

Option Nature of Company Acquisitions Motivated by Competence Acquisition

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ABSTRACT. The small business establishment is increasingly regarded as growth option creation. It is generally believed that a country will prosper if a sufficient number of small, technology-based companies are established to provide options for the development of new industries. Despite the general belief, empirical evidence concerning the conception of "small businesses as growth options" is yet non-existent. This paper tries to fill this gap by examining empirically the option nature of collaboration and acquisitions through an analysis of 111 small, technology-based company acquisitions. As a result, somewhat contrary to the earlier research, collaborative arrangements were not found to be used as options to acquire small, technology-based companies. Acquisitions, on the other hand, were used as options to enter a new technology or business area. The option nature of acquisitions was related to technology-based variables, such as the lower levels of maturity of the acquired competencies, possibilities to patent the acquired competencies, and the research and development intensity of the acquiring company. Growth option upside realization was found to be linked to market and cooperation-related variables: the relatedness of the acquiring and the acquired company, proactive sales motive of the seller, and favorable industry trend. The finding concerning the performance of the acquisition of related technological competencies would seem to be connected to imperfect markets of new technological competencies possessed by the acquired small businesses.

1. Introduction

Small technology-based companies can be regarded as growth options. Growth options and real options, in general, represent an expanding stream of research (Trigeorgis, 1993; Dixit and Pindyck, 1994). Concurrently with the research carried out in the field of finance, growth options and option platforms have become an important object of study in management research. Management research has increasingly moved

towards evolutionary resource and options views of the firm (Rumelt, 1984; Bowman and Hurry, 1993; Sanchez, 1993). Presently, applications of option theory are also being found in several other research areas. Examining small companies and decisions that are being made in small companies as options (see e.g. Calcagnini and Iacobucci, 1997) makes the option theory a relevant element in the research carried out in the field of small business economics.

Despite the concurrent methodological development in the field of finance and conceptual development in the field of management, the two streams of research on real options do not yet form a cohesive theory. There is also lack of empirical evidence. There are only few studies that empirically examine the existence of option characteristics of real life phenomena. Company acquisitions and collaborative arrangements are among the situations where the options analogy has been claimed to be applicable (see e.g. Trigeorgis, 1993). Kogut (1991) is one of the few researchers that have empirically addressed the option nature of collaborative arrangements. There is no published research that would empirically examine the option nature of company acquisitions.

The aim of this paper is to contribute to the understanding of growth options provided by collaborative arrangements and company acquisitions. A special emphasis is placed on empirical analysis. Studying small, technology-based company acquisitions makes it possible to test the validity of the conception of "small businesses as options". The purpose of the analysis is to find out whether competence-motivated small business acquisitions could, in fact, be considered as acquisitions of growth options into the acquiring companies. Assuming this is the case, a further objective of the paper is to examine factors contributing to the option nature of acquisitions and

Final version accepted on July 22, 1998

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factors contributing to option upside. It is argued that factors contributing to option upside should be taken into account in option-type of company acquisitions when the companies are valued. These factors should be taken into account when determining the uncertainty structure affecting the option value of the company.

The plan of this paper is as follows: Section 2 presents the theoretical background and the hypotheses. Section 3 provides a general description of the sample and describes the principles underlying the sample selection. Section 4 reports the results of data analysis. Finally, Section 5 provides the conclusions and summary.

2. Hypotheses

Collaborative arrangements as options to acquire

In line with the reasoning of the evolutionary economics' path-dependent view of technology (Nelson and Winter, 1982; Dosi, 1982), technology-motivated joint ventures and other collaborative arrangements can be regarded as options to buy technology. Mutual history, joint projects, and asset specific investments lead into increasing levels of commitment. Initial investments in collaborative arrangements can be modeled as call options (Kogut, 1991; Folta, 1994). If a joint venture arrangement proves out to be successful, it can be bought by one of the partners. In a study of 148 joint ventures, Kogut (1988) found that the industries that were the most active acquirers of joint ventures were chemicals, primary metal industries, communications, machinery, and other manufacturing industries. In a follow-up study of a subsample of 92 manufacturing joint ventures, Kogut (1991) found that 27 joint ventures had been terminated by dissolution, 37 by acquisition, and 28 were still operational. Hypothesizing that joint ventures are options to acquire, Kogut studied factors increasing the likelihood of acquisition. In line with the option hypothesis, the main relationships were found between the unexpected increases in the value of the venture, the degree of concentration of the industry, and the propensity to acquire the joint venture. Similarly in line with the option hypothesis, it was found that market decline did not correlate statistically significantly

with the dissolution of joint ventures (Kogut, 1991).

The successive option nature of the transition process has also been evidenced in studies focusing on the gradual transition from contractual collaborative arrangements to more integrated equity-based collaborative arrangements and to company acquisitions. For example, Harrigan (1988) found that contractual arrangement were replaced by other arrangements of more permanent nature. In general, contractual collaboration is assumed to lead into decreasing uncertainty and, in successful cases, into increasing levels of integration. The increasing levels of integration in a network can typically take place along many different dimensions including institutional integration, integration of decision making, and integration of execution (Herz, 1992). Demonstrating a similar gradually increasing involvement, Gulati (1995) discusses the effect of social structure in alliance formation.

Hagedoorn and Sadowski (1996) have studied the transition from collaborative arrangements to acquisitions on the basis of two extensive databases of collaborative arrangements and acquisitions. In addition, they studied whether contractual technology alliances are transformed into joint ventures. The results were contrary to expectations. Out of the total of 6060 alliances in the database only 143 or 2.4% had been transformed to joint ventures. Hagedoorn and Sadowski (1996) found that if the transition to an acquisition took place, it took place in 64% of the cases within a period of five years after the establishment of the partnership. It is interesting to note that over 70% of the companies in the transformed alliances had over 5000 employees. Only 19% of the companies in the transformed alliances had below 500 employees. The distribution of the transformed companies differs statistically significantly from the distribution of all the companies in the database. In the whole database, nearly 70% of the companies had below 5000 employees.

The empirical findings of Hagedoorn and Sadowski (1996) concerning the unexpectedly insignificant role of the transition would seem to contradict the findings of Kogut and the notion of gradual evolution. One explanatory factor for the differing findings may be that Kogut studied joint ventures, not collaboration in general. Another

explanatory factor for the differing findings may be the size of the acquired companies. It may be that the large acquiring companies do not use much equity collaboration in the pre-acquisition process when acquiring small companies. In the case of larger acquisitions, the importance of the gradual approach may be better acknowledged. Acknowledging the earlier results, it is interesting study the existence of option-type of collaborative arrangements when acquiring small technology-based companies. It is hypothesized that

Hypothesis 1

Previous option-type of collaborative arrangements *do not* play a significant role in the acquisition of small, technology-based companies by large companies

Company acquisitions as options

Following a similar logic than with collaborative arrangements, company acquisitions can be regarded as options to acquire a new technology or business area. In particular, small, technology-based company acquisitions can be expected to play an important option role. Small, technology-based companies are defined in this paper to be companies (1) whose business idea is essentially based on technology, (2) that are established and owned by entrepreneurs or entrepreneurs together with financiers, (3) and that have below 500 employees. The companies are not required to be new, but the technologies that the companies are developing should be *situationally* new. Situational newness means that the technologies of the small, technology-based companies should be new to the acquiring companies. Technologies possessed by the small, technology-based companies may in some cases have already reached a mature stage of the technology life cycle from the perspective of the small company. The word “small” refers to the requirement that the company size is under 500 employees.

The small, technology-based companies are interesting objects of study since they typically have one major area of specialization. Acquiring such a technology-based company could be regarded as an acquisition of an option to the technology possessed by the small company. By regarding technology-based company acquisitions

as option acquisitions, it is hypothesized that the acquiring companies in fact assume that the technology possessed by a small, technology-based company develops or can be developed favorably making the technology option valuable in the future. Other motivations to carry out the acquisition could be, for example, elimination of potential competition, acquisition of extra capacity, or other behavioral reasons.

The main purpose of the second hypothesis is to empirically test whether the acquisition of small, technology-based companies is regarded as option acquisition.

Hypothesis 2

Large companies acquire small, technology-based companies as options to enter business or technology areas that they do not already have

Assuming that the main hypothesis is supported, it is necessary to go deeper in the analysis of the option nature of the small, technology-based company acquisitions. In order to deepen the understanding of the phenomenon, it is important to understand factors contributing to the option nature of the acquisitions. The following hypotheses concerning the age and size of the acquired companies, the role of technology maturity, the possibility to patent technology, the role of industry trend, and the characteristics of the acquiring company, are grounded in the resource-based and evolutionary economics views of technology (Penrose, 1959; Nelson and Winter, 1982; Dosi, 1982).

Hypothesis 2a

The option-nature of small, technology-based company acquisitions is more apparent

- the less mature the acquired technological competencies are
- the younger the acquired companies are
- the smaller, in terms of sales revenue and personnel, the acquired companies are

The first three-part sub-hypothesis tests the small, technology-based company related population variables that are associated with option-type of company acquisitions: small, young companies possessing new technologies. The option nature of the acquisitions is expected to be more apparent, the newer the technological competencies pos-

sessed by the small, technology-companies. When the technologies are mature, many of the possible application areas, that can be expected to emerge, are already known. This can be seen to decrease the option nature of the acquisition. With less mature competencies, the co-evolution of markets and technology may not yet have proceeded as far. In addition to the maturity of technology and the size of the acquired companies, the age of the acquired company is another dimension describing the yet unfulfilled option nature of the small, technology-based companies. The younger the companies are, the less time there commonly has been for realizing the options inherent in the technological competencies. The age of the acquired company and the maturity of technological competencies are two, commonly related, dimension describing the position of the company and its technological competencies in their evolutionary cycle.

The option nature of acquisitions is also expected to be more important the smaller the acquired companies are at the time of acquisition. The small size of the acquired company could indicate that the technology has not yet created significant growth for the company. Even though all the acquired companies under study in this paper can be regarded small, the smallest companies could be assumed to be the clearest cases of option acquisitions. As the age of the company and the maturity of competencies reflect the time dimension, the small size reflects the outcome dimension in terms of non-realized growth. The maturity of technological competencies, the size of the acquired company, and the age of the acquired company are assumed to correlate with each other.

Hypothesis 2b

The option-nature of small, technology-based company acquisitions is more apparent

- the more patentable the acquired technological competencies are

The second sub-hypothesis examines the appropriability of technological competencies bought through option-type of company acquisitions. Being able to patent the acquired technological competencies is used as an indicator of the possibility to protect the acquired technology. It is

expected that option acquisitions represent acquisition of technological competencies that can be protected, allowing for the maximum value of the acquired options.

Hypothesis 2c

The option-nature of small, technology-based company acquisitions is more apparent

- the more research and development intensive the acquiring company

The third sub-hypothesis addresses the ability of the acquiring company to participate in the evolution of the acquired technology. It is acknowledged that several characteristics of the acquiring companies are linked to the eventual decision to carry out option acquisitions. In line with the evolutionary economics view of technology evolution, the research and development intensity of the acquiring company is chosen here as a variable characterizing the acquiring companies. The more research and development intensive acquiring companies are assumed to be better able to notice and link (Cohen and Levinthal, 1990) the potential technology options to their existing technologies providing for path dependencies with their own technology evolution.

Hypothesis 2d

The option-nature of small, technology-based company acquisitions is more apparent

- the more favorable the industry trend at the time of acquisition

The fourth sub-hypothesis addresses the influence of external factors on the decision to carry out option-type of acquisitions. Factors outside the acquiring and the acquired company can be assumed to play a role. The industry trend at the time of the acquisition is chosen as such an external variable. If the industry, where the small, technology-based company is positioned, is growing, even though the small, technology-based company itself would not be growing, the potential for growth is assumed to affect the option nature of the acquisition. The more favorable the industry trend at the time of the acquisition, the more likely an acquisition is regarded as an option to participate in the evolution.

Factors contributing to option upside realization

In addition to the behavioral aspects of small, technology-based company acquisitions, it is useful to study the option upside realization in option acquisitions. Factors related to option upside in company acquisitions are studied in order to get a deeper insight into the uncertainty structure of the option-type of company acquisitions. An analysis of the option upside realization is related to the research on the company acquisition success factors in general. The performance of company acquisitions has been the topic of a large number of both conceptual and empirical studies. It has attracted the interest of a large number of disciplines. The performance of acquisitions has been studied from the perspectives of financial economics, different schools of strategy, and organizational behavior. So far there are no studies, however, that would report results of the performance of specifically option-type of small, technology-based company acquisitions.

Studies in the field of financial economics have focused on stock market responses to company acquisitions. The focus of the studies has been on relatively large acquiring and acquired companies. In these studies, the companies have been clustered according to several variables. The clustering has been done mainly into related and unrelated companies according to the similarity of the acquired company and the acquiring company. The studies have empirically attempted to find out whether the acquisitions lead into above average cumulative abnormal returns for the shareholders of the acquiring and acquired companies. A typical finding has been that the announcements of acquisitions have created positive or no changes in the combined wealth. The gains have occurred mainly for the shareholders of the acquired companies while the gains for the shareholders of the acquiring companies have commonly been insignificant, see, for example, Jensen and Ruback (1983).

In parallel with the stock market studies, more in-depth conceptual work has been carried out in the management literature (Kitching, 1967; Rumelt, 1974). Earlier, the concept of relatedness between the acquired and the acquiring company played a major role also in the management literature. The main focus was on the relationships

between different acquisition strategies and company performance. Due to the dissatisfaction in the dominating relatedness focus of both the management and the financial economics schools of acquisition research, there has been an increasing shift in the focus towards postacquisition integration issues. Combining the organization theoretical approach to acquisition integration with the traditional management approach has resulted into a process perspective on acquisitions (Jemison and Sitkin, 1986; Haspeslagh and Jemison, 1991).

A handful of studies have been carried out with the main focus on success of small, technology-based company acquisitions. These studies include the studies carried out by the Chalmers University of Technology research team (Granstrand and Sjölander, 1990; Lindholm, 1994), the studies carried out by Chakrabarti (Chakrabarti and Burton, 1983; Chakrabarti et al., 1994), and the study of Laamanen (1997). Based on the research on small, technology-based company acquisition success factors, a number of factors can be expected to contribute to the option upside in option-type of acquisitions. The factors examined in this paper are based on this research. The main emphasis is on co-evolution of the technological competencies of the acquired and the acquiring company in line with the thinking of evolutionary economics. The continuing favorable industry trend is used as an external control variable. Other variables chosen for the analysis include (1) the relatedness of the acquiring and the acquired company (Granstrand and Sjölander, 1990), (2) technology, (3) finance, and (4) distribution complementarity of the acquiring and the acquired company (Laamanen, 1997), and (5) the atmosphere for collaboration measured as the proactive sales motive of the entrepreneur wanting to sell the company (Granstrand and Sjölander, 1990; Laamanen, 1997).

Hypothesis 3

In option-type of acquisitions of small, technology-based companies, the option upside is positively linked

- to the industry relatedness of the acquiring and the acquired company
- to the existence of technological complementarity

- to the existence of distribution complementarity
 - to the existence of finance complementarity
 - to the existence of cooperative atmosphere
- and as a control variable
- to the continuing existence of a favorable industry trend

According to the evolutionary economics and resource-based views, technological evolution is path dependent. Technologies tend to evolve to related directions. Resources provide the highest rents in uses that are most closely related to the original intended use of the resources (Penrose, 1959). Accordingly, certain industry relatedness is expected to contribute to the upside realization in the option-type of company acquisitions. The concept of industry relatedness is understood here as the closeness of the main areas of operation of the acquiring and the acquired company. Resources of the acquiring and the acquired company are combined in a dynamic manner continuously after the acquisition. Sometimes, complementing technological resources are needed from the large company to enhance the technological evolution of the acquired small company. Sometimes, complementing marketing and distribution is needed to commercialize the tech-

nology developed by the small, technology-based company. Sometimes, complementing financial resources from the large company may be needed to realize the option upside. To avoid sacrificing the knowledge and willingness of the personnel of the acquired company to collaborate after the acquisition, it can be expected that the probability for option upside realization is further enhanced by the existence of cooperative atmosphere after the acquisition. A simple measure of the cooperative atmosphere is the proactive sales motive of the entrepreneurs that sold the company (Granstrand and Sjölander, 1990). A construct summarizing the behavioral hypotheses 2a, b, c, and d, related to the option acquisition decision, and the normative hypothesis 3, related to option upside realization, is shown in Figure 1.

3. Empirical sample

The empirical sample of this paper consists of 111 small, technology-based company acquisitions. The focus was set intentionally on small, technology-based companies. These companies can be seen to represent bundles of technological competencies. Accordingly, the valuation of these companies could be seen to represent the valuation of bundles of technological competencies. The technological competence component can be

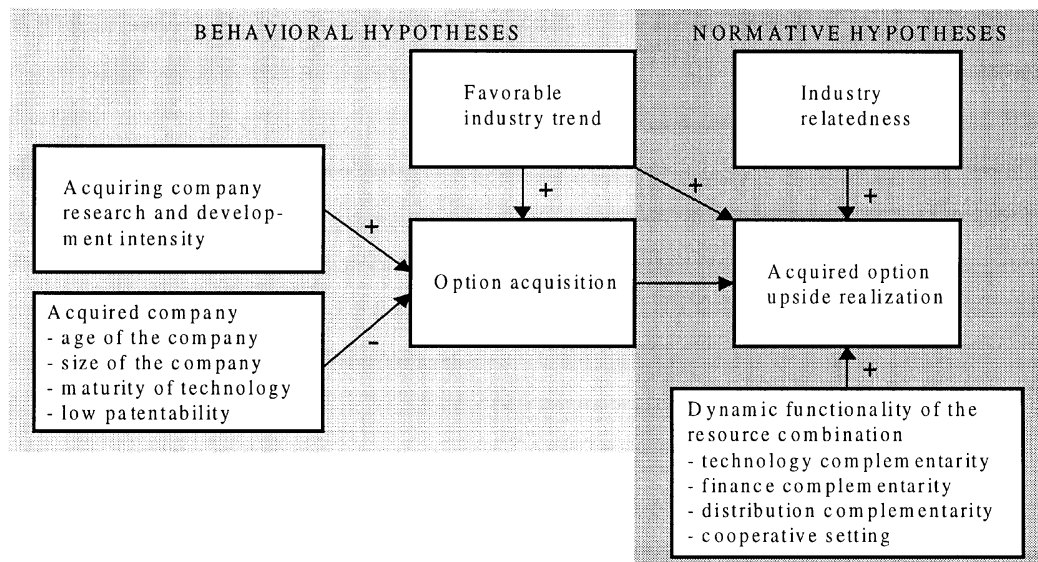


Figure 1. Construct summarizing the research setting and hypotheses of this paper.

seen to dominate the company acquisitions. Due to the small sizes of the acquired companies, it would seem improbable that many of the companies would have been acquired for other reasons. In the case of larger companies, there are often also several other assets and resources that could be regarded as targets in acquisitions. For example, in larger companies the existing customer base or brand name could be considered as such desirable assets. Examining acquisitions involving diverse assets as option acquisitions is beyond the scope of this paper. In such acquisition situations, clarity would be compromised by the increasing importance of several diverse acquisition motives. From the option perspective, ambiguity would be caused also by the existence of interrelationships between the different option values.

The sample of small, technology-based company acquisitions was selected from among the total of 4531 company acquisitions, during the period 1987–1995, where a Finnish company was either the acquiring or the acquired company. The company acquisition volumes in Finland have

varied over the years. The number of closed company acquisition deals has followed the economic cycles. The overall volume of company acquisitions has increased since 1980. Before the 1980s, relatively few company acquisitions took place in Finland. The development of the company acquisition volumes is shown in Figure 2. The time focus of this paper is on the most recent economic half-cycle. The half-cycle can be seen to start in 1987 and it would seem to end in 1994. The whole half-cycle has been selected as the total population to be studied. This has been done to control, if possible, the effect of systemic economic fluctuations on acquisition behavior. The nature of competence acquisition through the acquisition of companies may be influenced by the stage of the economic cycle.

Out of the total of 4531 acquisitions, 109 acquisitions were initially selected for a more detailed study. The initial case selection resulted from a process of examining the information of all the 4531 company acquisitions in the database. The database information was supplemented with more detailed descriptions of the acquisitions in the

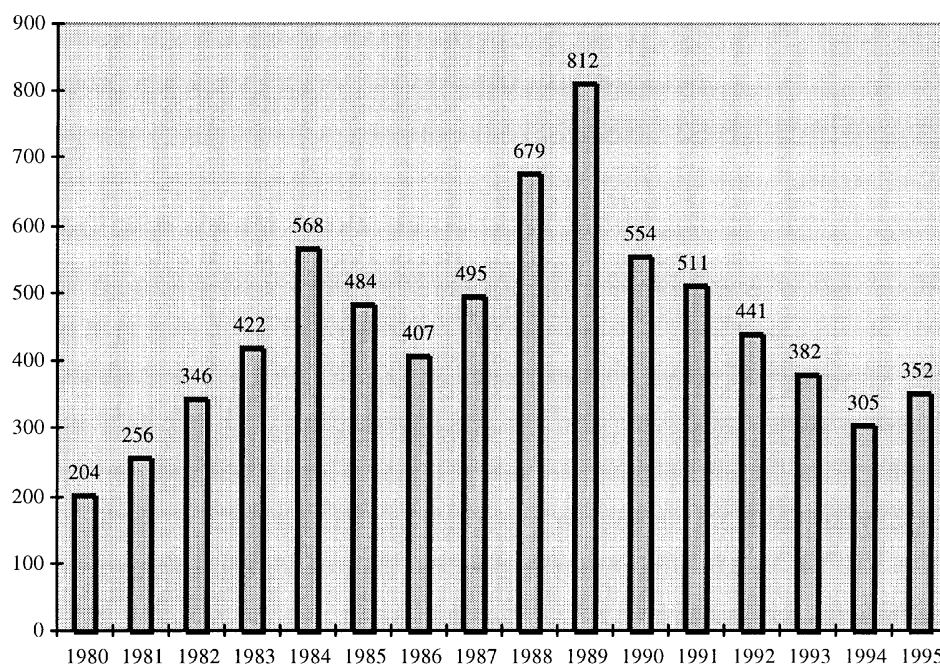


Figure 2. The development of the company acquisition volumes in Finland during the period of 1980–1995. The data on the acquisition volumes during the period 1980–1986 is based on Talouselämä 1, 1990. The data on the acquisition volumes during the period 1987–1989 is based on the Talouselämä database.

Finnish press. There were four selection criteria for the selection of the company acquisition cases. The first selection criterion, in accordance with the definition of the small, technology-based companies, was to select companies that had been sold by entrepreneurs. The companies needed to be majority owned by entrepreneurs before the acquisition transaction. If there was a group of entrepreneurs or entrepreneurs and a venture capitalist or entrepreneurs and a bank as the majority owner, the company was included in the sample. In some cases, the companies were sold through holding companies, for example, due to tax reasons. These company acquisitions were included in the sample if such holding company structure was recognized.

The second selection criterion was to select companies that would base their business on the exploitation of technological competencies. This was determined on the basis of the description of the acquired company. If there was uncertainty whether the acquired company based its business on the exploitation of technological competencies, the company acquisition case was included in the sample. The third selection criterion was to select only companies that were bought by other companies. Companies bought by private persons were excluded. The fourth selection criterion was to select companies that would not only be capacity expansions for the acquiring company. To be included in the sample, it was required that, in addition to possessing technological competencies, the acquired companies possessed *new* technological competencies for the acquiring companies. The fourth criterion was difficult to determine on the basis of the database. In some cases, the description of the background of the acquisition in the *Talouselämä* magazine or other press provided more information to decide on the criterion. Otherwise, the fourth criterion was used comparatively loosely in the selection of acquisition cases. All the acquisition cases that fulfilled the other criteria and that *could* have provided new competencies for the acquiring company were included. Carrying out a more detailed screen in the first interviews improved the validity of the sample. This was feasible in Finland where there are not many large companies in technology-based industries.

The case selection was adjusted after the first interviews. There were altogether 10 cases that

were excluded from the initial sample due to discovered non-conformance of the predetermined criteria. There were 20 cases that were added to the sample after the preliminary discussions in the acquiring companies. There were 8 acquisitions that could not be analyzed due to the inability to reach the appropriate persons or due to refusals. There were 5 refusals and 3 cases where the companies or the necessary persons could not be located. Four of these eight missing cases can be considered to have been failures as acquisitions. One was continued but it was confidential due to military reasons. Two were so new that they had no history. Concerning the eighth missing case there is no data.

As a result, the total number of cases included in the study became 111. The response rate of the study was $111/119 = 93\%$. The missing cases are not considered to cause any significant bias. Even though the 111 acquisitions represent only 2.4% of all the 4531 acquisitions in Finland during 1987–1995, the sample can be regarded to cover well the population where (1) the seller was an entrepreneur, (2) the acquired company based its business idea on technological competencies, (3) the company was acquired by another company, and (4) the acquisition was not capacity expansion. Since the population fulfilling the predetermined criteria was relatively small, a survey of the whole population was possible. Technology-motivated business unit transfers between companies were not included.

The time-industry distribution of the 111 acquisitions is shown in Table I. One third of the acquisition cases, 29%, took place in the electronics industry. One fourth, 25%, of the acquisition cases took place in the field of information technology. Around 18% of the acquisition cases represented the metals and machinery industry. The studied industries represent a relatively small proportion of all the acquisitions that have taken place during the chosen time period. On the other hand, in some of the industries included in the study, the studied acquisition cases are relatively representative. For example, the electronics acquisitions studied in this paper represent 19% of all the acquisitions in the electronics industry in Finland during the period. The information technology acquisitions represent 19% of all the acquisitions in the field of information technology during the period. In

TABLE I
Company acquisition cases selected for the analysis

Selected acquisition cases	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
1 Food and beverages										0
2 Printing and publishing		1								1
3 Furniture and wood items production										0
4 Chemicals	1	1		2	1	1			1	7
5 Plastics			1				1			2
6 Metal and machinery	3	6	7	2	1			1		20
7 Forestry										0
8 Construction										0
9 Electronics	4	8	3	3	4		5	1	4	32
10 Textile and clothing		1								1
11 Conglomerate companies										0
12 Other industrial production		1	1		3			1		6
13 Construction services										0
14 Wholesale										0
15 Retail										0
16 Financial services										0
17 Hotels and restaurants										0
18 Transportation										0
19 Information technology	3	9	6	1	5			2	2	28
20 Consulting and engineering	2	1	7	3	1					14
21 Marketing services										0
22 Information services										0
23 Other services										0
Total	13	28	25	11	15	1	6	5	7	111

the metal and machinery industry, the proportion is smaller constituting only 4% of all the acquisitions in the metal and machinery industry. In consulting and engineering, the studied acquisitions account for 11% of all the acquisitions during the period. In the chemicals industry, the acquisitions account for 6% of all the chemicals acquisitions during the period.

Due to the technological competence focus of this paper, the industry distribution of the sample does not correspond to the industry distribution of the total population of company acquisitions carried out in Finland during the period. All the acquisitions in all the industries were screened, but in many of the industries, there were no companies that would have fulfilled the predetermined criteria. The studied population of 111 company acquisition cases is not representative of the whole 4531 population of company acquisitions in the database. In addition to the different industry distributions, there are also systemic differences. For example, the acquired companies are on average smaller in the studied population than in the whole

population. The average sales revenue of the total population of acquired companies was 130 MFIM. The average sales revenue of the companies in the sample was 24.6 MFIM. The average number of people employed in the total population of acquired companies was 163 persons. The average number of people employed by the acquired companies in the sample was 47. Both differences in means are statistically significant.

Interviews were carried out with the managers responsible for the acquisitions and with the entrepreneurs that had sold their companies. The persons interviewed in the acquiring companies were typically presidents, vice presidents, or division managers. The persons interviewed in the acquired companies were typically founders or presidents. Altogether 128 interviews were carried out. There were altogether 62 companies that were responsible for the 111 acquisitions. In many of the large companies, the same person had been responsible for all the acquisitions carried out by the company. In all the cases, it was not possible to reach the entrepreneur. This is, however, not

seen to reduce the reliability of the findings significantly. The focus of the study was on relatively concrete issues that could also be verified from second sources in case there was any reason to doubt the quality of the data received. Such verification was in fact carried out in some of the cases. The interviews were complemented with internal material, for example, internal audits available in some of the acquiring companies. All interviews were carried out as personal interviews. Variable operationalization and variable distributions are shown in Appendix 1.

4. Data analysis

Collaborative arrangements as options

To study if pre-acquisition collaborative arrangements had an option-role in the 111 small, technology-based company acquisition sample, it was necessary to analyze in how many cases there were collaborative arrangements. The motives for the establishment of these collaborative arrangements were examined. Based on the analysis, an evaluation of the option role of collaborative arrangements in small, technology-based companies was made. The previous collaboration was divided into previous equity collaboration and previous non-equity collaboration. Out of the 111 acquisitions, there were 14 acquisitions where there was previous equity collaboration. In addition, there were 25 acquisitions with previous non-equity collaboration.

The previous equity collaboration does not differ in volume in the studied sample and the total sample of acquisitions carried out during the period of 1987–1995 in Finland. Out of all the 4531 company acquisitions carried out in Finland, there were 430 company acquisitions where there was previous equity collaboration. The relative proportions, 12.6% and 10.1% respectively, do not differ statistically significantly. The motives for the collaboration, as stated in the interviews by the representatives of the acquiring companies, are shown in Table II. In only relatively few of the contractual collaboration cases, the option to acquire the collaborative partner played an important role when establishing the collaboration. Fourteen cases can be seen to represent collaboration in business terms, for example, engineering,

TABLE II
Motives for collaboration in the 39 cases with previous collaboration

Primary motive for collaboration	Number of cases with previous contractual collaboration (N = 25)
Collaboration in business terms, e.g. engineering	14
Subcontracting relationship	6
Joint establishment background	3
Option-type of collaboration	2
Primary motive for collaboration	Number of cases with previous equity investment (N = 14)
Option-type of equity investment	8
Financial investment	4
Earlier established by the acquirer	1
Acquisition technique: earn-out formula	1
Total occurrences of collaboration	39

marketing, or installation collaboration. Six cases can be seen to represent collaboration in terms of sub-contracting. Only two of the contractual collaboration cases can be seen to represent option type of collaboration from the perspective of the larger company. In the previous equity collaboration, the initiation of collaboration would seem to have been more influenced by the options thinking. Eight cases represent investments into an option to acquire. Four cases were pure financial investments without any option considerations.

In addition to previous equity and non-equity collaboration, previous contacts between the companies were mentioned in 20 other cases. On the whole, the equity participation, non-equity collaboration, and previous contacts are represented in 59 cases. The previous contacts do not seem to provide much exposure alone. They would seem to act more as a mechanism to attract attention. Altogether, the option-role would seem to be present in the previous collaboration of 10 of the studied 111 small, technology-based company acquisition cases. This is such a small proportion, 9%, that it cannot be considered sufficient for rejecting hypothesis 1. Hypothesis 1 would seem to get support from the 111 small, technology-based company acquisition sample.

Company acquisitions as options

In the analysis of whether acquisitions of small, technology-based companies could be regarded as options to enter a new business or technology area, the 111 company acquisition cases were grouped into two categories. The first category consisted of company acquisition cases where there were no explicit option elements in the acquisition. The second category consisted of company acquisition cases where there was regarded to be an explicit option element in the acquisition. As expected, the option element was present in relatively many of the studied acquisition cases. Altogether 58 companies could clearly be classified as option acquisitions. In contrast to the lack of evidence concerning the role of collaborative arrangements as options to acquire small, technology-based companies, the acquisitions of small, technology-based companies would seem to have a more established option role. The first part of hypothesis 2 would seem to get support from the studied sample. To test the sub-hypotheses of hypothesis 2, correlation analysis is applied. The variables hypothesized to contribute to the option role of the small, technology-based company acquisitions are correlated with the dichotomous variable indicating whether the acquisition was an option acquisition or not. The Kendall correlation coefficients are shown in Table III.

The correlation analysis indicates that four of the hypothesized variables correlate statistically significantly with the option nature of the acquisition: the maturity of the acquired competencies, the research and development intensity, the

patentability of the acquired competencies, and the age of the acquired company. No statistically significant correlations were found between the option nature of the acquisition and the sales revenue of the acquired company, the personnel of the acquired company, and the industry trend at the time of acquisition.

The maturity of the acquired technological competencies correlates statistically significantly negatively with the option nature of the acquisition. The more mature the technological competencies are the less they typically are associated with uncertainty and, consequently, the less they seem to contain option elements. The research and development intensity of the acquiring company correlates positively with the option nature of the acquisition. The more research and development intensive the acquiring companies are, the more likely they seem to carry out option type of acquisitions. The patentability correlates positively with the option nature of the acquisition. It would seem that the acquiring companies acquire small, technology-based companies as options when the technology can be patented. One reason for this may be that the large companies are in fact buying the rights for an attractive technology. Similarly to the maturity of the acquired competencies, the age of the acquired company correlates negatively with the option nature of the acquisition.

The variables correlating statistically significantly with the option nature of the acquisition can further be analyzed with the aid of logistic multiple regression analysis. The variables are regressed against the dependent variable indicating the option nature of the acquisition. It is necessary

TABLE III

The correlation coefficients of the hypothesized variables and the option nature of the acquisition; N = 111. The logarithm of the personnel variable is used in the analysis to avoid bias due to large maximum values

Correlation coefficients of the variables hypothesized to correlate with the option nature of the acquisition	Expected sign	Kendall correlation coefficient	p-valued	Statistical significance
Age of the acquired company	–	–0.26	0.001	significant
Sales revenue of the acquired company	–	–0.04	0.657	n.s.
Ln (Personnel of the acquired company)	–	–0.07	0.390	n.s.
Maturity of the acquired competencies	–	–0.52	0.000	significant
Patentability of the acquired competencies	+	0.48	0.000	significant
Research and development intensity	+	0.45	0.000	significant
Industry trend at the time of acquisition	+	0.01	0.953	n.s.

to use the logistic multiple regression instead of the normal multiple regression since the dependent variable is dichotomous. To first determine that there is no collinearity among the four non-dependent variables, a correlation matrix is constructed. The correlation matrix is shown in Appendix 2. The correlation matrix shows that many of the independent variables correlate with each other. This would seem to indicate some degree of collinearity among the variables. Particularly, the age of the acquired company and the maturity of the acquired competencies correlate strongly positively, as expected. The patentability of the acquired competencies and the maturity of the acquired competencies correlate negatively. The patentability correlates also statistically significantly negatively with the research and development intensity. The collinearity is attempted to take into account in the logistic multiple regression analysis by carrying out the regression analysis both normally and by using the standard backward elimination procedure with the likelihood-ratio elimination criterion. The results of the regression analyses are shown in Table IV.

After the elimination procedures, three variables seem to remain to predict the dependent variable with a high level of prediction. These are the maturity of the acquired competencies, the research and development intensity of the acquiring company, and the patentability of the acquired competencies. The regression results do not show the relative importance of the different variables since the variables represent categorical

data that is coded differently in different variables. Coding the maturity of the acquired competencies and the research and development intensity further according to the indicator-variable coding scheme, the relative importance of the variables can be discovered. The results are relatively similar to the ones shown in Table IV. The influence of the competence maturity variable is the strongest. The research and development intensity of the acquiring company and the patentability of the acquired competencies are of relatively equal importance.

On the whole, the three explanatory variables are as expected. The younger companies with the less developed technological competencies are easily perceived and acquired as options. The importance of patentability would seem to indicate that the acquiring companies acquired the small, technology-based companies in a relatively high appropriability regime. Most of the acquisitions were also carried out without any pressure from competition. The acquisitions would pre-dominantly seem to have taken place in the high appropriability – low competition regime. The hypothesis concerning the option role of small, technology-based company acquisitions would seem to get additional support.

The third hypothesis addressed the value drivers in option upside realization. In real option valuation, these value drivers are elements of the uncertainty structure underlying the valuation situation. In company acquisition literature, the value drivers coincide with the company acquisi-

TABLE IV
Regression equations of two regression analyses: 1 with all the variables that correlated statistically significantly with the option nature of the acquisition, 2 with same variables as in 1 but with a backward elimination procedure that applies the likelihood-ratio (LR) test in eliminating the variables; N = 111

Regression analysis with the option nature of the acquisition as the dependent variable	All variables <i>B</i>	Significance	Backward elimination <i>B</i>	Significance
Maturity of the acquired competencies	-1.47	$p = 0.00$	-1.32	$p = 0.00$
Research and development intensity	0.90	$p = 0.01$	0.97	$p = 0.01$
Patentability of the acquired competencies	1.18	$p = 0.03$	1.18	$p = 0.03$
Age of the acquired company	0.02	$p = 0.34$	Eliminated	Eliminated
Constant coefficient	2.55	$p = 0.03$	2.30	$p = 0.04$
Goodness of fit statistic	97.0		93.9	
Chi-Square test value	63.2	$p = 0.00$	62.3	$p = 0.00$
Level of prediction (prediction table)	75.7%		77.5%	

tion success factors. To analyze the value drivers in option acquisitions, the 58 option acquisitions are taken as a basis for the analysis. In the sample of these 58 option acquisitions, the chosen company acquisition variables are correlated against the option upside realization. The option upside was realized in 28 of the 58 acquisitions. The correlation coefficients of the different acquisition variables and the option upside realization are shown in Table V.

The correlation analysis shows that five of the hypothesized variables correlate statistically significantly with the upside realization of the acquisition: technological complementarity, distribution complementarity, favorable industry trend after the acquisition, relatedness of the companies, and the proactive sales motive of the seller. Being able to provide funds for the acquired company does not correlate statistically significantly with the option upside in the acquisitions. The strongest correlations with the option upside seem to be the correlations with the industry relatedness and the industry trend after the acquisition. The closer the acquired company is to the acquiring company's core business area, the more successful the acquisitions seem to be. The importance of the favorable industry trend could mean that the acquiring companies were able to project the industry development and acquire the small, technology-based companies as options at the right time. From the complementarities, the distribution complementarity seems to have the highest statistically significant correlation with the option upside. Technological complementarity rates somewhat lower. Both are elements of fit between the companies. Similarly as in earlier studies (Granstrand and Sjölander, 1990; Lindholm, 1994), the pro-

active sales motive of the seller seems to stand out as a success factor.

The variables correlating statistically significantly with the option upside can further be analyzed with the aid of logistic multiple regression analysis. The variables are regressed against the dependent variable indicating the option upside. It is necessary to use the logistic multiple regression instead of the normal multiple regression since the dependent variable, option upside, is dichotomous. To first examine the collinearity among the five non-dependent variables, a correlation matrix is constructed. The correlation matrix is shown in Appendix 2.

The correlation matrix shows that some of the independent variables correlate with each other. Again, there would seem to be some degree of collinearity among the variables. Particularly, the distribution complementarity, the technological complementarity, and the relatedness of the acquiring and the acquired company correlate statistically significantly with each other. This is as expected. The technological complementarity correlates also with the proactive sales motive of the seller. The collinearity is taken into account in the logistic multiple regression analysis by carrying out the regression analysis both normally and by using the standard backward elimination procedure with the likelihood-ratio elimination criterion. The results of the regression analyses are shown in Table VI.

After the elimination procedure, three variables seem to stand out. These are the relatedness of the companies, the industry trend, and the creation of a positive setting for cooperation measured by the seller's proactive sales motive. Again, the regression results do not show the relative impor-

TABLE V
The correlation coefficients of the hypothesized variables and the option upside realization; N = 58

Correlation coefficients of the variable hypothesized to correlate with the option upside of the acquisition	Expected sign	Kendall correlation coefficient	p-value	Statistical significance
Relatedness of the companies	+	0.45	0.00	significant
Technological complementarity	+	0.26	0.05	significant
Distribution complementarity	+	0.34	0.01	significant
Finance complementarity	+	-0.15	0.26	n.s.
Proactive sales motive of the seller	+	0.28	0.03	significant
Industry trend after the acquisition	+	0.41	0.00	significant

TABLE VI

Regression equations of two regression analyses: 1 with all the variables that correlated statistically significantly with the option upside of the acquisition, 2 with same variables as in 1 but with a backward elimination procedure that applies the likelihood-ratio (LR) test in eliminating the variables; N = 58. Time from the acquisition time to year 1996 is included to control for the bias of the different acquisition times

Regression analysis with the option nature of the acquisition as the dependent variable	All variables <i>B</i>	Significance	Backward elimination <i>B</i>	Significance
Technological complementarity	1.06	$p = 0.26$	Eliminated	Eliminated
Distribution complementarity	-0.35	$p = 0.72$	Eliminated	Eliminated
Industry trend after the acquisition	2.07	$p = 0.01$	1.90	$p = 0.01$
Industry relatedness of the companies	5.73	$p = 0.05$	5.25	$p = 0.00$
Proactive sales motive of the seller	1.59	$p = 0.07$	1.69	$p = 0.05$
Time from the acquisition to year 1996	-0.16	$p = 0.48$	Eliminated	Eliminated
Constant coefficient	-5.99	$p = 0.02$	-6.22	$p = 0.00$
Goodness of fit statistic	36.6		43.9	
Chi-Square test value	32.1	$p = 0.00$	30.2	$p = 0.00$
Level of prediction (prediction table)	78.4%		84.3%	

tance of the different variables since the variables represent categorical data that is coded differently in different variables. Coding the relatedness and the industry trend further according to the indicator-variable coding scheme, the relative importance of the variables can be assessed. The results are relatively similar to the ones shown in Table VI. The influence of relatedness is the strongest. With the coding scheme, the goodness of fit of the logistic multiple regression model can be increased to 56.1 and the level of prediction up to 90.2%.

The fact that the acquisitions did not take place at the same time may bias the results of the regression analysis. The more recent option acquisitions have a lower probability of a realized upside since less time has passed after these acquisitions. If the time for each option realization could be determined exactly, the Cox proportional hazard regression model could be used to eliminate the bias. Unfortunately, the exact times of option exercise and option realization are difficult to determine in connection with company acquisitions. Fortunately, based on the regression analysis in Table VI, the different acquisition times do not seem to bias the regression analysis. The time variable is non-significant. To further analyze the time bias, sensitivity analysis can be carried out. Eliminating the acquisitions that have taken place from 1993 to 1995 would leave into the sample acquisitions where at least four years has passed.

In the remaining acquisitions, the time bias can be seen to play already a less significant role with respect to option upside realization. The elimination removes 11 acquisitions from the sample. Replicating the regression analysis with the remaining 47 acquisitions can be used to assess the magnitude of the bias caused by the different acquisition times. The results of the new regression analysis do not change much from the previous regression analysis. A further analysis that eliminates all the acquisitions younger than six years would seem to reconfirm this.

In a more elaborate analysis, also the magnitude of option upside realization could be taken into account. Such an analysis could be carried out by running the tobit regression. The main problem in running the tobit regression would be the actual measurement of the magnitude of the option realization. Sales revenue growth could be used as one measure. It would be, however, a biased measure since different companies had significantly different cost structures. Same sales revenue growth would mean different magnitudes of option realization in different companies. Furthermore, it is difficult to determine the point in time at which to measure the sales revenue growth. The real option realization does not take place instantaneously. A better measure would be the net earnings growth. The problem with the net earnings growth is that it is difficult to determine which net earnings can be attributed to the

acquiring company and which net earnings can be attributed to the acquired company. For example, the integration of distribution channels, production, marketing, and management functions makes the measurement difficult. The measurement becomes even more difficult the longer the time from the acquisition transaction.

5. Discussion and conclusions

The relatedness of the acquiring and the acquired company seems to be an important explanatory variable in the option upside realization. One possible explanation for the importance of relatedness for the option upside is the need for complementary resources. Acquiring a totally unrelated small, technology-based company may provide an option for a new technology area, but it may not be a realizable option even if the technology area would eventually start to grow. The importance of relatedness would seem to support the basic argument of the resource-based view: A related use of specialized resources provides the highest rent for the resources (Penrose, 1959). Interestingly, Barney and Turk (1994) contradict this basic proposition of the resource-based view in their study on company acquisitions. They point out that in efficient competitive markets, the acquisition of related resources should not provide any additional value creation potential. The value creation potential is already taken into account in the acquisition price. Barney and Turk argue that the main value creation potential is in the combination of unrelated resources into the operation of the company. This was clearly not the case in the present study. One reason for this may be that the markets for small, technology-based companies are not efficient. Valuation is necessarily based to some degree on imperfect, incomplete information, and incomplete methods. Based on the findings of this study, it would seem that higher value creation potential could be achieved by acquiring companies possessing options into related, instead of clearly unrelated, technological competencies. These findings would seem to be corroborated by the findings of Capron et al. (1995) and Capron (1996).

The evolutionary explanation does not seem to hold in connection with the option role of collaboration. Collaboration does not seem to be

extensively used as option creation when considering if a small, technology-based company should be acquired. Based on the acquiring company representatives' comments, it would appear that the small technology-based companies typically require relatively large investments for further development compared to the company size. For the large companies, it would not seem to be rational to make large investments in collaboration with small companies owned by entrepreneurs. It is more rational to acquire the companies immediately and start investing after the companies have been bought. This explanation would seem to provide support for the agency theoretical explanation instead of the evolutionary options theoretical explanation. To avoid post-acquisition incentive problems, the acquisition contract can be drawn with the entrepreneur so that the acquired companies are not integrated fully and that the entrepreneurs can also benefit from the option upside.

The evolutionary and option explanations would seem to apply better in explaining the role of small, technology-based company acquisitions. The option acquisitions, in addition to providing new technologies for the acquiring companies, seem to represent relatively new technologies in general. Companies that carry out option-type of company acquisitions seem to be more research and development intensive than companies that acquire small, technology-based companies in general. The research and development intensity can be seen to increase the ability of the acquiring companies to identify and to further develop the acquired technology options. The acquired technologies also seem to represent predominantly the high appropriability – low competition regime (classification by Kester, 1984). Options in this regime allow for long times to expiration. It seems logical that companies prefer to acquire and develop options that can be protected and have long times to expiration. The long time to expiration may be one of the reasons why the industry trend at the time of acquisition transaction does not seem to be linked to the decision to carry out the option acquisition.

In an analysis of the option upside realization, the industry trend seems to play an important role. In conjunction with the industry trend, the relatedness between the acquiring and the acquired

company and the collaborative atmosphere, measured by the proactive sales motive of the entrepreneur, were found important. The importance of relatedness has to be contrasted back to the definition of relatedness. Relatedness or “industry relatedness” was defined in terms of *operational* links to the core business of the acquiring company. It was examined whether the acquiring companies could connect the acquired company operationally to the core business or to an emerging new business area, see Appendix 2. Relatedness was not only measured in terms of technology, market, product or production relatedness, but as an aggregate structural combination of these. Technology and distribution complementarities did not correlate as strongly when looked at separately. In a way, relatedness, as defined in this paper, can be regarded to represent the complementing overall resource support system for the acquired small, technology-based company. The collaborative atmosphere was also found important. Creation of a collaborative atmosphere facilitated joint work integrating gradually the two companies. Capability to develop the existing competencies further was not lost.

On the whole, this study would seem to support the conception of “small businesses as growth options”. This study would seem to confirm the applicability on the acquisition level. Expanding the discussion to the level of an economy, an interesting analogy can be made. In acquisitions, the option upside could be realized when a complementing resource support system existed in the acquiring company. On the level of an economy, a similar requirement for a complementing resource support system would mean that accelerating the creation small businesses to create growth options is not sufficient. Attention has to be paid also to the complementing resource support system. The small businesses need complementing technological, distribution, and structural resource support systems to be able to realize the option upside. One interesting area for future research would be the search for the option characteristics of such systems in small economies. Other interesting future research areas would be the valuation of systemic resource platforms, option valuation of absorptive capacity, and the influence of pre-acquisition collaborative arrangements on the value of subsequent acquisitions.

Appendix 1. Variable operationalization

To test the hypotheses, the dependent and independent variables were operationalized. Both equity or non-equity collaboration can be considered to qualify as previous collaboration. Both can be measured on a binary scale indicating if there was equity or non-equity collaboration or not. The option nature of acquisitions can be determined on a binary scale. The option upside realization can be measured on a binary scale. The operationalization is shown in the exhibit 1 below.

EXHIBIT 1
Operationalization of variables necessary for the hypothesis testing

Name of the variable	Variable operationalization
Equity collaboration before the acquisition	Measured on a binary scale whether one of the companies owned shares of the other company before the acquisition
Non-equity collaboration before the acquisition	Measured on a binary scale whether the companies collaborated before the acquisition in business issues
<i>Dependent variables</i>	
Option nature of the acquisition	Measured on a binary scale whether there was in the acquisition an expectation of long term growth to be realized at a later point in time or whether the acquisition was motivated by short term objectives
Option upside realization	Measured on a binary scale whether the combined business of the acquiring and the acquired company started growing in terms of sales revenue or whether the growth was not realized

Exhibit 1 (continued)

Name of the variable	Variable operationalization
<i>Independent variables</i>	
Maturity of the acquired competencies	Measured on a four-level scale from technological competencies that have not been introduced to mature declining competencies [1, 4]
Sales of the acquired company	Measured in absolute terms in Finnish marks as the sales revenue of the acquired company at the time of the acquisition
Personnel of the acquired company	Measured in absolute terms as the number of persons employed by the acquired company at the time of the acquisition
The industry trend at the time of acquisition	Measured on a three-level scale whether the industry was declining stable, or growing at the time of the acquisition [-1, 0, 1]
Acquirer research and development intensity	Measured on a three-level scale: Acquiring companies or acquiring divisions having no or only insignificant explicit research and development investment are categorized into category 0. Companies or divisions having significant volumes of explicit investment into search and development are categorized into category 2. The remaining companies are categorized into category 1 [0, 1, 2]
Patentability of the acquired competencies	Measured on a binary scale whether the competencies cannot be patented at all [0] or whether the competencies of the acquired company had been patented before the acquisition [1] or whether the competencies could have been patented before the acquisition [1]
Age of the acquired company	Measured in absolute terms in full years as the age of the acquired company at the time of the acquisition
The existence of technological complementarity	Measured on a binary scale whether the acquiring company could support the acquired company technologically after the acquisition
The existence of distribution complementarity	Measured on a binary scale whether the acquiring company could provide the acquired company new customers after the acquisition through its existing distribution system
The existence of finance complementarity	Measured on a binary scale whether the acquiring company could provide funds for the acquired company after the acquisition
The industry trend after the acquisition	Measured on a three-level scale whether the industry has been in general declining, stable, or growing after the acquisition [-1, 0, 1]
The [industry] relatedness of the companies	Measured on a scale of [0%, 25%, 50%, 75%, 100%]. The relatedness between the acquiring and the acquired company is rated 100% if the acquired company can be operatively connected to the core business area of the acquirer. The relatedness is rated 75% if the acquired company cannot be operatively connected to the core business area of the acquiring company, but there is some direct link between the core business areas. The relatedness is rated 50% if the acquired company can be connected operatively to a new emerging non-core business area. The relatedness is rated 25% if the acquired company has some distant links to a new, non-core business area. The relatedness is rated 0% if there are no pre-existing links
The proactive sales motive of the seller	Measured on a binary scale whether the seller wanted to sell the company for further growth in contrast to cashing out

The numerical values for the variables were assigned based on interviews. For example, the variable indicating the option nature of the acquisition was determined based on the acquisition motivation of the acquiring company, as stated by the interviewed persons. If the acquisition was motivated by long-term growth possibly realizable in the future in contrast to short-term motivations, the acquisition was considered to have the option nature. The option upside realization was determined based on the sales growth of the acquired company. If the sales of the acquired business area started growing significantly, the option upside variable was assigned a value indicating option upside realization. The distributions of the variables used in hypothesis testing are shown in exhibit 2 below.

EXHIBIT 2
Distribution of variables used in hypothesis testing: total: 111, option acquisitions: 58

Name of the variable	Variable operationalization	
Equity collaboration before the acquisition	Equity collaboration	14 (13%) acquisitions
	No equity collaboration	97 (87%) acquisitions
Non-equity collaboration before the acquisition	Non-equity collaboration	25 (23%) acquisitions
	No non-equity collaboration	86 (77%) acquisitions
<i>Dependent variables</i>		
Option nature of the acquisition	Option nature of the acquisition	58 (52%) acquisitions
	No option nature	53 (48%) acquisitions
Option upside realization	Option upside was realized	28 (48%) option acquisitions
	Option upside not realized	30 (52%) option acquisitions
<i>Independent variables</i>		
Maturity of the acquired competencies	1: Competencies not introduced	17 (15%) acquisitions
	2: Introduction to the markets	20 (18%) acquisitions
	3: Growth in the markets	30 (27%) acquisitions
	4: Mature declining competencies	44 (44%) acquisitions
Sales of the acquired company	Sales revenue 0–5 MFIM	41 (37%) acquisitions
	Sales revenue 6–10 MFIM	21 (19%) acquisitions
	Sales revenue 11–20 MFIM	19 (17%) acquisitions
	Sales revenue 21– MFIM	30 (27%) acquisitions
The industry trend at the time of acquisition	–1: Industry declining	5 (5%) acquisitions
	0: Industry stable	70 (63%) acquisitions
	+1: Industry growing	36 (32%) acquisitions
Acquirer research and development intensity	0: No or insignificant R&D	30 (27%) acquisitions
	1: Moderate levels of R&D	30 (27%) acquisitions
	2: Significant volumes of R&D	51 (46%) acquisitions
Patentability of the acquired competencies	Patentable competencies	61 (55%) acquisitions
	Non-patentable competencies	50 (45%) acquisitions
The existence of technological complementarity	Technological complementarity	36 (62%) option acquisitions
	No technological complementarity	33 (57%) option acquisitions
The existence of distribution complementarity	Distribution complementarity	25 (43%) option acquisitions
	No distribution complementarity	33 (57%) option acquisitions
The existence of finance complementarity	Finance complementarity	47 (81%) option acquisitions
	No finance complementarity	11 (19%) option acquisitions
The industry trend after the acquisition	–1: Industry declining	10 (17%) option acquisitions
	0: Industry stable	33 (57%) option acquisitions
	+1: Industry growing	15 (26%) option acquisitions
The relatedness of the companies	No pre-existing relatedness	5 (9%) option acquisitions
	Distant links to new non-core area	8 (14%) option acquisitions
	Related to new non-core area	18 (31%) option acquisitions
	Distant links to core business area	12 (21%) option acquisitions
	Related to core business area	15 (26%) option acquisitions
The proactive sales motive of the seller	Proactive sales motive	25 (43%) option acquisitions
	No proactive sales motive	33 (57%) option acquisitions

Appendix 2. Correlation matrices

EXHIBIT 1

Correlation matrix 1; N = 111; variables used as independent variables when the option nature of the acquisition is used as the dependent variable

Research and development intensity	−0.31 $p = 0.00$			
Patentability of the acquired competencies	−0.36 $p = 0.00$	−0.36 $p = 0.00$		
Age of the acquired company	0.48 $p = 0.00$	−0.09 $p = 0.22$	−0.18 $p = 0.02$	
	Maturity of the acquired competencies	Research and development intensity	Patentability of the acquired competencies	

EXHIBIT 2

Correlation matrix 2; N = 58; variables used as independent variables when the option upside realization is used as the dependent variable

Technological complementarity	0.32 $p = 0.01$			
Distribution complementarity	0.12 $p = 0.35$	0.39 $p = 0.00$		
Industry trend after the acquisition	0.28 $p = 0.04$	0.22 $p = 0.11$	0.20 $p = 0.13$	
Relatedness of the companies	0.07 $p = 0.58$	0.20 $p = 0.09$	0.47 $p = 0.00$	0.01 $p = 0.95$
	Proactive sales motive of the seller	Technological complementarity	Distribution complementarity	Industry trend after the acquisition

Appendix 3. Empirical summary

This paper set out to analyze the option nature of collaborative arrangements and small, technology-based company acquisitions. To summarize, a number of specific findings can be pointed out

- Small, technology-based company acquisitions could be seen more as option acquisition than as option exercise. An analysis of the previous equity and non-equity collaboration shows that in only ten small, technology-based company acquisition cases, the previous collaboration was initiated with the purpose to get an option to acquire the collaborative partner. Most of the cases where the collaboration had the option role were initiated as equity collaboration. Only 2 of the 25 non-equity collaborative arrangements could be regarded to have had the option role.
- Contrasting to collaborative arrangements, the option analogy would seem to be more relevant in acquisitions. Altogether 58 of the 111 small, technology-based company acquisitions were found to have explicit option elements. This would seem to favor the use of real option valuation methods in the valuation of technology-motivated company acquisitions.
- Using the logistic multiple regression analysis to analyze the variables contributing to the option nature of the acquisitions, four variables stand out. These are the age of the acquired company, the maturity of the acquired competencies, the research and development intensity of the acquiring company, and the patentability of the acquired competencies. The level of prediction with these four variables is 75.7%. Backward elimination procedure is used to remove the age of the acquired company as a variable causing collinearity. This increases the level of prediction to 77.5%
- The patentability of the acquired competencies correlates with the option nature of the small, technology-based company acquisitions. The option nature of the acquisitions seems to coincide with high appropriability and low competition regimes. According to Kester's classification of real options (Kester, 1984), it is more optimal to defer the exercise of this kind of options than to exercise them early. The option to defer can be considered to create additional value-added when combined with the growth option.
- From logistic multiple regression analysis, three variables stand out to explain the realization of the option upside in the sample of 58 option acquisitions. These variables are: the industry relatedness of the acquiring and the acquired company, the industry trend after the acquisition, and the proactive sales motive of the seller. Technology, distribution, and finance complementarity were eliminated. The level of explanation with the three variables is 84.3%. The level of prediction can further be enhanced to 90.2% by coding the independent variables of the regression equations according to the variable-indicator coding scheme.

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