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THE LIVING DEAD – WHY THEY TURNED OUT THAT WAY?

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ABSTRACT

We contribute to entrepreneurship research through a 3.5 year follow-up of young biotechnology ventures that have been established to develop and commercialize science based innovations. We want to understand why some of these promising ventures end up as the living dead as a part of an acquired or a merged entity. Previous literature on mergers and acquisitions that considers the phenomenon from the perspective of an entrepreneurial firm -- for which M&A can be a lucrative exit strategy – is scarce. Since successful new business opportunities develop based on market knowledge as well as technology knowledge (Shane, 2000), we hypothesize that those new firms that have high levels of market and technological knowledge end up in M&A more often than firms with lower levels of the knowledge based resources. We also hypothesize that for surviving firms, both technological innovativeness and market orientation contribute to the firm's ability to raise capital and to license out technologies. Data came from CEO- entrepreneurs in 85 medical biotechnology firms located in the United States and in Scandinavia. Initial data collection took place through in-person interviews in 2004, and data for dependent variables were collected in the summer of 2007. Our results show that companies that exhibit higher levels of market knowledge end up merging or being acquired more often than less market oriented new firms. Among ongoing businesses, both market knowledge and technological knowledge contribute to capital investments in the firm and technology licensing deals. Performance consequences of market orientation in the existing literature are limited to financial performance outcomes, often established in a large firm context. We contribute to the literature by demonstrating market orientation's contribution to young firm M&A as well as other outcomes in the context of highly technology intensive young ventures.

INTRODUCTION

Because of their critical role in bringing new technologies and innovations to the marketplace, new technology ventures (NTVs) are important for economic growth. There is a growing body of literature that looks at the success factors of such ventures using a variety of theoretical backgrounds, such as resource based view of the firm (Powers and McDougall 2005), capabilities approach (Lee, Lee and Pennings 2001), social capital (Yli-Renko, Autio and Sapienza 2001), human capital (Marino and De Noble 1997; Shrader and Siegel 2007), and so on. Indeed, the variety in theoretical lenses adopted, in study methodologies, in industry settings, in operationalizations of variables, as well as in timing of the studies has resulted in findings that are, on aggregate, often inconclusive and even contradictory (Song, Podoynitsyna, Bij and Halman 2008). Overall, it is fair to say that each one of the theories listed above has potential in explaining variation in NTVs' success.

While researchers have focused on finding the mechanisms through which NTVs can achieve success, the concept of "success" itself has received much less scrutiny. In studying the factors that lead to "success", researchers have typically conceptualized NTV's success as superior financial performance (Roure and Keeley 1990; Song et al. 2008) or achieving a certain milestone (typically initial public offering) (Powers and McDougall 2005). However, both of these measures can be highly problematic. Financial performance during the firm's early years is typically highly volatile, and in industries like biotechnology new ventures can operate for long periods of time before achieving their first sales. What is more, in some industries – again, biotechnology being a prime example – the typical business models of young ventures aim at licensing out innovations to partner firms for late stage development and commercialization. In such cases, traditional sales based financial measures are poor indicators of the firm's performance. When it comes to IPO as a measure of success, only a small share of otherwise successful technology ventures achieve this milestone. As a conclusion, we suggest that "success" for many technology based ventures is something different from what academics typically study. Merger or acquisition (M&A) is often a preferred exit strategy for many entrepreneurs, but this outcome has remained relatively under-researched until now. However, as a group, acquisition targets are more successful than their industry peers (Walsh and Kosnik 1993; Graebner and Eisenhardt 2004). We report on an empirical study in the context of biotechnology ventures, and in addition to M&A, we focus on equity investments as well as firm's ability to license out innovations as indicators of success. In so doing, we expand entrepreneurship literature and challenge future researchers on the topic of NTV success to be more critical about the established measures of success than what has been the case thus far.

THE LIVING DEAD

Mergers and acquisitions provide an important exit strategy for numerous technology entrepreneurs; 60-75% of firms acquired in the US between 2000 and 2004 were private (Capron and Shen 2007). Despite the empirical phenomenon that speaks about the importance of M&A for entrepreneurial ventures, academic research on the topic has predominantly approached the phenomenon from the perspective of an incumbent bidder.

Hoetker & Agarwal (2007) show that even in cases when innovative ventures die (i.e. a category separate from M&A), other firms do build on the knowledge created by departed firms. Given that technology ventures are especially valuable because of their capabilities to innovate and bring new technologies to markets, it is rather surprising that entrepreneurship researchers have not looked more into knowledge diffusion and innovativeness in a merged or acquired entity. If a NTV's knowledge base lives on after its death, it must be doing even better as a part of a merged or acquired entity, as a "living dead".

The interesting question, then, becomes what types of NTVs participate in M&A? Or, in other words, if M&A is a potential exit strategy for a new venture, what should the venture do in order to appear as a promising partner for other firms seeking to merge or acquire?

Petty, Shulman & Bygrave (1994) study entrepreneurs' motivations to sell their firms and conclude that financial concerns may not even be the primary concern in company sale. Most entrepreneurs had "a lack of experience in negotiating the sale of the firms, and are a bit naïve in their expectations about the eventual outcome." (Petty et al. 1994) Even if Petty et al. (1994) prompted researchers to "gain a deeper understanding of the other alternatives for harvesting a company" beyond IPO, subsequent research has not taken on the challenge with a few notable exceptions (Graebner and Eisenhardt 2004). Hence, in order to find reasons that might lead to M&A for a NTV, we should look at the extensive literature on incumbents' reasons for M&A.

Over the past couple of decades, large pharmaceutical companies have been very active in acquiring young, promising biotechnology ventures (Ernst&Young 2007). Since knowledge is often difficult to unbundle from other resources, acquisitions can represent a relatively easy access to expertise and knowledge that would be costly to replicate or assemble through other means (Kogut, Shan and Walker 1992). Indeed, innovation is often a central motivator of acquisitions, especially in technology intensive contexts (Hitt, Hoskisson and Ireland 1990; Puranam, Singh and Zollo 2003; Sorescu, Chandy and Prabhu 2007). Sorescu et al. (2007) find evidence in the context of pharmaceuticals that successful bidders tend to emphasize innovation potential in their selection of targets, whereas unsuccessful firms do not. By retaining top scientists after acquisitions and by applying product ideas from targets more widely and effectively, such bidders pave the way for their future success. Since innovations in biotechnology are based on new technological knowledge and scientific advances, our first hypothesis is as follows:

Hypothesis 1: The higher the technological knowledge of a biotechnology NTV, the more likely it will be involved in M&A.

The risk of adverse selection in the context of M&A arises from information asymmetries across bidders and targets and the resulting incentives for targets to misrepresent their value, making it difficult for bidders to screen targets efficiently. This problem is especially prevalent when a private firm is being acquired; the lack of information on the private target increases the acquirer's risk of not evaluating properly the assets of private targets. At the same time, less information on private targets creates more value-creating opportunities for exploiting private information (Capron and Shen 2007).

Young, small ventures face difficulties in signaling their value to potential partners; NTVs have to make efforts to increase their marketability in the market for corporate control (Capron and Shen 2007). If a NTV wants to appear "sellable" to a potential M&A partner it can, on one hand, do some "sales work" and actually proactively try to understand the needs and foci of potential bidders. This orientation towards customers and other potential stakeholders has long been studied in the field of marketing, albeit typically in a traditional buyer-seller context. On the other hand, a NTV can also try to reduce the potential bidders' fear that because of limited information, they cannot properly assess the value of the target. This fear can be reduced, for example, by communicating the future market potential of the firm's innovations as accurately as possible. For a firm to be able to do this, it needs to constantly generate and absorb information on its future customers and competitors. Hence, it looks like a NTV's understanding of its markets has dual benefits when trying to sell the firm to bidders: NTVs with high levels of market knowledge are aware of the bidders out there, their needs and wants, which helps in marketing the firm directly to these potential bidders. At the same time, high level of market knowledge equips a NTV to tackle the information asymmetry problem, and a potential bidder gets a clear picture of the future market potential of target's innovations.

Hypothesis 2: The higher the market knowledge of a biotechnology NTV, the more likely it will be involved in M&A.

QUALITY OF LIFE AMONG THE LIVING

New business survival has been the outcome of interest in a wealth of studies on technology based ventures. It is true that very few new technology ventures survive. For example, in an empirical study of 11,259 NTVs established between 1991 and 2000 in the US, Song et al. (2008) found that after four years only 36 percent of companies with more than five full-time employees had survived. After five years, the survival rate fell to 21.9 percent. From these discouraging odds of survival it is easy to arrive at the conclusion that it is extremely important to examine how new technology ventures can better survive (Song et al. 2008).

However, the mere survival of a firm tells little about its “quality of life” (Eisenhardt and Schoonhoven 1990). Limited internal funds and lack of sales income typical of young firms in technology intensive markets combined with the imperfections of capital markets suggest that external equity financing is crucially important for NTVs (Carpenter and Petersen 2002). In the venture capitalists’ view, the expectation of high financial returns is mainly correlated with the size and growth of markets targeted by the young innovative firm, and the radical nature of innovation (Tyebjee and Bruno 1984; Shepherd and Zacharakis 1999). In the US in particular, the role of venture capitalists in backing up promising technology ventures is a phenomenon that has received a wealth of attention in research studies of these firms (Amit, Brander and Zott 1998; Gompers and Lerner 2001). A recent study of German biotechnology firms by Champenois, Engel and Heneric (2006) emphasizes the importance of venture capital finance as a source of funding for biotechnology firms developing new products and technologies in the therapeutic and diagnostic fields. Forty-two per cent of the “high risk” sample firms of Champenois et al. (2006) received early stage venture capital. Remembering that only a proportion of startup firms that search for venture capital investments actually receive funds, it is clear that venture capital is a crucially important phenomenon for biotechnology startups.

Given that investors’ expectations are mainly correlated with the size and growth of markets targeted by the young innovative firm, and the radical nature of innovation (Tyebjee and Bruno 1984; Shepherd and Zacharakis 1999), a NTVs technological knowledge and market knowledge emerge as potentially important predictors of investments in the firm. Both technological (“push”) and market (“pull”) knowledge are required for successful innovativeness. What is more, market knowledge provides the firm with an understanding of future size and growth potential of the markets.

Hypothesis 3: Technological knowledge of a biotechnology venture is positively associated with capital invested in the company.

Hypothesis 4: Market knowledge of a biotechnology venture is positively associated with capital invested in the company.

Small, young biotechnology firms may adopt different commercialization routes for their product opportunities: either take their technology direct to the market as a final product or channel it through large established companies that will then apply their know-how and resources to commercialize it (Pfirrmann 1999; Costa, Fontes and Heitor 2004). The deals between smaller, upstream inventors and larger, downstream marketers are typically structured as licensing agreements, and profit potential together with functional complementarity are the driving forces behind such agreements (McCutchen and Swamidass 2004). In comparison with other industries, biotechnology has the highest absolute number of strategic alliances, involving mainly licensing agreements. Using a secondary database, Kollmer & Dowling (2004) identify 360 North American biopharmaceutical firms as licensors out of a total population of 421 biopharmaceutical firms in the North America in 1999 (86%).

Similar to external investors, also expectations of licensees of NTVs’ innovations are based on the size and growth of markets, and the radical nature of innovation that’s being licensed. Hence, a

NTVs technological knowledge and market knowledge emerge as potentially important predictors of licensing activity.

Hypothesis 5: Technological knowledge of a biotechnology venture is positively associated with the number of innovations licensed out by the company.

Hypothesis 6: Market knowledge of a biotechnology venture is positively associated with the number of innovations licensed out by the company.

RESEARCH METHODOLOGY

Sample

Empirical data for the study come from 85 biotechnology ventures, and data collection has taken place at two points of time. The first wave of data collection (in-person interviews) happened between October 2003 and June 2004. The second wave (mail questionnaire) took place in May – October 2007. The development timescales in the field of biotechnology are long. For example, the journey of a pharmaceutical product from initial discovery of an active compound to the launch of a drug typically takes 12 to 15 years (Rothaermel and Deeds 2004). In this light, the time lag of approximately 3.5 years between the first data collection and the second round of data collection from the same companies seems justifiable.

Biotechnology was chosen as the empirical field for this research since mergers and acquisitions are a common exit strategy in the field. What is more, given the long product development timescales, many of the traditional financial performance measures do not apply in biotechnology. Also, biotechnology is a growing field of industrial activity, and the growth companies in this sector represent firms that are of interest for governments and politicians because of their high earning potential. The global nature of the biotechnology business and, especially, the international scope of biotechnology markets – be it global markets for medicines or the licensing markets for inventions – make it feasible to assume that despite location, exit strategies and performance of biotechnology firms can be assessed on a common scale. Having said this, there are national differences on the supply side of biotechnology. The role of the public sector in supplying the soft infrastructure of innovation support for enterprises is not uniform from country to country, continent to continent. Because of the potential influence of institutional setting on the opportunity recognition process, data is collected from two geographic areas, namely the US and Nordic countries.

The target population of the survey includes the small and medium-sized independent medical biotechnology companies in Finland, Sweden, San Francisco Bay Area, Philadelphia area and South Florida. These areas were chosen so that firms from different institutional environments (Nordic and American) would be included. Furthermore, some areas have long roots in biotechnology (like Bay Area and Pennsylvania), others have experienced a dominance of large pharmaceutical companies in the past (Sweden), and some areas have only witnessed rapid growth in the biotechnology field over the past decade (Finland and South Florida). Random sampling was used in this study to make the sample similar to the population. The sample was stratified using the following criteria: (a) corporate governance (independent firms), (b) employment size class maximum of 250 people following the European Union's cutoff for small and medium-sized enterprises, (c) industrial sector: active in R&D in human therapeutics (drug discovery & development), diagnostics, medical devices, and / or technology research that helps in developing the aforementioned classes of products, and (d) product-orientedness (i.e. even if firms provide services as a part of their business model, their main lines of business are about researching and developing physical products). The random sample of companies included in this research was derived from the local biotechnology industry databases. Altogether 193 firms in the chosen geographical areas fulfilled the sampling criteria in 2003. All of these firms were contacted and asked for an interview appointment with the company CEO. Fifty companies declined to participate, and it was impossible to establish contact with 49 firms. 94 firms agreed to participate, and interviews were conducted in 85 firms (Effective response rate 45%) in 2003-2004.

Data collection method 2003-2004, independent variables

In order to collect valid and comprehensive data from the sample firms, face-to-face interviews were conducted with the CEO (in some cases the business development manager or founder) of each sample firm in wave 1. This was important for a number of reasons. First, in addition to a structured questionnaire, the wave 1 survey instrument included questions that were open ended and the analysis of which has been reported elsewhere. Second, face-to-face contact gave the respondents a possibility to ask for clarification if they did not understand some questions. Third, a personal visit and data collection minimized the amount of missing data.

All interviews were conducted by the lead author. The interviewees were told about the general purpose of the research before the interviews, but they were not shown the questionnaires. In the actual interview, the session started with questions about company demographics, after which open-ended questions were presented. Finally, the interviewees filled in the standardized scales (used for analysis in this study) on paper. Overall, the questionnaire worked well and the personal interview approach resulted in a minimal amount of missing data. Table 1 below summarizes the positions of interviewees in wave 1 (n=85) and respondents in wave 2 (n=42).

Of the total of 85 interviews in wave 1, 58 were conducted in the US. The remaining 27 were divided between Finnish (n=20) and Swedish (n=7) companies. In Finland, the sample companies are located in the three major cities, namely Helsinki, Turku and Tampere. In Sweden, all seven companies are located in the Gothenburg area. Table 2 below illustrates the distribution of survey responses in wave 1 and wave 2 by geographic region.

A typical sample firm was three to five years old at the time of first data collection, and develops innovations either for the pharmaceutical markets or for use by other companies (technology platforms). Only three sample firms employed more than 100 employees, and half of the firms had not launched any products by the time they were first interviewed. Even out of the firms that did have some sales revenue many indicated that their most promising products were yet to be launched. The US-based sample firms are larger (number of employees) and exhibit higher levels of entrepreneurial orientation than their Nordic counterparts. No other significant differences were detected between American and Nordic sample firms.

Data collection method 2007, dependent variables

The purpose of the second wave of data collection was to follow up with the firms first interviewed in 2003-2004. Data collection started in May 2007 by secondary data collection from online sources to determine the status of each firm and original respondent. As illustrated in Table 2, sixty of the original 85 firms were still operating as independent businesses. In 43 of these 60 firms the interviewee from 03-04 was still in the same position or had even been promoted. In these 43 cases, a questionnaire was mailed to this individual. In the remaining 17 cases the new company CEO received the questionnaire. Mail survey was employed because it allowed a maximum amount of information to be collected from a maximum number of geographically dispersed firms in a minimum amount of time. 42 companies provided usable data in this second wave of data collection (effective response rate 70%).

Operationalization of variables

Even prior to wave 1 data collection, a qualitative study of six case companies in Pennsylvania was conducted that addressed the nature of technology knowledge, market orientation, and other types of knowledge in young biotechnology ventures. These six firms were excluded from the subsequent data collection. This inductive preliminary study helped in understanding the study phenomena in the empirical context of young biotechnology ventures and was pivotal for subsequent instrument development. The approach in the preliminary study was a qualitative one, not one geared towards testing existing hypotheses (either overtly or unconsciously). In addition, 10 of the first 85 interviews in wave 1 served as a pilot study. At this stage, only minimal changes to the questionnaire were made.

Market knowledge. The measurement of market knowledge is based on a widely used behavioral market orientation scale, originally developed by Kohli et al. (1993). This measure captures the behaviors of a firm that are geared towards understanding customers and competitors throughout the company. Hence, it captures the firm’s knowledge of customers, markets, and ways to serve markets (Shane 2000). The scale developed by Kohli et al. (1993) has been subsequently employed in a wealth of empirical studies in the field of marketing (For example, Matsuno, Mentzer and Ozsomer 2002; Kyriakopoulos and Moorman 2004; Kara, Spillan and DeShields 2005). The 18 market intelligence generation- and dissemination- items from the measurement by Kohli et al. (1993) were further developed to reflect the current empirical context, i.e. small, young biotechnology firms. These refinements were based on insights developed in the six preliminary case studies. Instead of “business unit” (the original focus of Kohli et al. 1993) the items were re-worded to reflect the firm. The final 22-item market knowledge scale has a Cronbach’s alpha value of 0.753.

Technology knowledge. Measurements of R&D activity, such as the total amount of R&D spending and R&D spending divided by total sales, have been used as indicators of technological capability in previous research (Coombs and Bierly 2001). Because most young biotechnology firms do not have sales income, *R&D expenses’ share (%) out of the total expenses of the firm* is used as a measure for technological knowledge. The probability of a firm coming up with an innovation can be proportional to the firm’s R&D spending (Nelson and Winter 1982). At the same time, R&D is regarded as a highly uncertain activity, and institutional structures supporting innovation are complex and diverse (Nelson and Winter 1977). R&D spending reflects investment in knowledge, rather than knowledge itself, and is a questionable proxy because knowledge generation is cumulative. Hence patents are used as an additional proxy for technology knowledge. *Patents* are output measurements of technological knowledge (Coombs and Bierly 2001). In biotechnology, most new technology is protected by patents. Patent data are used here as a proxy for technology knowledge. The patent data (numbers of patents) provided by the interviewees were checked against the publicly available USPTO data (correlation coefficient 0.433, significant at $p < 0.01$). Since the smallest firms’ patents that have been granted to e.g. universities or scientists instead of these startup firms may go unnoticed in company name searches in the USPTO database, a mean of self-reported and publicly available patent numbers was used in analyses. Patent citation data were also used as a proxy for technology knowledge (Shane 2001). Unfortunately, because of the young age of the sample firms and their patents, only patents of 14 firms have received citations by January 2007.

Firm status in 2007. Firm status in 2007 was determined mostly based on online information. Databases such as LexisNexis and Bioworld online were consulted to determine the current status of each one of the original 85 firms. In some cases, where no information was available, original company contacts from 2003-2004 were traced to their new positions and enquired about the fate of the sample company. After extensive research, it was determined that 8of the original 85 firms had completely seized to exist, and 17 firms had become parts of new entities through a merger or acquisition. 60 firms were still operating as independent businesses after approximately .35 years (Table 2).

Outlicensing. Another dependent variable used in this study is the number of technologies the firm has licensed out. The number of product candidates licensed out to other companies tells about the future profit potential of these products. In this study, the questions about the number of technologies the firm had sold or licensed out to other companies were added between waves 1 and 2, so licensing data is only available at wave 2. Out of the 42 companies for which data were obtained in wave 2, twenty-two had licensed out or sold at least one technology during the firm's existence. Out of the 14 biopharmaceutical companies from which data were collected in wave 2, eleven had been involved in such technology transfer as a seller / licensor (79%). A sum of the number of technologies the firm has licensed out or sold out since the beginning of 2004 is used in the analyses.

Equity investments. In the interviews conducted for the wave 1 as well as in the wave 2 questionnaire the respondents were asked to provide information on the capital invested in their firm up to the time of the interview. Seventy interviewees actually provided this information in phase 1 and thirty three in phase 2. The Pearson correlation coefficient between phase 1 and phase 2 data is .905 (Significant at $p<.01$). Since these young companies are not required to provide information about their sources of capital to the public, secondary data to confirm these numbers are not readily available. For currency conversions in wave 1, USD 1 = EUR 0.9 = SEK 8. For currency conversions in wave 2, USD 1 = EUR 0.74 = SEK 6.8. In the analyses, the amount of capital invested in the firm divided by firm age is used.

Control variables. The use of control variables is limited by the small number of cases (n=42) from which data were obtained in wave 2. Introducing many control variables to the dependence models would bring down the degrees of freedom. It might be that the results of the tests are somewhat different for different types of biotechnology firms (medical device / technological platforms/ diagnostics / drug discovery & development), for example. However, introducing dummy industry sector controls to the models would be detrimental for the degrees of freedom in the models. Three control variables have been selected for all the models. First, *firm location* is used as a control variable. The dummy variable for location (1 = USA, 0= Finland or Sweden) is used as a control variable in all statistical analyses. In addition, *firm age* and *firm size* (number of employees) are used as controls. The age of the firm is measured as the number of years between the year of the firm's formation (self-reported) and the year of wave 1 data collection.

RESULTS

Using company status in 2007 as a dependent variable, an attempt was made to distinguish those companies that were still in operation from those that had ceased to exist or had merged or been acquired by other firms.

Table 3 lists the correlations between the three company status variables in wave 2 and independent variables in wave 1. The number of cases in each status category is as follows:

Ongoing business = 60; merged or acquired (M&A) = 17; quit/no records = 8. The strongest correlation is between market knowledge at wave 1 and the M&A outcome in wave 2 (correlation coefficient .347, significant at $p < .01$). Market knowledge is also significantly but negatively ($p < .05$) related to subsequent "quit/ no records" category. This negative effect could have been expected based on the marketing literature that emphasizes the positive performance and survival effects of market knowledge and market oriented company culture (Kohli et al. 1993; Narver, Slater and MacLachlan 2004; Mavondo, Chimhanzi and Stewart 2005). The positive association between market knowledge and ending up acquired or merged supports our hypothesis 2. Assuming that involvement in a merger or acquisition is a positive development, the marketing literature that has linked market knowledge to positive firm level outcomes could explain this relationship. However, if the acquisition or merger is a result of the firm losing its viability as a standalone business, the relationship becomes harder to explain. There is no support for hypothesis 1.

Figure 1 further illustrates the differences between the three status groups at wave 2 with regard to market knowledge at wave 1 (0= quit, 1= M&A, 2=ongoing business). Figure 1 shows how the middle category (M&A) is significantly different from the two other categories using the 95% confidence intervals of market knowledge mean. Thus, evidence for the discriminating power of market knowledge is quite convincing.

We also tested the relationship between the independent variables and outcome category in two discriminant models. Both analyses resulted in a statistically significant discriminant function (Wilks' Lambda = 0.886, $p = 0.006$ for M&A as a dependent variable; Wilks' Lambda = 0.786, $p = 0.001$ for "Quit" as a dependent variable). The discrimination of merged or acquired firms from the rest was possible with only one variable, namely market orientation. This discriminant function correctly classified 85.7% of the cases. The discrimination of companies that have quit from the rest was possible with two variables, namely firm size and its patent count. This discriminant function correctly classified 94.1% of the cases. This finding provides further support for hypothesis 2.

Multiple linear regression analysis was used to assess the relationship between market / technological knowledge and equity investments as well as licensing. We tested for the main assumptions for using multiple linear regression, namely normality of the variables, homoscedasticity, and independence of the independent variables (VIF values). Correlations between the regression variables are reported in, Table 4 and the standardized coefficients along with R-squared and F-values are in Table 5.

As illustrated by Models A1-A4 in Table 5, both market knowledge and patents have a positive effect on capital investments in the firm. However, in the full model (A4) the effect of technology knowledge (patents) comes through stronger than that of market knowledge. Hence, we find strong support for hypothesis 3 and some support for hypothesis 4. Finally, models B1-B4 test the effects of independent variables on licensing. Both market knowledge and patents have significant effects ($p<.01$) on firm's subsequent success in licensing out innovations. This indicates support for hypotheses 5 and 6. However, the results presented in models B1-B4 should be interpreted with caution since the overall number of companies that have licensed out innovations is small in the sample.

CONCLUSIONS

This study has suggested alternative ways to analyze NTV success. Traditional financials measures used to assess firm "success" do not often apply in specific contexts of NTVs, as has been discussed here in the case of biotechnology. As alternatives, we have suggested that M&A exit, continued capital investments, and licensing success can and should be included when measuring the success of these firms. In addition, we have shown that knowledge based resources that have often been linked to firm success in previous research, namely technological knowledge and market knowledge, contribute to these "alternative" success outcomes as well.

Most interesting is the positive effect that a firm's market knowledge has on its subsequent likelihood to involve in M&A. This finding is unprecedented in previous research. We have suggested two mechanisms through which the positive effect may materialize. NTVs with high levels of market knowledge are aware of the bidders in the market for M&As, their needs and wants, which helps in marketing the firm directly to these potential bidders. At the same time, high level of market knowledge equips a NTV to tackle the information asymmetry problem, and a potential bidder gets a clear picture of the future market potential of target's (NTV's) innovations. Other mechanisms through which the positive effects of market knowledge on M&A come about are plausible and remain an interesting topic for future research.

Rather than a comprehensive assessment of reasons that lead to a young venture merging or being acquired, this research serves as an invitation for future research to study the topic further. There is a substantial body of work in strategy and finance that has investigated how firm- and transaction-level characteristics can shape the outcomes of mergers and acquisitions. For example, agency problems due to misalignment of interest between firms' owners and managers can affect acquisitions' motives and subsequent performance (Jensen 1986). Future research in the field of entrepreneurship should build on existing knowledge but look at the phenomenon of M&A from the perspective of the acquired or merged entrepreneurial venture. Just like agency problems inside the incumbent bidder can affect an acquisition, issues typical for entrepreneurial ventures can influence their acquisition performance.

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Table 1: Position of respondents

	Wave 1		Wave 2	
Position of the respondent	**N**	**%**	**N**	**%**
CEO	48	57	25	60
Founder	2	2	1	2
CEO and Founder	19	22	10	24
Vice President, Bus. Dev.	16	19	6	14
Total	85	100	42	100

Table 2: Survey response by geographic region

	Wave 1	Between wave 1 and wave 2		Wave 2			
Firm location	**Original N in wave 1**	**Quit or no record**	**Merged / acquired**	**Effective N 2007**	**Reply by mail**	**Reply after phone inquiry**	**Effective response rate wave 2**
Finland	20	2	4	14	4	9	93%
Sweden	7	0	1	6	4	1	83%
Bay area, CA	26	2	6	18	3	7	56%
Pennsylvania	13	1	2	10	7	2	90%
South Florida	19	3	4	12	5	0	42%
TOTAL	**85**	**8**	**17**	**60**	**23**	**19**	**70%**

Table 3: Correlations for selected wave 1 variables and company status in wave 2

		Wave1						Wave 2		
	Variables	Patents	R&D intens	Market knowl.	USA	Age	Size	Ongoing business	M&A	Exit
Wave 2	Ongoing business	-.122 (69)	-.061 (80)	-.146 (85)	-.052 (85)	036 (85)	-.028 (85)			
	Company merged or acquired	.138 (69)	.081 (80)	.347** (85)	.025 (85)	.097 (85)	.219* (85)	-.775** (85)		
	Quit / No records	-.004 (69)	-.016 (80)	-.248* (85)	.047 (85)	076 (85)	-.256* (85)	-.499** (85)	-.161 (85)	

*Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed). N in parentheses.

Figure 1: Error bars showing 95% confidence interval of mean for market knowledge by wave 2 status category (0=exit, 1=M&A, 2=ongoing business)

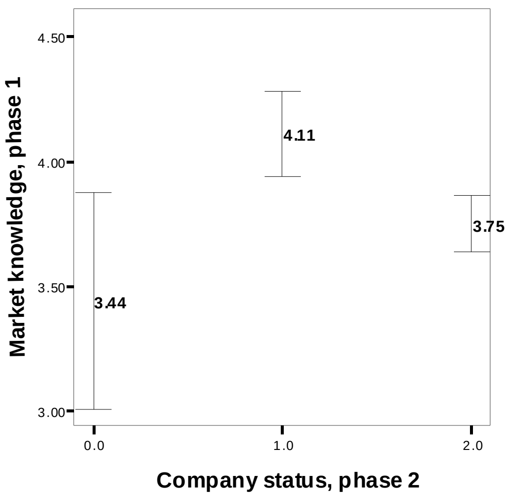

Table 4: Correlations for variables in the regression analysis

Variables	Mean	S.D.	1	2	3	4	5	6	7	8
1. Capital invested in firm per year (log) (wave 2)	5489	8202	1							
2. Number of innovations licensed out (log) (wave 2)	.747	.762	.331	1						
3. Location, USA / Scandinavia	.68	.47	.231	.043	1					
4. Age	6.09	3.84	-.158	.318	-.182	1				
5. Current number of employees (log)	2.99	1.15	.629**	.365	.102	.219*	1			
6. Patent count (log)	1.18	1.35	.423*	.618*	.174	.174	.382*	1		
7. Share of R&D expenses of all expenses of the firm	60.5	30.1	.225	-.098	.135	-.332**	-.065	.168	1	
8. Market knowledge	3.79	.46	.358*	.692**	.029	-.151	.236*	.269*	.110	1

*Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 5: Regression results

	Dependent variable: Equity investments in the firm (log)				**Dependent variable: Technology licensing and sales (log)**			
	Control variables	Main effect variables			Control variables	Main effect variables		
	Model A1	Model A2	Model A3	Model A4	Model B1	Model B2	Model B3	Model B4
Location, USA	.086	.077	-.092	-.101	.129	-.021	.462*	.100
Firm age	-.151	-.158	-.414**	-.423**	.252	.105	.023	-.038
Firm size (log)	.619***	.519***	.488***	.456***	.290	.018	.215	-.109
Market knowledge		.414***.		.215		.653***		.724***
R&D intensity			.127	.133			-.085.	.393
Patents			.544***	.473***			.748**	.694***
R-square	.400	.561	.723	.762	.192	.491	.580	.813
Adjusted R-square	**.328**	**.488**	**.636**	**.667**	**.04**	**.355**	**.370**	**.689**
F-value	**5.565*****	**7.673*****	**8.343*****	**8.022*****	**1.265**	**3.617****	**2.760***	**6.539*****

*** Significance p< 0.01, ** Significance p< 0.05, * Significance p< 0.1