

# Research on VC and PE Industry Chain Symbiosis Relationship and Mode

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**Abstract:** *This article analyzed VC and PE symbiotic relationship which combined the characteristics of VC, PE and their industry chain based on the symbiotic theory. It will identify and describe the VC and PE industry chain symbiosis mode. Moreover, it will use symbiosis analyze Method to study two kinds of symbiosis modes and the overall mode of symbiotic development. Based on the above research, derived the whole VC and PE symbiotic system. With the adaptation to the symbiotic and itself evolving, the VC and PE symbiotic system will evolve into the integration mutualism symbiotic mode which is the most ideal. Finally, this paper puts forward the harmonious development path for VC and PE in china achieving the reciprocity continuous symbiotic from improving the symbiotic environment and enhancing the symbiotic units viewpoints.*

**Keywords:** VC; PE; Industry Chain; Symbiosis Mode

## 1. Introduction

Researches show that VC and PE are extremely important for enterprise growth and development. The theorists focus on the relationship between VC and PE in recent years. The investments of every stage support the innovating enterprises during its rapid growth by the successful business such as Apple, alibaba, IBM and so on. Venture Capital and Private Equity form the industry chain from the different invest stage preference. This industry chain can meet financing needs of different stages. As capital amplifier, risk conditioner and enterprise incubator, the industry chain promotes the development of innovating and traditional enterprises. From the ecology view, VC and PE relevant economic symbionts based on the relation between supply and demand under the certain symbiosis environment, they can create and share profit through some kind of symbiosis model.

## 2. Literature Review

Germany Biologist Anton De Bary(1879) proposed symbiosis concept, that is different organisms live together closely. Economists and managerialists try to use the symbiosis theory in the economic life through developing and perfecting. Frosch and Gallopoulos(1989)proposed industrial ecology and industrial ecological system based on symbiosis theory, hereafter symbiosis theory begin to be widely used in industry research. Bradford(2003) summarized the symbiosis and evolution path of biotechnology industry and venture capital industry chain through analyzing the development history of venture capital industry in America. Lerner(1999) indicated that colleges and universities would like to establish independent VC department on account of the investment scope limitation after he researched the symbiosis relationship of

VC and academic community. Then he took examples and demonstrated various problems about venture capital funds based on colleges and universities. Avnimelech and Teubal(2004) combed the development process of venture capital in Israel, and conclude that venture capital funds push the developing of innovative enterprises. They also analyzed the co evolution and dynamic growth of VC and innovative enterprises by methods of variation, selection and reproduction. Avnimelech and Teubal (2006) analyzed the symbiosis and evolution of VC and high-tech industry in Israel by the industry life cycle model. In China, Yuan chungqing(1998) formulated the symbiosis theory on the base of economic perspective for the first time, and researched the small business problems. Venture capital clusters symbiosis were divided into homogeny symbiosis, diversity symbiosis and compounded symbiosis by Yang Qing and Zhang Lily(2010) , they established network type symbiosis model, satellite model and combined type model of venture industrial capital cluster, and through the empirical research to test in Wuhan. The related research of scholars at home and abroad concentrated mainly on the application of symbiosis theory, the species of symbiosis model. But the research of VC and PE industry is less.

## 3. Research on the Symbiosis relationship of VC and PE

### 3.1 Analysis of VC and PE Industry Chain

VC refers to that the investors receive funds in a certain way, then put the equity share capital into early stages of innovating enterprises which are emerging, high-growth or enormous potential. The investors have rich industry experience, specialized knowledge, then they can participate in the management of the innovating enterprises by taking full advantages of their efficient administration and financial expertise prorating. The investors will choose to

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IPO, M&A, Buy-back or transferable stock options to exit to get high returns when the enterprise has matured relatively.

VC invests innovating enterprises which are start-up stage or growth stage in general. PE invests mature enterprises which have gradually formed a certain scale, generated stable cash flows and management's efficiency. They focus on the equity investments of the innovating enterprises' later stage. VC and PE industry is a value-added chain that its operational object is capital. This industry keeps closely with the cycle process of the venture capital. The providers of capital(investors), the operators of capital(venture investors) and the users of capital form the trinity venture capital cycle system. One of the subjects is the VC operator .VC and PE should raise money from investors first, select and decide, then invest into the innovating enterprises. VC and PE rely on their procession and resource superiority , and they take full advantage of capital to the innovating enterprises which are high growth potentiality, high-tech, high-risk, high-return.VC and PE participate in corporate governance, supply value-added services, when they realize enterprise-hatching, they will exit the investment. The capital would return to the VC or PE, the investment income would be distributed to the investors, then the capital can continue to start a new-round investment operation.

The formation of VC and PE industry is closely bound up with the development process of the innovating enterprises, a large number of innovating enterprises establish multi-layers network. The progress of innovating enterprises went through five stages: Seed, Start-up, Development, Expansion and Maturity. Different VC and PE would invest to the same innovating enterprises or the same venture capital also invests to the different developmental stage of the same innovating enterprises. VC and PE industry in this study is composed of multitudinous investors, including VC which invests in Seed, Start-up, Development and PE which focus on the expansion and maturity. They form a connecting and interdependent chain-type associated organization according to logical relationship and space-time layout.

### 3.2 Symbiosis relationship Analysis of VC and PE Industry chain

The symbiotic relationship of VC and PE include three categories: the internal symbiotic of various subjects in VC and PE industry on the micro level; the symbiotic between various subjects in the VC and PE industry on the medium level; the symbiotic relationship between venture capital industry and other industries on the macro level. The key point of this paper is the symbiotic relationship on the medium level.

According to the theoretical analysis about symbiotic (Yuan Chunqing,1998),VC and PE are independent, they attract each other and cooperate because they can share the same resources or complement different species resources, then VC and PE would inherit and retain their respective property and state. The benefits of VC and PE can both increase when the internal and external resources collocation efficiency have improved, which would generate new energy in the whole symbiotic system. The essential characteristic of VC and PE symbiosis is cooperation. That

they coexistence and co-evolution can promote the venture capital industry to sound development and win-win.

The key three elements of VC and PE symbiotic system are symbiosis units, symbiosis model and symbiotic environment. VC and PE are the basic material conditions in symbiotic system, they invest into innovating enterprises, so VC and PE belong to homogeneous symbiotic units. The quantity and variety of symbiotic units are the important character in symbiotic system, they are also the fundamental constraints which to decide the formation and development of symbiotic system. The quantity of the same kind symbiotic units reflects the density. The symbiotic density of VC and PE will develop to the maximum which the symbiotic environment can sustain because of the similarity. The moderate symbiotic density benefits the evolving of symbiotic system which would to the symmetry mutualism.

The intrinsic nature of VC and PE and variation in symbiotic system depend on the quality parameters of symbiotic units. In the symbiotic system, the quality parameter is not the only, but is a group. There is one quality parameter which is the main parameters plays a leading role in the special financial, legal policy and industry environment. We choose ROI (Return on investment) as the main quality parameter. While the parameters reflect the external characteristics of VC and PE in the symbiotic system, they are the appearances of symbiotic units. We would identify the symbiotic relationship through analyzing quality parameters, and the main quality parameters are the determinants of symbiosis characteristic and symbiosis coefficient. They can prove the symbiosis relationship of VC and PE.

**Table 1: Qualitative Parameters and Parameters in VC and PE Symbiosis System**

Qualitative Parameters		Parameters	
VC	PE	VC	PE
Investment size	Investment size	Registered capital	Registered capital
Investment stage	Investment stage	Organization mode	Organization mode
Investment industry	Investment industry	Capital size	Capital size
Investment round	Investment round	Administration mode	Administration mode
Return on investment	Return on investment	Number of investment project	Number of investment project
Annualized return	Annualized return	Shareholding ratio	Shareholding ratio
Value-added service	Value-added service	Human resource	Human resource
Exit way	Exit way	.....	.....
Investment decision	Investment decision		
Main quality parameter: ROI			

## 4. Symbiosis Characteristic Correlation of VC and PE

Symbiosis characteristic correlation of VC and PE is a kind of association degree between the main qualitative

parameters, which reflect the degree of interaction effect that from VC and PE respective return on investment. Hypothesis VC is V, PE is P,  $Z_v$  is ROI of VC,  $Z_p$  is ROI of PE, then  $\delta_{vp}$  is symbiosis characteristic correlation of VC and PE:

$$\delta_{vp} = \frac{dZ_v / Z_v}{dZ_p / Z_p} = \frac{Z_p}{Z_v} \frac{dZ_v}{dZ_p} = \frac{Z_p}{Z_v} \bullet \frac{\Delta Z_v}{\Delta Z_p} (dZ_p \neq 0) (non - consecutive) \quad (2.1)$$

This is the most basic characteristic, the relationship of symbiosis characteristic correlation  $\delta$  and symbiosis is shown in Table 2.

**Table 2:** The relationship of symbiosis characteristic correlation and symbiosis

Symbiosis Characteristic correlation	$\delta > 0$		$\delta < 0$	
	$\delta_{vp} = \delta_{pv}$	$\delta_{vp} \neq \delta_{pv}$	$\delta_{vp} = \delta_{pv}$	$\delta_{vp} \neq \delta_{pv}$
Symbiosis status	Positive symmetric symbiosis	Positive non-symmetric symbiosis	Reverse symmetric symbiosis	Reverse non-symmetric symbiosis

### The symbiosis coefficient of VC and PE

The symbiosis coefficient of VC and PE describes the interactional degree between the main qualitative parameters of the two symbiosis units.

$$\theta_{vp} = \frac{|\delta_{vp}|}{|\delta_{vp}| + |\delta_{pv}|} \quad (2.2)$$

$$\theta_{pv} = \frac{|\delta_{pv}|}{|\delta_{vp}| + |\delta_{pv}|}$$

$$\theta_{vp} + \theta_{pv} = 1 \quad (2.3)$$

In the general way, the symbiosis coefficient  $\theta_{vp}$  will decrease with  $\theta_{pv}$  increase, there are some conditions shown in Table 3:

**Table 3:** The impact of symbiosis coefficient and symbiosis units

Symbiosis coefficient	$\theta_{vp} = 0$	$\theta_{vp} = 1$	$0 < \theta_{vp} < \frac{1}{2}$	$\theta_{vp} = \frac{1}{2}$	$\frac{1}{2} < \theta_{vp} < 1$
Impact of symbiosis units	VC have no impact on PE	PE have no impact on VC	VC's impact on PE is greater than PE's impact on VC	Interaction impacts of VC and PE is same	VC's impact on PE is less than PE's impact on VC

## 5. Analysis on Symbiosis Mode of VC and PE Industry

The interaction form of symbiosis units is the symbiosis mode of VC and PE. The interactional function mode of VC and PE, the functional intensity, the substance information and energy exchange relation of VC and PE are the embodiment of the symbiosis mode. On the basis of symbiosis theory, the symbiosis model consists of symbiosis organizational mode and symbiosis behavioral mode.

### 5.1 The Symbiosis Organizational Mode of VC and PE

The symbiosis organizational mode divides into point

symbiosis, interval symbiosis, successive symbiosis and integral symbiosis according to the connection level of VC and PE. VC and PE cooperate by accident form point symbiosis mode, which is the first stage of interval symbiosis, successive symbiosis and integral symbiosis. The spot symbiosis mode is rudiment of other modes. In the venture capital industry, the symbiosis of VC and PE is homogenous, they play a role each other in promoting. When the various business interact more and more frequently between VC and PE, the benefit mechanism can drive VC or PE, even both of them to promote symbiosis organizational mode to a higher level, then form a stable mutualism in the end.

**Table 4:** The symbiosis organizational mode of VC and PE

The symbiosis organizational mode of VC and PE	Stage	Feature	Development direction
The point symbiosis mode	lower	1. short-term, random, occasionality and uncertainty in interaction 2. They make efficiency finitely, the evolved result is not obvious.	The interval symbiosis mode
The interval symbiosis mode	low	1. looser cooperation relationship 2. relative stability, but incoherence 3. They form the co-evolution feature. 4. They can evolve and innovate respectively, and they can interact on each other to evolve and innovate.	The successive symbiosis mode  The point symbiosis mode
The successive symbiosis mode	higher	1. continuous, internal inevitability, stability 2. obvious evolving feature 3. They obtain resources and energy that they needed, in the mean while they keep independence ,which promote VC and PE industry evolution.	The integral symbiosis mode
The integral symbiosis mode	The highest	1. Ectosymbiosis evolves into endosymbiosis , independence fades away, VC and PE form symbiont. 2. VC and PE rely on the symbiont, and the specialization degree deepens vertically, the scope of division expands in horizontal. 3. VC and PE can evolve and innovate faster and better	Ideal state, it is difficult to achieve in reality

## 5.2 The Symbiosis Behavioral Mode of VC and PE

The symbiosis behavioral mode can be dividing into parasitism, commensalism, dissymmetry mutualism and symmetry mutualism according to the equality degree of energy distribution between VC and PE. The behavioral model will evolve into energy distribution symmetry from asymmetry.

a. The parasitism mode of VC and PE shows that one unit hatching another, but parasitism model doesn't make new energy by itself. In this symbiosis process, unidirectional energy and matter flow to parasite from the host of parasite. So the companies don't want to provide service to another company without rewards, this behavioral mode just the abstract in theory. Because of the active-passive relationship between the symbiosis units, there is little chance to realize parasitism model in VC and PE industry.

b. The commensalism mode of VC and PE shows that one unit supports another, this symbiosis model is single-win which can make new energy, and the new energy can transfer from one unit to another. When one unit benefits from another, it can't damage the benefit of another. This model is conducive to the innovating of profitable unit. But another unit is adverse while there is no compensate mechanism. So it is not win-win mode, this symbiosis behavior model lacks motivation. It is not steady and long although it occasionally appears.

c. The cooperation and communication of VC and PE can form the dissymmetry mutualism model gradually. VC and PE benefit from win-win ,the new energy from division and cooperation can allocate with asymmetric broad spectrum. The allocation of symbiosis achievement is asymmetrical. One unit obtains more, and another obtains little. VC and PE evolve unsynchronized because of the energy

accumulation difference. This model is the most common and it is heavily influential.

d. Dissymmetry mutualism and symmetry mutualism are collectively called the reciprocal symbiosis. The new energy from division and cooperation is the greatest. The new energy will allocate evenly and broadly between the units. VC and PE obtain the symbiosis benefit equally and accumulate the equal energy, then finish concurrent evolution. The mutuality symbiosis mode is the most efficient, the most cohesive and the most stable in the four symbiosis forms. It is the most precious and ideal type in the VC and PE industry. The active-active interaction makes the evolution synchronous and promotes them to take innovation advantages, then develop toward the win-win cooperation.

## 5.3 VC and PE Symbiosis System State

The symbiosis organization mode M consists of point symbiosis mode M1, interval symbiosis mode M2, successive symbiosis mode M3 and integral symbiosis mode M4. The symbiosis behavior mode P consist of parasitism mode P1, commensalism mode P2, dissymmetry mutualism mode P3 and symmetry mutualism mode P4 . In theory, the two models combine together to deduce 16 symbiosis mode. But not all VC and PE symbiosis modes exist in reality. The deduction is as follows:

$$P_i = \{P_1, P_2, P_3, P_4\}; \quad M_j = \begin{Bmatrix} M_1 \\ M_2 \\ M_3 \\ M_4 \end{Bmatrix}; \quad S = M \cdot P$$

$$S=M \cdot P = \begin{Bmatrix} M_1P_1 & M_1P_2 & M_1P_3 & M_1P_4 \\ M_2P_1 & M_2P_2 & M_2P_3 & M_2P_4 \\ M_3P_1 & M_3P_2 & M_3P_3 & M_3P_4 \\ M_4P_1 & M_4P_2 & M_4P_3 & M_4P_4 \end{Bmatrix} = \begin{Bmatrix} - & M_1P_2 & - & - \\ - & M_2P_2 & M_2P_3 & - \\ - & - & M_3P_3 & M_3P_4 \\ - & - & - & M_4P_4 \end{Bmatrix}$$

According to the development environment and characteristic, any symbiosis modes related to parasitism don't exist. The commensalism mode ( $P_2$ ) only beneficial to one unit can't be consecutive symbiosis, it only exist in point symbiosis model or interval symbiosis mode ( $M_1P_2$ ,  $M_2P_2$ ). The interval symbiosis mode and the successive symbiosis mode can appear dissymmetry mutualism mode. This model mainly is successive symbiosis mode on account of broad spectrum, that is  $M_3P_3$ . The interval symbiosis mode is difficult to form symmetry mutualism mode, so it mainly is dissymmetry mutualism mode. If there is symmetry mutualism mode, it is certainly enter into successive symbiosis mode ( $M_3P_4$ ). The integral symbiosis mode belongs to bureaucratic organization, it must be symmetry mutualism relationship once this happens which is symmetrical reciprocal integration symbiosis mode ( $M_4P_4$ ).

## 6. Conclusion and Suggestion

The symbiosis system of VC and PE form mutual interdependence by a certain symbiosis mode in the specific symbiosis environment. The symbiosis environment of VC and PE industry includes macro-economic environment, laws and policies environment, financial environment, reserve of talents, technical innovation, social and cultural environment, intermediary service system etc. The external environment and the system internal function which can self-adjust, self-update and self-organize form good interaction through the communicating and sharing of material, information and energy. VC and PE industry symbiosis system develop from point commensalism model to ideal successive mutualism model, then move toward the co evolution finally. The ideal venture capital industry development mode is that VC should focus on the early stage of innovative enterprises. The value-added service such as high-efficiency business administration, policy grasps accurately and the sharing of upstream and downstream resource make the innovating enterprises grow to maturity. PE will join in to invest when the innovating enterprise develop to the middle and late stages. PE can give full play to advantages to help the innovating enterprises choosing IPO, M&A, MBO and so on. Both PE and innovating enterprises will realize value-added. The short-sighted quick results investment mentality of VC and PE would lead the venture capital industry to the disorder development. But the symbiosis of VC and PE need to

connect and balance in venture capital operating process, which includes financing, investment, administration and exit.

To enhance VC and PE industry chain stability and promote the co evolution of VC and PE in China, the symbiosis environment should be improved. The government should provide the policy support to promote the development of VC and PE industry chain; regularize and guide the economic behavior of each participates to increase the operation efficiency of venture capital institutions. Firstly, financial service and financial innovation are the essential guarantee of VC and PE industry chain sound development. So we should accelerate the reform and innovation of the financial system, establish a multi-level capital market system, give full play to new tertiary board, growth enterprise market and small plate market. Over-the-counter market and technology property transaction market can offer perfect property regime environment. Secondly, the development of venture capital industry needs the venture capitalists that have rich financial knowledge, perfect mastery of moral sentiments, acute insight and business administration experience. The scientific and technological talents who master cutting-edge technology in high-tech fields and the entrepreneurs with innovative pioneering consciousness are essential for the sustainable improvement of VC and PE industry chain. A favorable talent environment should support the exploitation, cultivation, full and free mobility of talents. Thirdly, the high-tech industrial parks which are high scientific and technological content, the high density of capital, high degree of industrial mutual relation and rich human resource can gather various innovation resources and build a higher platform for the development of VC and PE industry chain. The harmonious and healthy successive mutualism model development of VC and PE industry chain in China need the joint effort of government, venture capital industry and high-tech enterprises. We should strengthen the business cultural construction of honesty, specification and cooperation in the cultural traditions which is rational, inclusive and diversified. It benefits to spread the developing space of VC and PE that constructs sociocultural environment which encouraging creative spirit.

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