danger of managerial deviations from value maximization.

It is important to discuss in more detail the second point – staged financing – since it has direct implication on the different methods adopted by VC firms to value patent portfolios on investee companies, as we will discuss in Section 2.3. The VC cycle is articulated in several steps (see Figure 12.2): deal origination, screening, due diligence, evaluation, contracting, investment and post-investment activities (Tyebjee and Bruno, 1984; Gompers and Lerner, 1999; Baeyens et al., 2006). As in the previous cases, also this multi-stage process is functional to reduce information asymmetries embedded in companies that operate in uncertain environments. During the phase of *deal origination*, companies enter into consideration as investment prospects. Some of these proposals are immediately rejected during the *screening* phase if they do not fit with the focus of the VC strategy and, then, they are more deeply analyzed in the *due diligence* stage through a set of key policy variables which reduce investment prospects to a more manageable number for in-depth evaluation. Subsequently, in the *deal evaluation*, VC managers assess the levels of perceived risk and expected return of the potential investee company to decide whether or not to invest. In the stage of *deal contracting*, the price of the deal and the covenants which limit the risk of the investor are negotiated. Finally, through the *investment and post-investment activities*, VCs monitor and assist the investee company along its growth by supporting the recruitment of key executives and strategic planning, providing further financing through various financial rounds and organizing a merger, acquisition or public offering to exit and liquidate the investment (Tyebjee and Bruno, 1984).



**Figure 12.2 – The VC cycle (adapted by Baeyens et al., 2005)**

## **2.2. Do patents facilitate VC financing?**

As discussed in section 12.1, the economic literature provide strong support to the role of patents as quality signals of a start-up capacity to create and protect value through innovation, thus increasing the likelihood of obtaining VC financing. The positive role of patents (and in particular of high-quality patents) for VC financing is well documented in several studies, and consistent across different industries, such as biotechnology, nanotechnology, semiconductors, with the partial exception of software.

At an industry level, Kortum and Lerner (2000) examined the relationship between the total number of patents issued at the USPTO and the total amount of VC financing across 20 manufacturing industries between 1965 and 1992 in the United States. They observe that increases in VC activities in an industry are associated with higher patenting rates.

Switching the focus at the company level, in a study of 204 biotech start-ups, founded in Canada between 1991 and 2000, Baum and Silverman (2004) found that start-ups with more patent applications and grants obtained significantly more VC financing. Similarly, Hsu and Ziedonis (2007), analyzing 370 semiconductor startups that received more than 800 rounds of VC funding from 1980 through 2005, found a statistically significant and economically large effect of patent filings on investor estimates of start-up value. In this study, a doubling in the patent application stock of a new venture is associated with a 28 percent increase in valuation, representing an upward funding-round adjustment of roughly \$16.8 million for the average start-up in the sample. Moreover, in this context more prominent VCs (as measured by the number of syndication ties with other VCs) seem to value start-up patents more highly than their less experienced counterparts, thanks to superior complementary legal and organizational resources. Evidence from the software industry, on the other hand, is more mixed, due to the higher uncertainty surrounding the effectiveness of patent protection in this context. Indeed, the dense patent thickets characterizing several software markets increase the likelihood of future litigations, thus delaying or reducing initial acquisitions of VC funding (Cockburn and Macgarvie, 2007). Nevertheless, the study by Mann and Sager (2007) in the

software industry found that patenting increases the likelihood of start-up firms receiving VC financing, although the relationship between patenting rates and VC financing seem to depend in such industry less on the size of the patent portfolio than on the firm's receipt of at least one patent.

Another stream of literature has more specifically assessed the determinants of patent value that are taken into consideration by VC firms in their investment decisions, suggesting that it is not only the simple availability of patents that matter for such kind of investors, but also their specific characteristics. In a study of 190 VC-seeking German and British biotechnology companies founded after 1989, Haussler et al. (2009) show that the quality of patent applications of the start-up - measured both in terms of forward-citations received by subsequent patents and in terms of share of the patent applications that received an opposition (under the assumption that an opposition at the EPO from a competitor indicates that the company possesses especially valuable technology) - increases the likelihood to receive VC financing.

Also patent breadth has been significantly associated with higher valuations by VC firms. The analyses by Lerner (1994), based on a sample of 535 financing rounds at 173 VC-backed biotechnology companies, highlight that patent breadth (operationalized as the count of different IPC classes to which the patent is assigned) positively affects the valuation of new biotech companies by VCs.

Moreover, there is evidence that VC firms assess the technological content of the patents in their financing decisions. In a study of 332 VC-backed companies in the nanotechnology sector in the period 1985-2006, Munari and Toschi (2008a) find that the stock of patents belonging to the nanotechnology class (which represents the core technological domains of the companies in the sample) has a positive and significant effect on VC financing. Moreover, VCs specialized in the field of nanotechnology tend to place more value on nanotech patents in their financing decisions, compared to unspecialized VCs.

A final interesting insight emerging from this literature refers to the importance of a well-designed patent strategy for the evaluation given by external VC investors. The study of Munari and Toschi (2008b) on 247 new ventures (123 academic spin-offs and 124 other companies) in the micro- and nanotechnology sector in the United Kingdom suggest that 247 new ventures (123 academic spin-offs and 124 other companies) VCs are more likely to finance new companies adopting business models based on patented technologies sold

through licenses or organized around a well-developed product concept, rather than those companies with consultancy-oriented business models. Specifically, in relation to university spin-offs, a key issue for VC is the distribution of IP ownership between the university or the spin-offs itself, since this can influence the company's subsequent development and the willingness of investors to invest. The same study suggests that VC investors tend to favour academic spin-offs with the direct ownership of a strong patent portfolio.

In conclusion, taken together, the abovementioned works provide very insightful indications for both entrepreneurs' seeking external equity financing for their companies and for VC investors' selection decisions. First, they suggest that the ownership of patents and patent applications significantly facilitate the access to faster and more favorable funding by VCs. Second, they suggest that not all VC investors are alike in their assessment ability and the way they evaluate patents. VC firms with more investment experience and a stronger specialization in the investee company's industry might possess a superior ability in inferring the economic value stemming from patents. Third, they highlight that it is not the mere possession of patents that matter for VCs, but how they are exploited to support unique and sustainable business models. As far as this last point, the breadth (or scope) of patent protection (Lerner, 1994) and patents protecting the core technological capabilities of the company (Munari and Toschi, 2008a) are significantly associated with higher valuations by VCs.

Starting from such considerations, in the following section we will provide a general overview of the patent valuation process adopted by VC firms in their selection decisions.

### **2.3. The valuation of patents over the phases of the VC cycle**

As previously pointed out, the VC financing process consists of multiple, successive stages in order to face this risk. Typically, VCs can receive more than 500 business plans per year, undertake about 80 due-diligence processes and finance only 5 investments. Therefore, VCs tend to rely on a set of different *criteria* depending on the stage of the VC cycle in order to drive their selection decisions, adopting a subjective assessment procedure driven not only by the company's business plans, but also by a multidimensional list of characteristics such as financial aspects, product-market attractiveness, technological characteristics, strategic-competitive impact, management team and deal criteria (Tyebjee and Bruno, 1984; MacMillan et al., 1985; Muzyka et al., 1996; Hsu; 2007).

Although the selection process depends on the management style of the VC funds and investment decisions are subject to the individual investor's interpretation of acceptable risk and return, we present a "standard checklist" approach in order to analyze both the general set of investment parameters used by VC firms and the specific assessment of patents across the different stages of the valuation process.

During the initial *screening* phase, VCs generally analyze the potential investee companies in terms of industry, stage of development, geographical location and size of investment to figure out whether the company corresponds to their investment strategy. This procedure reflects the tendency of VCs to limit their potential investments in areas in which they have some levels of familiarity. Furthermore, in deciding whether to finance or not a company, investors are likely to begin their screening process by focusing on aspects that validate the firm's ability to implement its concept successfully. Investors may be interested in understanding the familiarity of the company's management team with the target market, assessing its skills, ability demonstrated in the past, level of trust developed in previous relationships and reputation in a specific market. One of the most important requirement in this stage is foreseeing a large market opportunity. At this stage, the availability of patent applications may result of fundamental importance, since it signals the possibility to protect this market power in a sustainable way, allowing firms to earn extra-profits over time. For some of the VC funds we interviewed, such as Novartis Venture Fund, Siemens Venture Capital and Sofinnova, the availability of patent applications by the start-up companies is generally considered as a necessary condition to proceed further along the selection process. In this stage, however, given the high number of business plans to be evaluated and the limited amount of time that can be devoted in screening each of them, the value of patent application is not assessed in a systematic and detailed way. More typically their mere presence/absence is assessed as a "gate" to access to the subsequent stage.

Once the initial screening phase is positively completed, the target company enters in a more complex *due diligence* phase, in which it should provide to the VC firm several confidential and commercially sensitive information about financial, legal, scientific and commercial aspects of its business. The main objective of the VC firm at this stage is to reduce adverse selection and information asymmetry problems and increase the probability to finance the most valuable companies. Important criteria which are considered at this stage are characteristics of the entrepreneurs (managerial, engineering and marketing capabilities), the market attractiveness (size, growth and accessibility of the market) and, in particular, features of the technology as the quantity and quality of the patents portfolio.

Typical issues regarding investees' patent portfolios that need to be addressed in this phase are those described in due-diligence approaches presented in Chapter 2 of the book. They can be summarized as follows (Malackowski and Wakefield, 2002):

- A review of key issued and pending patents (i.e. check assignments, geographic extensions, search reports, examination reports, file histories, amendments to applications). In this sense, it is important to focus attention to the claims of the patents, in order to assess their adequacy to support the planned exploitation of the technology.
- An analysis of the freedom to operate, in order to assure that third-party patents are not infringed by the technologies and products of the target company.
- A review of potential IP-related deal-breakers (i.e. dependance on other patents; actual/impending litigation, oppositions/appeals, warning letters, incomplete chains of ownerships, missed due dates)
- An assessment of the company's patent strategy (i.e. which is the proportion of business value related to patent? Does the company engage in offensive/defensive patenting? Does the company engage in licensing-out, licensing-in strategies? Which is the recourse to other types of IPRs – i.e. trade secrets, trademarks, designs, copyrights, domain names, invention disclosures)

The assessment of such criteria in the course of the due diligence process clearly emerges by the interviews we performed with leading VC managers, as described in Inbox 12.1. They also show that generally VCs involve professionals of external IP and law firms to conduct the due diligence of target companies' patent portfolios. A further important lessons emerging from our interview is that VCs tend to analyze the entire set of patents owned by the company, not each single patent in isolation, to have a complete overview of the overall protection provided by the company's technological portfolio, its positioning and life cycle. Finally, in the stages of *deal evaluation and contracting*, VCs determine the profile of risk and return associated with the company to define the right amount to invest in. In this phase VC managers tend to calculate the value of the entire company, in order to determine how much of the company the investor will own on closing the transaction, without focusing on performing the economic evaluation of each single patent. However, patents can indirectly enter into the analysis in this phase through their impact on the expected cash flows that will be generated by the company, as suggested by the interview we performed with Sofinnova

(see Box 12.1). In particular, there exists a simple approach to valuation widely used by VC investors, that is referred to as the *Venture Capital Method* (Metrick, 2006). This method is a *post-money* valuation (i.e. once the initial investment has been made), based on the idea that the company's value can be assessed not through a forecast of the cash flows it is expected to generate in the future, but rather through an estimate of the company's terminal value at the time of exit (typically through an initial public offering on the stock market or a sale to strategic buyer). This procedure takes several steps: (1) forecast cash flows to equity for a period of years, (2) estimate the time at which the VC will exit the investment, (3) identify comparable public companies or comparable transactions to value the exit price based on the multiples model, (4) discount interim cash flows and exit value at rates ranging from 25% to 80% and (5) determine the VC's stake by dividing the amount invested in the company by the post-money valuation.

***Inbox 12.1 – How VCs value patent portfolios? Evidence from interviews with VC managers***

In order to complement previous literature on how VC firms value patent portfolios (Dunlop, 2008; Malackowski and Wakefield, 2002), we performed a set of interviews with managers of VC firms of different types, including both independent VCs (Sofinnova), corporate Venture Capital (Novartis and Siemens), and public/private VC (TT Ventures). Table 12.1 briefly presents the VC funds we interviewed and their investment strategies.

	<b>Novartis Venture Funds</b>	<b>Siemens Venture Capital</b>	<b>Sofinnova Ventures</b>	<b>TT Venture</b>	<b>Innogest Capital</b>
Type of Investor	Corporation	Corporation	Independent	Public-Private	Public-Private
Location	Basel - Switzerland Boston - USA	Palo Alto, Santa Clara, Orlando, Boston - USA	Paris - France	Milan - Italy	Turin, Milan, Padua - Italy
Industry specialization (Investment focus )	New therapeutics, medical devices, diagnostics and drug delivery	Industry, energy, healthcare, information technology	Life science and information technology	High-tech (biomedical, material science, agro-food, clean technologies)	High-tech (advanced mechanics, new materials, information and communications technology, biomedical, clean energy, innovative services)
Geographic specialization	USA/Canada, Europe, Switzerland and Asia/Pacific	North America, Western Europe, Israel, China, India	Europe and USA	Italy	Italy
Stage of Development	Early stage	Start-up and development	Sturt-up and early stage	Sturt-up and early stage	Start-ups and Small and Medium Enterprises (SMEs)

***Table 12.1 – Profile of the VC firms interviewed***

The importance of patents in the screening and due diligence phases clearly emerge from the following interviews with Sofinnova, Novartis Venture Fund and TTVenture.

*“Sofinnova looks for a high growth company, a solid development project, a good management team, a simple and transparent structure and an exit strategy. Investments in technology based start-ups implicitly involve investment in innovation and, thus, IP ultimately determines if the start-up has or not a solid development project. The presence/absence of IP is the starting point and essential for the value of start-ups. It is the key selection criteria to decide if the company is “in or out”. However, we also need to understand what kind of proprietary protection the patent gives and the level of utility of the patent in terms of market applications. Patents are, thus, analyzed in detail during a phase of due diligence to determine its technical/legal validity, the value added to the product in the end market by its utilization and its country coverage. Indeed, the IP portfolio is fundamental to the competitive positioning and life cycle of a product in the marketplace and, thus, the breadth and strength of the patent protection of the product itself and the fence around it need to be analyzed” (Partner, Sofinnova).*

*“Novartis Venture Funds proceeds along two steps: early, we assess the presence (yes or no) of patents and we try to understand if there exists freedom to operate. Later, patentability and the defensive/offensive use patents become more important and better analyzed. Early, you may not know what your art will be, but you need to know that you can practice. Later on, your device/product profile is better understood (Managing Director, Novartis Venture Funds)*

*We look at both individual patents and the collection of patents. It is the “picket fence” approach. Keep building multiple barriers that make it difficult to engineer around. (Managing Director of Novartis Venture Fund)*

*Our strategic decision in the investment process is that the presence of IP is the “conditio sine qua non” to invest in a company as it is the means to access the market and it offers barriers to entry, protection and a tangible way of technological transfer. However, a patent per se has no value. Thus, we look at patents in conjunction with the company’s business model to verify the extent to which patents protect the core technology of the company and not only a marginal component. During our technological due diligence, we also analyze in particular the likelihood that patent applications will be granted, the presence of office or actions lawsuits in progress and the possibility to extend actual patents into other patents to protect a broad industrial platform (Chief Technology Officer of TTVenture).*

Although monetary techniques are not generally adopted by VC firms to determine the value of single patents in the phase of deal evaluation and contracting, patent can

indirectly enter in the valuation of the entire company, as suggested by the interviews with Sofinnova and TTVenture:

*We do not evaluate each patent through quantitative techniques, but we assess the value of the company as a whole. The presence of patent is only condition to invest, but it is not an asset per se. Patents come with business models and patents without entrepreneurs have no value because they do not generate cash flows.*

*We perform an economic valuation of the company through qualitative techniques (i.e. benchmarking with industrial competitors or past performance) and quantitative tools like the net present value. We assess the expected revenues, costs, investments, time of development, risk of both technical failure and market competition and cost of capital. However, the value of a company depends also on the value of its patents, calculated in terms of the net present value of the commercial applications which takes into account the technical development risk, rate of market penetration, price of product, market size/peak sales and length of product life (Partner, Sofinnova).*

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### **3. Patent backed financial instruments**

#### **3.1 Different forms of Patent Backed Financial Instruments (PBFI): characteristics and examples**

Whereas VC funding represents a typical example of equity financing, different forms of debt financing may be acquired by companies by leveraging their patent portfolios. Given the widespread diffusion of the market for intellectual property and the ongoing innovation of financial tools, there is a growing need among companies to use IP portfolio, especially patents, as a source of funding and collateral security in order to finance new investments. Patent backed financial instruments can be defined as a wide set of tools and financial solutions<sup>3</sup> leveraging on patents value to raise funds: they are usually characterized by unique features and by a high level of customization<sup>4</sup>. Over the last years patent backed deals have been established through different financial vehicles from commercial banks to specialized financial operators (Walsh and Cohen, 2007) and their actual diffusion is quite low and

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<sup>3</sup> Literature offers a wide range of case analysis more than ever on loans collateralized by patent and patent cash flow securitizations (Wantanabe, 2004; Edwards, 2001).

<sup>4</sup> Tools and financial instruments leveraging on intellectual property and patents can be classified according to different variables: by asset ownership maintenance, since they can require a change of ownership for the underlying patents; by type of issuance, ranging from publicly or privately offered corporate bonds to non-recourse loans; by risk profile, type of issued capital, whether debt or equity, and so on.

financial solutions are not standardized . However, we will describe in more depth the most common patent backed financial instruments:

- patent loans,
- patent sale and lease back
- patent securitizations

A *patent loan* is a bank loan using patents as collateral. The lender usually offers the borrower a non recourse loan whose amount depends on asset quality, main risk factors, and owner credit merit. Patents can be used as primary or secondary form of collateral. According to industry experts of several US credit asset management companies recently involved in IP financing field (Walsh and Cohen, 2007), patent loans can be both classical banks debt and directly second lien loans ranging from 50 to 400 million dollars for bank loans and from 2 to 50 million dollars for the second lien solutions. However, fund size, duration and covenants clearly differ for each case depending on each lending institution. Usually, there is the possibility to insure the loan through special insurance policies which provide the lender a financial guarantee on principal and interest payments.

From lender perspective, the unique nature of patent as collateral in loan transactions can present some disadvantages relating to higher costs to monitor borrowers and to higher uncertainty for the quality of the collateral. However, covenants and insurance can clearly reduce overall transaction risks and over-collateralization<sup>5</sup>, provided by the loan to value ratio, enhances the loan issuance. From the asset holders' point of view, patent loans represent a further opportunity to raise debt capital leveraging on their patent portfolio value. On the one hand, the greatest advantage of patent backed loans is the introduction of a new asset class for debt financing and companies credit merit valuation. On the other hand, difficulties in patent valuation and collateral disposal in case of default remain open issues affecting the development of these financial solutions and can significantly increase borrowing transaction costs and reporting requirements (McFetridge, 2001).

Both SMEs with innovative technologies and large established companies with a wide and transversal patent portfolio can benefit from this funding possibility. For instance, GIK Worldwide, a small US company which developed a breakthrough technology in the field of video-conferencing, leveraged on a patent loan in order to finance its business development.

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<sup>5</sup> Over-collateralization credit enhancement mechanism posting more collateral than is needed to obtain or secure financing

With the help of the IP investment bank Taibbi Ltd, the company raised 17 million dollars in debt provided by Pitney Bowes Capital (Edwards, 2001): the funding was based on an appraised value of 57 million dollars for the collateral patents<sup>6</sup>. On the other hand, Dow Chemical, one of the largest chemical companies in the world, received in 1994 a loan raising 100 million dollars for a 50% of estimated value of the underlying patents (Bezant, 1998; Hillery, 2004).

Despite there is increasing evidence of this kind of transactions, mainly originating in the US or the United Kingdom, it is important to highlight that patent loan practice is quite limited to occasional cases and most banks and financial institutions have not established yet neither a patent due diligence practice nor a pipeline offer. Typically, banking systems are still ignoring intangibles, and patents in particular, when assessing companies credit merit (Ughetto, 2008) and, especially in European countries, commercial banks usually do not generally accept intangible assets as collateral for loans. However, some relevant initiatives have been established over the last years by some leading banks. The Initiative Finanzstandort Deutschland (IFD) is the biggest project implemented by all sectors of German financial services industry and has recently focused its attention on patents: the objective is supporting banks to recognize these assets as collateral in order to improve the access to credit finance for innovative SMEs. Another example is the action of the Chinese Bank of Communications Beijing Branch that, in 2006, began offering IP loans to local SMEs: according to official government sources, the State Intellectual Property Office, after only two years, registered more than 300 IPR mortgage contracts involving over 700 patents with a total value of 6 billion Yuan. Even if some doubts related to counterfeiting and enforcement risk can arise, these cases have pointed out wide spreading acceptance of the role of patent portfolio as funding collateral.

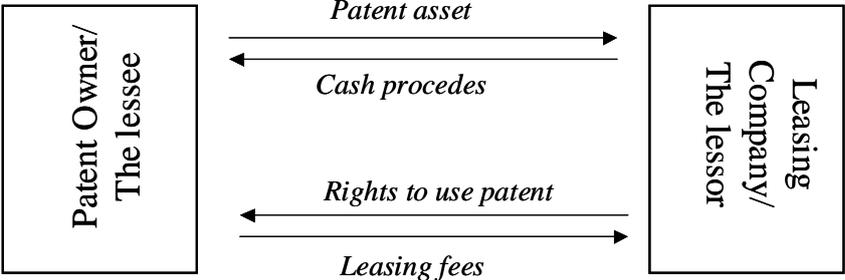
In 1995, the Development Bank of Japan started to support companies in a middle development stage offering loans secured by patents and other IP assets. According to the Director of the Department for Technology & Growth Business of the Development Bank of Japan, from 1995, in a decade, the bank offered 16 billion Yen for 260 IP backed loan

Another patent backed financial instrument is represented by *patent sale and lease back*. It is a lease back solution using patents as underlying asset. In a typical transaction, a specialized institution (the lessor) purchases a single or a pool of patents from a company (the lessee).

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<sup>6</sup> The loan was enhanced by insurance and financial guarantee provided by the Intellectual Property Insurance Services and XL Capital

The latter, subsequently, leases patents back from the lessor and obtains all rights to use them in its business activities paying some interests (see Figure 12.3). The specialized institution, usually, holds the ownership of the patents until the end of the lease.



**Figure 12.3 – Patent sale and lease back process (Adapted from Frank, 2005)**

Depending on the structure of the deal, the lessee can however maintain an option to repurchase in the end its patents at a defined nominal value. While in a patent securitization, the patents owner can transfer to the vehicle either the patent asset itself or the patents’ rights to receive future cash flows (originating, respectively, a direct or an indirect securitization), in patent sale and lease back the asset property is sold to the leasing company (Kirsh, 2005).

One of the first recorded cases of leasing transaction involving patents dates back to 1993 when the Aberlyn Capital Management completed a sale lease back transaction based on a single patent owned by RhoMed, a biotech company specialized in radio-pharmaceutical products<sup>7</sup>. Aberlyn was a venture leasing firm providing investment banking services to biotechnology and biomedical industries. In 1992, the company decided to provide leases based on firms’ patent portfolio. RhoMed received a three years loan of 1 million dollars with an interest rate of 15% according to its risk profile. The transaction was secured by the sale and lease back agreement for the patent that was evaluated at 5 million dollars<sup>8</sup>.

Patent sale and lease back can increase significantly company’s liquidity through assets sale allowing the firm to use patents in its everyday business. However, some open issues exist: apart from fiscal treatment on additional sale earning, the adequate valuation of underlying patents is critical to determine transaction security. Furthermore the likelihood of lessee default, the possibility of infringement and the selection of patents for lease inclusion are also

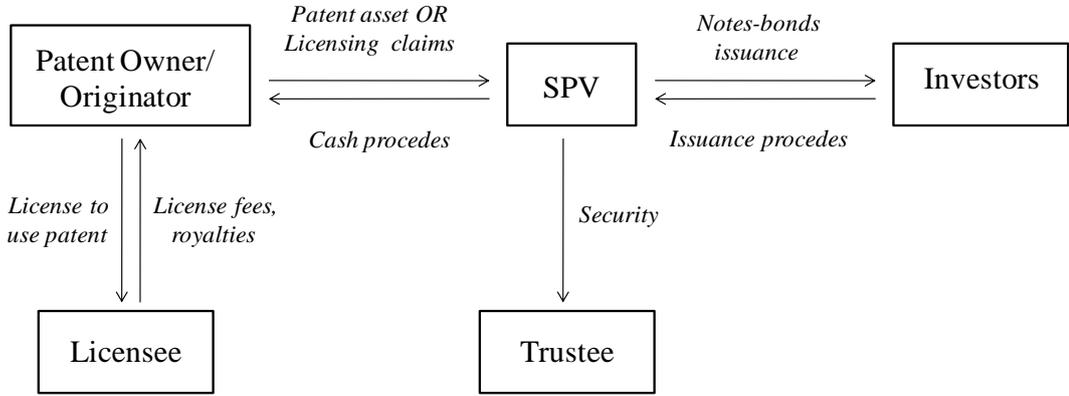
<sup>7</sup> See HBS case ‘Aberlyn Capital Management: July 1993 (1997) prepared by professors Josh Lerner and Pater Tufano.

<sup>8</sup> RhoMed would have to pay principal annually while interest from the second year. The deal included a warrant coverage of 10% of financed amounts for lessee equity acquisition. RhoMed could purchase back its patent at the symbolic price of 1 dollar at the end of financing period.

relevant problems. Aberlyn Capital Management tried to reduce risks limiting patent lease back weight on its overall investment portfolio and restricting its application only to granted US patents. Despite its effort, the RohMed transaction failed: on the one hand the biotech company lose a key alliance and was unable to cover debt service and, on the other, Aberlyn did not succeed in selling on secondary market a standalone patent.

Even if the market is still in an initial phase of development, the Equipment Leasing Foundation, in its research on the use of intellectual property in leasing industry<sup>9</sup>, found that IP leasing represented a major growth opportunity for the sector. Research results also underlined that the leasing industry needed to work on new solutions to leverage on IP assets growing importance: patents appeared to be particularly suitable for finance lease according to their ownership system and to their finite short life<sup>10</sup>.

*Patent securitization* represents another relevant category of patent backed financial instruments. Securitization is a structured finance tool typically applied to illiquid contracts where rights to receive certain future payments are sold in the form of securities. A basic structure (see Figure 12.4) starts from an originator (sometimes it can be the same original patent owner) that identifies a single asset or a pool with reasonably foreseeable cash flow.



<sup>9</sup> The Equipment Leasing Foundation Research Report “Intellectual Property Leasing and its implication for the Leasing Industry” was published in 2002.

<sup>10</sup> Apart from patent loan, securitization or lease back, some other patent backed financial instruments exist (Edwards, 2001; Hillery, 2004; Frank, 2005; Lipfert and Von Scheffer, 2006), even if their application is quite limited until now. Some examples are: a) patent asset trust, that has a structure similar to securitization but SPV issues equity share instead of debt; b) patent backed collateralized debt obligation (patent CDO) that bundles a diversified pool of patent loans and sell them to investors according to their risk profile; c) Technology Unit Investment Trust (TUIT) that is a bundled group of technology and patent assets combining into one marketable security; d) patent funds (PVF), that are special investment funds, structured as SPB and usually originated by a bank investing only in patents.

***Figure 12.4 – Patent securitization process (Adapted from Hillery, 2004)***

Then, the originator sells the asset itself or the cash flow rights to a legally separated entity known as a Special Purpose Vehicle (SPV) in order to remove the asset from its bankruptcy estate. The SPV designs the securities to be sold according to asset past performance and, finally, it issues securities on the capital markets backed by the asset's income stream. The transaction Trustee manages and aligns cash-in and cash-out-flows. Typically other subjects are involved in a securitization: the transaction arranger, the servicer to manage receivables, the rating agency for credit merit assignment, the placement agent to sell the security and other actors providing external credit enhancement. Usually patent securitization is based on existing royalties deriving from licensing agreements or contingent payment rights; however, it is possible to build securitization as well on future cash flows deriving from a future revenues share associated to the commercialization of products protected by the patent.

From the asset owner's perspective, patent securitization can help single companies to have access to funding conditions more advantageous than the corporate ones: a strong credit enhancement enables companies to achieve a lower total cost of capital and an higher flexibility compared to standard bank loans (Kirsh, 2005). Furthermore, patent securitization allows to divide asset risk from the company's one, enabling firms to raise funds by leveraging on their patents portfolio value. Another important benefit of patent securitization is the direct liquidity it provides which can be more useful to a company's funding needs than delayed royalty streams. In addition, patent securitization can be structured as non-dilutive of company's equity share since it is possible to issue mainly debt capital allowing asset owner to raise funds without losing firm control.

Currently, however, the patent securitization market is still in an initial life stage. The few, established transactions are concentrated in the US and can be considered as highly customized financial solutions. The first case of a patent securitization deal was established in 2000 by Royalty Pharma AG, an investment company specialized in the pharmaceutical industry.

In 1985, Yale University obtained a patent for the discovery of a new technology for the treatment of the HIV virus. Yale granted an exclusive license to Bristol Myers Squibb for the development and in 1994 the drug Zerit® was approved by the US Food and Drug Administration (FDA).

In 2000 Royalty Pharma entered into an agreement with Yale University to purchase and securitize the royalty stream associated with Zerit®<sup>11</sup>. Yale sold for 100 million dollars<sup>12</sup> its licensing rights to the BioPharma Royalty Trust, the securitization vehicle company, that raised 115 million dollars in senior, mezzanine and junior notes and in equity securities: the deal reached a single A rating on the senior tranche<sup>13</sup>. In November 2002, however, the BioPharma Royalty Trust entered into early amortization due to covenant defiance because for three consecutive reporting periods licensing cash flow were unable to reach coverage ratio defined by transaction covenants (Hillery, 2004).

A small number of other deals have been established: according to Kirsh (2005), in the period between 2000 and 2004 only five patent securitizations had been structured in the US. The reasons for the limited diffusion of this type of instruments resides in the significant asset complexity and high up-front costs, which reduce its applicability.

Not all organizations owning patent portfolios can profit from securitization advantages. On the one hand, patent securitization could be more suitable for universities or small and medium companies with a consistent patent portfolio but that are not able to easily access to capital markets or to unsecured financing. On the other hand, however, the high securitization costs are not a realistic target for this type of subjects. On the contrary, large, established companies should easier cover these high transaction overheads but they have few incentives for the recourse to the patent securitization since can usually leverage on a wide range of funding possibility thanks to high corporate credit rating. In this context, therefore, the role of intermediaries, such as Royalty Pharma AG or other specialized companies, is essential to foster future market development.

### **3.2 When are patent backed financial instruments effective?**

Patents still represent the smallest area of IP backed deals, which continue to be mainly based on trademarks and copyrights, but there is increasing evidence of companies trying to directly exploit the potential value of secured transactions of their patent portfolio. Some of the examples we discussed before show that patent backed financing can represent an alternative to equity financing for companies at the end of the early development stage. It could be a

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11 This securitization was built on 70% of royalty payments for patent rights on Zerit HIV drug

12 The an up-front payment of 100 million dollars was used to fund a capital project for its campus

13 Rating was based on Standard & Poor's valuation on legal structure, on historical and projected performance of Zerit licensing agreement and on Bristol-Myers Squibb credit merit.

valuable opportunity especially for those companies with promising technologies and strong patent portfolios, needing funds to further develop and commercialize these technologies, and that are unwilling to give up high equity shares through venture capital markets (Edwards, 2001; Davies, 2006).

Furthermore, these financial instruments allow the separation between IP assets and company evaluation, considering the strong demand for a mechanism in which innovative companies will be able to raise funds based on their patents' credibility and cash flows (Watanabe, 2003). Moreover, the liquidity afforded by patent based financing solutions may be particularly important for fast growing firms since it can be more useful for the company's operations and development than the future royalty streams (Fishman, 2002).

The market for patent backed financial instruments is still in an early stage of development, and it has probably grown less rapidly than expected. A small number of deals have been established (Lovells, 2002) and their transparency level is still really low. This market is, in fact, characterized by a high level of secrecy and according to some industry experts, apart from a few well known transactions, many other deals may have been issued privately and undisclosed. In fact, disclosure of sensible information is an important issue and can greatly affect the perceived potential of this market.

Both IP practitioners and academics have pointed out difficulties and uncertainties inherent in the use of patents as financial assets. The exceptional features of patents in comparison to other physical assets used in standard financial deals could determine some structural impediments limiting their applications as securities (Throckmorton, 2004), and, as a consequence, reduce the growth of patent backed financial instruments: cash flow generation has been identified as the only similarity between patents and other asset classes used for secured financing.

From the perspective of the financial institution, the development of these financial solutions is limited by the high complexity of assessing the value and risk profile of patent portfolio, since specific risk factors increase uncertainty in cash flow forecasts: uncertainty about patent valuation strongly affects confidence of financial institution and credit rating agencies for this kind of financial solution. Market potential for patent backed financial instruments is quite uncertain: only those patents generating consistent and predictable cash flow are suitable to be used as underlying for financial solutions. Furthermore, patents may be strictly linked to co-specialized assets and their value is strongly affected by the likelihood of being litigated or infringed. Finally, disposal in case of default is a relevant issue in defining collaterals because secondary market for this kind of asset is, until now, highly illiquid.

From the patent owners' perspective, IP assets valuation, demand issues and socio-behavioural reasons greatly affect the development of the patent backed financial tools. Few companies deeply know potential benefits and are able to face average transaction complexity; given patents uniqueness, it is quite challenging to design a standard process, even for simple bank loans: patent-backed financial instruments are, actually, customized financial solutions involving high structuring cost and requiring a consistent minimum size of underlying assets in order to establish a profitable deal

### **3.3 The valuation issue for patent-backed financial instruments**

Although different issues limits the widespread diffusion of patent backed financial instruments, from the previous considerations it emerges that valuation represents probably the most critical challenge. Patents valuation is, until now, an open research field and methodological uncertainty is clearly a barrier for effectiveness of patent backed finance since it can strongly affect confidence towards these kinds of tools.

So patent value appraisal is a turning point for the diffusion of patent backed financial instruments. In general terms, asset value is an essential information in order to use the asset itself as a collateral to raise funds. This information, however, is by far more critical for patents than for any other asset class, since only a small fraction of patents are economically valuable (see Chapter 3). In order to be suitable as underlying collateral in financial solutions, a patent must be valuable and generate a steady and consistent cash flow to cover the cost of issuance and the debt service: therefore, valuation represents a critical step to assure any successful transaction.

Considering patent valuation for financial collateral verification, what is important is not to estimate future price of the security but forecasting possible scenarios of future cash flow deriving from the patent (Martin and Drews, 2005). According to patent uniqueness and the lack of historical data<sup>14</sup>, a standard valuation is not feasible and a case by case assessment is required. Further challenges derive from the fact that the appraiser must estimate the patent value not only in a context of a normal business activity but also in a liquidation scenario: in a default setting patent value can be strongly reduced because it could be hard to sell the asset on the secondary market.

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<sup>14</sup> Fishman (2003): *"There is simply not enough good historical data to show how royalties for certain patent pools perform."*

Currently, there is not a single accepted method to value patents when are used in financial contracts. According to several practitioners, valuation approach and focus differ for each patent backed financial solutions: for example, transferability of patents rights and exploitation risks drives appraisal analysis for patent loan and securitization while freedom to operate business and monitoring of product market development are critical factors for lease back.

Typically, analysts try to assess patents value applying more than one single approach to obtain a multidimensional perspective: a synthesis of the various value indications, enriched by professional opinion and experience of the analyst, leads to a final assets value. Often, quantitative and qualitative methods are used together: the definition of a monetary value for the patent requires, obviously, a numerical approach. However a deep analysis and due diligence on technology underlying the patent, on its strategic role in the owner's portfolio, on its legal status and, above all, on targeted market are necessary conditions to any quantitative valuation.

Aberlyn Capital Management, for instance, proposed an income based method as valuation approach for its new patent lease back solution, forecasting patent profits and using resulting discounted cash flow as starting value to determine the lease back amount.

Appraisal process implemented by Standard&Poors in the BioPharma Royalty Trust case is an interesting example of the combined application of qualitative and quantitative elements for patent cash flow valuation and deal rating assignment. The rating agency implemented structured finance future flow valuation as well as corporate and market analysis (S&P Rating Report, 2003; Hillery, 2004). Factors related to market size and growth trends, to patent owners' business models, to drugs features and legal framework were considered in assessing the patents royalty cash flow. Future royalty revenues scenarios were stressed, according to each risk factor, in order to analyze transaction ability to timely pay principal and interest and, finally, were discounted to determine a net present value for each royalty asset<sup>15</sup>.

In RhoMed lease back case too, patent cash flow valuation was strongly based on qualitative factors: with the support of an external advisor, Aberlyn set up a detailed analysis of relevant patent rights for the agreement and estimated its target market size and development potential. While most of quantitative valuation approaches for patent backed financial instruments are based on ad hoc income and cash flow analysis, there are some relevant exceptions that leverage on market and real option methods, such as the IPB Approach.

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<sup>15</sup> For further details on rating determination see S&P Rating Report, 2003

Given its active role as asset manager of the three Deutsche Bank patent value funds, the advisory company IP Bewertungs has integrated its quantitative valuation method in patent fund investment process in order to better distinguish valuable patents from worthless ones. Leveraging on cooperation with several IP practitioners and seven German universities, IPB developed a patent valuation method which combines the objectivity of market based approaches with patents value indicators (Lipfert and Von Scheffer, 2006): the IPB model is based on a wide range of data of traded patents and on several value-indicators included in each patent document. The interesting point is that German banks can consider patents as single collaterals for short and medium-term financing just leveraging on a certification granting the application of IPB model provided by the accountant group KPMG. (Loop, von Scheffer and Lipfert, 2005).

A concluding remark should be made to some recent projects established at the European level in order to define standard general principles for patent valuation process, so that to facilitate assessment and financing by external investors. For instance, the International Organization for Standardization (ISO) has published a new work item proposal for the patent valuation standardization initiated by the German Institute for Standardization (DIN). Another case is the Italian memorandum of understanding signed by the Ministry for Economic Development, the Confederation of Italian Industry, the Association of Italian Banks and The Conference of Italian University Rectors to develop a common patent value assessment methodology (based on scoring method) among industry, financial sector, academic world and government.

Valuation standardization will support the dissemination of IP value information and broader acceptance of the patents reliability as financial assets. A reduction in the uncertainty surrounding patent as security should lead to a wider diffusion of patent backed financial instruments allowing companies and other organization to leverage on their most valuable assets to finance the development.

## **Conclusions**

In this chapter, we have shown that ownership of a strong patent portfolio can represent an important signal to external investors that the firm has a technological advantage over its competitors and the ability to protect it. From the entrepreneur's point of view, valuation of patents and other forms of IPRs is therefore important, because limited knowledge and experience in valuing and understanding the nature of IP can be seen as key obstacles in

access to finance. From the investors' point of view, a correct understanding the economics of valuating patents may favor the best allocation of capital and the reduction of investment risks. Patent present therefore a strong potential as a way to attract financing, in particular when supported by reliable valuation methodologies.

We showed that patents play a fundamental role in enabling new technology-based firms to attract VC financing. Although the valuation of patents by venture capitalists varies over the different phases of the life cycle, it is generally based on a qualitative assessment of patents and their impact on the firm's strategy. On the other hand, actual background for patent backed financial practice shows a wide and fragmented range of solutions and initiatives: it is a complex and borderline area in ongoing development that involves both structured finance and IP management. IP and patent backed financial deals are still relatively extraordinary events: as underlined before, one of the main issues affecting the diffusion of patent rights monetization solutions is the lack of a widely recognized method for value appraisal that can be deeply accepted and communicated among an extensive community of managers, analysts, financial institutions, IP professionals and investors.

## References

- Akerlof, G. A. 1970. The market for 'lemons': Quality, uncertainty, and the market mechanism. *Quarterly Journal of Economics*, 84: 488-500.
- Arrow, A. K., (2002), 'Managing IP Financial Assets'. in Berman, B. (Eds.), 'From Ideas to Assets – Investing Wisely in Intellectual Property', New York, John Wiley & Sons, Inc , pp 111-138.
- Baeyens, K., Vanacker, T., Manigart, S. 2006. Venture capitalists' selection process: The case of biotechnology proposals. *International Journal of Technology Management*, 34(1-2): 28-46.
- Barney, J. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17(1): 99-120.
- Baum, J. A. C., Silverman B. S. 2004. Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology start-ups. *Journal of Business Venturing*, 19(3): 411–436.
- Berger, A. N., Udell, G. F. 1998. The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking and Finance*, 22: 613-673.
- Bezant, M. 1998. The use of intellectual property as security for debt finance, *Journal of Knowledge Management*, 1(3): 237-263.
- Bygrave, W. D., Timmons, J. A. 1992. *Venture Capital at the Crossroads*. Boston: Harvard Business School Press.
- Carpenter, R. E., Petersen, B. C. 2002. Capital market imperfections, high-tech investment, and new equity financing. *The Economic Journal*, 112(477): F54-F72.
- Cockburn, I., MacGarvie, M. 2007. Patents, thickets and the financing of early-stage firms: Evidence from the software industry, NBER Discussion Paper. No. 13644.
- Davies I., (2006), 'Secured Financing of Intellectual Property Assets and the Reform of English Personal Property Security Law', *Oxford Journal of Legal Studies*, Vol. 26, No. 3, 559–583.
- Edwards, D., (2001), 'Patent Backed Securitization: Blueprint for a New Asset Class', *Gerling NCM Credit Insurance publication*.
- Fischer, B. H., (2002), 'New Patent Issue: BioPharma Royalty Trust'. in Berman, B. (Eds.), 'From Ideas to Assets – Investing Wisely in Intellectual Property', New York, John Wiley & Sons, Inc , pp. 485-495.
- Fishman, E., (2003), 'Securitization of IP Royalty Streams: Assessing the Landscape', *Technology Access Report*, September 2003, 6-7.
- Frank, D., (2005), 'Intellectual property in financial contracts', Diploma Thesis.
- Gambardella, A., Harhoff, D. and Verspagen, B. (2008), 'The value of European patents', *European Management Review* 5, 69–84.
- Gans, J. S., Hsu, D. H., Stern, S. 2002. When does start-up innovation spur the gale of creative destruction?. *RAND Journal of Economics*, 33: 571-586.
- Gompers, P., Lerner, J. 1999. *The Venture Capital Cycle*. MIT Press, Cambridge.
- Gompers, P., Lerner, J. 2001. The venture capital revolution, *The Journal of Economic Perspectives*, 15(2): 145-168.
- Griliches, Z. 1990. Patent statistics as economic indicators: A survey. *Journal of Economic Literature*, 28: 1661–1707.

- Hall, B. H. 2005. The financing of innovation. In: Shane, S. (Eds.) *Handbook of technology and innovation management*. Blackwell Publishers, Oxford.
- Haussler, C., Harhoff, D., Muller, E. 2008. The role of patents for VC financing, Paper presented at the Babson College Entrepreneurship Research Conference (BCERC) 2008.
- Harhoff, D. and Scherer, F.M. (2000), 'Technology policy for a world of skew-distributed outcomes', *Research Policy*, 29 559–566.
- HBS case n° 9-294-083, (1997), 'Aberlyn Capital Management: July 1993'.
- HBS case n° 9-601-019, (200), 'The Patent & License Exchange: Enabling a Global IP Marketplace'.
- Hellmann, T., Puri, M. 2002. Venture capital and the professionalization of start-up firms: Empirical evidence. *The Journal of Finance*, 57(1): 169-197.
- Hillery, J. S. (2004), 'Securitization of Intellectual Property: Recent Trends from the United States', *Working Paper, Washington/CORE*.
- Hsu, Y. 2007. Experienced entrepreneurial founders, organizational capital, and venture capital funding. *Research Policy*, 36(5): 722-741.
- Hsu, Y., Ziedonis, R. H. 2007. Patents as quality signals for entrepreneurial ventures. Paper presented at the DRUID Summer Conference 2007.
- Kirsh A., (2005), 'Securitization of Intellectual Property as a Funding Alternative', Master thesis.
- Kogut B, Zander U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3: 383-397.
- Kortum, S., Lerner J. 2000. Assessing the contribution of venture capital to innovation, *RAND Journal of Economics*. 31(4): 674 – 692.
- Kulatilak, N., Lin, L. 2006. Impact of licensing on investment and financing of technology development. *Management Science*, 52(12): 1824-1837.
- Leland, H. E., Pyle, D. H. 1977. Informational asymmetries, financial structure, and financial intermediation. *Journal of Finance*, 32: 371-87.
- Lerner, J. 1994. The importance of patent scope: An empirical analysis. *RAND Journal of Economics*, 25: 319-333.
- Lev, B. 2001. *Intangibles: Management, measurement and reporting*. Washington, DC: Brookings Institution Press.
- Levitas, E. Mcfadyen, A. 2009. Managing liquidity in research-intensive firms: Signaling and cash flow effects of patents and alliance activities. *Strategic Management Journal*, 30: 659–678.
- Lipfert, S. and von Scheffer, G., (2006), 'Europe's first patent value fund', *Intellectual Asset Management*, December/January 2006, 15-18.
- Litan, R., Wallison, P. 2003. Beyond the GAAP. *Regulation*.
- Loop, D., von Scheffer, G. and Lipfer, S., (2005), 'Patent Valuation at IP Bewertungs AG (IPB)', Working paper, [http://www.wipo.int/sme/en/documents/patent\\_valuation.htm](http://www.wipo.int/sme/en/documents/patent_valuation.htm).
- Lovells, (2002), Intellectual property securitization: a new asset class for Japan?' Client note.
- MacMillan, I. C., Siegel, R., Narasimha, P. N. S. 1985. Criteria used by venture capitalists to evaluate new venture proposals. *Journal of Business Venturing*, 1(1): 119-128.
- Malackowski, J. E., Wakefield, D. I. 2002. Venture Investment Grounded in Intellectual Capital, in Berman, B. *From Ideas to Assets. Investing Wisely in Intellectual Property*. John Wiley and Sons, New York.
- Mann, R. J., Sager, T. W. 2007. Patents, venture capital and software start-ups. *Research Policy*, 36: 193-208.
- Martin, D. and Drews, D. C., (2005), 'Collateral for Securitization or Lending', *The secured lender*.
- McFetridge, D. G., (2001), 'Intangible Collateral and the Financing of Innovation'. Working Paper.

- Metrick, A. 2006. *Venture Capital and the Finance of Innovation*. John Wiley & Sons.
- Munari, F., Toschi, L. 2008a. How good are VCs at valuing technology? An analysis of patenting and VC investments in nanotechnology. Paper presented at the Academy of Management, Anaheim, CA, USA and the EPIP Annual Meeting, Lund, Sweden.
- Munari, F. Toschi, L. 2008b. Do venture capitalists have a bias against investment in academic spinoffs? Evidence from the micro and nanotechnology sector in the UK. Paper presented at the DRUID Summer Conference, Copenhagen, Denmark.
- Murray, G., Lott, J. 1995. Have UK venture capitalists a bias against investment in new technology-based firms? *Research Policy*, 24: 283-299.
- Muzyka, D., Birley, S., Leleux, B. 1996. Trade-offs in the investment decisions of European venture capitalists. *Journal of Business Venturing*, 11: 273-287.
- Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1): 14-37.
- Shapiro, C. (2000), 'Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting', *Innovation Policy and the Economy*, 1, 119-150.
- Throckmorton, R., (2004), 'Securitization can be a goldmine for IP owners', *Intellectual Asset Management*, January 2004.
- Tyebjee, T. T., Bruno, A. V. 1984. A model of venture capitalist investment activity. *Management Science*, 30(9): 1051-1066.
- Ughetto, E. (2008), 'The financing of innovative activities by banking institutions: policy issues and regulatory options', in B. Laperche and D. Uzunidis (Eds.), *Powerful finance and innovation trends in a high-risk economy*, Palgrave Macmillan.
- Walsh P. and Cohen G. (2007), 'Liquidity in the IP space – an overview', *Intellectual Asset Management* April/May 2007, 87-92.
- Watanabe, H., (2004), 'Intellectual Property as Securitized Assets', *The Institute of Intellectual Property*, March 2004.