Impacts of Venture Capital on Development
of Sichuan High-Tech Enterprises

Zhen Zhang & Qizhi Yang

Sichuan Agricultural University, Chengdu 611130, China

E-mail:zhangzhen0223@sina.com

Abstract

The international financial crisis is encouraging new science and technology revolution and industrial revolution. To accelerate the transformation of economic development mode is urgent. We must pursue for an innovative development. Venture capital will play a greater role in the process. In this paper, authors start from describing the current development of venture capital and high-tech enterprises in Sichuan province, and make a model analysis of them. By means of a case study of Chengdu Geeya Technology Co., Ltd, authors conclude that there is a strong correlation between venture capital and high-tech enterprises. Sichuan province should focus on developing venture capital and promoting the development of high-tech enterprises.

Keywords: Venture capital, High-tech enterprise, Development

1. Introduction

Today, the world new technology revolution flourishes and the trend of economic globalization grows. High technologies and the industry pioneered by information technology are in a sudden emergence. Humans are entering an age of knowledge economy. High technologies are increasingly becoming the booster of social economic development. To change high technology into productivity, we must develop venture capital. From the current conditions of Sichuan province, venture capital is not the "catalyst" for the development of high- tech enterprises. The venture capital of Sichuan province is insufficient for the transformation of scientific and technological achievements and the development of scientific and technological enterprises. There is an urgent request for studying the effective integration of venture capital and high-tech enterprises in Sichuan province.

China's venture capital starts in the mid-80s. After entering the 90s, a large number of international venture capital funds and companies rush into China, inputting more funds into China's venture capital industry, bringing about new risk management technologies and standard risk operation mechanism, and finally promoting the development of China's venture capital industry. During the late and mid-90s, the venture capital industry develops fast in China. From 1997 to 2000, the average annual growth rate of venture capital agencies reaches 68.7%, and the average growth of total venture capitals reaches 74.6% over the same period (Fugong Yu, 2009). Promote the development of high-tech industry by developing the venture capital industry and achieve the economic growth. Compared with developed countries, although China's venture capital industry faces more problems, its development supplies sound bases for the development of local venture capital industry.

2. The development of venture capital and high-tech enterprises in Sichuan province

2.1 The development of high-tech enterprises in Sichuan province

Sichuan province has strengths in science and technology. It has competitive advantages in developing the high-tech industry. Firstly, Sichuan province has rich scientific and technological resources: 78 colleges and universities, 30 national scientific research institutes, 11 key national laboratories, 10 key national laboratories of defense technology, 11 national engineering technology centers, 22 national enterprise technology development centers, and 1,590,000 professionals (ranking No.6 in China, including 59 academicians). The comprehensive scientific and technological power of Sichuan province is at the top level in China (Jiming Cai, et al., 2010, p75-77). Secondly, Sichuan province has superior fields. Lots of national backbone enterprises, such as Dongfang Electric Corporation, Pangang Group, and Erzhong Group, have gained initial achievements in six fields: electric information, aeronautics

and astronautics, advanced manufacturing, new materials, biological engineering, nuclear technology, and new energy.

The contribution of high-tech enterprises rises steadily. In 2009, the added value of high-tech industry in Sichuan province is 124.14 billion Yuan, nearly three times in 2006. The contributed share to Sichuan GDP rises from 4.9% in 2006 to 8.8% in 2009. The industrial added value share rises from 13.4% to 21.8%. The contribution rate to GDP rises from 7.97% to 24.7%. The percentages in 2008 drop slightly, because of the international financial crisis and Wenchuan earthquake. But in 2009, it recovers quickly and realizes substantial growth (see Table 1).

The proportion of R&D expenses from government decreases annually. In Sichuan province, the R&D expenses are mostly from provincial government, accounting for 50% of the total. Few are from enterprises or individuals. But in recent years, the proportion of funds from government decreases annually, from 55.57% in 2003 to 42.15% in 2007 (the data in 2008 is an exception due to the impacts from international financial crisis and Wenchuan earthquake), and the proportion of funds from enterprises rises gradually (see Table 2).

Most high-tech enterprises are private. In 2009, the number of national high-tech enterprises is more than 1000 in Sichuan province, being the seventh in China. Sichuan has 40,000 high-tech enterprises statistically, at a leading position in western area considering the development speed and quality. From the composition of high-tech enterprises in Sichuan province, 44.1% are state-owned, 45.7% are private, and 10.2% are funded by Hong Kong, Macao, Taiwan, and foreign agencies. These percentages indicate that we should introduce more Hong Kong, Macao, Taiwan, and foreign-owned enterprises into the high-tech industry in an open way. The large proportion of R&D expenses from private enterprises means that more and more enterprises emphasize on high technologies, and seize the opportunity of developing economy by high technologies.

Three reasons contribute to the fast development of high technologies in Sichuan province. The primary reason is that Sichuan province has lots of innovative scientists and rich high-quality resources. It is a province with advanced science and technology, developed military industry, and rich talents. But it still needs venture capital. Secondly, Sichuan has good economic environment and comfortable life environment. It is well known that Chengdu is a city persuading people to stay. Chengdu is the place for pleasure, innovation, and entrepreneurship. People can do business and enjoy life at the same time. Thirdly, provincial government carries out the policy of encouraging innovation.

2.2 The development of venture capital in Sichuan province

The period from 1999 to 2002 is the golden term for venture capital agencies in Sichuan province. Triggered by the rise of Hong Kong GEM (Growth Enterprise Market) and the preparation of domestic GEM, not only local venture capital agencies have been established in Chengdu city, but some foreign venture capital firms set up branches and invest in high-tech projects there. However, afterwards it has been in a downturn state. Till 2009 the GME has been approved, venture capital agencies are alive again. But generally speaking, the venture capital industry in Sichuan province is still at the starting stage, lagging far behind the provincial economic development and the development of eastern venture capital industry. Especially, the undeveloped local venture capital agencies can not satisfy the real needs of western economic development. There is a large space for developing venture capital market in Sichuan province.

In Sichuan province, the local venture capital agencies do not grow well. Till late 2008, venture capitals from Chinese venture capital agencies are 250.616 billion Yuan RMB, and in the year of 2008 the total are 33.954 billion Yuan RMB. Only 6.62% (about 1 billion Yuan RMB) are from mid and western venture capital agencies, of which 70% have government background. Sichuan province just has two national high-tech zones respectively in Chengdu and Mianyang. And the venture capital agencies are mostly in Chengdu, few in Mianyang. The majority of venture capital agencies centers in Chengdu. There are about a dozen venture capital agencies in Chengdu. However, most venture capital agencies are merely in the name of venture capital but focus on services or traditional investment business (Gongmeng Chen & Xinying Cai, 2009).

Sichuan province is lack of professionals of venture capital. Venture capital professionals are complex talents with the professional knowledge of scientific research, finance, securities, and market, a sense of venture capital and competition, and experiences in capital market. However, local venture capital starts late in Sichuan province and lacks of a strong financial background and experienced investors who know the high- tech industry well. A survey shows that managers in most venture capital agencies are not professional, who may know finance but not high technologies, or know technologies but not finance. Therefore, it is necessary to strengthen talent training, accelerate the pace of continuing education for venture capital talents, and focus on cultivating new professionals of venture capital.

The government encourages the development of venture capital. Since 2009 the government has hold two meetings for "High-Tech and Venture Capital in Western China" and signed dozens of contracts successfully, helping many high-tech enterprises get venture capital. Create the GEM (Growth Enterprise Market) and establish a solid foundation for the exit of venture capital. Venture capital agencies are not afraid of capital "rushing in but not out". One year later, more than 130 enterprises are listed in GEM, and there are six from Sichuan, including Guibao Tech, Gifore, Geeya Technology, Kexin Mechanical and Electrical Equipment, Goldtel Electronic Technology, and Galaxy Magnets, of which five register in Chengdu. These are beautiful prospects for the success of Sichuan venture capital industry.

By analyzing the conditions of Sichuan high-tech industry and venture capital market, we know that Sichuan province has rich high-tech resources and active technological market. The venture capital market develops gradually under the direction of government. However, venture capital does not exert the effect on high-tech enterprises fully in Sichuan province. The combination between them is not close. In the long run, domestic and foreign experiences prove that only when venture capital plays the roll well in high-tech enterprises, can it really promote the local economic growth, achieving fast economic growth. Therefore, the effective integration of venture capital and high-tech enterprises in Sichuan province is the object of current urgent research.

3. The theoretical relation model of venture capital and high-tech enterprise

Venture capital market is the carrier of knowledge capital, industry capital, and financial capital, and the innovative institution for the development of high-tech enterprises. High technologies can not become real productivity unless realizing industrialization. Here, we establish a theoretical model to illustrate the relation of venture capital and high-tech enterprise.

In the model, assume that venture capital is only part of funds needed by enterprise, and the high-tech enterprise has two sources of funds: venture capital and bank loans and the entrepreneur can not borrow loans from banks unless getting venture capital. The loan interest rate r_f is risk-free. The venture capital is high- risk share capital, and the expected yield $r_s > r_f$. The total investment of start-up enterprises is I and the net present value of profits is V_r.

Suppose r with two values. As the enterprise successes, $r = r_g$, $r_g > r_f$, and the probability of success is P. As the enterprise fails, $r = r_b$, $r_b < r_f$, and the probability of failure is $(1 - P)$. Meanwhile, the return of a successful enterprise is determined by whether there is an active GEM, ensuring venture capital benefiting from "gold harvest". The return of successful enterprise is the random function of degree of small-company stock market maturity, $r_g = f(S) + \varepsilon$. Here, S is random variable usually reflected by GEM transaction growth rate or changes of return. Because of uncertainty of high-tech enterprise, the value of r is unknown. But venture capitalist can predict its value by his or her knowledge of technology, commerce, and enterprise. If the investment of venture capitalist $I_v < I$, the entrepreneur has to get loans from banks $L = I - I_V$. According to banks' risk-free rate, get $Lr_f \le Ir_g$. Meanwhile, as venture capitalists buy shares, he or she hopes to maximize the investment. Therefore, the optimal investment is:

$$Min \ (I - I_V)r_f \le Ir_b \tag{3.1}$$

From (3.1), get: $I_v^* = (1 - r_b / r_f)I$; $L^* = I - I_V^* = (r_b / r_f)I$

From the optimal solution, we can get the venture capitalist's expected return r_s:

$$r_s = [(1 - P)r_b + P \cdot r_g)I - L^* r_f] / I_V^* = P(r_g - r_f) / (1 - r_b / r_f) \tag{3.2}$$

Suppose there are N start-up enterprises in the society. N_{it} means the new thought from an entrepreneur is presented in industry i during the period of t. When certain enterprise gains success, the return is a random variable. Suppose r_g submit to the following independent index distribution:

$$P_r (r_g \le x) = 1 - e^{u(x - r_b)}, x \ge r_b \tag{3.3}$$

As a venture capitalist selects a target from amounts of projects, he or she sets the minimum profitability $\bar{r}$. Then, the critical value of the venture capitalist j is $\bar{r}_j$. Other venture capitalists also have a critical $\bar{r}_{i \ne j}$. The entrepreneur should find out the venture capitalist with lowest critical value in order to get venture capital. Under

the Nash Equilibrium, each venture capitalist will choose $\bar{r}_i = \bar{r}^*$. Plug $\bar{r}^*$ into the equation (3.2), then:

$$r_s = [P(r_g - r_f)/(1 - r_b/r_f)|r_g \geq \bar{r}^*]$$

$$= \frac{u \cdot r_f E(r_g - r_b)}{r_f - r_b} = \frac{u \cdot r_f(\bar{r}^* + u^{-1} - r_b)}{r_f - r_b} \tag{3.4}$$

Use the equation (3.4) to get the value of $\bar{r}^*$ $\bar{r}^* = \frac{r(r_f - r_b)_s}{r_f \cdot P} - \frac{1}{u} + r_b$ (3.5)

Then, the probability of one enterprise getting venture capital is:

$$F = P_r(r_g > \bar{r}) = e^{-u(\bar{r}^* - r_b)} = EXP[1 - \frac{u \cdot r_s(r_f - r_b)}{r_f \cdot P}] \tag{3.6}$$

From the equation (3.4), we know that r_s is the function of r_g. So, in equation (3.6), F is also the function of r_g. For one start-up enterprise, whether getting venture capital is directly associated with the return r_g of enterprise.

Suppose the average size of venture capital is standardized as 1. Suppose there are N_t start-up enterprises applying venture capital during the time period t, then total venture capital $V_t = FN_t$. Suppose α of start-up enterprises with venture capitals produce patents. The number of patents produced by venture capital is αFN_t. Besides venture capital, entrepreneurs can also find other financial sources to fulfill the dreams. Suppose β of start-up enterprises without venture capital produce patents, then the number of patents is $(1-F)\beta N_t$. So, the total social patents are:

$$P_t = \alpha FN_t + \beta(1-F)N_t = (\alpha - \beta)FN_t + \beta N_t = kV_t + N'_t \tag{3.7}$$

In the equation (3.7), P_t are the total patents in the society. V_t is the total venture capital. The coefficient k reflects the effects of venture capital on technological innovation. N'_t is the constant term in the model. The equation (3.7) proves that venture capital exerts higher stimulating effects on technological innovation than others. Venture capital has a special function. Technological innovation can trigger the development of high-tech enterprises. Finally, we can conclude that venture capital has a significant stimulating effect on the development of high-tech enterprises.

4. A case study of venture capital financing of Chengdu Geeya Technology Co.,Ltd.

In Sichuan province, local venture capital industry does combine closely with high-tech industry. But the province does have some high-tech enterprises that are financed by venture capital in development. Next, we make a case study of venture capital financing of Chengdu Geeya Technology Co., Ltd. Use it to illustrate the development of high-tech enterprises caused by venture capital in Sichuan province. The successful case of Chengdu Geeya Technology Co., Ltd. listing on the market offers a possibility of coordinative development of venture capital and high-tech enterprises in Sichuan province.

4.1 Background of Geeya Technology Co., Ltd. financing

Chengdu Geeya Technology Co., Ltd. (hereinafter Geeya for short) is formally known as "Chengdu Geeya High-Tech Co., Ltd. It was established in November 1999 and its annual turnover is nearly two hundred million. Geeya has always followed the world advanced level, adhering to the business philosophy of "trying to be the technological leader and creating the first class brand". By means of introducing and practicing new technologies and self innovation, Geeya Technology acquires abilities of designing and integrating TV terminal and engineering construction, and experiences. The financing process of Geeya Technology is as follow:

The first step is to obtain private equity investments. Geeya Technology has experienced transfers of equities for many times during the operation. Based on the increment of registered capital, Geeya Technology acquired four times of private equity investments, totally valuing 43.1 million Yuan RMB. Qing Lu and other people are very optimistic about the Geeya Technology. They gained a lot from it (See Figure 1).

The second step is to obtain professional venture capital. In the development of Geeya Technology, with the capital increment, the enterprise won professional venture capitals for three times. In June 2007, the first venture capital was from Beijing Zhengdao Jiuding Investment Co., Ltd., Shanghai Fengze Investment Management Co., Ltd., Shanghai Fengrui Investment & Development Co., Ltd., and Hangzhou Dehui Investment Co., Ltd. Those

enterprises offered 19 million RMB to Geeya Technology. In November 2008, the second venture capital was from Changsha Xin'ao Investment Co., Ltd., which offered 5 million RMB. In June 2009, the third venture capital was from Changsha Xin'ao Investment Co., Ltd., Shenzhen Hangyuanfu Investment Co., Ltd., and Hangzhou Jiaze Investment Co., Ltd. They offered 15.9 million RMB. From these professional venture capitals, Geeya Technology obtained 39.9 million RMB totally. All the investments are one-time injections (See Figure 1).

With the assists of venture capital, Geeya Technology has done four tasks quickly: improving organizational structure, internal management mechanism, enterprise incentive distribution mechanism and market promotion plans, classifying and re-organizing the business, focusing on software development, and partially adjusting enterprise's strategic direction. Besides, with the help of venture capitalists, Geeya Technology achieves technological innovation, develop software programming based on existing system integration business, set up branches in Shenzhen, Beijing, and Shanghai, seizing the key areas of market.

The third step is to achieve financing by market listing. In October 2009, Geeya Technology is the first enterprise listing on GEM successfully in the radio and television field. On October 30, 2009 the stock is in trading at the Shenzhen Stock Exchange, raising net capitals of 391.86 million RMB, more than the planned 206.86 million RMB. Listing on GEM and entering the capital market present Geeya Technology a brand-new platform for development, providing financial support for enterprise's sustaining development, playing a positive rule in brand promotion and standard government, and improving enterprise's competitiveness and profitability. In 2009, Geeya Technology realized the business return of 189,748,592.93 RMB, up 20.52% over last year, and total profits 189,748,592.93 Yuan, up 15.76% over last year (http://www.geeya.cn/).

4.2 An analysis of financing operation in Geeya Technology

Geeya Technology has experienced private equity investment, professional venture capital, and finally listing on GEM successfully. Now we make a case study of Geeya Technology financing, hoping to give some clues to high-tech enterprises' venture capital financing.

Joint-investment is one of characteristics of venture capital. For venture capitalists, joint-investment is a way to reduce risks and costs. For entrepreneurs, joint-investment can help to achieve mutual compensations of venture capitalists, guaranteeing the enterprise with better services. Geeya Technology employed the joint-investment in its four venture capitals and three professional venture capitals. By this way, Geeya Technology acquires more cash investments, reducing investment risks for venture capitalists, and benefiting the sustainable development of venture capital.

Venture capital has two ways to exit. For Geeya Technology, one way is equity transfer. For many private equity investors, as non-professional venture capitalists, they can not exactly know the industry or predict the future market. They are eager to get return from investments. So, to transfer equities before listing on market is a good exit. The other way is public listing. It is optimal for monitoring funds and exiting ways. In The United States, about 30% of venture capitals choose to exit from the market by initial public offering. This way can bring about huge economic benefits and social benefits for venture capitalists and entrepreneurs. In the case of Geeya, the second exit of venture capital was the successful public listing in China's GEM in 2009. It gave Geeya a new financing source and also offered a better exit channel and rich benefits for venture capital. Practices prove that the most ideal financing mode for high-tech enterprises is public listing after financing by venture capital. In 2009, Geeya got total profits of 50,317,945.63 RMB, up 15.76% over last year.

By the empirical analysis of Geeya financing by venture capital, we find that during the whole development process, Geeya continuously won venture capital, which supplied financial support for its fast development. And that is also one reason for the success of Geeya. The development of high-tech enterprises needs the support from venture capitals, and the development of venture capital market has to take high-tech industry as the base.

5. Conclusion

In this paper, by introducing the development of venture capital industry and high-tech industry in Sichuan province, authors find that venture capital does not play its role in Sichuan high-tech industry. Sichuan local venture capital industry is still at the initial development stage. The connection between venture capital industry and high-tech industry is not close. By analyzing the theoretical mode of venture capital and high-tech enterprises and the case of Geeya financing, authors conclude that venture capital plays a crucial role in the development of high-tech enterprises. Venture capitals offer a possibility for the fast development of high-tech enterprise. At the same time, venture capitalists obtain huge profits. Therefore, the development of high-tech enterprises should start from venture capital industry, ensuring the "catalyst" effect of venture capital in high-tech enterprises, and promoting the economic development in Sichuan province. This paper merely studies high-tech industry and venture capital

industry in Sichuan province from the angle of present conditions and relations. As for how to develop the two industries and how to coordinate their relationship, it deserves further study. Because of authors' limited capacities, this paper also has some problems. Authors look forward to suggestions and corrections.

References

Cai, Jiming. Wang, Nan. Mo, Xiaomei & Liu, Keran. (2010). Analysis of high-tech industry development in Sichuan. *Soft Science*. No.7.

Chen, Gongmeng & Cai, Xinying. (2009). A research on the regional differences of Chinese venture capital development. *Securities Market Herald*. No.5.

Chen, Weihua. (2000). *Venture capital on high-tech industry --- experiences from American venture capital*. Hebei: Master Theses from Hebei University.

Chengdu Geeya Technology Co.,Ltd. http://www.geeya.cn/

Ding, Jutao. (2002). *Research on technological innovation driving western economic development*. Shaanxi: Doctor Theses from Northwestern University.

Jiang, Tao. Fu, Xinhong & Jiang, Qian. (2008). A co-integration analysis of public finance technology input and independent innovation in Sichuan Province. *Science and Technology Management Research*. No.12. p27-29.

Li, Meng. (2002). *High-tech industry and venture capital*. Beijing: Master Theses from Capital University of Economics and Business.

Ma, Guangqi & Duan, Lizhi. (2010). Empirical analysis of high-tech venture capital development --- a case study of Wenzhou city. Communication of Finance and Accounting. No.8. p8-9.

Mo, Guihai. (2007). Research on function mechanism of venture capital intervention in the high-new-tech industrial clusters up-growth. Science and Technology Management Research. No.1. p56-59.

Science and Technology Department of Sichuan Province. http://www.scst.gov.cn/info/

Sichuan Statistics Information Network. http://www.sc.stats.gov.cn/

Wang, Xuli. (2009). *On the venture financing mode for high-tech enterprises*. Tianjin: Master Theses from Tianjin University of Technology.

Yu, Fugong. (2009). *High-Tech Industrialization and Venture Capital Market*. Beijing: People's Publishing House.

Table 1. The high-tech industrial added value and the contribution to GDP. (100,000,000 Yuan)

Year	GDP	GDP increment	Industrial added value	High-tech industrial added value	Contribution percentage of high-tech industry to GDP	Increment of high-tech industrial added value	Contribution rate to GDP (%)
2006	8637.8	1252.7	3144.7	422.7	4.9	99.8	7.97
2007	10505.3	1867.5	3860.6	627.3	6.0	204.6	10.95
2008	12506.3	2001.0	4939.3	835.8	6.7	508.5	10.42
2009	14151.3	1645.0	5678.3	1241.4	8.8	405.6	24.70

Source: Sichuan Bureau of Statistics, Science and Technology Department of Sichuan Province, Statistical Statement of Sichuan High-Tech Industry in 2009.

Table 2. Sources for R&D expenses in Sichuan province. (10,000 Yuan)

Sources	2003	2004	2005	2006	2007	2008
Government	441331	361701	438399	473458	586403	768660
Enterprises	257502	356951	456173	551310	731824	787050
Foreign sources	5484	3743	3966	1390	1832	3727
Other sources	89895	57672	63912	49501	71071	63171
Total	794211	780066	962450	1075659	1391130	1622607
Proportion of R&D expenses from government (%)	55.57	46.37	45.55	44.02	42.15	47.37

Source: Sichuan Statistical Yearbook 2009.
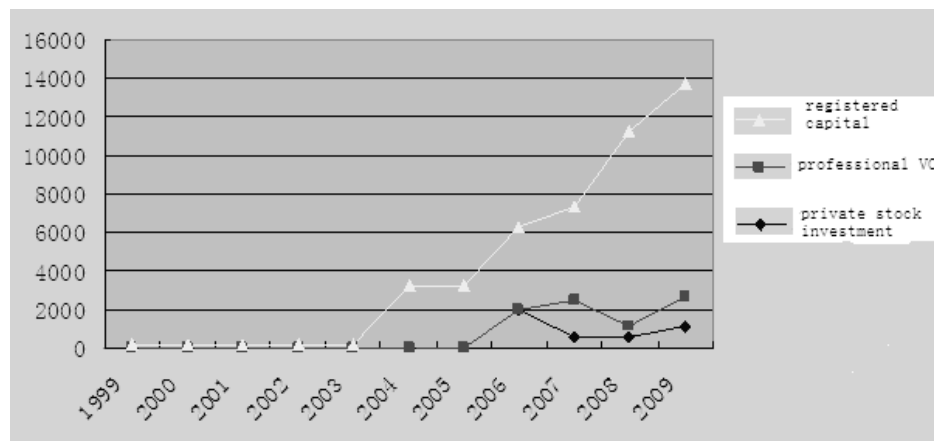
Figure 1. Geeya's Financing by Venture Capital. (Unit: 10,000 RMB)