Evaluating Value-Addition Activities and Signaling Effects of Government-Private Funds

— Structuring and Assessing Value-Added Activities Mechanisms and Signaling Effects from the Perspectives of Investees and Investment Officers—

Waseda University Satoshi Okuda
NUCB Business School Yuriko Sawatani
Design for All Nobuo Kanai

Abstract

This study aims to elucidate the impact of value-added activities provided by government-affiliated venture capital (GVC) firms on their investee startups. Focusing on Innovation Network Corporation of Japan (INCJ), the research empirically examines the effectiveness of such activities. Based on exploratory factor analysis, the support provided by INCJ is categorized into three domains: R&D support, business growth support, and market expansion support. The study analyzes how each domain influences performance indicators such as "revenue and business growth," "fundraising expansion," and "signaling effects." Structural equation modeling (PLS-SEM) was applied using data from surveys conducted with both INCJ investment officers and investee companies. The results reveal that the effects of value-added activities differ depending on their type, and a gap in perception of effectiveness exists between INCJ officers and the investee companies.

These findings suggest that the outcomes of GVC support are not uniform and that strategic design tailored to the type and purpose of value-added activity is essential. By structurally organizing GVC activities and providing an empirical foundation for enhancing the quality and effectiveness of policy-based support, this study makes a significant contribution to the field.

Keywords: Government Venture Capital, Value-Added Support, Signaling Effect, Startup Growth

1 Introduction

1.1 Background

The supply of risk capital is important for fostering new industries. In venture investment, Venture Capitalists (VCs) not only supply risk capital but also exert significant influence on management and administration. VCs are an important source of funding for entrepreneurial firms in high-tech sectors (Denis, 2004; Gompers and Lerner, 2001), and in addition to providing capital, they complement management resources through a series of value-adding activities such as finance, management, marketing, strategy and management support (Gorman and Sahlman, 1989; Sahlman, 1990), and are said to have an overall positive effect on the performance of portfolio companies (Da Rin et al., 2011).

As players in venture investment,VCs are broadly categorized into government venture capitalists (GVC) and private venture capitalists (PVC; including independent venture capitalists (IVC), bank-affiliated venture capitalists and venture capitalists owned by business companies, etc.). According to the Japan Venture Capital Association (2016),GVCs account for 18% of venture investments and are a steady presence in venture investment.

On the other hand,PVCs tend to concentrate on a few industrial sectors deemed to have high growth potential (Lerner, 2002), and also tend to concentrate solely on core regions at the expense of economically lagging peripheral regions (Harrison and Mason, 1992; Sunley et al., 2005).

The establishment of GVC funds is common in

many European countries as part of government efforts to fill funding gaps in early-stage investments. The objectives of GVC investment are diverse, including direct supply of capital for industrial development, indirect support through signaling effects (enhancement of the market evaluation and credit of target companies through investments from highly credible entities, thereby inducing additional private investment) by governmental involvement in funding, and promoting regional economic revitalization and job creation through the establishment of regional funds. There are many studies on the impact of such venture investment by governments on totalVC funding from a macro perspective (nationwide or by region), and some results even suggest a positive impact (Leleux and Surlemont, 2003). It has been pointed out that Europe lags behind the United States in the development of the VC market, whereby the ratio ofVC investments toGDP in Europe is only one-fourth that of the United States (Kelly, 2011). Therefore, there is an understanding that European high-tech entrepreneurial firms rely on internal funds for new investments and their growth is restricted for reasons of funding (Carpenter and Petersen, 2002a). These background circumstances are common with Japan, so previous efforts and evaluations of GVCs in Europe can serve as a reference for evaluating the performance of INCJ, a Japanese GVC.

As such, related research in Europe evaluates the significance of funding by GVCs as having a certain policy effect from a macro perspective. On the other hand, from a micro perspective, that is, concerning the effectiveness of value-added activities in individual support actions for investee companies, the results have not necessarily been clear. Specifically, it is suggested that the impact of GVC support on the performance of investee companies, such as exit performance (Cumming et al., 2014), growth of sales and employment (Grilli and Murtinu, 2014) and improvements in productivity (Alperovych et al., 2015), is limited. Furthermore, even in subjective evaluations by investee companies, the contribution of GVCs for lead investors - in refining business ideas, strengthening management structures (management changes, selection of executive candidates) and supporting exit strategy formulation - is considered relatively low compared to that of IVCs (Luukkonen et al., 2013).

On the other hand, it has been shown that investment by GVCs can promote fundraising from PVCs by signaling that the investee company has been examined and certified (Guerini and Quas, 2016). Also, in terms of investment areas, GVCs for deep tech sectors such as biotech and high-tech tend to achieve better performance compared to PVCs (Bertoni et al., 2015).

The VC industry fundamentally operates with asymmetrical information and high uncertainty, leading to various structural challenges between investors and VCs, and between VCs and investee companies. Responding to this, there is a historical background by which investment methods specific to VCs have evolved, such as phased capital commitments, performance-based compensation schemes and institutional mechanisms for profit distribution.

Sahlman (1990) presented three basic challenges faced byVCs: selecting optimal investment targets, reconciling conflicts of interest between investors andVCs, and maximizing operational efficiency. However, this study does not explicitly mention the perspectives of value-added activities or signaling effects. Attention began to focus on such ancillary functions as a result of subsequent research developments. For example, Politis (2008) reviewed previous research and classified VC value-added activities into the following four functional areas: strategic advice and consultative support, management oversight and monitoring, assistance in acquiring external resources and mentoring for executives. However, the causal structure of how these activities affect the performance of venture companies is considered an issue for research (Croce et al., 2013).

Based on existing research, this study attempts to redefine the value-added activities conducted by GVCs and to empirically examine how these

activities correlate with the growth and performance of venture companies.

1.2 Research Objectives

The purpose of this study is to evaluate the effects of INCJ's investments and value-added activities from different facets and to clarify their characteristics and impacts. The investigation was conducted from the two perspectives below.

First, the effects of value-added activities. We evaluated the effects of the value-added activities implemented by INCJ for its investee companies from both quantitative and qualitative perspectives, based on the perceptions of both the investee companies and INCJ investment managers. Here, concrete insights will be derived through the structuring of support content and analysis of the perception gap between the two parties. The central question here is how value-added activities by the GVC affected corporate growth.

Secondly, this study will examine whether INCJ's investment and value-added activities had a signaling effect by indicating reliability and future potential to external stakeholders such as other investors, clients and job seekers. For this question, we will focus on how GVC involvement affected external evaluations and behavior (improving credit with investors, clients, members and business partners).

Based on the above two viewpoints, the objective of this study is to analyze the structure and effectiveness of value-added activities provided by GVCs and to clarify how the signaling effect through the investment acted as a catalyst for external resources.

2 Research Methods

This study adopts a mixed-methods approach, combining quantitative and qualitative analysis, with the aim of empirically elucidating the impact of value-added activities by GVCs on investee companies and their signaling effects.

First, prior research was reviewed and materials provided by INCJ as well as public information were collected to construct a theoretical framework, set hypotheses and establish questions to be examined for the study. In addition, interviews were conducted with INCJ's head of investment and investment managers to understand their investment policies, decision-making process, the criteria used for selecting investees and the actual conditions of their support. Based on these inputs, a questionnaire was developed regarding the importance of value-added activities, the degree to which support contributed and the signaling effect.

Next, a survey was conducted targeting INCJ's investee companies and INCJ managers. Furthermore, semi-structured interviews were conducted with the selected investee companies and INCJ managers to understand the actual conditions of the value-added activities, their interactions and the value creation process. These were used for qualitative case analysis to complement the quantitative analysis.

2.1 Survey Items

The support areas and specific support activities for the value-added activities were organized in consideration of interviews with the co-heads of the VG investment group regarding INCJ's value-added activities, public documents and prior international research. Support areas were organized into "Business Strategies" and seven other categories, and specific support activities were presented for each. Additionally, for an overall evaluation, we requested assessments concerning "Contributions to Revenue Growth or Business Growth" and "Contributions to the Expansion of Funding." For "Corporate Credit," instead of assessing contributions from individual support activities, we asked for an evaluation of the contributions of INCJ's investment toward improved credit. This is a survey item concerning the signaling effect associated with investment by public-private funds and it also examines the effect on stakeholders other than investors. The survey items in the questionnaire are shown below (Table 2.1).

Table 2.1 Survey Items in Questionnaire

Support Area	Support Activities (name of variable)
Business Strategies	Introduction of business partners (Business 1) Formulation of management strategies and business plans (Business 2)
Technological Strategies	Formulation of R&D plans (Technology 1) Formulation of intellectual property strategies (Technology 2) Technology development collaborations/Utilization of external resources (Technology 3)
Market Strategies	Formulation of sales and marketing plans (Market 1) Sales support (customer referrals, etc.) (Market 2) Value chain construction (Market 3)
Management Structure	Strengthening of corporate governance (Management 1) Enhancement of management personnel (Management 2) Management efficiency - internal systems, production plans (Management 3)
Financial Strategies	New fundraising - attracting co-investors (Finance 1) Additional fundraising - engaging existing shareholders (Finance 2) Introduction of other public-private funds (Finance 3)

2.2 Data Collection

In this survey, responses were obtained using a 5-point Likert scale for each question. Response options ranged from "Low (1)" to "High (5)", in five stages. An additional open-ended subsidiary question was provided in the questionnaire. We requested that respondents' names be provided but also accepted anonymous responses and the responses were collected using a web questionnaire.

Regarding investee companies, we requested responses from 61 companies out of 116 INCJ EV investees, excluding 9 LP investees and companies that were no longer concerned due to having been dissolved or acquired by other companies. The research team sent a request email to the target companies on December 6, 2024, after INCJ had announced the survey and requested cooperation in advance, and collected responses with the deadline of January 10, 2025. During this period, two reminder emails were sent individually to target companies that had not yet responded.

For INCJ investment managers, after collecting responses from the companies, we requested responses about the respective companies from the named respondents. The structure of the questionnaire was the same as that for investee companies. Note that the contents of the responses from investee companies were not disclosed to the managers.

As a result, valid responses were obtained from 32 investee companies (52.5%). Among these, all 26 named responses (42.6%) were provided by representatives. For the 26 named responses, we obtained responses from all 26 INCJ investment managers (100%).

In addition, semi-structured interviews were conducted with specific investee companies and INCJ managers. Interviews were conducted face-to-face in a meeting room at the company for approximately 1 to 2 hours.

2.3 Method of Analysis

We first analyzed the survey responses from investee companies and INCJ investment managers. In this analysis, we examined the impact of value-added activities on corporate performance and the presence and extent of signaling effects from INCJ's involvement. Furthermore, we qualitatively analyzed the relationship between INCJ and its investees through the interview surveys.

Next, we clarified what effects INCJ's value-added activities had on investee companies by conducting exploratory factor analysis (EFA) on the investee companies. Furthermore, we examined the value-added activities and signaling effects through an analysis with Partial Least Squares Structural Equation Modeling (PLS-SEM) based on the latent variables extracted by EFA. Unlike traditional covariance-based structural equation modeling (CB-SEM), PLS-SEM is suitable for relatively small sample sizes and for theory development at an exploratory stage (Hair et al., 2021). Additionally, we independently conducted cluster analysis on the investee companies' perceptions across two axes: "Importance of Value-Added Activities (Expectations)" and "Contribution of Value-Added Activities (Perceived Outcomes)" to

gain a deeper understanding of the existing company groups.

Through the above process, we examined multiple facets of the actual state of support by GVCs and the mechanism of its effects.

3 Results of Analysis

3.1 Analysis of Survey Responses from Investee Companies and INCJ Investment Managers

This section analyzes the survey responses obtained from named investee companies and INCJ investment managers (Table 3.1).

Concerning the importance and contribution of support activities

Regarding the responses from investee companies, for all activities across the seven support areas, the average evaluation of the contribution of support activities (3.06) was lower than the perception of the importance (3.60). This trend was found to be significant by a t-test with a 5% significance level for the difference in average values. The same trend was observed for all support areas, and these were recognized as statistically significant differences. We believe that this result is also influenced by the fact that the survey was conducted retrospectively, looking back in time and making it difficult to assume cases where the perceived importance (expectation) would be exceeded by the contribution (outcome). In addition, while some survivorship bias and success bias are assumed in the analysis sample, the inclusion of cases where the evaluation of the contribution (outcome) is expected to be low due to business conditions also influences the result. Next, to confirm the absence of multicollinearity, the Variance Inflation Factor (VIF) was calculated for each observed variable. Generally, if the VIF exceeds 5, there is concern about multicollinearity; however, in this study, the maximum VIF for all items was 4.85, and the VIF was around 2.0 or less for the majority of items. This confirmed that each item provides independent information and that multicollinearity is not an issue in the model.

For individual support activities, no significant difference was observed in the average between importance and contribution for the responses to "Strengthening Corporate Governance" (importance 3.53, contribution 3.38), indicating a high evaluation for the contribution relative to the perception of the importance.

On the other hand, the responses from the INCJ investment managers also showed a similar tendency to rate the self-assessment of the contribution lower than the recognition of the importance of support activities. Furthermore, when compared to the responses from investee companies, the average difference in the perception of the overall importance of activities (investees 3.60, managers 3.48) and the evaluation of the contribution (investees 3.06, managers 2.85) was not found to be significant. Even when viewed by support area, no significant difference was observed, except for a few cases. Regarding the perception of the importance of support in market strategy where a significant difference was observed (investees 3.69, managers 3.05), a significant difference was found only in "Value Chain Construction" (investees 3.57, managers 2.65) at the level of specific activity items. Here, INCJ investment managers perceived the importance of support to be low, but it is possible that they viewed themselves as outsiders to the investee companies' industries and businesses and thus felt it was not an item that should be prioritized. Additionally, for financial strategy, while investee companies' perception of importance (average 4.28) significantly exceeded that of managers (average 3.46), the investee companies also gave a higher evaluation to contribution (average 3.63) than the managers' self-assessment (average 2.95).

Regarding the perception of importance by support area, we will compare the priorities of the investee companies and the managers with their respective overall averages. Investee companies highly recognized support in business strategy, market strategy, management structure and financial strategy as being highly important. On the other hand, managers tended to recognize support in business strategy, management structure, financial strategy and exit strategy as being highly

important. Thus, differences in priorities were observed between investee companies and managers concerning market strategy and exit strategy. As mentioned earlier, for market strategy, investee companies perceived the importance in this support area higher than managers, with the difference being significant. Managers had a lower perception of the importance of support activities, including "Formulation of Sales and Marketing Plans" (average 3.17) and "Sales Support such as Customer Referrals" (average 3.17), than the overall average. Regarding exit strategy, although the difference in the perception of importance between investee companies and managers was not found to be significant, we believe that managers, as investors, gave it high priority because this support area is directly related to their own investment performance.

The comprehensive results of the evaluation of the contribution of these support activities showed high ratings from the investee companies for "Contribution to Growth" (average 3.48) and "Expansion of Funding" (average 3.96). This significantly exceeded the overall average evaluation of contribution for each individual activity item (average 3.06). This suggests that investee companies do not necessarily require all support activities and that contributions in specific support areas or activities significantly contribute to business growth and fundraising outcomes.

Thus, no significant gap was observed in the perception of the importance of support activities and the evaluation of the contribution between investee companies and managers, with the survey results being generally consistent. However, due to their respective positions, investee companies and managers exhibited differences in their perception of relative importance and priorities between support areas and activities. While the outcomes of support activities were comprehensively highly evaluated, the results suggest that the contribution of support activities to business growth and fundraising outcomes functions selectively. Therefore, although INCJ's value-added activities appear to be managed effectively overall, it was also suggested that there may be room for greater efficiency by reconciling the perceptions regarding support activities between investee companies and managers. Building frameworks for visualizing support outcomes and sharing perceptions interactively will likely constitute an important task in future institutional design.

Expectations for improved corporate credit and actual contributions

Regarding "Corporate Credit," which is a signaling effect of INCJ's investment as a public-private fund, both "Expectations for Improved Credit" (average 4.02) and "Actual Contribution to Improved Credit" (average 4.05) from investee companies were highly evaluated, with over 80% of companies giving a rating above 3.00 for both. Specifically, they highly rated the contribution in "Negotiations With Business Partners and Collaborators" (average 4.30) and "Improved Credit With Other Investors" (average 4.30). Here, it is clear that investment plays a role in enhancing a company's external reputation for outside stakeholders with significant interests, such as business partners and collaborators. This also suggests that investment from a government-affiliated fund functions as a strong signal to the investor community. This is also likely to be an aspect that strengthens the impression of effectiveness, in conjunction with the high evaluation of the contribution of support in the financial strategy. Furthermore, high evaluations were also given for "Improved Credit With Customers" (average 3.83) and improved credit in the "Recruitment of Management Personnel and Employees" (average 3.91), confirming that INCJ's investment enhances a company's social recognition in multiple ways. These items were answered by referencing the effects arising from the indirect improvement of corporate reputation and recognition through INCJ's investment, rather than an outcome from INCJ's direct support.

Table 3.1 – Responses from Investee Companies and Investment Managers

Support Area	Importance /Contribution	Investee Companies Average	Investee Companies Standard Deviation	Investment Managers Average	Investment Managers Standard Deviation	Average Difference	
Overall	Importance	3.83	1.02	4.27	0.97	−0.44	
	Contribution	3.21	1.14	3.54	1.26	−0.33	
Business	Importance	2.97	1.00	3.06	1.27	−0.09	
	Contribution	2.56	0.93	2.22	0.90	0.35	
Technolog	Importance	3.69	0.92	3.05	1.09	0.64	*
	Contribution	2.90	1.12	2.69	1.19	0.21	
Market	Importance	3.65	0.98	3.85	1.12	−0.19	
	Contribution	3.13	1.07	3.18	1.10	−0.05	
Managem	Importance	4.28	0.62	3.46	0.73	0.82	*
	Contribution	3.63	0.80	2.95	0.85	0.68	*
Financial	Importance	3.23	1.09	3.08	1.62	0.15	
	Contribution	2.65	1.07	2.04	1.34	0.62	
Overseas	Importance	3.35	1.09	3.56	0.93	−0.22	
	Contribution	3.12	1.01	3.04	1.01	0.08	
Exit	Importance	3.48	1.21	3.13	1.33	0.35	
	Contribution	3.96	1.23	3.96	1.23	0.00	
Overall	Contribution to Expansion of	4.02	0.96	3.75	1.00	0.27	
	実際の寄与	4.05	0.92	3.56	1.04	0.49	
Corporate	Expectation for Actual	担当者を対象　*有意水準5%でのt検定により有意					

3.2 Structural Analysis of Value-Added Activities

In this study, EFA was employed to grasp the overall picture of value-added activities by GVCs and their structural characteristics. EFA was deemed appropriate because it is situated in the exploratory stage of measurement models, while there were no clear assumptions regarding item factor attribution or the number of factors. The targets were 18 items related to value-added activities in the survey of investee companies.

The minimum residual method, which minimizes the reproduction error (sum of squared residuals) of the correlation matrix, was used to extract latent factors. This method is similar to the principal factor method and does not require the assumption that data follows a normal distribution, making it robust even for real-world data that may not satisfy normality. Varimax rotation, which assumes independence between factors, was used for factor rotation. Three factors were set as the criterion by the elbow method for determining the number of factors. At this stage, the cumulative contribution rate of the factors was 65.79%.

The analysis revealed that the value-added activities could be broadly classified into three factors.

The first factor showed high factor loadings for items indicating continuous and comprehensive involvement with investee companies, such as "Advisory Support," "Corporate Governance Support," "IPO/Exit Support" and "Fundraising Support." These represent the cumulative effect of support from GVCs regarding the business growth and fundraising of investee companies and are based on collaborative relationships with investee companies. Therefore, this factor was named "Business Growth Support Factor."

The second factor includes support that delves deeper into business practices, such as "Sales and Marketing Support," "Business Partner Introduction" and "Management Efficiency Support." Since these activities pertain to situations where the GVC actively engages in sales practices and partnership building, this factor was named "Market Development Support Factor."

The third factor classified support activities characterized by technology-related strategic support and the supply of human networks, such as "Intellectual Property Strategy," "Research and Development" and "Technology Development Support." These were defined as "Research and Development Support Factors" because they are mainly related to the strategic and mediating role of human and social network resources in research and development.

All three of these factors are clearly distinguishable from each other both theoretically and conceptually, while the validity of the constructs is considered to be sufficiently ensured. Furthermore, regarding data reliability, the Cronbach's alpha coefficients for each factor were high, ranging from 0.86 to 0.92, confirming sufficient internal consistency (Appendix 1). Moreover, each factor included multiple items with factor loadings of 0.7 or higher, and none fell below 0.4, indicating a good factor structure from the perspective of convergent validity.

Table 3.2 below shows the factor structure.

Table 3.2 - Factor Structure

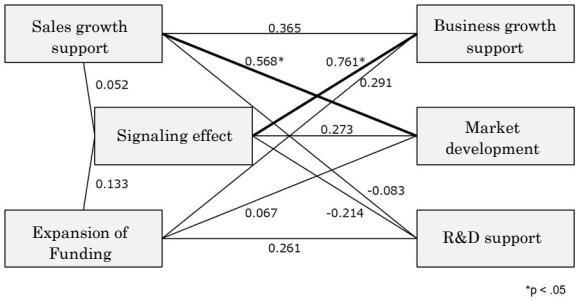
Variables	Business Growth Support	Market
Exit 1	**0.811**	0.261	0.047
Overseas 1	**0.806**	0.268	0.129
Management 1	**0.704**	0.016	0.529
Exit 3	**0.693**	0.240	0.263
Finance 3	**0.689**	0.147	0.203
Management 2	**0.608**	0.298	0.483
Finance 1	**0.437**	0.216	0.348
Finance 2	**0.401**	0.339	0.288
Market 2	0.214	**0.984**	0.057
Market 1	0.273	**0.714**	0.474
Strategy 1	0.208	**0.677**	0.253
Market 3	0.382	**0.616**	0.481
Management 3	0.486	**0.502**	0.490
Technology 2	0.061	0.193	**0.787**
Technology 1	0.334	0.268	**0.698**
	0.194	0.549	**0.589**
	0.467	0.519	**0.546**
	0.284	0.161	**0.511**

3.3 PLS-SEM of Investee Companies

Prior to implementing PLS-SEM, t-tests were conducted between the different factors to confirm p-values and check for statistical significance. The results of the t-tests are shown in Appendix 2. As noted in the appendix, the p-values for many paths exceeded the 5% significance level, but this is attributed to the small population of GVC investees surveyed, and the model needs to be evaluated with this discounted. The interpretability of the structural model for each dependent variable was evaluated by R^2. As a result of the analysis, the R^2 for "Sales Growth/Business Growth" was 0.681, for "Signaling Effect" it was 0.623, and for "Expansion of Funding" it was 0.468, confirming that all had a medium to high level of interpretability. In this study, these factors were used as latent variables to construct an SEM model for analyzing the structural relationship between the GVC's value-added activities and the outcomes of investee companies.

The PLS-SEM results are shown below. PLS-SEM was conducted to examine how the three latent variables extracted by factor analysis ("Business Growth Support," "Market Development Support" and "R&D Support") along with "Signaling Effect," "Sales Growth/Business Growth" and "Expansion of Funding" as constructs, affect the business outcomes of investee companies. PLS-SEM is suitable for relatively small sample sizes and for theory development at an exploratory stage (Hair et al., 2021). In this study, given the limited sample size that could be collected due to the research characteristics and the objective of exploring and predicting the relationship between multiple value-added activities by the GVC and their outcomes, PLS-SEM was deemed an appropriate method for the data characteristics and objectives.

Figure 3.1 - PLS-SEM Results



The structural model shown in Figure 3.1 is a visualization of the results of PLS-SEM estimated using standardized path coefficients. This model was constructed to clarify how multiple GVC support elements function in relation to the growth outcomes of investee companies.

The analysis confirmed that "Market Development Support" has a strong positive influence (β = 0.568) on "Sales Growth/Business Growth." This result indicates that market access support provided by the GVC, such as market development, marketing assistance and sales channel introductions, provides an immediate contribution to expanding the company's business and improving its revenue. The results particularly suggest that access to reliable sales channels and customer networks is a key factor in accelerating sales growth for B2B investee companies. "Business Growth Support" also showed a weak positive influence (β = 0.365) on sales growth/business growth, indicating that the GVC's IPO support, overseas expansion support and corporate

governance support affect business growth. This indicates that "Business Growth Support" contributes to "Sales Growth/Business Growth," although not as strongly as "Market Development Support."

Next, for the "Signaling Effect," the strongest positive influence (β = 0.761) was from "Business Growth Support." This suggests that such GVC value-added activities as IPO support, overseas expansion support and governance support function as signals that enhance external trust and recognition for investee companies, attracting additional support.

Furthermore, "Market Development Support" was also confirmed to have a positive influence (β = 0.273) on the "Signaling Effect." Activities such as support for sales strategy formulation, hands-on marketing assistance and introduction to business partners are interpreted as contributing to increased external credibility by enhancing the company's market presence.

On the other hand, no direct correlation was observed between the "Signaling Effect" and "Expansion of Funding" or "Sales Growth/Business Growth." This means that the signaling effect alone does not directly lead to these outcomes, but rather that it is effective when combined with specific value-added activities such as "Business Growth Support" and "Market Development Support."

Moreover, while "R&D Support" showed a weak negative correlation with the "Signaling Effect," it was found to have a weak yet positive correlation (β = 0.261) with "Expansion of Funding." This suggests that while R&D support may not directly lead to increased trust, it potentially contributes to promoting fundraising activities to some extent.

Finally, "Business Growth Support (β = 0.291) and "R&D Support" (β = 0.261) both had a weak but positive influence on "Expansion of Funding", suggesting that this support contributes indirectly to increasing fundraising capabilities.

3.4 Analysis of Interviews with INCJ and Investee Companies

In addition to quantitative analysis, we examined the actual support of INCJ for the firm Astroscale as a qualitative analysis case. This case gives a clear, concrete image of the "Market Development Support" and "Business Growth Support" value-added activities as well as the signaling effect.

Function of Market Development Support and Reliability

In its support to Astroscale, INCJ did not offer direct third-party marketing or the establishment of sales channels, but we confirmed that "the very fact that INCJ had invested [in Astroscale]" served as a guarantee of corporate reliability and had a major indirect effect in market development. The following statements by Astroscale representatives indicate that the involvement of the GVC enhanced the company's external reputation and backed sales activities psychologically and in terms of trust:

> "There may have been a sense of security thanks to INCJ's presence."
>
> "I do feel that there might have been more trust thanks to [INCJ's] presence."

Thus we can see even without the direct support of the GVC linking to the market, its very presence functions as a medium for improving trust.

Function for Business Growth Support and Support for Decision-making

Furthermore, we also confirmed that in the appointment of management personnel, INCJ offered its evaluation from a third-party perspective in the process of hiring a CFO. We can interpret this as a "Business Growth Support" function.

> "When hiring our CFO, we had INCJ meet candidates and offer us a third-party review."

In addition, INCJ offered support in refining corporate planning (so-called "idea bouncing") and expressing constructive opposing opinions at board meetings. This serves to support the strengthening of the corporate executive basis and contributes to improved capabilities to make strategic decisions.

> "Actually this is project planning. Something like bouncing off ideas."
>
> "This factory transfer was rejected twice. (...) I think the discussions were very productive."

This suggests that these different types of support go beyond simply providing capital, they function as structural aid values supporting the company's mid- and long-term growth.

Effectiveness of the signaling effect

Furthermore, the fact that Astroscale achieved its greatest amount of funding in its Series D round clearly testifies to the fact that INCJ's involvement served as reassurance to other investors.

> "I do believe that INCJ's presence served as reassurance."
>
> "[INCJ] extended us credit and of course gave us some financing, but it also made additional investments and these were public-private funds, and I think these two factors played a major role."

Thus, investment by INCJ functions not simply as financing but also as a credit medium (signaling device) for attracting private investors. In particular, the fact that these are "public-private funds" with government involvement increases the sense of security and trust for external stakeholders and this clearly functions as a basis for trust for attracting additional support.

3.5 Cluster Analysis of Importance and Contribution

In this section, to clarify the diversity of evaluations of hands-on support by a governmental VC, we performed independent cluster analyses of the perceptions of investee companies on two axes, namely "the importance (expectations) of value-added activities" and "the contribution of the value-added activities (perception of results)" and typified the patterns of perception based on the intersection of the two axes. As a result of the analyses, three clusters were extracted concerning the importance of the support. The first is an independence-oriented type not requiring support, the second type is neutral to moderately negative regarding support, while the third is a proactive, expectative type valuing support. The results of the cluster analyses are shown in Appendix 3.

Likewise, three clusters were obtained concerning the contribution of support as well. The first type is one with a low evaluation of the contribution, the second is a neutral to moderately positive type, while the third type perceives that the contribution was substantial.

Based on the matrix obtained with the intersections of the clusters (Table 3.3), we performed our analysis with focus on particularly symbolic combinations.

1. Proactive, expectative type valuing support × type perceiving that the contribution was substantial (n = 7)

This group has a high recognition of the importance of support and feels that the actual results were substantial, so the expectations and the perception of the results were consistent. This is considered the most ideal success pattern in this study and serves as the reference model for considering support design and deployment strategy. We can expect the results of support activities to be maximized by constructing the support strategy with this group as the base point.

2. Proactive, expectative type valuing support × neutral to moderately positive type (n = 6)

This cluster has high expectations for support but perceived the results to be moderate, so there is a certain dissociation between the expectations and the perception of the results. We believe there is room for improvements in the quality of the support, its timing and the visualization of the results. In particular, for the group that had high levels of expectation, the fact that the results were not perceived to have reached expectations could produce a latent dissatisfaction in support and there is a risk that the group will turn its back from support in the future, so continuing to provide value and communicating with this group is essential.

3. Neutral to moderately negative type × Neutral to moderately positive type (n = 10)

This group had low expectations for support at first but perceived the support to have had certain results. Because this group felt that the results were above expectation, it could reevaluate the effectiveness of the support. It is possible that, with

follow-up and the appropriate timing for re-experiencing support, this group could deepen its understanding and trust in the support and in the future evolve into highly loyal support receivers.

4. Type with low evaluation of the contribution (n = 8)

This group had low expectations for the support from the start. Half of this group consists of the "2. neutral to moderately negative type"; i.e., they are distinguished by having had a negative experience in that they didn't think the support was really necessary and receiving it left a bad impression. In addition, most of the others correspond to the "1. independence-oriented type not requiring support" and had low expectations for the support from the start. We can therefore interpret their low evaluation of the contribution as natural given that their expectations from the start were low.

The above results suggest that there may have been issues with the coordination of expectations in the process of providing support and with the quality of the support activities, and possibly a mismatch with the target companies, so there is a need to reexamine the management practices and the criteria for selecting the companies to receive the support.

There is a clear disparity in the receptivity to value-added activities and how the results are perceived, suggesting that the design policy, namely who and how to offer support and with what objectives, is directly related to maximizing the results. In constructing future support policies, plans centered around consistency between expectations and perception should be introduced. In particular, it is probably important to maximize and visualize the results for those who value support and to build a relationship for those who hold a neutral or negative perception of support through an appropriate timing and approach.

Table 3.3 - Cluster Comparison of Investee Companies' Views of Importance and Contribution

	Venture contribution			
Venture importance	1. Type with low evaluation of the contribution	2. Neutral to moderately positive type	3. Type perceiving that the contribution was substantial	Total
1. Independence-oriented type not requiring support	3	0	0	3
2. Neutral to moderately negative type	4	10	1	15
3. Proactive, expectative type valuing support	1	6	7	14
Total	8	16	8	32

4. Observations

In this study, Section 3.1 compared and analyzed the evaluations of value-added activities by investee companies and INCJ investment managers. Overall, the importance of support tended to outweigh the contribution and a statistically significant difference was confirmed, but we believe this to be influenced by the characteristics of the after-the-fact evaluation and biases due to the specific growth stages of the companies. Investment managers also had modest self-assessments, while no significant gap was observed in the average values between the two groups. On the other hand, for market strategy and value chain construction, a significant difference was observed in the perception of the importance, suggesting that differences in role perception may be at play. Investee companies had high evaluations for outcome-related aspects such as "contribution to growth" and "expansion of fundraising," suggesting that specific value-added activities were functioning effectively. In the future, we believe that deepening mutual understanding through the visualization of

support and shared perceptions will contribute to improving the efficiency of value-added activities.

Next, an exploratory factor analysis was conducted and the GVC support activities were categorized into three factors: "Business Growth Support," "Market Development Support," and "R&D Support" (Section 3.2).

Through PLS-SEM, we demonstrated that each of the three factors has different characteristics and different effects on the outcomes (Section 3.3). First, it is particularly noteworthy that "Market Development Support" had a strong positive influence (β = 0.568) on "Sales Growth/Business Growth." This result suggests that GVC support for sales channel development and customer access directly contributes to business growth. We demonstrated that support related to market entry and sales channel expansion has an immediate effect and is a major factor in promoting the growth of the companies' businesses.

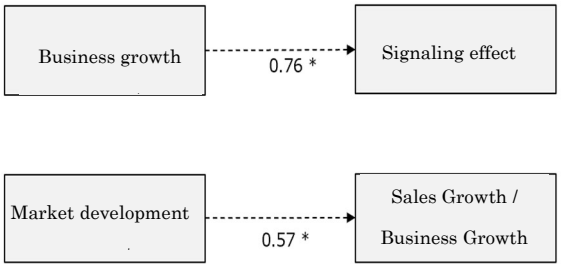
Second, the fact that the "Signaling Effect" was significantly influenced by "Market Development Support" (β = 0.273) and "Business Growth Support" (β = 0.761) means that GVC involvement acts as a trigger to attract other support. In other words, GVC investment and support serve as a signal that enhances a companies' credibility, thereby enabling additional support and resources to be mobilized.

Third, "Business Growth Support" had a positive correlation with all three dependent variables ("Sales Growth/Business Growth" (β = 0.365), "Signaling Effect" (β = 0.761) and "Expansion of Funding" (β = 0.291)), indicating a multifaceted contribution. Business Growth Support includes direct support directly linked to companies' growth strategies, such as IPO support and exit preparation, as well as indirect support for establishing the foundation for executing such strategies as corporate governance support and management personnel support. Thus, Business Growth Support covers the series of processes from the strategy conceptualization to the execution stage, playing a central role in preparing both internal and external environments for growth.

The overall implication derived from the structure of this model and the interviews in Section 3.4 is that GVC support contributes to corporate growth not through the effect of a single intervention, but through a network structure of mutually related support. In particular, the chain of indirect effects centered around the signaling effect clearly highlights the structural value of GVC involvement — namely, its dual role of "building trust" and "inducing support." Understanding this complex support structure is important knowledge that will contribute to improving the effectiveness of future GVC design and startup policy.

Figure 4.1 shows the findings from PLS-SEM. The observed variables and dependent variables were statistically significant, while high correlation coefficients were confirmed in their interrelationships. Specifically, "Business Growth Support" had a strong positive influence on " Signaling Effect" (path coefficient = 0.76, $p < 0.05$), suggesting that expansion into new markets may lead to credibility among investors and stakeholders. In addition, "Market Development Support" had a significant positive influence on the "Sales Growth/Business Growth" (path coefficient = 0.34, $p < 0.05$), suggesting that GVC value-added activities contribute to corporate sales expansion and overall business growth. These results indicate that the manifestation of outcomes differs depending on the type of support content, suggesting the importance of selecting value-added activity strategies according to the objective.

Figure 4.1 - Findings from PLS-SEM



Furthermore, as a result of a cluster analysis based on two axes of support (importance (expectation) and contribution (perception))

(Section 3.5), it was shown that there are diverse patterns among investee companies depending on the consistency between expectations and perceptions, including "those who valued and expected support but had a poor perception of the outcome" and "those who did not originally expect support but felt that the outcome was greater than expected." This indicates that the results of GVC value-added activities are influenced not only by the support itself but also by managing expectations and building relationships with the recipients. In particular, the group corresponding to those "valuing support × high perceived outcome type" can form the ideal success model where the value of support is sufficiently conveyed and the outcome is recognized. On the other hand, for groups with a low perception of the outcome relative to their expectations for support, a re-evaluation of the suitability of the support content and a review of communication design are required. This suggests that in designing the support, ensuring that the perceptions of the investors and recipients align is more important for maximizing the results than the quantity or quality of the support content.

In summary, it became clear that GVC value-added activities contribute to corporate growth not merely through funding, but through a multi-layered network structure and the function by which the activities serve as a medium for trust. In particular, the structure of inducing other support via the "signaling effect" speaks of the complexity and interdependence of the support. Focusing on this structural value, in future GVC policy design, it will be important to design support based on the signaling effect and the chain structure between value-added activities, in addition to the strength of individual support measures. In other words, a strategic perspective that contributes to improving the effectiveness of GVC support involves not only the optimization of individual measures but also the design of trust-building and ripple effects.

Many existing studies address the provision of added value by GVCs (e.g., Luukkonen et al., 2013; Bertoni & Tykvová, 2015), while "the impact of support activities on corporate performance" and "the signaling effects of government VCs" have been receiving attention. However, these studies have mainly evaluated the outcomes of support from the perspective of the support provider or based on quantitative indicators such as investment performance and IRR, while research delving into "the impact of each support type" and "evaluation gaps between stakeholders" for value-added activities has been limited.

5. Conclusion

5.1 Summary and Implications of Research Findings

This study examined how the value-added activities by a Government Venture Capitalist (GVC) influenced the growth of investee companies, and whether the investments and support by INCJ's - a representative example of a GVC - could serve as a signaling effect indicating reliability and future potential to external stakeholders such as other investors, clients and job seekers.

First, regarding the impact on corporate growth, it became clear that GVC value-added activities do not uniformly generate results, but are associated with different outcomes depending on the content of the support. For example, market development support was strongly related to sales and business growth, contributing to actual sales expansion and increased business. On the other hand, business growth support, such as strengthening business strategy and organizational structure, underpinned medium- to long-term growth by improving companies' decision-making capabilities and establishing executive foundations. This support functioned not merely as advice, but as structural support that accompanied companies and led to results.

Next, regarding the question of the signaling effect, the statements of investee companies and actual investment trends corroborated that INCJ's investment and support effectively

functioned as a signal that enhanced the companies' credibility. With INCJ's involvement, situations arose where other investors confidently decided to invest or customers and potential employees held positive expectations towards the company. In particular, support areas such as business growth and market development were often directly linked to external evaluations of companies and were perceived as important factors in building the trust of external stakeholders.

Meanwhile, some discrepancies in perception regarding the effectiveness of support were also confirmed on the part of the GVC and the investee companies. Especially concerning the extent to which the signaling effect contributed to fundraising, the supporter tended to strongly recognize the effect, while investee companies viewed its impact more restrictively. Such asymmetry in perception provides important implications for reviewing evaluation systems and dialogue approaches in future value-added activities.

From the above, it was confirmed that GVC value-added activities generated different results depending on the type of support and had a substantial impact on the growth of investee companies. Furthermore, INCJ's investment and support also functioned as a signal to external parties, indicating reliability and future potential, thereby promoting the further development of investee companies. Additionally, by visualizing the differences in perception between stakeholders regarding the outcomes of support, we were able to derive specific improvement proposals for the future evaluation system and practical operations. This study is significant in that it comprehensively examined the actual state of GVC support and its effects and empirically clarified the strategic significance of public-private partnership investments.

5.2 Contributions

This study made significant contributions, both academic and practical, by analyzing the impact structure of GVC value-added activities on the growth of investee companies and structurally visualizing the differences in perception between the INCJ investment managers and the investee companies.

First, as a theoretical contribution, it explicitly analyzed the correlation structure with results for each type of support. This quantitatively demonstrated that activities such as business growth support, R&D support, and market development support by GVC have different correlations with outcome indicators such as sales growth, signaling effects and enhanced fundraising, revealing diverse structures of support outcomes that traditional research had not sufficiently grasped.

Second, it analyzed in parallel the differences in perception between INCJ investment managers and investee companies, revealing that the two parties' perceptions of support outcomes were not monolithic and that a gap existed. While traditional research tended to rely on one-sided evaluations, this study focused on the possibility that the effectiveness of support is influenced by mutual perceptions, achieving an analysis that reflects actual conditions.

Third, through these analyses, the study showed the necessity of "weighting value-added activities according to desired outcomes" and of "a bidirectional evaluation system for support outcomes" as practical implications, providing guidelines for redesigning GVC value-added activities.

As described above, this study theoretically complements existing research from two perspectives: "elucidating the structure" of GVC value-added activities and "visualizing the gap of perception with the field," while also presenting practical implications useful for policy formulation and advancing value-added activity practices.

5.3 Limitations of This Study and Implications for Future Research

This study provided certain insights by clarifying the structure of GVC value-added activities and

visualizing the differences in perception between INCJ investment managers and investee companies, but there are limitations in the points described below.

First, this study targeted INCJ and its investee companies, so the survey subjects and the applicability of the model are limited. Since GVC operational policies and support styles vary by country and institution, we can expect to achieve a more generalizable theoretical construction by conducting comparative studies targeting GVC in other countries or VC with different operational forms.

Second, the data used for analysis is based on subjective evaluations (survey data), and the consistency and strength of correlation with objective outcome indicators (sales trends, fundraising results, presence of exits, etc.) were not within the scope of verification. In the future, we believe a more robust inference will be possible by conducting multi-source analysis integrating subjective and objective data.

Third, in interpreting support effects, differences due to corporate attributes such as type of industry, growth stage and regional characteristics were not sufficiently considered. Support effects could be more precisely grasped by introducing a multi-layered analysis that incorporates corporate segment characteristics into the framework of the study.

In future research, building on the above limitations, we can expect developments in such directions as: (1) comparative analysis among different GVC funds, (2) estimation of support effects using objective performance data, and (3) elucidation of the optimal form of support considering corporate development stages and attributes. Additionally, by track-and-tracing the impact of the evaluation gap between support providers and beneficiaries on policy implementation and operations, an empirical analytical approach to the question of how "perception gaps" affect the outcomes and sustainability of support will also be an important challenge for the future.

We extend our heart-felt gratitude to all at INCJ for their invaluable support and advice in advancing this research. We would like to extend our sincere thanks. We are also deeply grateful to everyone at Astroscale for providing the necessary information for this research. Finally, we express our profound gratitude to the secretariat of the Japan Academic Society of Ventures and Entrepreneurs for providing opportunities for academic exchange and operational support.

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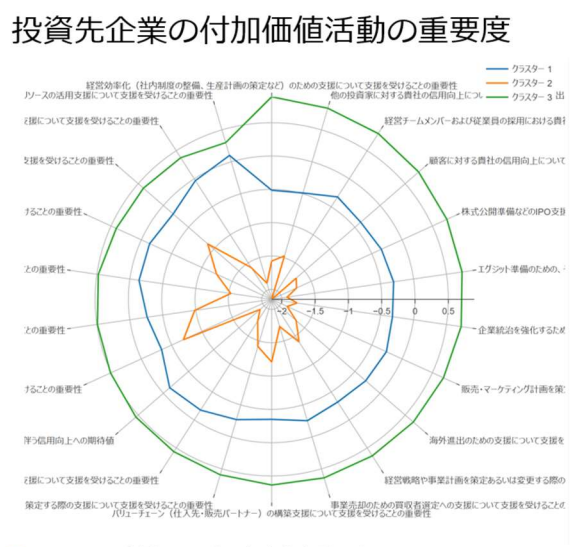
[Appendix 1] PLS-SEM of Investee Companies' Cronbach's α

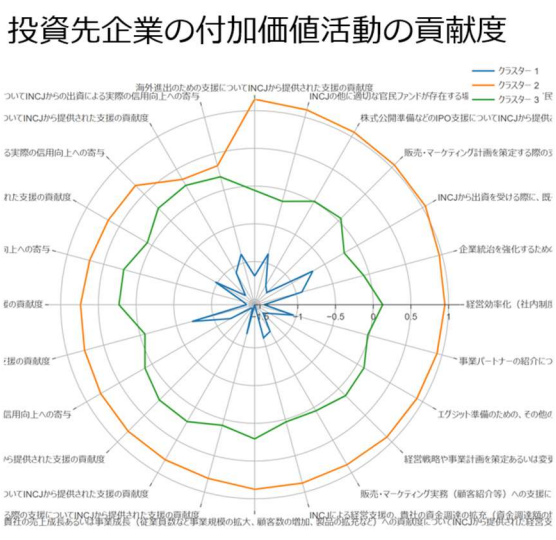
	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Signaling effect	0.906	0.913	0.935	0.781
Business growth	0.905	0.915	0.924	0.603
support	0.92	0.926	0.94	0.76
Market	0.862	0.896	0.899	0.641

[Appendix 2] T-test and P-value for Investee Company SEM

	Original	STDEV	T statistics	P values
Signaling Effect -> Sales Growth / Business Growth	0.052	0.205	0.252	0.801
Signaling Effect -> Expansion of Funding	0.133	0.323	0.412	0.68
Business Growth Support -> Signaling Effect	0.761	0.281	2.71	0.007
Business Growth Support -> Sales Growth / Business Growth	0.365	0.293	1.244	0.214
Business Growth Support -> Expansion of Funding	0.291	0.412	0.706	0.48
Market Development Support -> Signaling Effect	0.273	0.223	1.221	0.222
Market Development Support -> Sales Growth	0.568	0.202	2.805	0.005
	0.067	0.242	0.278	0.781
	−0.214	0.279	0.769	0.442
	−0.083	0.25	0.33	0.741
	0.261	0.322	0.81	0.418

[Appendix 3] Cluster Analysis Radar Chart





● Cluster 1：支援不要・強い自立志向型（3名）
● Cluster 2：支援中立～やや消極型（15名）
● Cluster 3：支援重視・積極期待型（14名）

● Cluster 1：貢献低評価型（8名）
● Cluster 2：中立～軽度肯定型（16名）
● Cluster 3：高い貢献実感型（8名）