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CALLS ON HIGH-TECHNOLOGY: JAPANESE EXPLORATION OF VENTURE CAPITAL INVESTMENTS IN THE UNITED STATES

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The strategic logic of Japanese high-technology venture capital investment reveals the existence of an implicit call option, or 'shadow option', on new technology. This option is exercised by further investment in product development, manufacturing and distribution. The process is described with reference to a comparative study of Japanese and U.S. venture capital firms. Similarities and differences between the two groups are reported, and a conceptual model of Japanese option strategy is formulated. The implications for our understanding of Japanese strategy and for strategic management theory are discussed.

INTRODUCTION

Japanese corporations are well-known for their recent commercial successes in the United States in the form of a growing market share in major industries (e.g. Toyota and Honda) or through highly visible acquisitions such as Sony's purchase of Columbia Pictures and Matsushita's takeover of MCA Entertainment. These successes, however, are largely a mature consequence of a basic thrust which has characterized Japanese business from its beginnings: the development of technology first obtained from external sources. Though less visible than the more publicized successes, this thrust still continues through a sustained emphasis on improving and refining products and processes initially developed in the West (Jauch and Osborn, 1981; Zimmerman, 1985; Osborn and Baughn, 1987; Johnson, 1988).

A strategy of technology acquisition might take several forms, including out-sourcing of product design, licensing of new technologies, strategic alliances such as joint ventures and research programs, and venture capital investments in high-technology enterprises. This paper studies one of these forms viz. venture capital investment in high-technology companies. The objective is to describe the Japanese process of investment and to examine how the Japanese strategy differs from that used by U.S. firms. Twenty Japanese venture capital companies with investments in the United States and twenty U.S. venture capital firms with similar investments form the sample for this study.

Key words: Option, venture capital, Japanese strategy.

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HIGH-TECHNOLOGY VENTURES AND VENTURE CAPITAL

A new high-technology venture start-up is a risky proposition for most stock market investors and hence is usually financed partly by the entrepreneur and largely by venture capital firms. These firms are often limited partnerships of investors who are willing to provide risk capital and who can afford to wait for 5 to 7 years before earning returns. Once the venture has succeeeded in introducing new products and earning revenues, it will make its initial public offer of stock. At this point, the venture capital firms are in a position to reap their rewards.

Venture capital investment in its basic form is similar to a long-term project in which investment is made in year 1 and positive cash flow is earned in say, year 7, often in the form of a lump sum.

However, a new high-technology venture also offers a potential source for new technology for the investing firm. A firm interested in exploring new technologies might invest in a new high-technology venture in order to participate in the development of the new technology and to share in its profits. This is similar to the practice of large companies (e.g. Apple Computer) to 'spin-off' new firms in which the parent firm retains an interest. External ventures may be preferred over internal corporate ventures since they avoid problems of structural incompatibility between the parent firm and the entrepreneurial new venture.[1]

A firm's technology plays a central role in developing and sustaining its competitive advantage (Schumpeter, 1934; Ansoff, 1965; Andrews, 1971; Kantrow, 1980; Porter, 1983; Venkatraman and Camillus, 1984; Frohman, 1985; Grinyer, Al-Bazzaz and Yasai-Ardekani 1986). The rapid rate of diffusion of technology (Mansfield, 1985; Ghemawat, 1986) exerts a pressure on the firm to retain competitive vitality through innovation. Outside sources of knowledge are critical to the innovation process (Cohen and Levinthal, 1990). In fact, innovation mainly arises from external sources (March and Simon, 1958; Mueller, 1962; Hamberg, 1963; von Hippel, 1988). Hence, it is reasonable to expect high-technology outside ventures to form vehicles for technological revitalization.

If venture capital investment is aimed at gaining new technology, the investment pattern goes beyond a simple project. Investment will be motivated less by the new venture's profit potential and more by the opportunity for gaining a new technology. This will entail further in-house investments in product design, development, manufacturing and marketing. Two investments are required: first there is the basic 'external' investment in the venture, and next there is the further 'internal' investment needed to acquire the new technology. The return from the second investment cannot be forseen at the first stage, even its timing cannot usually be known in advance, because the second investment will depend on the successful development of the new technology by the venture in the first place. The initial investment yields more than a simple project return, for it enables the firm to position itself to capture the future technological opportunity.

The first investment thus gives the firm an implicit right, or option, to acquire the new technology at a future point in time. This option will be exercised by making the further investment necessary to adopt the new technology. The outcome of the first-stage decision is the purchase of a real call option (Myers, 1984) while the outcome of the second is the exercise of this option. A real call option works analogously to a stock call option in conferring a right to take future discretionary action towards capturing an underlying economic opportunity (Bowman and Hurry, 1987). In the same way that a stock call option gives the holder the right to purchase the underlying stock at a later date, the real call option gives the investor the right to make a subsequent investment to capture the underlying opportunity. Several studies have confirmed that corporate investments in operating assets and ventures behave like stock options (Paddock, Seigel and Smith, 1983; Majd and Pindyck, 1987; Mitchell and Hamilton, 1987; Kogut, 1983, 1988, 1991; Kester, 1984; Hurry, 1991).

Venture capital investment, therefore, in its broader form, is similar to the purchase of a call option in year 1. This option may or may not pay dividends during its holding period and is exercisable at the holder's discretion any time after say, year 7 upon payment of a 'strike price' in the form of the investment needed to acquire the technology.

[1] This problem has been identified as a cause of failed internal ventures by several authors (e.g. Weiss, 1981; Block, 1982; MacMillan, Block, and Subbanarasimha, 1986).

Thus a firm can have one of two strategic alternatives: a 'project strategy' of seeking direct venture gains, or an 'option strategy' of seeking new technology. While not mutually exclusive, the two strategies reflect different perceptions of the available opportunity set. A project strategy implies that the new technology opportunity was not recognized (or positively evaluated, if recognized) by the investing firm. On the other hand, an option strategy (or a combined project-cum-option strategy) suggests recognition and positive evaluation of this opportunity.

At the outset a new high-technology venture, therefore, can be said to offer a 'shadow option' or latent option to the investing firm. The positive value of this shadow option may or may not be recognized, thus yielding the two different investment patterns.

VENTURE CAPITAL INDUSTRIES IN THE UNITED STATES AND JAPAN

Venture capital investment by U.S. firms has existed for approximately 25 years, with a peak around the mid-to-late 1980s when over 75 major corporations had formal venture capital investment programs while three times that number were in the market through limited partnerships (Winters and Murfin, 1988). A firm typically began by investing in a venture capital fund as a limited partner, and would then progress to direct investments in venture companies, sometimes eventually establishing its own venture capital subsidiary. Venture capital investments in the U.S. were enormously lucrative to investors in the early to mid-1980s, when venture capital funds recorded an average return of 25% per year compounded since 1965 (ibid.).

Venture capital investment by Japanese firms is a more recent phenomenon which became noticeable in 1982 when the Japan Associated Finance Company (JAFCO—a consortium of banking, industrial and securities' firms) established the country's first venture capital fund. Prior to this event, several large, cash-rich corporations had begun to invest in high-technology ventures in the United States. JAFCO began formal U.S. operations in 1987 by which time many companies had set up their own venture capital subsidiaries in the United States.

It appears that Japanese corporations have adopted a theme originating in the U.S. and, as seen on several occasions in the past, have enlarged its scope. This has led to basic structural differences in the two industries. In the U.S. there is a preponderance of limited partnerships in the form of multiple investor venture capital funds while in Japan the industry appears to be dominated by large cash-rich firms with multinational operations. The U.S. business press has generally reported on venture investments by U.S. firms in terms of the return on investment earned by the investing company upon disposal of its holdings following the venture's initial public stock offering. The Japanese press, on the other hand, has tended towards a strategic description of Japanese venture investments. For example, Japan's leading business news journal, *Nihon Kezai Shimbun*, reported in 1986 that Sumitomo Corporation had invested in Grace Venture Partnership and Hambro International Venture Fund in order 'to obtain new technologies and new business opportunities'. This view is consistent with studies of other Japanese foreign direct investments such as joint ventures and acquisitions which reflect similar strategic motivations and contrast the Japanese long-term approach with the U.S. short-term, returns-driven stance (Yoshino, 1975; Tsurumi, 1976; Osborn and Baughn, 1987; Jubak, 1988; Rapoport, 1988; Reich and Mankin, 1986; Kester, 1991).

The usefulness of venture capital investments in the process of technological and competitive revitalization is a function of the firm's 'absorptive capacity' for new technology (Cohen and Levinthal, 1990). Japanese and U.S. firms differ in their ability to exploit external knowledge, U.S. firms being 'poor imitators' while the opposite is true of Japanese firms (Westney and Sakakibara, 1986; Mansfield, 1988; Rosenberg and Steinmueller, 1988). The institutional context in the U.S. and Japan reinforces this difference by encouraging technological isolationism in the U.S. firm and technological eclecticism in the Japanese firm. In the U.S., patent protection is sought in order to obtain a temporary first-mover advantage against competition (Scherer, 1977). On the other hand in Japan, the Ministry for International Trade and Industry (MITI) encourages the diffusion of technology and import of technology to support continuous innovation (Baba, 1989).

THE STUDY

Most academic studies of new ventures have presumed that investments are made for the strategic aim of developing new products, processes and technologies (Kazanjian, 1988). On the assumption that technology and commercial development occur largely in the venture itself and not in the investing firm, these studies have looked at the determinants of venture performance (Van de Ven, Hudson and Schroeder, 1984; Roure and Maidique, 1986; Stuart and Abetti, 1987; Sandberg and Hofer, 1984; MacMillan and Day, 1987). This view is appropriate from the standpoint of studying simple project strategies. If investment in the investing firm is also required at a later point in time, this view may ignore the existence of option strategies. The success of a firm's option strategy need not always be identical with the venture's performance because the two phenomena are not necessarily congruent. If the new venture is designed to serve as a transition mechanism to carry the investing firm to a new technology, the success of the transition will take precedence over the success of the venture itself.

It is therefore necessary to study venture investments from the viewpoint of the investing firm and to consider the possible existence of an option strategy.

Japanese venture capital firms

Based on published sources in Japan and discussions with venture capital fund managers in the U.S. and Japan, we estimated that the total population of Japanese venture capital investors with U.S. investments was around 50 companies. Of these we were able to clearly identify 35 companies. We were able to obtain positive responses from 20 companies (40% of the estimated population) upon guaranteeing complete confidentiality of information. The sample of investing organizations was distributed over the following broad industries: banking, chemicals, communications, electronics, food and beverages, light manufacture, securities, steel and trading. Five of the firms surveyed were venture capital partnerships of two or more investing firms, while the remainder were venture capital subsidiaries of major corporations.

The sample was surveyed through structured telephone interviews which were immediately documented in a written questionnaire administered by fax. The primary respondent to the survey was a member of senior management (in most cases the Chief Executive Officer of the firm). In some cases the questionnaire was actually completed by a mid-level manager. Given the short time lag between interview and questionnaire (a few hours in most cases), it is not surprising that agreement between the two reports was virtually perfect (minor details conflicted in one case, which we were able to resolve quickly).

The sample firms were reluctant to divulge sensitive or specific detailed information, but we were able to collect categorical data covering a variety of topics including the firm's venturing history, its stated venture policy, method of evaluation of potential ventures, venture management, venture portfolio performance, external relationships with venture firms outside the basic funding arrangement, venture divestiture and disposal, a brief conclusion regarding the firm's underlying motivation for venture capital investment, and summarized descriptions of typical actual ventures.

The questionnaire was pretested using the U.S. and Tokyo office executives of a major U.S. consulting firm with experience in the venture capital industry. Several key items of data (e.g. strategic motivation for venturing) were confirmed by multiple questions distributed over different sections of the instrument. All questions offered a list of response categories but were left open-ended, a facility which was extensively used by the responding organizations. These residual responses have been included in the analysis upon placement in additional categories or in summarized category groups. This classification was performed independently by two members of the research team. Since the responses were straightforward and succinct in all cases, it was possible to obtain complete agreement between the researchers.

U.S. venture capital firms

We contacted 60 comparable U.S. venture capital firms, of which 20 responded to our survey. We were able to match investing firm industries completely across the two groups, but we were not able to match investing firms in terms of

their constitution. The Japanese group comprised 15 venture capital subsidiaries and 5 partnership funds, while the U.S. group consisted of 4 venture capital subsidiaries and 16 partnership funds. It is our belief that the sample reflects structural differences in the two industries. We were able to control for this population effect during hypothesis testing. Since both groups had investments in identical target high-technology industries in the United States, we felt that a comparison was valid and would yield valuable insights.

Research hypothesis

Based on the prior studies reviewed earlier, it seems that U.S. firms are poor imitators of outside technology who take a short-term view towards their investments. Japanese firms, on the other hand, are excellent imitators with high absorptive capacity and a long-term strategic view of their investments. Moreover, the venture capital industry yielded high returns to U.S. investors prior to Japanese large scale entry. Given these observations, our research hypothesis is as follows:

U.S. venture capital investing firms will follow a project strategy while Japanese venture capital investing firms will follow an option strategy.

This in turn yields several testable hypotheses.

Venture portfolio hypotheses

Call options are small, limited-risk investments which position the investor to make the full-scale exercise investments at some later point in time. The investor's downside risk is limited to the investment in the option.

In comparison to a project investor, a venture capital investor following an option strategy would therefore: (a) make smaller individual investments, (b) make a larger number of investments so as to be better positioned to capture a wide range of future technology opportunities, and (c) be less concerned about the possibility of loss-making investments, since downside risk has been fixed in advance at an acceptable level. Accordingly, we have the following hypotheses:

Hypothesis 1: Japanese firms will have a larger portfolio of ventures than U.S. firms.

This is because Japanese firms, being option players, will seek to explore several technologies simultaneously.

Hypothesis 2: Japanese firms will make smaller individual investments than U.S. firms.

As option investors, there will exist a pressure to limit risk to small, manageable amounts of capital.

Hypothesis 3: Japanese firms will have a higher percentage of loss-making ventures than U.S. firms.

Given a downside risk that is held constant at a small possible capital loss in each venture, option players are likely to reflect a high level of 'overall' loss tolerance.

Venturing strategy hypotheses

The option investor has a different perception of the available opportunity set than the project investor, since an option strategy presumes recognition of the shadow option contained in the external venture. While a project strategy will include a clear perception of a time horizon in which the project must earn returns, an option strategy is more fluid since recognition of the shadow option implies an awareness that this opportunity may become realizable at some currently unforseeable point in time.

Hypothesis 4: Japanese firms will describe their venturing objectives in terms of long-term, indirect strategic gains while U.S. firms will state their venturing goals in terms of short-term, direct gains.

The above strategic objective will motivate both industry and venture selection by Japanese firms.

Hypothesis 5: Japanese firms will choose indirect strategic reasons over direct venture-related and financial reasons to explain their choice of target industries, while U.S. firms will choose the latter type of reasoning.

Hypothesis 6: Japanese firms will choose ventures based on strategic considerations such

as future technology possibilities while U.S. firms will choose ventures based on the possibility of direct venture gains.

Venture management hypotheses

Project investments yield returns 'when the project is ready' while real option investments yield returns 'when the investor is ready'.

In other words, a firm following a project strategy will monitor its ventures frequently to check whether the venture is ready to produce returns, while a firm following an option strategy will monitor its own readiness for the new technology and will hence evaluate the venture infrequently.

Hypothesis 7: Japanese firms will monitor venture performance less frequently than U.S. firms.

A firm following a project strategy will, further, seek to gauge project readiness through external measures such as ROI or sales, while the option player will seek to gauge compatibility of the venture with its own technology and organization. Thus:

Hypothesis 8: Japanese firms will evaluate venture performance using measures related to the investing firm, while U.S. firms will use measures related to the venture.

Finally, a firm following a project strategy will gain from attempts to actively make the venture ready for profit-taking. On the other hand, an option player will tend to allow the venture to develop without assistance.

Hypothesis 9: Japanese firms will manage their ventures at arms' length compared to U.S. firms which will offer their ventures more administrative and managerial support.

Venture culmination hypothesis

The venture capital investors role comes to an end when the new high-technology venture makes its initial public stock offering (IPO). An investing firm following a project strategy may now conclude its investment by profit-taking through disposal of its stock, thus earning a return on its investment. A firm following an option strategy, however, has to make a second, and larger, investment before earning its final return. The latter firm might choose to retain its option on the new technology, by not selling off its stock, or it might choose to commence exercising its option, by forming contractual arrangements to acquire and use the new technology (e.g. upgrading the investment to a joint venture or forming other business arrangements with the venture). This leads to our final hypothesis:

Hypothesis 10: Japanese firms will culminate their venture investment by either retaining their stock or by entering into a contractual business relationship with the venture, while U.S. firms will dispose of their shares following the venture's initial public stock offering.

Method of analysis

Given the categorical nature of the available data, we were able to make some inferences by simply inspecting the relevant frequency distribution. One obvious limitation of the small sample size (coupled with the reluctance of the surveyed firms to divulge sensitive information) is that controlling for confounding variables such as size of the investing firms and constitution of the venture capital fund was not possible. However, we were able to control for age effects in testing hypotheses where this variable might have a confounding influence. Another limitation of this study is that our data gave us general information rather than specific information in the sense that we were given ranges of values rather than the values themselves, or a list of important criteria rather than a precise ranking of items.

Despite these limitations, we were able to obtain a fairly coherent picture of the process of Japanese venture capital investment and to make a comparison with the U.S. group. We were also able to confirm inferences by using the Del method (Hildebrand, Laing, and Rosenthal, 1974, 1977).

The Del method is suitable for small sample sizes and permits evaluation of relationships between categorical variables based on specific *a priori* predictions (Auster, 1990; Drazin and Kazanjian, 1990). The statistic is based on the proportionate reduction of error under the

prediction rule being tested. Another possible approach might have been the chi-square method which, however, suffers from the limitation of being sensitive to small or zero cell sizes. This limitation does not apply to the Del method, since it tests the entire distribution of observations rather than cell-wise frequencies. Further, the Del statistic is analogous to the coefficient of determination (R squared) and hence permits inferences to be drawn in a manner similar to correlation analysis. The significance of Del was tested as a Z value since it follows the normal distribution for the number of observations available in this study.

Two Del values were computed for each hypothesis. In the first place the data were retained as pure observations drawn from the two groups, while in the second instance the data were adjusted to control for population effects. Both Del values were taken together in forming inferences. The adjusted Del values permit conservative inferences to be made to confirm the results of the primary unadjusted Del analysis. The unadjusted Del values point to differences in venture capital activity that suggest that Japanese and U.S. firms take inherently different approaches to strategic investment. These approaches have produced the divergent industry structures reflected in the composition of the two groups in our sample.

FINDINGS

Venture portfolios

The venture investment portfolios of the Japanese firms in our sample were found to be larger than those of the U.S. firms. While 11 U.S. firms had invested in 25 ventures or less, only 1 Japanese firm had a portfolio containing so few ventures. On the contrary as many as 12 Japanese firms reported between 100 and 400 venture investments, whereas only one U.S. firm had invested in more than 100 ventures. After controlling for age of the venture capital investment program, and after adjusting for the population effect (i.e. the difference in composition of the two groups) Hypothesis 1 received strong support.

Hypothesis 2, that Japanese firms typically make smaller venture capital investments than U.S. firms was tested by comparing responses to questions about the size of the firm's typical contribution to the total cost of a venture and its typical investment in a single venture over time (see Table 1). Del values of 0.85 and 0.75 (adusted) show support for this hypothesis at the 0.1% level.

Responses to other questions confirmed this finding. 18 Japanese firms reported that their smallest investment was between $100,000 and $300,000, while only 9 U.S. firms reported comparably small investments. While 12 U.S. firms reported their largest individual investment in the $5–20 million range, for 16 Japanese firms the largest single investment did not exceed $5 million.

Our prediction that Japanese portfolios will hold a higher proportion of loss-making ventures than U.S. firms (Hypothesis 3) was tested through two sets of questions in order to obtain internally consistent responses. One set asked for the proportion of loss-making and negative cash flow ventures in the portfolio while the other asked for the proportion of ventures at break-even point and in the profit and positive cash flow region. This hypothesis was not supported by the unadjusted Del statistic which, though in the right direction, did not have a significant value. The adjusted Del statistic, however, was significant at the 5% level (see Table 1).

Venturing strategy

Our *a priori* expectation was that the goals stated by Japanese firms would reflect recognition of the technology shadow option while the goals stated by U.S. firms would not show such recognition (or positive evaluation). Fourteen U.S. firms reported 'ROI' as their venturing objective while 17 Japanese firms reported 'technology'. This part of the fourth hypothesis received strong support (see Table 1).

An option strategy would also imply a longer time horizon than a project strategy. The time horizon of venture capital investment was not, however, significantly different for the two groups of firms (see Table 1). This finding is somewhat counter-intuitive given the widespread general belief that Japanese firms have a longer time frame in their business activities than U.S. firms.

We found no significant differences across the two groups in terms of their reasons for choosing their target industries (Hypothesis 5). Both

Table 1. Observations and Del statistics

Category	JAPAN Corp.	JAPAN Funds	JAPAN Total	US Corp.	US Funds	US Total	US Adj. Total[1]
HYPOTHESIS 1: Venture portfolio size[2]							
Small/Young	–	2	2	1	3	4	5
Large/Young	14	1	15	–	2	2	1
Small/Old	1	1	2	3	11	14	14
Large/Old	–	1	1	–	–	–	–
Total	15	5	20	4	16	20	20
Del[3] = 0.70 ($p < 0.01$) Adjusted Del[4] = 0.74 ($p < 0.001$)							
HYPOTHESIS 2: Individual venture investment size							
(a) Contribution to total cost of venture							
Low (1–20%)	15	3	18	–	10	10	3
High (> 20%)	–	2	2	4	6	10	17
Total	15	5	20	4	16	20	20
Del = 0.85 ($p < 0.001$) Adjusted Del = 0.75 ($p < 0.001$)							
(b) Typical investment in a venture over time							
Low ($.1m–0.5m)	3	2	5	–	2	2	1
(>$.5m–1m)	12	1	13	–	4	4	2
High (>$1m–5m)	–	2	2	4	10	14	17
Total	15	5	20	4	16	20	20
Del = 0.60 ($p < 0.001$) Adjusted Del = 0.75 ($p < 0.001$)							
HYPOTHESIS 3: Percentage of loss/−ve cash flow ventures							
0– 25%	3	–	3	1	3	4	5
26– 50%	3	2	5	2	4	6	9
51– 75%	5	3	8	1	6	7	5
76–100%	4	–	4	–	3	3	1
Total	15	5	20	4	16	20	20
Del = 0.10 ($p < 0.25$) Adjusted Del = 0.30 ($p < 0.05$)							
HYPOTHESIS 4: Venturing strategy							
(a) Objective							
ROI	1	2	3	2	12	14	11
Technology	14	3	17	2	4	6	9
Total	15	5	20	4	16	20	20
Del = 0.55 ($p < 0.001$) Adjusted Del = 0.40 ($p < 0.01$)							
(b) Time horizon							
1–5 yrs	–	–	–	–	5	5	2
5–10 yrs	13	5	18	4	11	15	18
> 10 yrs	2	–	2	–	–	–	–
Total	15	5	20	4	16	20	20
Del = − 0.09 ($p < 0.63$) Adjusted Del = 0 ($p < 1$)							

Table 1. Continued

Category	JAPAN Corp.	JAPAN Funds	JAPAN Total	US Corp.	US Funds	US Total	US Adj. Total[1]
HYPOTHESIS 5: Choice of target industry[5]							
Strategic directives	10	2	12	3	6	9	13
To diversify	15	2	17	4	9	13	18
Fit	5	1	6	4	10	14	18
Business relations	8	3	12	–	5	5	2
Marketing forecasts	5	5	10	4	16	20	20
Venture tech/ Managerial skills	2	7	9	–	13	13	5
Del = 0.14 ($p < 0.08$) Adjusted Del = – 0.04 ($p < 0.61$)							
HYPOTHESIS 6: Choice of target venture[5]							
Option strategy							
Past relations							
– Always	9	–	9	–	–	–	–
– Sometimes	8	2	10	–	3	3	1
Present relations	11	3	14	–	5	5	2
Future relations	13	2	15	–	–	–	–
Project strategy							
Profit	–	2	2	4	16	20	20
Sales	1	3	4	4	10	14	18
Technical ability	–	4	4	1	16	17	9
Managerial skills	–	5	5	3	16	19	16
Del = 0.63 ($p < 0.001$) Adjusted Del = 0.73 ($p < 0.001$)							
HYPOTHESIS 7: Frequency of performance reviews							
Quarterly	–	–	–	3	13	16	15
Six-month	15	5	20	1	3	4	5
Total	15	5	20	4	16	20	20
Del = 0.67 ($p < 0.001$) Adjusted Del = 0.60 ($p < 0.001$)							

groups reported similar reasons such as: strategic directives, diversification, strategic fit, the search for future business relations, financial and market forecasts, venture management's technical ability and managerial skills (see Table 1).

Significant differences were seen in the two groups' reasons for selecting target ventures, however, in strong support of Hypothesis 6 (see Table 1). Most U.S. firms used sales and profit forecasts and assessments of the venture management's technical and managerial abilities to select target ventures. Most Japanese firms, on the other hand, chose ventures based on the existence of past or present business relations with the venture (outside of the current arrangement) and the possibility of future relations with the venture.

Venture management

Hypothesis 7 predicted that the Japanese group would monitor their ventures less frequently than the U.S. firms. This prediction was supported by the data (see Table 1).

Our prediction, in Hypothesis 8, that Japanese firms would evaluate venture performance using

Table 1. Continued

Category	JAPAN Corp.	JAPAN Funds	JAPAN Total	US Corp.	US Funds	US Total	US Adj. Total[1]
HYPOTHESIS 8: Venture evaluation measures[5]							
Option strategy							
Tech. fit	3	1	4	2	4	6	9
Tech. access	3	2	5	1	–	1	–
Project strategy							
ROI	13	5	18	4	16	20	20
Sales growth	11	2	13	4	7	11	17
Del = 0.01 ($p < 0.94$) Adjusted Del = 0.03 ($p < 0.79$)							
HYPOTHESIS 9: Method of venture management							
Board	8	2	10	3	9	12	14
Staff	3	1	4	1	4	5	5
Other admn.	4	2	6	–	3	3	1
Total	15	5	20	4	16	20	20
Del = 0.10 ($p < 0.92$) Adjusted Del = 0.2 ($p < 0.18$)							
HYPOTHESIS 10: Venture culmination[5]							
Option strategy							
Retain	15	2	17	1	3	4	5
Internal sale	8	–	8	–	–	–	–
Upgrade	13	–	13	2	–	2	1
Other relations	15	4	19	1	6	6	6
Project strategy							
Private sale	–	–	–	3	13	16	15
Sale to mgmt.	–	–	–	2	9	11	10
Public sale	–	–	–	2	14	16	12
Del = 0.76 ($p < 0.001$) Adjusted Del = 0.63 ($p < 0.001$)							

[1]Adjusted totals were obtained by weighting the U.S. group's observations to match the composition of the Japanese group. (U.S. Corporate figures were given a weightage of 15/4 and U.S. Fund figures were given a weightage of 5/16).
[2]Portfolio size: Small: < 50 Large: > 50 ventures Age: Young = started in 1981 or later, Old = pre 1981.
[3]Computation of Del statistics shown in the Appendix.
[4]Del statistic computed using adjusted U.S. total figures.
[5]Since multiple measures were reported, the Total columns will not add to 20.

measures related to the investing firm (viz. fit with existing technology, or transferability of the new technology), while U.S. firms would use venture-related measures (viz. ROI, or market growth) was not supported (see Table 1). Both groups showed a strong preference for venture-related measures, notably return on investment, in venture performance evaluation.

We also predicted that the Japanese group would manage ventures at arms length relative to the U.S. group, with fewer firms reporting supportive measures (e.g. appointing executives to the venture's board of directors, transfer of managerial staff to the venture, and other administrative support). The data did not support this hypothesis, since the Del statistics did not take significant values, although they were in the right direction (see Table 1).

Venture culmination

Our final hypothesis was that the Japanese firms would culminate their venture investment by either retaining or exercising their technology option, while we expected the U.S. firms to complete their project by profit-taking. We found that the Japanese group responded to our open-ended question on venture culmination to report that: (a) stock in the venture was either retained by the firm or transferred to a sister firm in the keiretsu (corporate group), or (b) a variety of business relations, including joint ventures, were commenced. While a few responses from the U.S. group were similar, the majority reported the following actions: (a) negotiated sale of stock to private investors, (b) sale of stock to venture management and employees, and (c) public sale of stock. Our hypothesis thus received strong support (see Table 1).

Japanese venturing as a strategic process

Most of the Japanese firms in our sample had invested in ventures with whom they had prior business relations or with whom they hoped to have future relations. Firms often reported as follows: 'we have had good dealings with this management in the past', or 'investment was made because the venture company had a special relationship with a Japanese firm which had a good relationship with our company'. The intention of future relations was apparent in comments such as 'possibility of future relationship with the venture', 'potential business relationship', and 'any type of future relationship or joint venture with the company'.

A clear recognition of the new technology shadow option was evident. While most of the U.S. firms stated objectives such as '25% to 50% ROI in 5 years', most of the Japanese firms reported: 'we are looking for technology', 'we are looking to buy more viable businesses', 'new technology and business development', 'a strategic move to new areas', 'proprietary technology or unique marketing potential with market opportunities in Japan', 'diversification of our company's business is the most important factor', and 'the possibility to develop a market in Japan'. Only one U.S. firm reported seeking a 'window on technology for parent company'.

Both groups reported the following target industry choices: biotechnology, computer hardware, electronics, medical equipment and health care technology, plastics and synthetic materials, semiconductors and computer software. The Japanese firms also reported seeking technology for automotive component manufacture and investment management (i.e. quantitative 'black box' securities trading methods).

Despite the fact that the Japanese investing firms were typically multinationals with multi-billion dollar assets and cash reserves, their typical investment per venture was in the region of three to five hundred thousand dollars and rarely exceeded one million dollars prior to the IPO stage. This suggests that venture investments are merely preliminary in nature and are intended to precede the full-scale investments needed to develop and commercialize new technology. Only four Japanese firms reported that over 25% of their portfolios contained newly started ventures, compared to eight for the U.S. group, the preference being for ventures which had proved themselves by earning revenues. Over the years, venture investments accumulated to form a portfolio of between 50 and 400 wide-ranging exploratory investments.

Although the Japanese firms' venture investment was motivated by past and current business relations with the venture, subsequent evaluations were made along strictly financial and market-driven lines (e.g. ROI) similar to the U.S. firms in the sample.

While most of the U.S. firms in the sample eventually divested their venture stock, this practice was rare among the Japanese firms. Two Japanese firms reported instead that divestment was 'rarely an issue' and 'not usually considered'.

After a venture had shown itself to be successful (i.e. in terms of ROI and the initial public stock offering) the Japanese firms sought to establish contractual arrangements with the venture to begin the large-scale commercial use of the new technology. It is possible that these arrangements were provided for in the initial financing contract with the venture. While the U.S. firms reported business relations mainly in the form of debt-financing arrangements with their ventures, the Japanese firms reported the following:

1. Joint research programs.
2. Licensing agreement for the venture's new technology.

3. Product technology development arrangements.
4. Manufacture (usually in Japan) of the venture's products.
5. Distribution of the venture's products in Japan.
6. Marketing and after sales service of the venture's exports to Japan.

These arrangements suggest that the Japanese firms acquired the new technology and continued development through further research and the provision of manufacturing and distribution capacity.

In some instances, the venture was upgraded to a joint venture or was acquired. *Nihon Kezai Shimbun*, a Japanese business journal, reported one such case on April 15, 1987. In 1985, JAFCO, Japan's largest venture capital investment firm, had invested in Japan Fellow Fluidex Corporation, a subsidiary of Fellow Fluidex Corporation, a U.S. firm in the field of magnetic fluid technology. JAFCO had stipulated that the venture develop certain viable technologies. In 1986, Japan Fellow Fluidex Corporation recorded revenues of Yen 2.2 billion. In 1987, JAFCO and Kubota Limited (a Japanese manufacturer and partner in JAFCO) acquired the venture. This step was said 'to reflect an acceleration of Kubota and JAFCO's high-technology strategy'.

An instance of venture option abandonment was reported, however, on December 6, 1988 by the *Asian. Wall Street Journal*. Mitsui and Company had invested more than $20 million over 3½ years in Gain Electronics Corporation, a U.S. high-technology venture which sought to develop gallium arsenide computer chips. The venture failed to yield a net positive cash flow, and Mitsui reported that 'it became clear that a market for gallium arsenide was unlikely to develop soon . . . it was a really promising technology when we went in, but the timing just wasn't right'. The Japanese firm consequently announced its withdrawal of investment from the venture.

The strategic process of Japanese venture investment and technology acquisition forms an example of a real call option which is purchased and exercised in two stages as shown in Figure 1. The process unfolds as follows:

1. **Shadow Option:** High technology venture investments provide a latent option on technology acquisition. Prior relations with the venture firm encourage the possibility of investing in the heretofore unproven technology by creating a working base of contacts, shared experience and familiarity with the venture.
2. **Recognition of Option Value:** At some point, this latent opportunity is recognized by the investing firm, possibly on being approached by the venture for capital and other resources.
3. **Call Option Purchase:** A decision is made to invest in the venture with the clear objective of acquiring a new technology at some currently unforseeable point in the future. In keeping with the risk-limiting property of option investments, only a small sum is kept at risk in this first-stage investment in the new venture.
4. **Holding the Option:** Venture investments take around 5–7 years to produce commercial successes in most instances. During this period, the investing firm seeks to maintain its option by infusing capital in small doses if needed. The venture portfolio meanwhile continues to grow.
5. **The Strike Signal:** During the option holding period, the investing firm evaluates performance through stringent ROI and market criteria. This is very different from the relative disregard for such considerations at the exploratory option purchase stage.[2] The venture's initial public stock offer signals the successful attainment of performance that satisfies the investing firm's evaluation criteria. This signal triggers the investing firm's exercise or 'strike' of its option to acquire the now proven technology.
6. **Call Option Exercise:** The investing firm, accordingly, exercises its 'call' on the technology upon payment of a strike price in the form of a larger investment. The investment usually takes the form of joint programs for product development, manufacture and distribution in Japan, but sometimes might occur as the acquisition of the venture.

[2] Though somewhat counter-intuitive, this behavior admits a straightforward explanation. At the purchase stage, the main objective was to gain access to a potential future source of technology. At the option holding stage, the objective is to evaluate this technology for the larger exercise investment to follow.

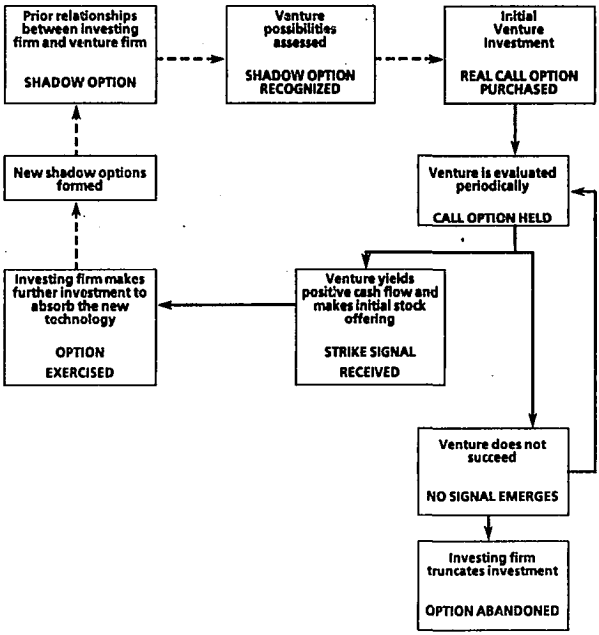

Figure 1. Venture Investment: The option strategy process

7. **Option Abandonment:** During the holding period, if it seems likely that a strike signal might never emerge from the venture the investing firm may divest the venture, thus abandoning its option.[3] This is, however, a rare occurrence.
8. **Formation of new Shadow Options:** As a consequence of its venture involvement, the investing firm has acquired more business contacts and shared experiences with a U.S. firm or management team, thereby forming the background for new venture investments.

Thus, by commiting a small amount of risk capital, the Japanese firm is able to purchase the right to acquire a new technology at a later date. When the benefits of this new technology appear realizable, and not before, the firm will make a full scale investment.

[3] It is precisely the choice of walking away from a venture that gives meaning to the term 'option', incidentally.

DISCUSSION AND CONCLUSION

Our findings suggest that Japanese and U.S. venture capital investment have different motivations.[4] Even though the U.S. firms in our sample were probably aware of the new technology window open through venturing (cf. Winters and Murfin, 1988) and invested in generally the same industries as the Japanese group, a significant number seemed to follow a project strategy. They did not recognize (or positively value) the technology shadow option (Hypothesis 4) nor did they conclude venturing with technology transfer (Hypothesis 10). The strategic nature of venture investment is clearly visible in Japanese venturing, which appears to

[4] DeSarbo, MacMillan, and Day (1986) reported that U.S. venture capitalists judged the following variables to be important in their choice of ventures: low initial investment, fit with existing businesses, proprietary technology, low competitive threat, experienced venture champions in the investing firm and, above all, return on investment. Only the first three of these variables appear to be important to the Japanese corporation.

proceed in accordance with an option strategy (Hypotheses 1, 2, 4, 7 and 10). National differences in absorptive capacity and the resulting structure of the two industries are reflected in these alternative strategic responses to high-technology venture opportunities.

Recognition of the shadow option in several Japanese firms in our sample appeared to arise out of the prior or current relations (outside that particular venture) with the same management (Hypothesis 4). This suggests a process of retrospective sense-making of prior investments (cf. Weick, 1979) which possibly underlies the well-known Japanese trait of seeking to build long-term relationships. Culmination of venture investments also took the form of further relations with the same parties.[5] However, one should note that the Japanese firms sought further relations with ventures only in cases which met rigorous performance criteria. The U.S. firms in the sample used similar criteria during the life of the project but did not base initial venture investments on prior relationships. Hence, since they appeared to operate without a sense-making apparatus that favored such business relations, these firms were not inclined to seek continued involvement with their ventures past the initial public stock offering stage.

At first glance, one might be persuaded to believe that the Japanese management's preference for long-term business relations supports the commonly held opinion that they take the 'long-term view' of strategy. In contrast, it is often said that U.S. managements are myopic to the point of rarely seeing beyond the next quarter's earnings. Our findings do not reveal a significant difference between the stated time horizons of the two groups. This suggests that the Japanese long-term view might be best understood instead in the form of a sequence of medium-term investments.

Our findings contain two sets of implications for strategic management theory. The first set enhances our understanding of Japanese strategy specifically, while the second applies more generally to descriptions of strategy at the organizational level. The Japanese economic 'miracle' has been attributed in part to business strategies based on knowledge-intensive products and cooperative alliances (Smothers, 1990). A reciprocal relationship probably exists between these strategies and Japanese venture capital behavior. On the one hand, the deliberate exploration of new technologies and business relationships clearly supports a strategy of cooperative, knowledge-intensive production. On the other hand, it is possible that this strategy could have evolved from the retrospective sense-making of exploratory behavior in the early days of Japanese manufacture, when technology was often licensed from U.S. firms. Our findings have also revealed that the exploration of new technology occurs in two stages, which might facilitate its eventual absorption by permitting familiarity with the new technology to develop gradually over a few years. It is possible that the linkage between a firm's strategy of exploration and its absorptive capacity is in the opposite direction. A Japanese firm might exhibit a high absorptive capacity as a consequence, rather than as a cause, of its incremental strategy of exploration.

Though similar in spirit to the notions of building on past activities (Nelson and Winter, 1982) and incremental trial-and-error strategic processes (e.g. Mintzberg, 1977; Pondy, 1983; Quinn, 1980; Johnson, 1988), Japanese venture exploration implies a modification of the picture supplied by the currently prevalent incrementalist view of strategy. Under this view, a strategy is described as a sequence of decisions (and hence, as the sequential investment of organizational resources). Each decision is a step taken under the constraints of environmental uncertainty and bounded rationality to provide the best course of action possible at the time. This description, however, is silent on the question of whether investment occurs as a project or an option.

Our findings imply that descriptions of strategy at the organizational level require a distinction between project and option investments. It is generally thought that the objective of a decision is to earn the best possible returns from the investment under review. However, in many business situations the best possible returns may be obtained instead by sacrificing gains from the investment on hand in favor of the next investment. The current decision may seek little more than a foothold in preparation for the next

[5] This accords well with the finding that high-technology ventures predominantly form cooperative arrangements to commercialize their new products in foreign markets (Shan, 1990).

decision. Some decisions, therefore, seek gains from the current investment, while others seek to defer gains till a later stage when higher returns may be possible from future investments. As our study shows, firms behave differently based on whether the initial decision to invest is made as a project or as an option. In our sample, the firms which followed the former course (i.e. the U.S. firms) did not eventually acquire the technology, while those which followed the latter course (i.e. the Japanese firms) did acquire the new technology.

A theoretical description of strategy, therefore, needs to reflect an appreciation of the linkage across successive strategic decisions. Over time, this linkage has two aspects: an 'economic' linkage and a 'cognitive' linkage. The economic linkage is in the form of the 'positioning value' which a decision or investment gives an organization. This is comprised of the value of 'waiting to invest' under uncertainty (cf. Cukierman, 1980; Bernanke, 1983) and the value of 'accumulating prior investments'. The first investment yields the right, or option, to make the second investment and thus holds the window of opportunity open for the organization. In this way the organization is allowed to gather sufficient information before commiting itself to a course of action. When it makes the next investment, the organization benefits from the effect of the 'critical mass' of investment and effort which has now been achieved.

The cognitive linkage across decisions occurs through a cumulative sense-making process involving both retrospective and prospective rationality. Several Japanese firms in our sample reported both types of motivations for their venture investment. Responses such as 'prior relations' indicating retrospective reasoning and the more usual prospective ones such as 'diversification' and 'new technology' were reported simultaneously. At the outset, the Japanese corporation is probably no more able to foretell the future than its U.S. counterpart. However, its cognitive and strategic processes structure the investment in two stages such that its shadow or implicit option value is recognized, realized through investment, and finally exercised through further investment upon receiving the strike signal. The resulting description takes the form of a decision-dyad sequentially linked over time by both strategic sense-making and economic value.

APPENDIX: COMPUTATION OF DEL STATISTIC

The general procedure for computation of Del statistic is as follows (Hildebrand et al. 1974, 1977):

Observations are arranged in a matrix designed to show the *a priori* categories for analysis. Under each hypothesis a prediction rule is established. This prediction rule will classify the observations in some cells as 'errors'. These are given a weight = 1. The other cells are given a weight = 0. The cell probabilities and marginal probabilities are computed by dividing cell values and row and column totals by the number of observations in the matrix.

$$\text{Del}\,(\nabla) = 1 - \frac{K}{U}$$

where $K = \Sigma_i \Sigma_j (\omega_{ij} P_{ij})$

and $U = \Sigma_i \Sigma_j (\omega_{ij} P_{i\cdot} P_{\cdot j})$

where ω_{ij} are cell weights, P_{ij} are cell probabilities, and $P_{i\cdot}$ and $P_{\cdot j}$ are row and column marginal probabilities.

The hypothesis $\nabla > 0$ is tested against normal tables using the following statistic:

$$Z = \frac{\nabla}{\sqrt{v}}$$

where v = variance of Del =

$$\frac{\Sigma_i \Sigma_j (\omega_{ij} P_{ij}) - (\Sigma_i \Sigma_j \omega_{ij} P_{ij})^2}{n[\Sigma_i \Sigma_j(\omega_{ij} P_{i\cdot} P_{\cdot j})]^2}$$

For each test, the adequacy of the sample size was checked using the following rule of thumb:

$$\frac{5}{n} \leqq u(1 - \nabla) \leqq 1 - \frac{5}{n}$$

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