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The Function of Venture Capitalists Investing in
New Technology Based Firms

Tetsuya Kirihata ¹

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1 Visiting Associate Professor, Ph.D., Kansai Urban Banking Corporation Chair of Kansai Economic and Management Research, Graduate School of Management, Kyoto University, Yoshida-Hommachi, Sakyo-Ku, Kyoto, 606-8501, JAPAN,
E-mail; tetsuyakirihata ()gmail.com(@)
Associate Professor, Hirao School of Management, Konan University
Visiting Associate Professor, Intellectual Property Division, Nara Institute of Science and Technology

Abstract

In this paper, I review the existing literature in order to elucidate the investment processes of venture capitalists from the pre-investment stage to the post-investment stage, with a focus on venture capitalists who invest in new technology based firms. Additionally, I discuss factors associated with growth stages and factors associated with technology separately, with regard to the function of these venture capitalists.

With respect to investment processes of venture capitalists, Manigart et al. claimed that the post-investment activities of venture capitalists will influence the rate of required return in pre-investment valuations. Bygrave and Timmons discussed the function of venture capitalists that revolves around the growth stages, and stated that venture capitalists that invest in early stage ventures must have, in addition to the astute ability to select promising portfolio firms, the ability to support and add value to the portfolio firms after investment. With respect to venture capitalists that invest in new technology based firms, Pfirmann et al identified 3 types of risk; i.e. business risk, innovation risks and financial risks. Baum and Silverman maintain that venture capitalists investing in new technology based firms are likely to consistently combine both scouting for excellent technology as well as being able to coach by imparting management skills.

With the rise of the developing nations, and the escalation of global economic competition, the commercialization and industrialization of new technologies such as biotechnology and nanotechnology is promising for the revitalization of the economies of Japan and other industrialized nations. The creation of ventures based on these new technologies is one of the important options for commercialization and industrialization, and it is desirable that during this creation process, venture capitalists not simply parasite high-tech entrepreneurs, but instead provide value to them and exercise originality.

Introduction -Academic venture capital research-

It is only in relatively recent years that academic research has been conducted on venture capitalism. According to Timmons, academic research on venture capital was “practically non-existent” prior to the 80s (Timmons, 1981). Barry followed up by saying that “empirical research on venture capital was virtually non-existent” prior to the 90s (Barry, 1994). With regard to the relationship between investors, venture capitalists and their portfolio firms, Sahlman stated that “much research remains to be done on the venture capital organization” (Sahlman, 1989). Therefore, it would seem that the 1970s lacked academic research in general on venture capital, and that the 1980s lacked empirical research.

Venture capital research started to take off in the 1990s, with researchers identifying topics that had already been elucidated and those that should be further looked at. According to Barry, topics that should be covered in the future include “angels and venture capitalists”, “do venture capitalists add value within the portfolio firm?”, “the interaction among multiple principals and agents”, “exit strategies and value maximization”, “alternative organizational forms and venture capital performance”, “risk and return in venture capital”; and topics that had been studied in the early half of the 90s include “what do venture capitalists do?”, “how successful are venture capitalists?”, “venture capital and the going public process”, “contracting technology between venture capitalists and entrepreneurs”, “contracting technology between venture capitalists and their investors”, and “the positive role of venture capital” (Barry, 1994).

Maison and Harrison noted that the field of venture capitalism has “been studied by researchers from many other disciplines, including finance, accounting economics, sociology, psychology, and geography” (Maison and Harrison, 1999); and that prior research had been categorized into such topics as “forms of venture capital”, “industry-market perspective”, “venture capital and business development”, “the venture capital investment process”, “economic impact”, “international focus”, and “demand-side perspectives”.

Gompers and Lerner asserted that future research topics should include, amongst others, “the relative performance of venture capital and other financial assets”, “the degree to which public policies affect the formation of venture capital funds” and “the extent to which the U.S. model of venture capital investment will be transferred into foreign markets.”. Furthermore, they stated that “venture capital can be viewed as a cycle that starts with the raising of a venture fund; proceeds through the investing in, monitoring of, and adding value to firms; continues as the venture capitalist exits successful deals and returns capital to their investors; and renews itself with the venture capitalist raising additional funds. To understand the venture capital industry, one must understand the whole ‘venture capital cycle’”, and based on this approach, analyzed fund raising, investment, and monitoring (Gompers and Lerner, 1999).

Cornelius and Persson stated that “there were a large number of papers written by financial economists from a neo-classical economic point-of-view”. These included topics such as agency theory, capital market theory, signaling and the more classical supply and demand economics and game theory. Another large grouping of papers, particularly among the early researchers, included descriptive or exploratory studies and did not have a strong theoretical perspective. The majority of

these were written by those in the management disciplines and written earlier than those that had utilized a theoretical paradigm. Finally, there were studies that used a variety of more recent theoretical perspectives including institutional theory, social capital or resource exchange theories, evolutionary theories (environmental, organizational) and even one using critical theory (Cornelius and Persson, 2006).

An overview of venture capital research reveals that the field started to gain momentum in the latter half of the 1980s, typified by the work of researchers such as Sahlman, who clarified that the reality of investments and exploratory research has progressed a long way (Sahlman, 1989). In the 1990s, in addition to further forays into empirical research investment process of venture capital, epitomized by Gompers and Lerner (1999), research based on academic point of views from many academic fields such as management, financial economics, and entrepreneurship also started to take off.

Academic research of venture capitalism in Japan only started to take off in the latter part of the 1990s. Hamada noted that in addition to considering the formation of the venture capital industry in Japan and positioning the future strategy investments for venture capital investments, the consideration of venture capitalism from the point of view of Japan's financial system was also important (Hamada, 1996). Kutsuna, when comparing the situations in Japan, US and UK, and discussing the function of venture capital investments when seen from the general finance system, stressed the importance of the strategically relationship between direct and indirect finance in venture financing (Kutsuna, 1997). Yoshida stated that based on his experience in setting up a venture capital fund, the Japanese economic system has a weakness in that venture construction is extremely difficult, and also discussed the efficiency of venture capital creation for a new industry (Yoshida 1998). In addition, Osano discussed the function of venture capitalists in Japan, in the context of financial contract theory (Osano, 2001). Tsuru (2001) addressed the issues of Japan's venture capitalists from a point of view of a comparative analysis of financial systems, and Yoshikawa, Phan and Linton (2004) discussed the risk management of Japan's venture capital firm and governance structure. Furthermore, research related to the valuation of venture capitalists in Japan has been conducted by Ray and Turpin (1993) and Hata and Kamijyo (1996); while research focused on post investment activities has been conducted by Kutsuna (1999), and Hamao, Packer and Ritter (2000). Empirical studies on the relationship between venture capitalists involvement and the performance of portfolio firms, as well as research addressing the post-investment activities of venture capitalists in Japan while taking into account empirical research of venture capitalists in England has been conducted by Higashide and Birley (1999), and Hata and Higashide (2000). Furthermore, Hasegawa (2004) addressed investments by venture capitalists in early stage firms, and Masuda (2006) discussed the function of venture capitalists in high-tech startups.

In this study, I review the existing literature in order to elucidate the investment processes of venture capitalists from the pre-investment stage to the post-investment stage, with a focus on venture capitalists who invest in new technology based firms. Additionally, I discuss factors associated with growth stages and factors associated with technology separately, with regard to the function of these venture capitalists.

2. Investment process of venture capitalists

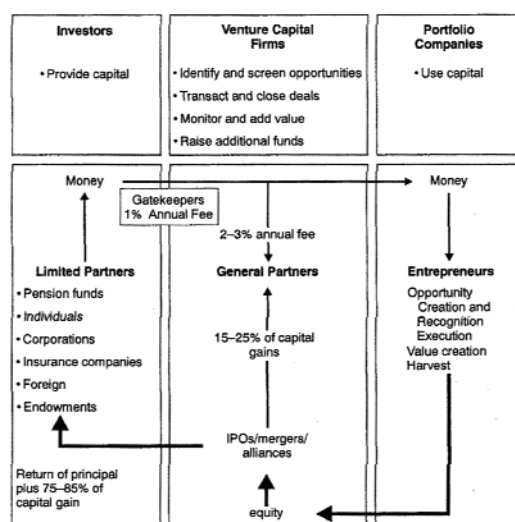
2.1. Capital provider

Venture capitalists essentially raise money from institutions and individuals for investment in unlisted companies that are relatively high-potential but accordingly high-risk. New technology based firms are not the only investment targets for venture capitalists. Besides the conventional industrial fields or management buyouts, venture capitalists also provide capital to cultivate later-stage enterprises. However, venture capitalists have been shown to play important roles in the development of entrepreneurial new technology based firms in the U.S. such as Intel, DEC and Sun Microsystems. Florida and Kenny claimed that “there is little doubt that venture capital plays a critical role in high technology entrepreneurship and economic change. Clearly, the vibrancy and rapid growth of California’s Silicon Valley and Boston-Route 128 area owe much to the significant amounts of venture capital available there (Florida and Kenny, 1988)”. Furthermore, according to an OECD study, “relative to GDP, venture capital investment is quite small, but it is a major source of funding for new technology-based firms. It plays a crucial role in promoting the radical innovations often developed by such firms (OECD, 2003)”. Firms that aim to grow quickly are extremely dependent on the capital provided by venture capitalists. However, for early stage firms with intrinsically weak management, there are limited alternative methods to obtaining resources. Furthermore, R&D funds for new technology based firms are very high, and therefore increase this degree of dependency on venture capitalists (Pfirrmann, Oliver, Udo Wupperfeld and Josh Lerner, 1997). Black and Gilson describe venture capital as “investment by specialized venture capital organizations in high-growth, high-risk, often high-technology firms that need capital to finance product development or growth and must, by the nature of their business, obtain this capital largely in the form of equity rather than debt.”, and go on to point out that some advanced countries have acknowledged the efficiency of the U.S. venture capital model and sought to emulate it without success (Black and Gilson, 1998).

2.2. Financial inter mediator

Chan, in one of the pioneering studies that focused on the financial inter-mediator function of venture capitalists, stated that venture capitalists help to assuage the problems of adverse selection in venture capital investments, to administer and pass along the capital collected from investors to ventures that have the possibility of quick growth, and are financial mediators that provide societal and economical welfare. In a venture capital market where all investors have positive information costs, entrepreneurs are induced to offer inferior projects, and this results in investors avoiding the market and placing their funds in other low return investments, thus leading to an undesirable allocation of resources (Chan, 1983). In markets such as these, the presence of an information asymmetry between investors and entrepreneurs will result in investors being unable to distinguish between promising ventures and those that are not, and therefore there is an increased risk of the investor investing in an inferior venture. This will cause increases in capital costs, may deter promising ventures due to high costs for capital procurement, and finally result in a phenomenon where investors are unable to invest in promising ventures.

According to Bygrave and Timmons, venture capitalists, as financial mediators between investors and ventures, have the following investment process (see Figure 1): at the stage of composing funds, venture capitalists become general partners, while other investors provide remaining required capital and become limited partners. General partners legally have operation liability and bear unlimited responsibility for liabilities associated with partnership. In terms of costs, in addition to receiving 2-3% of annual total fund for operation remuneration, they can also receive 15-25% of capital gains obtained during operations. In contrast, the responsibility of limited partners is limited to the boundaries of capital investment, and they also have a requirement to pay commissions to the general partners. Limited partners are able to receive 75-85% of the cash and stocks of the distributed funds after deducting the portion of the general partner (Bygrave and Timmons, 1992).



2.3. Investment process of venture capital

2.3.1. Pre-investment activities

operations by themselves, and their operations includes assessing received business plans, contact the appropriate target investors and develop investment plans. Venture capitalists in the U.S. regularly receive approximately 10 applications daily, and only about 3 out of every 1,000 applications are able to obtain contracts for investments (Hamada, 1996).

The proposal of a business plan by entrepreneurs is one of the most important aspects of pre-investment activities. This business plan sets benchmarks for investment price and investment contract conditions and contributes to alleviating the unavoidable problem of information asymmetry (Nishizawa, 1998). Many entrepreneurs tend to form business plans that focus more on an overly-optimistic forecast rather than feasibility in order to obtain capital from venture capitalists. However, in cases when entrepreneurs are present such optimistic forecasts in their business plans; the venture capitalists are able to discontinue additional investments in subsequent stages. Entrepreneurs, depending on the mechanisms of stage investments of the venture capitalists, sometimes have no choice but to build business plans with the assumption that progress reports will be milestone administered. That is to say, entrepreneurs are made to ensure that their business plans are developed with the highest level of feasibility.

Venture capitalists, when selecting portfolio firms, judge the value of candidate firms based on their business plans. Timmons, in reference to the methods of evaluating firms, introduced such methods as the Venture Capital Method, the Fundamental Method, the First Chicago Method, and Discounted Cash Flow. Out of these methods, the Venture Capital Method estimates the company's net income in a number of years, whereupon the investors plan on harvesting. This estimate will be based on the sales and margin projections presented by the entrepreneur in their business plan. Next, the appropriate price-to-earnings ratio, or P/E ratio is determined. The appropriate P/E ratio can be determined by analyzing multiples companies with similar economic characteristics. The projected terminal value is calculated by multiplying net income and the P/E ratio. Furthermore, the terminal value can then be discounted to find the present value of the investment. Due to the risk involved in these types of investments, venture capitalists use discount rates that range from 35 percent to 80 percent. To determine the investor's required percentage of ownership, based on their initial investment, the initial investment is divided by the estimated present value (Timmons, 1994).

Discount rate when viewed by the venture refers to the capital costs, while to venture capitalists it is the expected internal rate of return. With regard to the expected internal rate of return in each growth stage of firms, the study of Wetzel (1997) on US venture capitalists shows the following results: 80 percent annually at the seed stage prior to establishment of a firm; 60% annually at the start-up stage immediately following establishment of a firm; 50% to 30% annually at the first, second, and third stages of growth; and 25% annually at the bridge stage immediately preceding IPO.

Entrepreneurs, with regards to venture capitalists' valuation, can certainly work to increase the credibility of their business plans in order to reduce expected internal rate of return as the hurdle rates for evaluating the investments by venture capitalists, but as technology levels can influence growth, a high level of potential for growth is needed to convince venture capitalists. On the other hand, it is assumed that venture capitalists will invest in ventures that have a high potential to clear such high hurdle rates.

2.3.2. Post investment activities

Post-investment activities differ for individual venture capitalists. The function of venture capitalists range from many levels, from a very hands-off approach in which there is only provision of capital and almost no further involvement with portfolio firms, to a hands-on approach in which there is a belief in adding value to the portfolio firms, and thus the venture capitalists take almost a daily level of management in the running of the business.

According to Bygrave and Timmons, venture capitalists are not passive providers of capital but active coaches and cheerleaders for the entrepreneurs with whom they work. Furthermore, venture capitalists seek to add value in several ways: identifying and evaluating business opportunities, including management, entry, or growth strategies; negotiating and closing the investment; and tracking and coaching the company; providing technical and management assistance; attracting additional capital, directors, management, suppliers, and other key stakeholders and resources (Bygrave and Timmons, 1992).

Sahlman observed that venture capitalists are actively involved in the management of the ventures they fund, typically becoming members of the board of directors and retaining important economic rights in addition to their ownership right (Sahlman, 1990). The function of venture capitalists is, in addition to providing capital to portfolio firms, providing non-monetary support (Bygrave and Timmons, 1992, Manigart, Sophie, Koen De Waele, Mike Wright, Ken Robbie, Philippe Desbrieres, Harry J. Sapienza and Amy Beekman, 2002). Considerable diversity exists between venture capital industry in different countries, and the notion of non-financial involvement may differ across countries (Sapienza, Harry J., Sophie Manigart and Wim Vermeir, 1996, Wright Mike, Andy Lockett, Sarika Pruthi, Sophie Manigart, Harry Sapienza, Philippe Desbrieres, Ulrich Hommel, 2004). However, in more developed venture capital markets such as U.S, it is assumed that venture capitalists offer more than money, by actively participating in the portfolio companies' management (Black and Gilson, 1997). According to Timmons and Bygrave, successful venture capital investing in technologically innovative firms requires more than just money, as "it is management intensive, requiring very early involvement by venture capitalists in nurturing budding innovators and technology, and thereby bird-dogging and accelerating the emergence of highly innovative technologies" (Timmons and Bygrave, 1986). Sapienza claimed that the greater the innovation pursued by the venture, the more frequent the contact between the lead investor and the CEO, more open the communication, the less conflict of perspective in the venture capitalist-CEO pair, the greater was the value of the involvement and that firms aspiring for more groundbreaking innovations will depend very much on the involvement of venture capitalists (Sapienza, 1992).

With regard to the post-investment activities of venture capitalists, Macmillan, Kulow and Khoylian identify 3 distinct levels of involvement adopted by venture capitalists: 1. *laissez faire involvement*, in which the venture capitalists display limited involvement, 2: *"moderate involvement"*, in which the venture capitalists displays moderate involvement and 3: *"close-tracker involvement"*, in which the venture capitalists displays more involvement than the entrepreneur in the lion's share of his business activities (Macmillan et al., 1989). According to Pfirrmann et al, based on

their comparative case study between U.S. and Germany and upon the classification by Macmillan et al, most of the venture capitalists in both countries do not belong to the first category of laissez faire involvement, and that many German venture capitalists belong to the second category of moderate involvement. U.S. venture capitalists tend to belong to the third category of close-tracker involvement (Pfirrmann et al, 1997). According to Zider, U.S. venture capitalists spend their time serving as directors and monitors, recruiting management, acting as consultants, soliciting business, assisting in outside relationships, selecting opportunities, analyzing business plans, negotiating investments, exiting, with the most amount of time spent on the first three roles (Zider, 1998).

Manigart, et al, in a study based on 229 venture capital firms in 5 countries (U.S., England, France, Holland and Belgium), showed that with respect to the rate of required return in venture capital investment, actions such as specialized investment and diversified investment, as well as monitoring during the growth stage of portfolio firms are highest in the U.S. when compared to the other 4 countries. They claimed that one interpretation is where greater knowledge and venture-assisting competencies are brought to bear, high rate of required return can be commanded (Manigart et al., 2002) and point to the depth of knowledge and value-adding abilities as background to explain the high rate of required return observed in US venture capitalists.

When reviewing the investment process of venture capitalists, it should be noted that one of the components is an assumption that involvement of venture capitalists in post-investment activities has an effect on the rate of required return in pre-investment valuations.

3. The functions of venture capitalists and growth stages of their portfolio firms

3.1. Classic venture capitalists and merchant venture capitalists

Bygrave and Timmons discuss the functions of venture capitalists around the growth stage of portfolio firms. Venture capitalists that actively involve themselves during the early stages of ventures are known as classic venture capitalists. The origins of classic venture capitalism began in 1946 in the U.S., with American Research and Development, the first organized venture capital firm. After the 1980s in the U.S., as the venture capital industry grew in magnitude, there was also an increase of merchant venture capitalists that fulfilled only the role of providers of capital without investment methods where the lead investor actively supported the portfolio firms. Bygrave and Timmons continue to discuss the differences between classic venture capitalists and merchant venture capitalists with regard to investment targets, strategies and post-investment activities. For investment strategies, classic venture capitalists invest in startups and early stage ventures with high market potential and focus on being lead investors, while merchant venture capitalists target relatively cheap publicly-listed companies and management buyouts without much thought for market potential, and remain as co-investors. With regards to post-investment activities, classic venture capitalists focus on increasing value, while merchant venture capitalists rely on financial engineering for quick entry and exits, and exploit hot IPO markets to harvest early and often (Bygrave and Timmons, 1992).

3.2. Diversified investment or specialized investment -pre-investment activities-

According to portfolio theory, factors that affect fluctuations in return on investments can include

the unique factors of individual firms and factors that are shared by all firms. The former refers to unique risk, while the latter refers to market risk. When as many portfolios as possible are mixed during a risk diversification, it is possible to reduce a large portion of unique risk while leaving market risk (Brearley and Myers, 2000). The co-investor investment strategy taken by merchant venture capitalists is a diversified investment strategy based on portfolio theory. This diversified investment strategy can be described as “Trade the horse before the horse dies” (Bygrave and Timmons, 1992), with investments diversified by several criteria, and a quick withdrawal from portfolios that do not appear to be able to produce the expected results.

On the other hand, the lead investor investment strategy adopted by classic venture capitalists is known as specialized investment strategy. In portfolio theory, if all other conditions are similar, the risk of portfolio firms that are insufficiently diversified is higher than portfolio firms that are sufficiently diversified. Specialization at a particular growth stage and industry has a strong correlation with the results of an investment in a portfolio. However, due to the active participation of classic venture capitalists in post-investment activities, when venture capitalists are observed individually, it is natural that there are limits to the number of possible portfolio firms that can be supported. Therefore, the specialized investment strategy of classic venture capitalists is supported by a resource-based approach. Classic venture capitalists that adopt this specialized investment strategy require a high level of valuation capability.

3.3. Value protecting or value adding -post investment activities-

There is the existence of an issue of whether the post-investment activities of venture capitalists involve value protection or value addition (Manigart et al., 2002). Prior studies involving the post-investment activities of venture capitalists usually centre on research approaches which focus on value protecting and research approaches which focus on value adding. For research approaches that focus on value protecting, the function of venture capitalists is to provide capital to ventures, and to act from the position of value protectors of the capital provided. Merchant venture capitals tend to adopt a hands-off approach with little involvement with the portfolio firms, or a reactive approach with involvement only in times of emergencies. However, a value adding approach would involve the venture capitalists participating in more functions than simple capital provision, from the viewpoint of value adding, and classic venture capitalists, which take a hands-on approach, will have active involvement with the portfolio firms. In this kind of research approach, focus is on the involvement of the venture capitalists outside of capital provision.

3.3.1. Value protecting

Venture capitalists, as value protectors, take the function of reducing agency costs between investors and entrepreneurs. The moral hazard in venture capital investment is the phenomenon of entrepreneurs not participating in behavior that will benefit investors. The function of venture capitalists as principals is more to reduce the agency costs than to closely monitor the entrepreneurs as agents. Entrepreneurs that have information that will result in personal benefits but represent low returns for investors will hope to continue their enterprise and tend to pursue the strategy that will

result in an increase in their own value at the cost of loss to investors. As such, there is concern that venture capitalists will not produce a perfect mutually-dependent relationship between entrepreneur's personal benefits and investor returns (Gompers, 1995).

From the context of agency theory, the bulk of research tends to focus on value protection of venture capitalists. According to Gompers, an empirical study based on 794 firms that received investments from venture capitalists from 1961 to 1992 showed that as the lower the proportion of tangible assets belonging to industry of portfolio firms, the shorter the period till the next investment. Furthermore, the earlier the stage of the firms and the lower the ratio of tangible assets, the higher the proportion of options and specialty of the assets. Due to this, information asymmetries are highly significant, with venture capitalists concentrating investments in early stage companies and high-tech firms where monitoring is more valuable. Monitoring contributes to the increase in value of portfolio firms if appropriately conducted (Gompers, 1995). According to Lerner, in an empirical study consisting of 271 biotechnology venture firms from 1978 to 1989, apart from the periods of time immediately prior to and after the changing of a CEO, board members additionally dispatched by the venture capital averaged at 0.24 people, while this number increased to 1.75 people around the time of CEO changes. It was further pointed out that during the period of CEO change, in which the need for monitoring became especially high, there was much higher participation of venture capitalists in the board of directors of their portfolio firms. Lerner also showed that for more experienced venture capitalists, there was a strong trend of selecting venture capitalists/firms with the same amount of experiences as syndicate partners, and the formation of venture capitalists' syndicates are one of the major reasons for the improvement of accuracy in monitoring (Lerner, 1995).

3.3.2. Value adding

With respect to venture capitalists functions outside of capital provision, research by those holding the viewpoint that venture capitalists add value are theoretically supported by the concept that classic venture capitalists act with a hands-on approach. With respect to research that takes an approach with a focus on value protecting, for venture capitalists as investors, there is a trend of an assumption that there is no direct influence on the ability of entrepreneurs to generate returns. However, for an approach which focuses on the value adding aspect of venture capitalists, there is the assumption that it is possible to directly influence the ability of entrepreneurs to generate returns, and this is supported by a resource based approach (Manigart et al, 2002). According to Barney, "sources of sustained competitive advantage are firm resources that are valuable, rare, imperfectly imitable, and non-substitutable. These resources include a broad range of organizational, social, and individual phenomena within firms that are the subject of great deal of research in organization theory and organizational behavior may be a rich source of findings and theories concerning rare, non-imitable, and non-substitutable resources in firms" (Barney, 1991), and that the resource-based approach of sustained competitive advantage of firms has usability. Nonaka and Takeuchi indicate that resource-based approach sees competencies, capabilities, skills, or strategic assets as the source of sustainable competitive advantage for the firm (Nonaka and Takeuchi, 1995).

According to Brav and Gompers, in a study that followed the long-term stock value performance

in newly listed firms from 1976 to 1994, it was found that when analyzing the relationship with venture capital investments, poor stock performance of newly listed firms are shown by small-scale firms with no investments from venture capitalists, and that newly listed portfolio firms of venture capitalists show higher performance than those firms with no investments (Brav and Gompers, 1997). According to Hata and Higashide, in Europe and the U.S, the quality of value adding activities are the most important point for evaluating venture capital and venture capitalists (Hata and Higashide, 2000). There are numerous studies that have shown that venture capitalists add value to portfolio firms during post-investment activities based on specialized knowledge (Jain and Kini, 1994, Hellmann, 2000, Hellmann and Puri, 2002).

With regard to the value-adding abilities of venture capitalists, Barney Jay B., Lowell W. Busenitz, James O. Fiet and Douglas D. Moesel conducted an empirical study that analyzed the learning effectiveness of the management team of ventures based on advice and support from venture capitalists, in a sample of 203 portfolio firms in the U.S. In that study it was found that ventures with management teams with longer industry experience and team tenure would be less likely to accept business management advice and operational assistance from venture capitalists. However, ventures with management teams that had previously worked together and held primary experience from another industry were more open to business management advice from venture capitalists and also that appropriate levels of support from the venture capitalists were dependent on the openness of the venture with respect to learning (Barney et al., 1996). According to Higashide and Birley, high levels of involvement of venture capitalists with portfolio firms need to be supplemented by “good interpersonal relationships between the venture capitalists and the portfolio firm team members. In a later empirical study that focused on venture capitalists in England, Higashide and Birley pointed out that while it is possible for conflicting opinions to positively affect venture performance, conflict at the personal level can negatively affect performance (Higashide and Birley, 2002). According to Busenitz, Lowell W., James O. Fiet and Douglas D. Moesel, in a study from 1987 to 1989 that focused on the long-term performance of 235 portfolio firms under venture capitalists in the U.S., in a correlation analysis of the provision of strategic information from venture capitalists, rotation of the management team, and the procedural just interventions of the venture capitalists and management team, it was found that only the procedural just interventions were significantly associated with improved performance, which this points to the importance of this aspect in the involvement of venture capitalists (Busenitz, et al., 2004). De Clercq and Sapienza, in an empirical research that focused on 298 venture capitalists in the U.S., showed that the social capital formed by the venture capital firm and portfolio firms, as well as the level of involvement of the venture capital firm in portfolio firms are strongly correlated to the performance recognition of portfolio firms under venture capital firms (De Clercq and Sapienza, 2006).

4. The functions of venture capitalists and technology of their portfolio firms

4.1. Factors of new technology

According to Pfirrmann et al, new technology based firms perform complex innovation projects, therefore incurring high innovation risks (such as commercialization of technology, marketing) and

business risks (bankruptcy of firms). New technology based firms have a high demand for capital that remains liquid in the long term. Ascertaining the risk and future development of firms, as well as estimating the total essential capital required is very difficult for investors, especially indirect financial institutions. Together with the absence of real assets, banks are hesitant to finance the initial developmental phases of new technology based firms. However, the injection of capital to the portfolio firms needed to deal with financial problems may not be reduced or spread over a long time as there is the risk that innovations would not occur favorably, or competitive advantages gained over competitors may be lost (Pfirrmann et al., 1997). Also, they pointed out 3 factors of new technology based firms' risk include innovation risk (commercialization of technology, marketing), business risk (bankruptcy of firms) and financial risk involving large sums of R&D capital.

With respect to innovation risk (commercialization of technology, marketing), Baum and Silverman state that new technology in particular is dangerous with high risk (Baum and Silverman, 2004), with the reasons being that market based on new technology is still undeveloped and unforeseeable, and the blinding speed at which new technology becomes obsolete. According to Kirihata, nanotechnology²⁾, as one of the domains in promising new technology, breakthrough developments in fullerene and carbon nanotubes occur one after another, showing the high speed of obsolescence and stiff competition including materials and manufacturing machines that exists in the domains of new technology, thereby pointing out high risks in enterprises based on new technology (Kirihata, 2005).

For "financial risk", Hata and Higashide point out that investments in new technology based firms that are based in new technologies such as IT, biotechnology and nanotechnology, that in order to start up an enterprise in a short period of time in a market with changes, there is high requirements for not only manpower but also massive amounts of capital injection. As such, this increases financial risk. Furthermore, they also pointed out that highly innovative ventures have more potential to mature, and if they succeed will be able to produce high returns (Hata and Higashide, 2000).

According to Kazusa, the life cycle of ventures consists of start-up, maturation, stability and degeneration, and furthermore, a special characteristic is that there is a necessity for large sums of R&D capital during the initial stages. In the case of entrepreneurs who are able to use one's own resources, this is not such a problem but such cases are rare. For most entrepreneurs, the procurement of capital is of the utmost importance (Kazusa, 2003). According to Hasegawa, in the case of U.S. venture capitalists, high-tech firms (biotechnology, nanotechnology and IT), when compared to traditional firms, require much higher amounts of capital during initial stages, and there is a necessity to conquer this "Valley of Death" (Hasegawa, 2004). Furthermore, in new technology based firms investments, the newer the technology and the earlier the stage, the higher the amount of capital required.

4.2. Necessary abilities for investing in new technology based firms

2) OECD (2003) defines nanotechnology as a range of new technologies that aim to manipulate individual atoms and molecules in order to create new products and processes: computers that fit on the head of a pin or structures that are built from the bottom up, atom-by-atom.

Baum and Silverman, in a study of venture capitalists that invest in biotechnology firms in Canada, analyzed if success is due to venture capitalists selecting excellent entrepreneurs or the presence of strong support after investments. First, in an analysis of the valuation of main potentials of technology start-ups, in addition to showing the framework that consists of alliance capital, intellectual capital and human capital, venture capitalists affect selection both by acting as a scout that can identify future potential in excellent technologies as well as a coach to help realize this potential by imparting management skills (Baum and Silverman, 2003).

Furthermore, Masuda claimed that for venture capitalists that focus their investments mostly on high-tech start-ups, in addition to digging out promising ventures, providing capital and support, there is a requirement for the ability to be selected as partners by researchers who produce the cutting-edge technology, to plan enterprise concepts, and to assemble an entrepreneur team (Masuda, 2006). Hasegawa also pointed out that the important functions for such venture capitalists include strategic planning, advice as a mentor, marketing, finance and recruitment. Furthermore, in a comparison of Japan's venture capitalists and U.S. venture capitalists, in the case of high-tech industries such as biotechnology, nanotechnology, IT, it is essential to recruit specialists with specialized skills, but in the case of ventures in Japan, it is difficult to procure specialists even if headhunting companies are used. In Japan, it is important for venture capitalists, in addition to introducing appropriate human resource using networks in the industry, to judge the competency of company executives to offer counsel regarding replacements, and in general support human resource (Hasegawa, 2004).

5. Summary and Discussion

5.1. Summary

In this study, I have reviewed the existing literature in order to elucidate the general investment processes of venture capitalists from the pre-investment stage to the post-investment stage, with a focus on venture capitalists who invest in new technology based firms. I then separately discussed factors associated with growth stages and technology and their connection to the function of venture capitalists.

With respect to investment processes of venture capitalists, Manigart et al. claimed that the post-investment activities of venture capitalists will influence the rate of required return in pre-investment valuations. Bygrave and Timmons discussed the function of venture capitalists that revolves around the growth stage, and stated that venture capitalists that invest in early stage ventures must have, in addition to the astute ability to select promising portfolio firms, the ability to support and add value to the portfolio firms after investment. With respect to venture capitalists that invest in new technology based firms, Pfirrmann et al stated that consideration must be given to the 3 types of risk; namely business risk, innovation risks and financial risks (Pfirrmann et al., 1997). Baum and Silverman maintain that venture capitalists investing in new technology based firms are likely to consistently combine both scouting for excellent technology as well as being able to coach by imparting management skills (Baum and Silverman, 2003).

5.2. Discussion

Bygrave and Timmons observed that, in the venture capital industry in the U.S., “With no technological, regulatory, legal, or capital requirements barriers to impede them, new entrants flocked to the industry in the 1980s. Entry was also fairly swift. Angels, foreign investors, and corporations became increasingly active in providing capital to these companies”, point out the importance of differentiation from competitors and potential new participants, and also that “opportunity for those who focus on value-adding and peril for those who bring only capital to venture capital deals (Bygrave and Timmons, 1992)”, implying that in order to preserve a competitive advantage in the venture capital industry, there is the importance of providing something more than just capital. Hamada has stated that it is necessary for venture capitalists to exercise creativity in order for venture capitalists to stay on the edge of the financial world, and not just parasite entrepreneurs. Parasitism in venture capitalism refers to when the venture capitalists only try to obtain profits from the entrepreneurs (Hamada, 1996), while creativity, on the other hand, occurs when the venture capitalists work hard together with the entrepreneurs and participate in improving the value of the portfolio firms (Hamada, 2002)

With the rise of the developing nations, and the escalation of global economic competition, the commercialization and industrialization of new technologies such as biotechnology and nanotechnology is promising for the revitalization of the economies of Japan and other industrialized nations. The creation of ventures based on these new technologies is one of the important options for commercialization and industrialization, and it is desirable that during this creation process, venture capitalists not simply parasite high tech entrepreneurs, but instead provide value to them and exercise originality.

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