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# How Do Venture Capitals Build Up Syndication Ecosystems for Sustainable Development?

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**Abstract:** When the resources of a focal organization are limited, strengthening the capability of sustainable performance by building up an ecosystem through cooperation is a good choice. When venture capital firms invest in sustainable projects, due to the non-rival and non-exclusive features of sustainable projects, venture capital firms that have built up the cooperation ecosystem can invite more investors to join the sustainable projects. This article analyzes what factors venture capital firms take into consideration when building relations to nurture sustainable investment ecosystems. The quadratic assignment procedure (QAP) method is used to explore how Chinese venture capital firms build up the syndication ecosystems. We conclude that very dominant venture capital firms like to cooperate with venture capital firms that have brokerage benefits and proper positions in the cluster to gain sustainable development. This article indicates that venture capital firms can build up syndication ecosystems by obtaining opportunities from indirect ties.

**Keywords:** venture capital firms; syndication network; ecosystem; sustainable development

## 1. Introduction

The sustainable development of an organization often concerns the long-running economic benefits of the organization itself. The resources to strengthen the capability of sustainable financial performance of the focal organization are limited [1,2]. Building up an ecosystem through cooperation is the right choice [1,3]. The sustainable development of stakeholders is also essential for the sustainable development of the focal organization. Those stakeholders include employees, the supply chain partners, and cooperation partners [4,5]. In this article, we focus on how to choose partners to cooperate with to maintain a healthy and efficient “cooperation ecosystem” around the focal organization in the long run. By leveraging the information and resources from cooperation partners, the cost of sustainable development is reduced [4–6].

The existing literature has focused on the importance of the cooperation ecosystem. The cooperation ecosystem is a stable system formed by long-term cooperation. It can help organizations expand their boundaries and strengthen their abilities. The network of the focal organization’s neighbors play vital roles in building up the cooperation ecosystem. Indirect neighbors can become direct neighbors easily and help the focal organization effectively. The trust level in the cooperation ecosystem is higher than trust between short-term cooperation partners.

For the venture capital industry, venture capital firms invest in startups or projects for five to seven years. The risk of investing is higher than in other forms of traditional investments. Therefore, building up a trustworthy ecosystem is good for long-term investments, especially for venture capital firms that want to invest in sustainable projects. Sustainable projects are projects that can help the long-term development of economics, the environment, and society [5]. For instance, clean tech is one

important group of sustainable projects [6]. Clean tech protects the environment by reducing carbon emissions and other pollutants. Those projects are often alternatives to the dominant solutions and can be substituted by competitors' projects that do not focus on sustainability [5]. The risk of investing in sustainable projects is higher than in traditional investments. If more investors are involved, the amount of money that every investor pays is reduced. That is to say, the financing of sustainable projects is non-rival and non-exclusive [6]. New participants are welcome to join the projects.

The non-rival and non-exclusive nature of sustainable projects makes the ecosystem of venture capital more valuable. Venture capital firms that have already participated in sustainable projects would want to find more partners to join the sustainable projects. If one venture capital firm has more co-investment partners, that venture capital firm would have a higher probability of bringing in more partners to join the sustainable projects.

If building an ecosystem is important, how can we build it up? Which network factors encourage Chinese venture capital companies (in brief, VCs) to jointly invest? Is the strategy different in different cultures? We fill the literature gap using Chinese market evidence that shows that Chinese VCs tend to build a syndication circle around themselves to form an ecosystem that aids their activities. A syndication circle can be defined as an ego-centered network built around a VC to overcome the resource and information limitation of the VC itself, which is gradually formed via co-investments with other VC firms [7,8]. In general, there are several layers of the ecosystem, from frequent cooperation to occasional cooperation partners, and each circle has some influence on the focal VC's long-term strategy. The Chinese often call this circle a *guanxi* circle [9], since the syndication between VCs usually involves personal friendships between venture capitalists. In other words, these VC firms emphasize the importance of long-term social relations and sustainable development in the network. They are *guanxi*-oriented [10,11] and sustainable, rather than driven by short-term self-interest in each transaction. *Guanxi* is the term for a social relationship in Chinese, and it can be described as the relationships that can keep steady for a rather long period of time [10].

We also contribute to the literature in the following ways. Firstly, we analyze how indirect ties are influencing the formation of ecosystems. Venture capital firms choose partners, not only through the resources of their potential partners, but also through the network of potential partners [12,13]. Comparing the traditional status theory, we emphasize that ties are formed, not only to improve the status, but also to build up an ecosystem that can foster further cooperation. The ties formed in the ecosystem are long-term ties and *guanxi* ties [13]. The ecosystem could stay stable, and the core members formed small groups. Secondly, we also focus on how sustainable projects can get extra benefits from the ecosystem of venture capital firms because of the non-rival and non-exclusive features of those projects [5,6]. If more investors are invited to take part in the sustainable project investments, the risk shared by every investor is lower. Thirdly, we explain that in China, the *guanxi* network plays an important role in network building [11,13,14].

## 2. Theory

### 2.1. Networks, Ecosystem and Sustainable Development

Cooperation between financial institutions has a long and time-honored history, beginning with the 1870 offering by the Pennsylvania Railroad. This paper clarified the primary function of syndication as risk hedging. Subsequent theoretical developments from resource-dependence theory emphasize how syndication partners compensate for each other's insufficiencies and sustainable development [6,15,16], especially in terms of diversified knowledge, experience and technology, which help increase the probability of success [7,17]. Venture capital firms can create more value for the startups using their own unique resources [18]. As different venture capital firms have different resources, when they co-invest, the startups can have diversified resources to develop. The investment of startups can help the parent companies to expand their business. If the startups have the same business as the parent companies, by investing in the startups, the parent companies can explore new markets and strengthen

their internal capability at the same time [19,20]. That is another reason why venture capital firms syndicate. By investing in more companies, they can expand their external markets.

However, joint investment may bring about an even higher failure rate than investments by a single entity. It is in the context of joint investments where the potential moral hazard of syndication becomes more pronounced due to potential information asymmetry between the two parties [21,22]. Theorists later turned their attention to information asymmetry and bonded rationality [22] concerning joint investment. Governance structure, such as monitoring "free-riders" and building up a reputation system [23], was another subsequent addition to the research agenda. Literature about the management control system also indicates there are several mechanisms for VCs to manage their partners. For instance, controlling the budgeting and planning, controlling performance-based compensation, and transferring prices can help the governance of partners [24]. To control the behavior of partners by the supervision of the third party is widely used in practice. Due to the moral hazard risk, we must consider a firm's reputation as an essential factor [23]. Additionally, venture capital firms need to limit the number of investors. The characteristics of the board can influence the innovation level of companies. Board size is negatively related to the innovation level of companies. If too many partners invest in the startups, the innovation level of the startups will drop [25].

Due to the fact that syndication is a product of commitment disburers, reputation, and repeated ties [26], syndication networks develop from broad cooperation between VC investment firms. This extensive and dynamic syndication network affects VC firm behavior in turn [7]. Similar to the individual network, the network structure changes with time [26]. Actors within a syndication network could change their roles to acquire better positions [8], which could benefit them by providing greater knowledge or a better reputation in the industry for sustainable development [27–29].

Following that research, the network dynamics perspective was introduced in [30,31]. Organizational networks are dynamic, new roles are added in, and new ties are built [32,33], while old ties might disappear or be maintained [34,35]. A VC may build and cut ties for a better position in this network [8] to find newly emergent companies [26] and to obtain a higher probability of development [29,36]. The motivations for networking behavior include diverse geographical and industrial distribution [37]. For example, in the biotech industry, multiple connectivity and following-the-trend are confirmed as major factors influencing companies' behavior in these networks [16].

A solely performance-focused approach constricts the potential contribution of syndication research. When looking at previous syndication research, it is difficult to use traditional corporate finance methods to analyze the complexity of the motives behind syndication [38]. The patterns of network formation can better explain the phenomenon in this field.

Although Chinese VCs have some things in common with their Western counterparts, they are operated under a different culture and institutional logics. Guanxi is emphasized, rather than individual motivations stemming from self-interest, which might bring about different activities and relation-building logic [39]. Few studies have shed light on the VC industry and syndication network in this context. This paper uses the social network perspective to investigate the logic behind syndications that help VCs to expand the boundary of the organization and achieve sustainable financial performances.

## 2.2. Sustainable Project Investments and Ecosystems

In this essay, we would like to discuss how partner selection is influenced by the partners' networks when investing in sustainable projects [40]. That is to say, the focal venture capital firm will choose partners, not only based on the current sustainable projects, but also on long-term cooperation opportunities with the partners' neighbors [32,41]. We extend the neighbor networks theory into an ecosystem building theory to explain the long-term behavior of venture capital firms. This ecosystem building theory is extremely important for the quick adaptation of sustainable projects.

The existence and the number of common neighbors can promote cooperation between venture capital firms when venture capital firms invest in sustainable projects. Most Chinese VCs avoid cooperating with strangers. If the focal VC and the potential partners have common friends, the chances of cooperation improve, because the common neighbors can play the role of supervisors and punish moral hazard behavior [42]. Without knowing some detailed information concerning a possible new partner, a focal person may find it hard to make a decision. If there are more common neighbors, the possibility that they will become partners is higher.

When venture capital firms invest sustainable projects, the risk is quite high. The existence of common neighbors can help venture capital firms make such high-risk decisions [43]. For instance, investing in clean tech projects at the very beginning is risky. The costs of clean tech are usually higher than the costs of traditional energy, especially when the scale economy of clean tech is not achieved [44]. The existence of common neighbors can mitigate the moral hazard brought by risky decisions. The common neighbors can help venture capital firms to put more trust in sustainable projects. We propose the hypothesis:

**Hypothesis 1 (H1).** *The number of common neighbors is positively associated with the possibility of joint investment in sustainable projects.*

When the focal venture capital firm wants to expand its ecosystem, coordinating with venture capital firms that have more common neighbors with the focal venture capital is a good choice. Besides, the network that the potential partner has is also important to consider when the focal venture capital firm tries to invite partners. To be more specific, among the indirect neighbors of the focal venture capital firm, who will be invited to the syndication in a new round of investment?

Venture capital firms with a high brokerage advantage are more likely to be invited. Venture capital plays a key role in the value chain of innovation and entrepreneurship, i.e., it creates cross-network bridges connecting various resources [45] and stimulates innovation in entrepreneurial ecosystems [46]. This cross-network exchange helps transfer new ideas into different domains, especially from technical innovation to commercial application. If a VC is in a bridging position, it generally signals the VC's ability to act as a cross-network exchange. A VC with a high brokerage advantage is thus more likely to be accepted as a syndication partner of a successful VC with high centrality. A VC that has a bridging position can have access to more diversified information and combine it.

When the project is sustainable, venture capital firms are more likely to invite the potential partners that have a brokerage advantage to join sustainable projects. For example, the clean tech industry welcomes more new partners to join the investments [47]. For electric cars, the more charging stations there are, the lower the cost that every electric car user pays. For a focal VC, if they are investing in a sustainable project, inviting a partner that has a brokerage advantage is more valuable than an investor without many partners, because the pool of potential partners is larger. We develop the following hypothesis from this:

**Hypothesis 2 (H2).** *When investing in a sustainable project, VCs with high centrality are inclined to form syndication ties with VCs that have brokerage advantages.*

In addition to VCs with an important status, small VCs with specific resources [48] are also good choices for future syndication. A rather small VC embedded in a clique with specific resources, such as local relations, specific domain knowledge, and specialized technology, is welcomed. However, a VC with a very high cluster coefficient often indicates that the clique's closure constrains the actor, so the smaller firms' cluster coefficients should not be too high.

A small, robust group with a dense network is the best way to hedge against risks and maintain the long-term performance inherent in a highly uncertain environment. Guanxi-orientated thinking ensures those small groups of VCs often pay more attention to their long-term profits beyond the profit or loss of one single transaction. However, if the small group is too dense, cooperation with outsiders

is difficult [15]. The information that the group members have will be homogenous, and the other information and opinions from those outside the group might be ignored. That kind of small, dense group is not ideal for further cooperation. Therefore, when the focal VC chooses a partner to co-invest, it is good to find one partner that has already been in a stable, but open, group [31]. When investing in sustainable projects, inviting a small group of VCs can accelerate the speed of money raising and the chances of further development.

**Hypothesis 3 (H3).** *When investing in a sustainable project, VCs with a higher centrality are inclined to form syndication with ones that have medium cluster coefficient values.*

The centered ego in a syndication network gains a good reputation and more opportunities [23,25], so it has more influence on others and more control over investments. We found that more attachments provide the centered VC with a broader network, more indirect ties, and better investment opportunities, which are the keys to sustainable development for a VC in a highly uncertain environment.

The position in a syndication network is essential for joint investments and sustainable development. A VC may sacrifice profit in one or two transactions for the sake of maintaining relations so that it can harvest a better position in the network. If this focal VC forms a small syndication circle of its own, or it gains the center position in a community, then safety and profit will follow. One single transaction is fragile, but a series of investments in a series of collective network actions is robust.

### 3. Method

#### 3.1. Modeling

When we analyze how networks are formed, we need to figure out the relationship between matrices. The most important difference between the regression model and the matrix-based model is the independence of variables [49]. One of the basic assumptions of classical regression models is that the observations are identical and independent. When it comes to the network data, the variance of every node is fixed. Every row and every column of the matrix is not independent. If we still use traditional regression methods to analyze network data, we will get wrong estimations because of spurious correlations. The quadratic assignment procedure (QAP) test is thus introduced to solve the interdependence problem [49]. QAP is basically a Monte Carlo simulation method that can help us get an unbiased and efficient estimation of the relationship between matrices.

#### 3.2. Data Collection and Measures

We delineate the dynamic development of joint investments by utilizing a major database in the venture capital field, the ZeroToOne Database, over the period of 2000 to 2013. Statistical data provide evidence of a surge in new entrants from 2000 to 2011, but this trend declined sharply after 2012. Table 1 provides more evidence for the growth of this field.

In Table 1, we can find that almost every year has a growth rate from 20% to 30%. In 2011, 757 new investing firms entered into this field. But what is their ability to find joint investment partners? We collect the data of VCs and their investment subjects to form a two-mode network. Then, we transform this two-mode network into a one-mode network containing only VCs and joint investment ties.

We select the data of companies that have joint investments in the premature stages of the startups. In the mature stage of a firm, PEs may join in its investment. There are 611 nodes which have syndications in this field before 2010, and 824 joint investments among them from 2011 to 2013. Additionally, several variables are controlled—including following the trends and similarities [20].

**Table 1.** The number of new entrants in the Chinese investment industry (2000–2013).

Year	Number of Active Investors	Number of Investment Events	Number of New Entrants	Total Number of Investors
2000	128	277	82	192
2001	131	226	63	255
2002	120	213	40	295
2003	143	283	50	345
2004	179	420	60	405
2005	223	533	86	491
2006	345	990	150	641
2007	511	1476	232	873
2008	557	1471	212	1085
2009	551	1490	193	1278
2010	753	2687	316	1594
2011	882	3636	376	1970
2012	681	2639	229	2199
2013	462	2021	125	2324

We adopt QAP to test the explanatory model, where the number of joint investments between two nodes from 2011 to 2013 is the dependent variable. The joint investment network  $Y$  is a non-direct graph. But in the following analysis, this paper will take this network as a direct graph, since the characteristics of one side of the ties will be taken into account. For example, if there are three joint investments between node  $i$  and node  $j$ , then  $Y_{ij}$  will be equal to  $Y_{ji}$ , and both values of these two cells equal 3.

All the independent variables are computed from the data from 2000 to 2010 in a matrix format. In other words, we use the network data of VCs before 2010 to explain their joint investment behaviors in the next three years.

We first compute the relational distance between two VCs. If they are neighbors, then the distance is 1. If they have one common neighbor, then the distance is 2. If they are connected by three steps, then the distance is 3, and so on. If two nodes have eight joint investments in the past, then the relation distance is  $1/8$ .

In the explanatory model, the variables are stated as follows:

1. The previous syndication number is a variable to measure the number of joint investments between two nodes during the period 2000–2010.
2. The relationship distance is measured by the Euclidean distance between two nodes in the industrial network formed from 2000 to 2010.
3. The common neighbor is a measurement of the number of common neighbors between two VCs before 2010.
4. The centrality–structural hole effect indicates the effect size, in the network during 2000–2010, of a selected VC who has syndication ties, during 2011–2013, with a leader ranking in the top 20% for degree centrality.
5. The centrality–cluster coefficient effect indicates the clustering coefficient, in the network during 2000–2010, of a selected VC who has syndication ties, during 2011–2013, with a leader ranking in the top 20% for degree centrality.

Table 2 delineates the measurement of dependent, independent, and control variables.

**Table 2.** The measurement of variables.

Variable Name	Measurement
Syndication Number	The number of joint investments between two nodes during the period 2011 to 2013.
Previous Syndication Number	The number of joint investments between two nodes during the period 2000 to 2010.
Distance	Relational distance between two nodes in the industrial network formed from 2000 to 2010.
Common Neighbor	The number of common neighbors in the industrial network from 2000 to 2010.
Centrality–SH	The effect size, in the industrial network, during 2000–2010, of a selected VC who has syndication ties, during 2011–2013, with a leader ranking in the top 20% for degree centrality.
Centrality–CC	The clustering coefficient in the industrial network during 2000–2010, of a selected VC who has syndication ties, during 2011–2013, with a leader ranking in the top 20% for degree centrality.
Industry Similarity	Was there any previous partner of a surveyed VC in the same industry of the end node of the syndication tie? If yes, this variable is 1; otherwise, 0.
Long Trend	The proportion of the industries jointly investing in two nodes, which belong to the top ten popular targets of investment.

#### 4. Data Analyses and Results

We first compute the correlation among all variables in Table 3. All explanatory variables and controls have a positive association with the dependent variable. We then use QAP to test our hypotheses. Following the long trend and the similarity of industries are significant in the regression model. The previous syndication has a significant association with the dependent variables. In other words, frequent cooperation encourages more joint action in the future.

In Table 4, due to the results in model 3 and model 6, the first hypothesis is confirmed, since both distance and common neighbors significantly impact the number of joint investments. Hypothesis 2 also gets supported, as illustrated in model 4 and model 6, since the centrality–structure hole effect is significant in the regression result.

**Table 3.** QAP correlation of relational variables (matrix variables), number of permutations performed: 5000.

Variable	2000–2010 Frequency	Common Neighbor	Distance	Centrality–SH	Centrality–CC	Square of Cluster Coefficient	Industry Similarity	Long Trend	2011–2013 Frequency
2000–2010 Frequency	1	0.539 ***	−0.308 ***	0.195 ***	0.095 ***	−0.006	0.120 ***	−0.034 **	0.247 ***
Common Neighbor		1	−0.531 ***	0.400 ***	0.269 **	0.002	0.209 ***	−0.052 *	0.234 ***
Distance			1	−0.362 ***	−0.278 **	−0.021	−0.228 ***	−0.023	−0.150 ***
Centrality–SH				1	0.539 ***	−0.041	0.092 ***	−0.038	0.117 ***
Centrality–CC					1	−0.004	0.059 ***	−0.039	0.053 ***
CC square						1	−0.002	0.015	−0.008 *
Industry Similarity							1	0.413 ***	0.117 ***
Long Trend								1	−0.025 **
2011–2013 Frequency									1

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

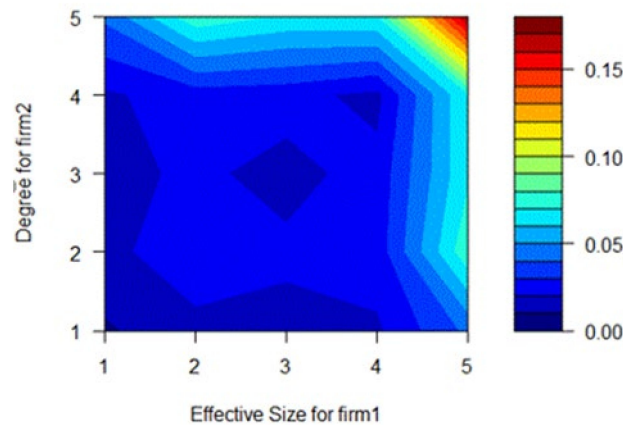
**Table 4.** Results of multiple regressions QAP via double decker semi-partialling.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
2000–2010 Frequency	0.216 ***	0.171 ***	0.209 ***			0.170 ***
Common Neighbor		0.100 ***				0.101 ***
Distance			−0.031 ***			−0.003 *
Centrality–SH				0.040 ***		0.017 ***
Centrality–CC					0.003	−0.021 **
CC square					−0.004	−0.005
Industry Similarity	0.108 ***	0.092 ***	0.104 ***	0.136 ***	0.137 ***	0.092 ***
Long Trend	−0.059 ***	−0.050 ***	−0.059 ***	−0.076 ***	−0.077 ***	−0.050 ***
Intercept	0.000	0.000	0.000	0.000	0.000	0.000
AdjR <sup>2</sup>	0.078	0.084	0.079	0.035	0.034	0.084

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . Coefficients are standardized coefficients. The number of permutations performed: 200.



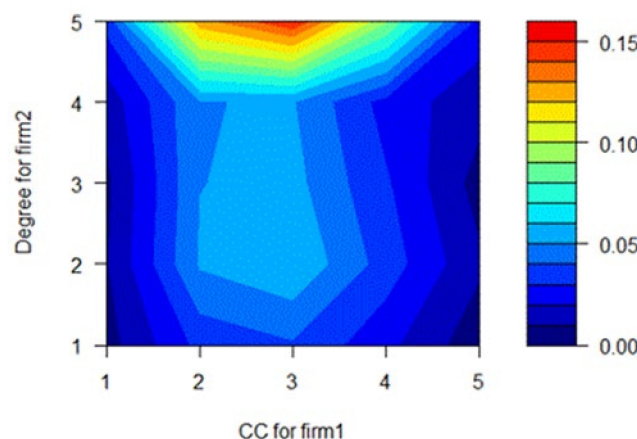
In addition to the QAP regression analysis, Figure 1 illustrates the preference of a VC with the top twenty percent degree centrality—i.e., those with the highest effect size are preferred by dominant VCs. Hypothesis 2 is confirmed.



**Figure 1.** The topography of co-invest probability. We plot the density of joint probability. This graph plots the joint probability density of the effect size for firm one and the degree centrality of firm two. More combinations are located in red areas compared with combinations in blue areas.

Hypothesis 3 gets only partial support, since both the centrality–cluster coefficient and square of cluster coefficient square effects are significantly associated with the dependent variable in the correlation table. However, the estimated results of these two variables in model 5 become insignificant due to the influence of the control variables. Their effects are again controlled for in the full model, model 6.

Figure 2 shows the relation between the focal investor’s centrality and its partner’s cluster coefficient. The result indicates that a node with the top twenty percent centrality, i.e., a focal investor in the VC industry, doesn’t prefer partners with cluster coefficient values that are too high or too low. However, the preferred range is slightly below the average cluster coefficient value of all nodes. That means a node without any group support is not welcome, like a lonely wolf. But a node with the strong support of a group is also not a preferred joint investment partner.



**Figure 2.** The topography of co-invest probability. We draw the joint probability density of the clustering centrality for firm one and the degree centrality of firm two. More combinations are located in red areas compared with combinations in blue areas.

## 5. Discussion and Future Directions

### 5.1. Syndication Circle: An Investment Ecosystem for Sustainable Development

Although a focal VC may find a friend's friend as a partner in a new investment, those partners with frequent cooperation may foster strong trust and intimate relations, which encourages more joint investment in the future. And the prediction of structural embeddedness does indeed work. Weak ties, or occasional cooperation partners, are more likely to be chosen for new investments. Indirect ties with common neighbors, or those ties with a two-step distance, have a higher probability of becoming new partners, while those with a three-step distance have almost no chance.

The confirmation of hypothesis 2 illustrates that those with a high effect size, among friends' friends, are most eligible for forming new syndication ties. However, the effects of the cluster coefficient and CC square are not significant in the QAP regression models, as is shown in Model 5 and Model 6. These effects are correlated with the control variable of industry similarity. The control variable might be the mediator between the CC and investment cooperation. These are challenges to be worked on in future studies.

Summarizing the social networking phenomenon in the Chinese VC industry, we find that a core group of partners with long-term and frequent cooperation increases the possibility of new-run syndication among them. Second, the boundary of this joint investment group is open, and new partners need the introduction of a mediator to join in. Finally, the focal VC in the core group with high centrality attracts more opportunities for cooperation.

In Chinese society, this phenomenon can be called a "circle" (in Chinese, *quanzi*) or "guanxi circle" [50]. The circle is a social network (generally a sub-network of the whole VC industrial network) centered on one big VC. The boundary of the circle is not closed, so new entrants can enter into this network by networking with circle members, especially those in central roles. In a series of favor exchanges [51], a new entrant may build up many cooperative ties, which will change its structural position. This new entrant needs to sacrifice short-term self-interest in exchange for related technology, tacit knowledge, and opportunities to get to know key people [52,53]. It gradually moves from the peripheral position to the inner ring, and then may enter into the core of the circle. The core member has many opportunities to access good investment projects. That is why we call the behavior of this type "guanxi-oriented" investment since the most crucial motivation of syndication is the accumulation of favor exchanges for long-term development, rather than profitability in a single transaction [54]. The focal firm adopts a syndication circle strategy to manage three levels of the syndication network for sustainable performance. They are:

- 1st level: frequent cooperation partners (core circle);
- 2nd level: occasional cooperation partners (peripheral circle).
- 3rd level: indirect ties with VCs that have high brokerage benefits (H2) or medium CC value (H3); (outer-circle partners for the future).

### 5.2. Nurturing an Investment Ecosystem

To build up a friendly investment ecosystem for the focal firm's sustainable development, the focal firm should take a syndication circle strategy to manage the three levels of the syndication network rather than caring about the profit of every single syndication. The focal firm needs a big picture of its network, or ecosystem position, in the VC syndication network and how well it could leverage the different levels of resources to maintain its daily operation and capture future growth opportunities as well [1,4,30].

Hence, we have the following strategies:

- Frequent cooperation partners help generate stable revenue. We call this strategy relational embeddedness.

- VCs can quickly build up mutual trust with weak-tie partners who can help reach many other VCs who otherwise have no common neighbors with the focal VC. Firms will use this strategy to quickly expand their current business landscape by finding some new partners through their strong- or weak-tie partners.
- Focal firms have to think about partners that are not in their current circle for future business growth, to hunt for business opportunities throughout the broader network, not just within their immediate network [5,55]. Bigger VCs tend to search for small players in bridging positions or those that represent a clique, as these firms possess a significant amount of resources that are beneficial to the focal firm. Focal firms need to maintain indirect connections with these “outsider” VCs and explore opportunities for future growth.

In summary, to establish a healthy investment ecosystem, focal firms work closely with frequent cooperation partners in the first ring, know more occasional cooperation partners in the second ring well, while looking for common neighbors and smaller partners in the outer ring.

### 5.3. Contributions and Practical Implications for the Investment Ecosystem

We contribute to the literature in the following ways. Firstly, we analyze how indirect ties are influencing the formation of ecosystems. Venture capital firms choose partners, not only through the resources of their potential partners, but also through the network of potential partners. Comparing the traditional status theory [56], we emphasize that ties are formed, not only to improve status, but also to build up an ecosystem that can foster further cooperation. The ties formed in the ecosystem are long-term ties and guanxi ties. The ecosystem could stay stable, and the core members form small groups. Secondly, we also focus on how sustainable projects can get extra benefits from the ecosystem of venture capital firms because of the non-rival and non-exclusive features of those projects [57]. If more investors are invited to take part in the sustainable project, the risk shared by every investor is lower. Thirdly, we explain that in China, the guanxi network plays an important role in network building.

In the investment ecosystem, focal firms need to manage three levels of partners. Focal firms need to understand the functionality of each level of partner. Normally, the focal firm will work more closely with frequent cooperation partners, who form a strong team for seizing investment opportunities [41]. Additionally, they have to set up relationships with occasional cooperation partners to reach out to indirect ties, who are common neighbors with them, to gradually expand their current business. In terms of future business, focal firms will look for some indirect ties to acquire complimentary resources and maintain future growth. When investing in sustainable projects, venture capital firms have to recognize the importance of ecosystem building, because many projects are non-rival. More investors are welcome [58]. If the focal VC can bring more investors to sustainable projects, the risk of investing in such projects can be mitigated.

### 5.4. Limitations and Future Directions

We have explored the relationship between focal firms with partners at their core, peripheral, and outer circles. We also discovered some of the strategies focal firms use to grow their partnerships for investing in sustainable projects [59]. But many questions are waiting for future studies; for example, we have not studied the synergy of the three different types of circle partners. How will the synergy of these three levels of circle partners affect focal firms? How can the ecosystem help sustainable projects? Those questions can help future studies construct better theories.

Additionally, we have examined which outside or non-circle companies gradually enter into core circles. Still, we have not discussed the reverse trends, where the core partner relationships decay. If the cooperation outcome is not ideal, will the partnership maintain or not? Future studies can focus on which partnerships last for long [60]. Future studies could also focus on how to motivate different levels of partners to follow each focal firm’s strategy. Ecosystem governance could set a future research agenda for focal firms in terms of sustainable development and mobilizing ecosystem partners.

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## References

- Davis, J.P. The group dynamics of inter-organizational relationships collaborating with multiple partners in innovation ecosystems. *Admin. Sci. Q.* **2016**, *61*, 621–661. [[CrossRef](#)]
- Umit, C.; Bilal, A. Big social network data and sustainable economic development. *Sustainability* **2019**, *11*, 2027.
- Chen, Y.S.; Lei, H.S.; Hsu, W.C. A Study on the sustainable development strategy of firms: Niche and social network theory. *Sustainability* **2019**, *11*, 2593. [[CrossRef](#)]
- Gomes, L.A.D.V.; Facin, A.L.F.; Salerno, M.S.; Ikenami, R.K. Unpacking the innovation ecosystem construct: Evolution, gaps, and trends. *Technol. Soc.* **2016**, *136*, 30–48. [[CrossRef](#)]
- Cumming, D.; Henriques, I.; Sadorsky, P. ‘Cleantech’ venture capital around the world. *Int. Rev. Financ. Anal.* **2016**, *44*, 86–97. [[CrossRef](#)]
- Buerer, M.J.; Wuestenhagen, R. Which renewable energy policy is a venture capitalist’s best friend? Empirical evidence from a survey of international cleantech investors. *Energy Policy* **2009**, *37*, 4997–5006. [[CrossRef](#)]
- Brander, J.A.; Amit, R.; Antweiler, W. Venture capital syndication: Improved venture selection vs. the value-added hypothesis. *J. Econ. Manag. Strat.* **2002**, *11*, 422–452. [[CrossRef](#)]
- Bygrave, W.D. Syndicated investments by venture capital firms: A networking perspective. *J. Bus. Ventur.* **1987**, *2*, 139–154. [[CrossRef](#)]
- Gu, W.; Luo, J.; Liu, J. Exploring Small-World Network with an Elite-Clique: Bringing Embeddedness Theory into the Dynamic Evolution of a Venture Capital Network. *Soc. Netw.* **2018**, *57*, 70–81. [[CrossRef](#)]
- Burt, R.S.; Burzynska, K. Chinese entrepreneurs, social networks, and guanxi. *Manag. Organ. Rev.* **2017**, *13*, 221–260. [[CrossRef](#)]
- Chen, X.P.; Chen, C.C. On the intricacies of the Chinese guanxi: A process model of guanxi development. *Asia Pac. J. Manag.* **2004**, *21*, 305–324. [[CrossRef](#)]
- Burt, R.S. People you know. In *Neighbor Networks—Competitive Advantage Local and Personal*; Oxford University Press: New York, NY, USA, 2010; pp. 1–18.
- Bruton, G.D.; Ahlstrom, D. An institutional view of China’s venture capital industry: Explaining differences between China and the west. *J. Bus. Ventur.* **2003**, *18*, 233–259. [[CrossRef](#)]
- Gulati, R. Network location and learning: The influence of network resources and firm capabilities on alliance formation. *Strateg. Manag. J.* **1999**, *20*, 397–420. [[CrossRef](#)]
- Ter Wal, A.L.J.; Alexy, O.; Block, J.; Sandner, P.G. The best of both worlds: The benefits of open-specialized and closed-diverse syndication networks for new ventures’ success. *Admin. Sci. Q.* **2016**, *61*, 393–432. [[CrossRef](#)] [[PubMed](#)]
- Zhang, L.; Gupta, A.K.; Hallen, B.L. The conditional importance of prior tie: A group-level analysis of venture capital syndication. *Acad. Manag. J.* **2017**, *60*, 1360–1386. [[CrossRef](#)]
- Luo, J. Guanxi Revisited: An Exploratory Study of Familiar Ties in a Chinese Workplace. *Manag. Organ. Rev.* **2011**, *7*, 329–351. [[CrossRef](#)]
- Rossi, M.; Martini, E. Venture capitalists and value creation: The role of informal investors in the growth of smaller European firms. *Int. J. Glob. Small Bus.* **2019**, *3*, 233–247. [[CrossRef](#)]
- Rossi, M.; Festa, G.; Fiano, F.; Giacobbe, R. To invest or to harvest? Corporate venture capital ambidexterity for exploiting/exploring innovation in technological business. *Bus. Process Manag. J.* **2019**. [[CrossRef](#)]
- Powell, W.D.; White, D.R.; Koput, K.W.; Owen-Smith, J. Network dynamics, and field evolution: The growth of inter-organizational collaboration in the life sciences. *Am. J. Sociol.* **2005**, *110*, 1132–1205. [[CrossRef](#)]

21. Granovetter, M. Introduction: Problems of explanation in economic sociology. In *Society and Economy—Framework and Principles*; Harvard University Press: Cambridge, MA, USA, 2017; pp. 1–26.
22. Holmstrom, B. Moral hazard in teams. *Bell J. Econ.* **1982**, *13*, 324–340.
23. Tykvov'a, T. Who chooses whom? Syndication, skills, and reputation. *Annu. Rev. Financ. Econ.* **2007**, *16*, 5–28. [[CrossRef](#)]
24. Marcela, P. Management control systems in joint ventures: Literature review and description of three cases. *Int. J. Manag. Financ. Acc.* **2013**, *5*, 45–63.
25. Jamel, C.; Habib, A.; Younes, B. Characteristics of the board of directors and involvement in innovation activities: A cognitive perspective. *Int. J. Manag. Financ. Acc.* **2010**, *2*, 240–255.
26. Sorenson, O.T.; Stuart, E. Syndication networks and the spatial distribution of venture capital investments. *Am. J. Sociol.* **2001**, *106*, 1546–1588. [[CrossRef](#)]
27. Hochberg, Y.V.; Ljungqvist, A.; Lu, Y. Whom you know matters: Venture capital networks and investment performance. *J. Financ.* **2007**, *62*, 251–301. [[CrossRef](#)]
28. Stacey, R.D.; Griffin, D.; Shaw, P. Complexity and human action. In *Complexity and Management*; Routledge: New York, NY, USA, 2000; pp. 157–181.
29. Padgett, J.F.; Powell, W.W. Introduction: The problem of emergence. In *The Emergence of organizations and markets*. Princeton University Press: Princeton, NJ, USA, 2012; pp. 4–30.
30. Rong, K.; Hu, G.; Lin, Y.; Shi, Y.; Guo, L. Understanding business ecosystem using a 6C framework in Internet-of-Things-based sectors. *Int. J. Prod. Econ.* **2015**, *159*, 41–55. [[CrossRef](#)]
31. Ahuja, G.; Soda, G.; Zaheer, A. The genesis and dynamics of organizational networks. *Organ. Sci.* **2012**, *23*. [[CrossRef](#)]
32. Beckman, C.M.; Haunschild, P.R.; Phillips, D.J. Friends or strangers? Firm-specific uncertainty, market uncertainty, and network partner selection. *Organ. Sci.* **2004**, *15*, 259–275. [[CrossRef](#)]
33. Polidoro, F.; Ahuja, G.; Mitchell, W. When the social structure overshadows competitive incentives: The effects of network embeddedness on joint venture dissolution. *Acad. Manag. J.* **2011**, *54*, 203–223. [[CrossRef](#)]
34. Rowley, T.J.; Greve, H.R.; Rao, H.; Baum, J.A.C.; Shipilov, A.V. Time to break up: Social and instrumental antecedents of firm exits from exchange cliques. *Acad. Manag. J.* **2005**, *48*, 499–520. [[CrossRef](#)]
35. Hochberg, Y.V.; Ljungqvist, A.; Lu, Y. Networking as a barrier to entry and the competitive supply of venture capital. *J. Financ.* **2010**, *65*, 829–859. [[CrossRef](#)]
36. Kogut, B.; Urso, P.; Walker, G. Emergent properties of a new financial market: American venture capital syndication, 1960–2005. *Manag. Sci.* **2007**, *53*, 1181–1198. [[CrossRef](#)]
37. Lerner, J. The syndication of venture capital investments. *Financ. Manag.* **1994**, *23*, 16–27. [[CrossRef](#)]
38. Bruton, G.D.; Fried, V.; Manigart, S. Institutional influences on the worldwide expansion of venture capital. *Entrep. Theory Pract.* **2005**, *29*, 737–760. [[CrossRef](#)]
39. Eisenhardt, K.M. Building theories from case study research. *Acad. Manag. Rev.* **1989**, *14*, 532–550. [[CrossRef](#)]
40. Dean, T.; McMullen, J. Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. *J. Bus. Ventur.* **2007**, *22*, 50–76. [[CrossRef](#)]
41. Granovetter, M.; Ferrary, M. The role of venture capital firms in Silicon Valley's complex innovation network. *Econ. Soc.* **2009**, *38*, 326–359.
42. Burt, R.; Knes, M. *The Gossip of the Third Party in Trust in Organizations*; Kramer, R.M., Tyler, T.R., Eds.; Sage Publications, Inc.: London, UK, 2001; pp. 68–89.
43. Barabasi, A.; Albert, R. Emergence of scaling in random networks. *Science* **1999**, *286*, 509–513. [[CrossRef](#)]
44. Powell, W.W. Neither market nor hierarchy: Network forms of organization. *Organ. Behav.* **1990**, *12*, 295–336.
45. Nambisan, S.; Baron, R.A. Entrepreneurship in innovation ecosystems: Entrepreneurs' self-regulatory processes and their implications for new venture success. *Entrep. Theory Pract.* **2013**, *37*, 1071–1097. [[CrossRef](#)]
46. Pitelis, C. Clusters, entrepreneurial ecosystem co-creation, and appropriability: A conceptual framework. *Ind. Corp. Chang.* **2012**, *21*, 1359–1388. [[CrossRef](#)]
47. Wüstenhagen, R.; Teppo, T. Do Venture capitalists really invest in good industries? Risk-return perceptions and path dependence in the emerging European energy VC market. *Int. J. Technol. Manag.* **2006**, *34*, 63. [[CrossRef](#)]
48. Tsujimoto, M.; Kajikawa, Y.; Tomita, J.; Matsumoto, Y. A review of the ecosystem concept — Towards coherent ecosystem design. *Tech. Forecast. Soc.* **2018**, *136*, 49–58. [[CrossRef](#)]

49. Krackardt, D. QAP partialling as a test of spuriousness. *Soc. Netw.* **1987**, *9*, 171–186. [[CrossRef](#)]
50. Luo, J.; Cheng, M.; Zhang, T. Guanxi circle and organizational citizenship behavior—Taking a Chinese workplace as an example. *Asia Pacif. J. Manag.* **2016**, *33*, 649–671. [[CrossRef](#)]
51. Hwang, K.K. Face and favor: The Chinese power game. *Am. J. Sociol.* **1987**, *92*, 944–974. [[CrossRef](#)]
52. Chowdhry, B.; Nanda, V. Stabilization, syndication, and pricing of I.P.O.s. *J. Financ. Q. Anal.* **1996**, *31*, 25–42. [[CrossRef](#)]
53. Chiplin, B.; Robbie, K.; Wright, M. The syndication of venture capital deals: Buy-outs and buy-ins. *Entrep. Theory Pract.* **1997**, *21*, 9–28.
54. Burt, R. The social structure of competition. In *Structural Holes: The Social Structure of Competition*; Harvard University Press: Cambridge, MA, USA, 1992; pp. 8–45.
55. Wareham, J.; Fox, P.B.; Cano Giner, J.L. Technology ecosystem governance. *Organ. Sci.* **2014**, *25*, 1195–1215. [[CrossRef](#)]
56. Podolny, J.M. A Status-based model of market competition. *Am. J. Sociol.* **1993**, *98*, 829–872. [[CrossRef](#)]
57. Inchauspe, J.; Ripple, R.D.; Trueck, S. The dynamics of returns on renewable energy companies: A state-space approach. *Energy Econ.* **2015**, *48*, 325–335. [[CrossRef](#)]
58. Marcus, A.A.; Ellis, S.; Malen, J. Conferring Legitimacy: Takeoff in Clean Energy Venture Capital Investment. *Acad. Manag. Annu. Meet.* **2012**, *2012*, 16439. [[CrossRef](#)]
59. Wüstenhagen, R.; Wolsink, M.; Bürer, J.M. Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy* **2007**, *35*, 2683–2691. [[CrossRef](#)]
60. Cox, P.E.; Katila, R.; Eisenhardt, K.M. Who takes you to the dance? How partners' institutional logics influence innovation in young firms. *Adm. Sci. Q.* **2015**, *60*, 266–276.



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