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Look Before You Leap: Market Opportunity Identification in Emerging Technology Firms

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Entrepreneurs play a fundamental role in bringing new technologies to market. Because technologies are often configurable to serve a variety of different markets, it is possible for entrepreneurs to identify multiple market opportunities *prior* to the first market entry of their emerging firms, and if they elect to do so, to therefore have a choice of which market to enter first. The empirical results presented in this paper offer three new insights regarding this important early-stage choice in new firm creation. First, they reveal that serial entrepreneurs have learned through prior start-up experience to generate a "choice set" of alternative market opportunities before deciding which one to pursue in their new firm creation. Second, the analysis indicates that entrepreneurs who identify a "choice set" of market opportunities prior to first entry derive performance benefits by doing so. Third, the positive relationship between the number of market opportunities identified prior to first entry and new firm performance is nonlinear and subject to decreasing marginal return. The research literature has yet to acknowledge the notion of multiple opportunity identification prior to entry, and the related idea of selecting the most favorable market opportunity for the creation of a new technology firm.

Key words: market opportunities; serial entrepreneurs; technological commercialization; new firm creation
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1. Introduction

A growing number of studies highlight the fact that new technology firms are an important source of innovation and wealth creation (Shane 2004). Before entrepreneurs can exploit the value inherent in their technological competences, however, they need to identify at least one market domain in which their technologies meet customer demand. Notably, because technological competences may create benefits for end users in *multiple* market domains (Penrose 1959, Prahalad and Hamel 1990, Jolly 1997, Danneels 2007), by identifying more than one market opportunity, entrepreneurs might be able to select the most favorable market conditions for new firm creation.

However, due to limited prior knowledge of markets in which a technological competence may be valued, the identification of multiple market opportunities prior to the first entry appears to be fairly uncommon among nascent entrepreneurs. Shane (2000) shows that in a set of eight entrepreneurs who sought to commercialize a technology from MIT, *none* identified more than one market opportunity, although at least eight different markets existed. Intriguingly, these market opportunities offered highly diverging prospects for value creation. Hence, for an entrepreneur seeking to establish her new firm as a prospering economic entity, the failure to identify a major market opportunity prior to first entry may be particularly problematic.

Research that could provide further insights on the technology-to-market linking problem in new firm creation is surprisingly scant (Helfat and Lieberman 2002), given that this problem is of considerable theoretical interest for the entrepreneurship, strategy, and organizational literatures (Dougherty 1992) and is also of high practical relevance (Jolly 1997, Shane 2004). Beyond the value creation aspect, the choice of which market to enter is one of the most profound organizational decisions entrepreneurs are faced with, because the nature of the market has strong imprinting effects on a new firm's identity, the capabilities and assets it needs to build, and its organizational structure (Boeker 1989).

Drawing from the literatures on learning and innovation and resource-based theory, the purpose of this paper is to advance theoretical understanding of the technology-to-market linking problem in new firm creation. We address two important yet unanswered questions. First, against the backdrop of recent studies that uncover important effects of

prior entrepreneurial experience on the process of opportunity identification (McGrath and MacMillan 2000, Baron and Ensley 2006), we seek to understand whether *serial* entrepreneurs (i.e., individuals who are proficient in new firm creation) have developed particular approaches to the technology-to-market linking problem and the associated search for market opportunities. Specifically, we examine whether serial entrepreneurs identify more market opportunities for their technologies prior to first entry—i.e., construct a larger choice set—than novice entrepreneurs. Second, there is a major gap in our understanding of whether entrepreneurs may indeed benefit from the identification of multiple market opportunities. Whereas the MIT example shows that market opportunities stemming from the same technology may have substantially different value creation characteristics (Shane 2000), there is also research that suggests that entrepreneurs may not be able to select effectively between opportunities or may not be able to exploit opportunities that are more distant from their current knowledge base. We thus investigate whether the identification of multiple market opportunities prior to first market entry leads to superior performance outcomes in new firm creation. We address these research questions using an original data set of 83 venture capital (VC)-backed technology ventures.

The scarcity of studies on the technology-to-market linking problem in new firm creation conceivably warrants any addition to the literature. We believe that several insights of the present study make a contribution. Most important, our findings reveal that a key element of commercialization learned by technology entrepreneurs through prior start-up experience is to generate a choice set of alternative market opportunities before deciding which opportunity to pursue first. Furthermore, the analysis indicates that entrepreneurs can derive performance benefits from the identification of a set of market opportunities prior to first entry, and that a positive yet nonlinear relationship exists between the number of market opportunities identified (i.e., the size of the choice set) and firm performance. We proceed with a discussion of the theoretical background and develop our hypotheses in §3. We describe the estimation methodology and the data in §4 and present the empirical results in §5. Section 6 concludes the paper.

2. Theoretical Background: Linking New Technologies with Market Opportunities

In its most basic form, technology-to-market linking can be seen as the combination of technological knowledge with information on market demand, i.e., end-user domains where the technology, as embodied in a product, can be meaningfully employed and can create benefits for its users (Dougherty 1992, Danneels 2002). To understand the technology-to-market linking problem in new firm creation, it is necessary to delineate the components of this problem.

2.1. Technological Competences and Their Fungibility

Following Mitchell (1992), technological competence typically stems from a combination of tangible and intangible technically related resources. The idea that technological competences are fungible and can create benefits for end users in multiple market domains is firmly anchored in the resource-based view in strategic management. As a case in point, Penrose (1959, p. 25) observed that "(e)xactly the same resource when used for different purposes or in different ways and in combination with different types or amounts of other resources provides different service (...)." Subsequently, many authors have noted that technological competences lie upstream from the end product and transcend any particular product (e.g., Prahalad and Hamel 1990, Danneels 2007). Because a firm's technological competence is distinct from the products in which it is embodied, it may be utilized in a range of applications, and thus leveraged across different market domains.[1]

At this point it is important to note that the range of market opportunities emerging from a new technology and thus the generality of a technological competence are rarely clear from the outset, because they depend on people's (ingenious) efforts in technological competence building and market opportunity identification (Penrose 1959). First, from a technology perspective, fungibility depends on how far and in what direction the knowledge components embodied in a new technology are recombined with other bits of technological knowledge (Fleming and Sorenson 2004). Whereas some elements of a technological competence are specific to a particular application area, others are of a more general nature and have implications for products in a great array of markets. Hence, although research and development efforts may be focused on particular applications, emerging technologies may be untangled, altered, and integrated with other knowledge bases in order to be transformed into a more general, or more specific, type of technological competence (Galunic and Rodan 1998, Danneels 2007). Second, from a market perspective, fungibility depends on the identification of different markets in which the same type of technological functionality is valued, and thus on the extensiveness of the search process and

[1] The logic behind this argument corresponds to the rationale for related diversification (e.g., Miller 2006), which involves expansion into different markets based on shared organizational competences.

the ingenuity that founders apply in their explorations. To identify promising market opportunities, a complex array of insights into application domains and customer needs must be gathered (Dougherty 1992).

2.2. Acquiring Knowledge on Market Opportunities

The acquisition of knowledge on market opportunities can be conceptualized as an organizational search problem. In the organizational learning literature, search activities are considered instrumental for firms' adaptation to environmental change and the identification of opportunities to enhance performance. Building on March and Simon (1958), local search is defined as the behavior of a firm in seeking solutions in the immediate neighborhood of its existing stock of knowledge. Because local search is associated with less-risky search activities, it is the most commonly used algorithm in technological search (Stuart and Podolny 1996). In terms of market search, this suggests that entrepreneurs tend to identify a market opportunity either known to them in the past, or closely related to their existing stock of prior knowledge (Shane 2000). At the other end of the spectrum, distant search (also referred to as exploration) is defined as the behavior of people attempting to build new knowledge bases (March 1991). To conduct a distant search, entrepreneurs need to engage in some form of boundary spanning and bridge disparate knowledge domains (Miller et al. 2007).

The process of market search and its outcome depend on whether one assumes *rational* or *boundedly rational* behavior by founders. In a classic model of rational decision making, founders are assumed to explore the complete landscape and evaluate the whole set of alternatives for linking their technological resources with market opportunities (Janis and Mann 1977). Behavioral decision theorists stress, however, that people's search activities are strongly influenced by cognitive and social phenomena (Cyert and March 1963). Specifically, individuals have limited information-processing capacity, which can readily be exceeded when they perform complex tasks such as organizational searches. This deficiency is augmented by the uncertainty, resource constraints, and time pressures experienced in new firm creation. Realistically, one can thus expect individuals to engage in a boundedly rational search by employing simplified representations of search landscapes and decision heuristics (Gavetti and Levinthal 2000).

If boundedly rational founders cannot readily identify all solutions, the question becomes how many do they identify before they terminate their search for market opportunities? Behavioral decision theory suggests that actors search for alternatives until they identify one that is good enough to meet an initial set of requirements, i.e., they satisfice (Simon 1982). Search is seen to commence when the newly identified alternative does not meet the aspiration levels of founders, and to stop when a satisfying alternative has been identified. In new firm creation such differences in aspiration levels may be most evident when comparing founders who seek to create "lifestyle ventures" with those attempting to create high-growth, VC-backed businesses. What is considered a satisfactory alternative is typically a function of an actor's prior experience and her observation of other referent organizations (Greve 2003).

3. Hypotheses

The preceding discussion indicates that the initial market choice is one of the most profound decisions in the early life of firms and that some heterogeneity can be expected in how extensively entrepreneurs engage in a market opportunity search prior to first entry. Extending this discussion, our hypotheses study two critical yet hitherto unaddressed questions. First, against a backdrop of recent research, which has uncovered that serial entrepreneurs possess special insights on opportunity identification (McGrath and MacMillan 2000, Baron and Ensley 2006), we seek to understand whether they also possess special insights on the technology-to-market linking problem in new firm creation. We ask whether they identify more market opportunities for their technological competences prior to first entry—i.e., construct a larger choice set—than novice entrepreneurs. Second, theory offers strongly conflicting arguments regarding the core question of whether entrepreneurs may indeed benefit from the identification of multiple opportunities prior to first entry (cf. March 1991, Peteraf and Bergen 2003). Our second set of hypotheses thus investigates the relationship between preentry market opportunity search and postentry performance.

3.1. Prior Entrepreneurial Experience and Market Opportunity Search

Individuals who create new firms are equipped with a stock of knowledge that they can apply in the process. Because new firms in technology-intensive industries are typically founded by teams, it is the preexisting knowledge of the founding team that affects the knowledge available to the firm, the ability of the team to access and use the knowledge, its information-gathering and information-processing behavior, and the number and variety of solutions that will be generated (Pelled et al. 1999). One particularly important type of preexisting knowledge is the knowledge that has been acquired through prior entrepreneurial experience, because *repeat* founders can draw on high levels of task-specific knowledge and may have obtained special insights on the

entrepreneurial process. Because prior entrepreneurial experience has many tacit components that are learned by doing, it provides a particular type of knowledge that cannot be acquired easily through other types of learning (Delmar and Shane 2006). In this vein, expert information-processing theory suggests that people develop refined and complex cognitive structures (schemata) as they gain experience in a particular area. These structures may help repeat founders in processing new information and in unifying disparate sets of information, and also in arriving at qualitatively more sophisticated judgments (Gagné and Glaser 1987).

In terms of opportunity identification, these arguments suggest that serial founders could have developed specific insights on the process of opportunity identification and have refined cognitive structures in place that assist in market opportunity search. Two recent studies support this assumption. First, Baron and Ensley (2006) find that experienced founders have acquired richer and more refined cognitive representations of business opportunities than novices (opportunity prototypes), which helps them pursue opportunities most likely to yield positive financial outcomes. Whereas novice entrepreneurs emphasize evaluation criteria such as the novelty of the idea, the superiority of the product or service, and the potential to change the industry, repeat entrepreneurs look for business opportunities that will quickly generate positive cash flow, have a manageable level of risk, and solve a customer's problem. Second, field research by McGrath and MacMillan (2000) indicates that experienced founders have developed a distinct entrepreneurial mindset that provides these individuals with rich cognitive frameworks for identifying and pursuing business opportunities. They find that entrepreneurs who have repeatedly created successful new firms employ so-called "opportunity registers;" i.e., they identify and keep track of multiple business opportunities before they decide which one is the best to pursue. Although McGrath and MacMillan's observations concern business opportunities as such, the underlying logic may also apply in the context of market opportunities for technologies: Serial entrepreneurs seek out a larger number of market opportunities prior to first entry, so that they have a larger choice set at hand before deciding which market opportunity to pursue with their emerging technology firms.[2] As indicated above, serial entrepreneurs may not only possess superior abilities in market opportunity identification, but may also have a higher awareness of the importance of market conditions for successful new firm creation and thus may be more willing to search for markets.

Hypothesis 1 (H1). *Founding teams that have members with prior entrepreneurial experience will consider a larger number of market opportunities prior to first market entry than teams without such experience.*

3.2. Preentry Market Opportunity Search and Postentry Performance

Given the uncertainties associated with market opportunity identification and evaluation, the fleeting nature of some opportunities, and a variety of other factors that impact search and firm creation processes, it is unclear whether performance benefits can be derived from the identification of multiple opportunities. Several theoretical arguments suggest that the identification of multiple market opportunities is an important precursor to achieving superior performance outcomes in new firm creation.

First, it is one of the premises of classical decision-making theory that the availability of alternative solutions will enhance organizational problem-solving outcomes (Janis and Mann 1977). This notion is echoed by behavioral decision theorists (March and Simon 1958) and also in studies on human creativity suggesting that people who can brainstorm several solutions to a problem have a higher likelihood of finding the most promising solution (Osborn 1957).

Second, market characteristics are of great importance in entrepreneurship because they have a considerable impact on the rent-earning potential of firm resources (Peteraf and Bergen 2003). Market opportunities usually vary along key dimensions such as market size, lifecycle stage, demand uncertainty, entry barriers, and competitive rivalry. For example, the eight markets discussed in Shane (2000) had projected market sizes that ranged between 10 million and several billion USD. Thus, moving beyond the local solution by increasing the search space can lead to highly novel recombinations of knowledge, potentially more valuable opportunities, and a greater set of opportunities from which to choose. Research on established firms supports this reasoning by suggesting that whereas local search can lead to the identification of local performance optima, above-average firm performance relies more heavily on a firm's ability to identify a global optimum through a distant search (e.g., Rosenkopf and Nerkar 2001).

Third, the market choice defines a core element of a new firm and has a strong imprinting effect, because it forms the basis for other key strategic decisions such as the configuration of the internal and external value chain (Abell 1980, Geroski 1998, Danneels

[2] As an illustration of the multiple market opportunities that can arise from a technological resource, consider the example of a young European plastic manufacturer. This firm developed a new form of plastic that remains water resistant while in use, but can be dissolved when a reagent is added to the water. It identified multiple markets for its innovative plastic, with applications ranging from diapers to humidity sensors to agricultural films (Jolly 1997).

2003). New firms can get stuck with their initial (inferior) choice, because they may not be in a position to afford the adjustment costs incurred by changing the target market.

Fourth, although the exploitation of more distant market opportunities requires an adequate knowledge base and access to appropriate core and complementary resources, some managerial practices can support entrepreneurs in pursuing distant configurations. For example, they may acquire distant knowledge by hiring new team members, or by creating alliances (Roy 2005).

Against this backdrop, we argue that it is important for successful firm creation that technology entrepreneurs have a *choice* of target markets prior to first entry. We thus postulate the following hypothesis:

Hypothesis 2A (H2A). *Technology start-ups that consider more than one market opportunity for a technological competence prior to the first market entry will be more successful than those that consider just a single market opportunity.*

Extending further, the question arises whether founders who search for ever-more market opportunities can expect to benefit from constructing a *larger* choice set of such opportunities prior to first entry. To construct a larger choice set, founders need to broaden the scope of their search and explore more distant regions of the search landscape (March 1991). As discussed, distant searches allow a combination of existing knowledge with new, far-flung knowledge elements. Although research indicates that the integration of distant knowledge elements may not necessarily lead to a viable combination, it also suggests that combinations involving distant knowledge can lead to highly valuable and potentially path-breaking solutions (Fleming and Sorenson 2004, Nerkar and Roberts 2004). Thus, chances are that founders may indeed identify highly attractive market domains when they explore more distant regions of the market search landscape.

However, the construction of a larger choice set is also associated with additional search costs and mounting challenges in opportunity evaluation and exploitation. Specifically, founders will need to devote increasing amounts of monetary resources, time, and energy to extend their exploration of the market landscape (March 1991, Gavetti and Levinthal 2000).[3] Thus, when entrepreneurs extend their market opportunity search they may be able to do so with only few resources and may thus fail to identify major opportunities. Those who engage in an extended search may also have fewer resources available for opportunity exploitation (Gifford 1992, 1998), and may face an important opportunity cost, or cost of delay (Radner 1996), since the opportunities identified early on could be of a fleeting nature.

Further, decision processes will become more arduous and costly, and the limited information-processing capacity of entrepreneurs will be increasingly strained when more information has to be collected and more market alternatives have to be evaluated (Simon 1982). In this vein, research on cognitive abilities indicates that the most complex set of interrelationships an individual can process in working memory is a three-way interaction (Halford et al. 1994). Thus, beyond some number of market opportunities in a choice set, founders may become overwhelmed by the complexity of the evaluation task and may not be able to evaluate the causal relationships between potential alternative actions and possible outcomes (Radner 1996).[4] In the extreme, they may even become dysfunctional as they suffer from cognitive distress or paralysis by analysis (Peters and Waterman 1982).

It can also be expected that the costs of exploiting more distant market opportunities are higher than for closely related opportunities. The more distant the identified market opportunities are, the higher the costs of acquiring and integrating the knowledge required to exploit them will be (Katila and Ahuja 2002). Similarly, acquiring or developing the required resources may be too costly or may take too long to be practical (Dierickx and Cool 1989).

In sum, these arguments suggest that although an extended search for market opportunities can lead to a larger choice set with potentially more valuable options, there are also important costs and major challenges associated with a more extensive search and evaluation process. Given the uncertainty of an extended search and these costs and challenges, we believe that, overall, there are decreasing marginal returns in constructing a larger choice set.[5] It should be emphasized, however, that the specific nature of

[3] Note that some of the costs mentioned in the following discussion could be of differential importance for novice and for experienced entrepreneurs. For example, the latter may have a social network in place that can provide different kinds of resources and capabilities for new firm creation.

[4] In this vein, the uncertainty associated with more distant opportunities may make it difficult, or even impossible, to arrive at proper evaluations (Knight 1921).

[5] There could also be economies of scale in opportunity search activities. For example, entrepreneurs engaging in a more extensive search may purchase third-party databases to acquire information on potential application areas. Because of the possibility of increased search efficiency with such inputs, a decrease in the average cost of identifying additional market opportunities may be observed. However, following the arguments presented above, we believe that there are increasing challenges and costs associated with performing a distant search for market opportunities.

this relationship is ultimately an empirical question—one that we investigate with this hypothesis:

HYPOTHESIS 2B (H2B). *The performance benefit of considering more than one market opportunity is subject to decreasing marginal returns.*

4. Research Design

4.1. Sample

To examine the research questions outlined previously, we required data on the founding team, preentry market opportunity identification, firm performance, and other organizational characteristics. No public data set offers such information, so we collected data through a self-administered survey of new firms backed by venture capital. With this sample of new firms, we could be confident that we were studying performance-oriented new firms with high growth aspirations.

Data for this study comes from two sources: (1) a questionnaire addressed to founders of VC-backed companies in Germany, and (2) a separate data set containing performance data on a subset of the surveyed firms. Survey data were collected in the summer of 2003 using a standardized Web-based questionnaire. Access to the sample of 348 VC-backed firms was provided through collaboration with a professional services firm specializing in Web-based solutions for the VC industry. Following a comprehensive pilot study that included interviews with more than two dozen entrepreneurs, we developed the survey instrument and pretested it with 10 entrepreneurs, 4 venture capitalists, and 9 academics. Prior research considers founders highly knowledgeable and valid information sources, so we addressed the questionnaires directly to the firms' founders, following a key-informant approach (Huber and Power 1985, Glick et al. 1990). The questionnaire was online for 12 weeks. A telephone follow-up was conducted after Week 6. We received questionnaires from 142 VC-backed firms, yielding a response rate of 40.8%. Respondent firms had a median founding year of 1999. We conducted an analysis for nonresponse bias by comparing early and late respondents, with the latter serving as a proxy group for nonresponding firms (Armstrong and Overton 1977). No indication of nonresponse bias was found.

We merged the survey data set with a second data set obtained from our collaboration partner and containing information on firm performance. Specifically, this data set provided monthly revenue data, which we totaled to obtain the yearly revenue figures used in our analysis. However, because not all ventures obtained venture capital prior to their initial market entry (see statistics provided further below) and because some VC-backed ventures joined the reporting platform of the collaboration partner only after they had performed their market entry, the second data set provided revenue data for the first and second year after market entry only on a subset of ventures represented in the first data set. The merged data set contained full observations from a total of 83 VC-backed ventures. We analyzed whether any bias was introduced because of the reduced sample size by comparing firms in our merged data set with firms that were not part of the merged data set. No indication of such a bias was found.

4.2. Definition and Measurement of Variables

4.2.1. Dependent Variables (Market Opportunity Count Models/Performance Models). *Number of Alternative Market Opportunities*. This variable records the number of alternative market opportunities entrepreneurs considered for their technological competence prior to the first market entry. In a multistage question, respondents were asked to indicate whether, prior to first market entry, they had considered commercializing their technological resources (respectively, competences or know-how) in market domains completely different from the market entered. Respondents who had indicated that they had considered alternative markets were then asked to report the number of alternatives considered.

Sales Revenues. Annual sales revenues (in euros) achieved by the new venture in Year 1 and in Year 2 after the initial market entry were used as dependent variables. Following Fox (1991), we utilized logarithmic transformations (natural logarithms) for the positively skewed sales variables.[6]

4.2.2. Covariates. *Prior Entrepreneurial Experience*. Respondents reported the number of members of the founding team who had previously started a new firm. We created a dummy variable to capture whether the founding team possessed prior entrepreneurial experience (1) or not (0).

Management Experience/Technological Experience/Marketing Experience. Following Wiersema and Bantel (1992, p. 95), we used the average level of a given trait in a team to represent the group's overall characterization. Respondents rated the levels of management experience, technological experience, and marketing experience that the team possessed (on a five-point Likert-type scale, "very low" to "very high").

[6] There is no consensus as to what constitutes entrepreneurial success (Delmar and Shane 2006). Entrepreneurs have differing objectives for starting new firms (e.g., "lifestyle ventures" versus "gazelles"), and objectives also vary in importance at different stages of firm creation. Our study analyzes a sample of VC-backed ventures, i.e., new firms that are highly growth oriented. The achievement of sales revenues once a new firm has entered the market is important, because it shows financiers and other stakeholders that a firm's vision of the market is real ("proof of market") and that it can deliver on its vision.

Total Time Spent on Planning and Organizing the Venture. Searching for additional opportunities involves both direct and indirect opportunity costs. We thus controlled for the total time spent on planning and organizing the new firm. The measurement of planning duration utilized in this study follows prior studies (Brüderl et al. 1996) and is similar to measures in strategy research (Brews and Hunt 1999). We measured how many months it took from the start of active preparation of the new firm to its market entry.

VC Seed Funding Prior to Market Entry. Extant research suggests that the availability of resources will influence founding team behavior (e.g., Helfat and Lieberman 2002). Access to financial resources will likely impact market opportunity search, because entrepreneurs with a resource buffer should be less pressed for a speedy market entry and can spend more on search activities and on reconfiguring their knowledge/resource base to perform long jumps on the search landscape. Although all firms in our sample were backed by venture capital, not all of them obtained it during the seed stage prior to market entry. A dummy thus indicates whether the emerging firm acquired seed funding (1) or not (0).

Total Costs in Year 1/Year 2. The total costs incurred by the new firm in the first and in the second year after market entry are used as controls in the first- and second-year performance regressions, respectively. Cost data were obtained from the database of the collaboration partner.

Breadth of Market Entry. New firms vary in the breadth of their product offerings when entering markets, so we created a dummy variable that indicates whether the new firm entered with multiple products (0) or with a single product (1).

Founding Team Size. Because team size is an important indicator of the human capital available in a new firm, market opportunity search may be influenced by founding team size. Following Wiersema and Bantel (1992), we used a count of the individuals in the initial team (prior to first entry).

We also used several controls pertaining to the technologies employed by the emerging firms:

Technological Fields. The resource requirements to develop new technologies and other factors vary across technological fields. To parcel out such variation, we included dummies to control for the technological fields represented in our study: Multimedia and Communication (11% of the sample), Internet (12%), Electronics (6%), Process Engineering (13%), Software (19%), New Materials (5%), Measuring/Regulation Technology and Handling Systems (20%), and Others (14%).

Generality of Technology. Whereas the dummies for technological fields are "catch-all" measures to control for variations across technologies, we also employed a more specific measure to parcel out the generality of employed technological competences in our market opportunity count models. The ex ante determination of the generality of an emerging technological competence is, however, not only a major theoretical problem (Bresnahan and Trajtenberg 1995, cf. §2.1), but also poses a difficult empirical challenge. We took advantage of the information contained in our data set and utilized the full number of observations on market opportunity identification ($n = 133$) to denote technological fields in which entrepreneurs identify additional market opportunities more frequently. The derived index captures the share of new firms in a particular technological field that considered more than one market opportunity.[7]

Self-Developed Technology (*Licensed-In Technology*). Using a five-point Likert-type scale, respondents reported the degree to which the technology they sought to commercialize had been licensed in (1) or developed internally (5).

4.3. Methods

We used two statistical methods to test our hypotheses. Our first dependent variable—*number of alternative market opportunities*—takes on only nonnegative integer values and consists of zeros and ones to a significant degree. An ordinary linear regression is not applicable in this context, because it relies on the normality of the dependent variable (Wooldridge 2002, Greene 2003). Poisson regression can be used to model count variables, but the negative binomial regression model is preferred when the assumption of the equality of the conditional mean and variance functions is violated (Greene 2003). Because a likelihood ratio test indicated overdispersion, we used the negative binomial model, which generalizes the Poisson model by introducing an individual unobserved disturbance term that allows the mean and variance to vary (Hausman et al. 1984). The negative binomial model (cf. Greene 2003) takes the following form: $\ln \lambda_i = \beta x_i + \varepsilon_i$ (λ_i equals the mean and variance of y_i, x_i is the vector of regressors, and $\exp(\varepsilon)$ is the gamma-distributed error term). For our second set of dependent variables, sales revenues in Year 1 and Year 2 after market entry, we employ an ordinary least-squares estimator (Wooldridge 2002).

Recent publications (Hamilton and Nickerson 2003) suggest that endogeneity might pose a problem in empirical management research, because managers (entrepreneurs) make decisions based on expectations

[7] Index values: Multimedia and Communication (0.27), Internet (0.17), Electronics (0.33), Process Engineering (0.17), Software (0.25), New Materials (0.17), Measuring/Regulation Technology and Handling Systems (0.26), and Others (0.30). In unreported robustness checks, we find that results are consistent when employing this measure in lieu of the technological field dummies.

of how their choice impacts future firm performance. In particular, self-selection on unobservable or hard-to-measure factors may simultaneously influence market search and performance. To address potential problems arising from endogeneity in the market opportunity count models, we followed Heckman's (1979) method to correct for self-selection, because 2SLS and 3SLS models are not applicable in the context of negative binomial regressions (Wooldridge 2002). We first estimated a reduced-form probit model capturing the decision to consider additional market opportunities. Second, we estimated market opportunity counts as a function of identified variables and corrected for possible self-selection bias by including the inverse Mills ratio, i.e., an index that was generated from the probit estimates. To address potential problems arising from endogeneity in the performance models, we performed instrumental variables regression (by first predicting the number of alternative market opportunities with a set of exogenous variables in a negative binomial model, then utilizing the predicted number in our performance models); we report these results in Table 3 (Models 4 and 8). Moreover, we include a lagged dependent variable in the second-year models (Models 5–7), because the inclusion of this variable offers a straightforward way to correct for potential biases from unobserved factors that codetermine market search and performance (Wooldridge 2002, p. 300; Hamilton and Nickerson 2003). We will thus be able to obtain accurate estimations of the ceteris paribus effect of market opportunity identification.

5. Empirical Results

5.1. Descriptive Statistics

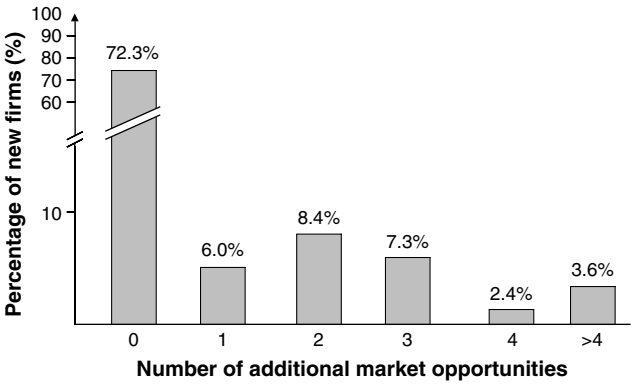
The descriptive statistics and the correlation matrix are reported in Table 1. Correlations are relatively low, indicating that collinearity should not be a concern. We see that 28% of the firms considered more than one market opportunity prior to first entry. This evidence provides an important extension to Shane's (2000) qualitative study of the eight MIT entrepreneurs, each of whom identified just one market opportunity prior to entry. Notably, we find that firms with multiple market opportunities can be found in all technological fields represented in our study (see values in Footnote 7). Figure 1 depicts the number of additional market opportunities that had been considered prior to first entry. In the subsample of new firms that considered multiple markets, the majority considered three additional markets (subsample mean = 3.68; median = 3). A separate calculation shows that firms that considered multiple opportunities achieved median revenues in the first and second year after

Table 1 Descriptive Statistics and Correlation Matrix

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Revenues Year 1 (log)	10.01	3.59	1.00															
2 Revenues Year 2 (log)	11.72	1.88	0.58***	1.00														
3 Alternative market opportunity	0.28	0.45	0.51***	0.38***	1.00													
4 Number of market opportunities (log)	0.35	0.62	0.48***	0.35***	0.98***	1.00												
5 Total time spent organizing and planning the new firm	15.06	10.84	−0.11	−0.32***	−0.12	−0.10	1.00											
6 VC funding prior to market entry	0.53	0.50	0.28*	0.20†	−0.01	−0.03	−0.13	1.00										
7 Breadth of market entry	0.23	0.42	−0.05	0.00	−0.15	−0.16	−0.07	0.05	1.00									
8 Self-developed technology	4.69	0.68	−0.10	−0.06	0.04	0.04	0.13	−0.06	0.01	1.00								
9 Generality of technology	0.25	0.21	−0.12	0.14	−0.01	0.00	−0.10	−0.05	−0.05	0.13	1.00							
10 Total costs in Year 1	13.40	0.93	0.05	0.27*	0.06	0.06	−0.37***	0.19†	0.04	0.17	0.25*	1.00						
11 Total costs in Year 2	13.38	0.86	0.07	0.37***	0.05	0.04	−0.41***	0.09	0.08	0.16	0.23*	0.86***	1.00					
12 Number of firm founders	2.77	1.57	0.21†	0.18†	0.08	0.08	−0.02	0.06	0.02	0.05	−0.10	−0.02	0.03	1.00				
13 Prior entrepreneurial experience	0.42	0.50	0.11	0.25*	0.18	0.19†	−0.14	0.17	0.05	−0.08	0.11	0.08	0.08	0.03	1.00			
14 Management experience	3.02	1.06	0.18†	0.12	0.27*	0.28*	−0.11	0.12	0.07	0.14	0.24	0.16	0.12	0.07	0.30**	1.00		
15 Marketing experience	2.72	1.05	−0.05	0.12	0.05	0.07	−0.17	0.03	0.14	0.05	0.46***	0.18†	0.18†	−0.10	0.39***	0.63***	1	
16 Technological experience	4.48	0.74	−0.07	−0.08	−0.16	−0.16	0.03	0.05	−0.15	0.21	−0.17	0.06	0.07	−0.02	0.09	−0.08	−0.17	1

$^{\dagger}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Figure 1 **Market Opportunity Count of Emerging Technology Firms Prior to First Market Entry**



Note. $n = 83$.

entry of €145,000/€329,000, whereas firms that considered a single market opportunity achieved revenues of €33,000/€121,000.

5.2. Market Opportunity Count Models

Results of the negative binomial regression are presented in Table 2. Model 1 estimates a baseline model of controls, Model 2 adds the predictor variable *prior entrepreneurial experience*, and Models 3 and 4 estimate interaction effects of team variables. The predictor variable and the interactions significantly increase the explanatory power of Models 2–4, as measured by twice the difference in the respective log-likelihoods and compared to a chi-square statistic with degrees of freedom equal to the number of newly added variables. Note that we utilize conservative two-sided tests of significance in Table 2.

Hypothesis 1 predicted that founding teams with prior entrepreneurial experience would identify a larger number of market opportunities than teams lacking this experience. We find support for this hypothesis in Model 2 of Table 2. Whereas the effects of prior entrepreneurial experience and management experience are positive, technological experience and marketing experience have a negative association. Additional support for Hypothesis 1 is provided in Models 3 and 4, which offer a more detailed examination of the knowledge available in founding teams by including interaction terms. We see that prior entrepreneurial experience positively moderates the relationships between marketing experience and market opportunity identification, and between technological experience and market opportunity identification. Because interaction effects do not lend themselves to easy interpretation in nonlinear estimation models, we provide a pictorial representation of these interactions in Figures 2a and 2b. Both graphs show that teams with prior entrepreneurial experience consider a larger number of market opportunities prior to first market entry. Notably, these effects do not show up in interactions with management experience (Model 5).

Table 2 **Negative Binomial Regressions: Models of Market Opportunity Counts**

	Model 1	Model 2	Model 3	Model 4	Model 5
Variable	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)
Prior entrepreneurial experience	#	0.80† (0.44)	1.25* (0.53)	0.78† (0.45)	0.80† (0.45)
Management experience	0.78** (0.30)	0.70* (0.30)	0.93** (0.33)	0.65* (0.30)	0.73* (0.31)
Marketing experience	−0.39 (0.28)	−0.53† (0.29)	−1.46** (0.51)	−0.46 (0.30)	−0.57† (0.31)
Prior entrepr. exp. × Marketing exp.	#	#	1.26* (0.52)	#	#
Management exp. × Marketing exp.	#	#	#	#	0.04 (0.18)
Technological experience	−0.54** (0.25)	−0.67** (0.25)	−0.79** (0.28)	−0.86** (0.28)	−0.59† (0.31)
Prior entrepr. exp. × Technol. exp.	#	#	#	0.69† (0.38)	#
Management exp. × Technol. exp.	#	#	#	#	−0.13 (0.28)
Number of firm founders	−0.01 (0.10)	0.01 (0.10)	−0.05 (0.11)	−0.02 (0.10)	−0.01 (0.11)
Self-developed technology	0.43 (0.43)	0.45 (0.42)	0.37 (0.43)	0.67 (0.46)	0.40 (0.42)
VC seed funding prior to market entry	0.65 (0.47)	0.64 (0.47)	0.68 (0.49)	0.82† (0.50)	0.63 (0.48)
Generality of technology	1.05 (0.82)	0.89 (0.84)	0.58 (0.85)	1.07 (0.87)	0.96 (0.87)
Inverse mills ratio (selection correction)	0.39 (0.42)	0.40 (0.42)	0.76† (0.46)	0.27 (0.44)	0.41 (0.43)
Constant	−3.70† (2.18)	−4.20† (2.16)	−4.73* (2.22)	−5.30* (2.38)	−3.99† (2.15)
Log-likelihood	−92.37	−90.71	−87.30	−89.04	−90.55
Observations	83	83	83	83	83

†$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, #not included, two-tailed tests.

5.3. Performance Models

To test the performance hypotheses, we have estimated two sets of regression models (Table 3). The first set of estimations (Models 1–4) gives results for performance in the first year after market entry. Model 1 reports the baseline model in which a number of control variables, including the technology field dummies, were introduced. In Model 2 we introduce the dummy variable capturing the consideration of alternative market opportunities prior to the first entry. In Model 3 we substitute the dummy variable for the number of market opportunities considered in order to assess the functional form of the relationship between market opportunity identification and new firm performance. In Model 4 we substitute the variable *number of market opportunities considered* with an instrumental variable derived in a two-stage estimation procedure (see above). The second set of

Figure 2a **Interaction Effect of Prior Entrepreneurial Experience and Marketing Experience**

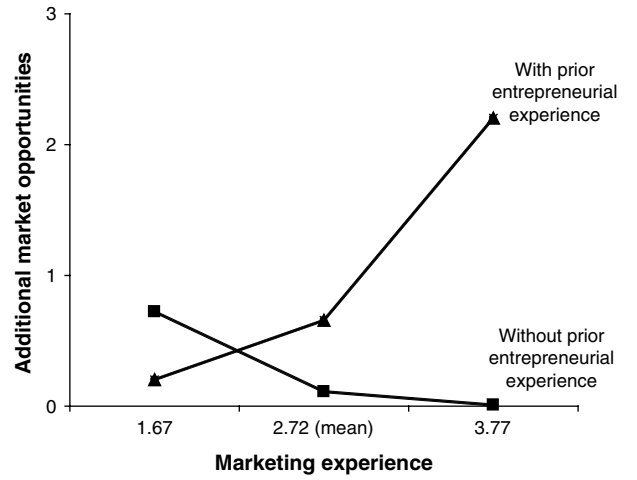
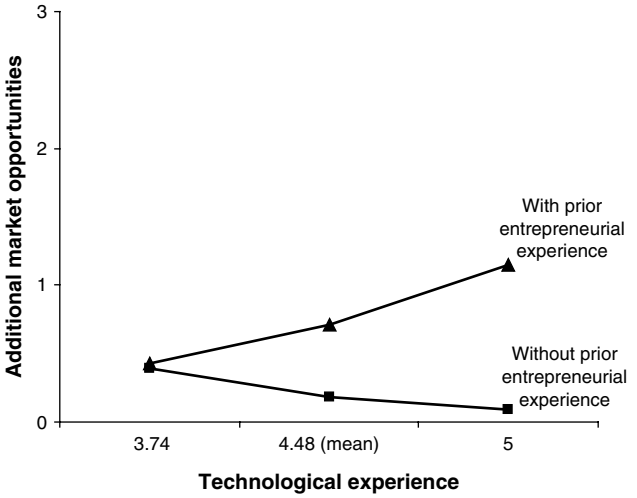


Figure 2b **Interaction Effect of Prior Entrepreneurial Experience and Technological Experience**



estimations (Models 5–8) replicates this setup using second-year performance as the dependent variable. Again, we use two-sided tests of significance.

In H2A we propose that the consideration of more than one market opportunity prior to first entry has a beneficial effect on new firm performance. Even after controlling for differences across technological fields using the technological field dummies, the estimates provided in Model 2 reveal that the coefficient of the dummy variable *more than one market opportunity* is positive and significant. Hence, we claim support for H2A. New firms that considered more than one market opportunity prior to first entry generated significantly higher revenues early on, which is an important achievement in firm creation.

Hypothesis 2B proposes that the performance benefits of considering multiple market opportunities are subject to decreasing marginal returns. We tested this hypothesis by substituting the dummy variable in Model 2 with the continuous variable *number of alternative market opportunities* (logarithmic form) in Model 3 and the predicted continuous variable (instrument) in Model 4. The positive and significant coefficients of both variables suggest support for H2B, with point estimates from the regression estimation confirming a positive yet decreasing relationship with performance (we did not find evidence of an inverted-U-shaped relationship).

Models 5–8 in Table 3 give results for firm performance in the second year after market entry. As mentioned, a lagged dependent variable (performance in the first year) was included to account for unobserved factors (Wooldridge 2002). Although effect sizes are somewhat smaller, Models 6–8 mirror the findings from the first set of regressions, and thus provide additional support for H2A and H2B. Again, the effect of identifying an increasing number of markets is nonlinear; point estimates from the regression equation confirm a positive, yet decreasing, relationship with performance.

Among the controls, we confirm earlier studies on entrepreneurial teams by finding a significant positive relationship between the number of founders and firm performance (e.g., Eisenhardt and Schoonhoven 1990). We do not find a significant effect of prior entrepreneurial experience; this result is in line with earlier studies showing insignificant effects (e.g., Westhead and Wright 1998).

5.4. Robustness Tests

We performed several additional analyses to test the robustness of our results. First, we utilized the full sample to analyze the robustness of our market opportunity count models. Results are consistent with those of the restricted sample. Second, we performed a probit estimation utilizing the dummy *analyzed additional markets or not* as a dependent measure. Results are consistent with the negative binomial regressions of market opportunity counts, in both the restricted and full samples. Third, to analyze the robustness of our performance models we utilized the combined sales performance in the first and second year after market entry as the dependent variable. The analysis produced results (see Model 9 in Table 3) that are consistent with those discussed earlier. Fourth, although profits in the first and second year after market entry are a highly debatable measure of the early performance of strongly growth-oriented ventures, we nonetheless ran our analysis with this dependent variable. We did not find that the identification of a single market opportunity, or multiple ones, is significantly related to early profit outcomes, nor were any of the other substantive variables. Given the characteristics of VC-backed ventures, we believe that profits could be a meaningful early performance measure

Table 3 Performance Models

	Log revenues–Year 1				Log revenues–Year 2				Log revenues–Years 1 & 2
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Variable	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)	Coeff. (S.E.)
More than one market opportunity (0/1)	#	1.08*** (0.28)	#	#	#	0.58† (0.30)	#	#	#
Number of alternative market opportunities (log)	#	#	0.73** (0.22)	#	#	#	0.49* (0.21)	#	0.46* (0.18)
Predicted number of alternative market opportunities (log)				2.27** (0.84)	#	#	#	1.35† (0.77)	#
Log revenues Year 1	#	#	#	#	0.14** (0.03)	0.11** (0.04)	0.12** (0.03)	#	#
Total time spent organizing/ planning the new firm	−0.02 (0.01)	−0.01 (0.01)	−0.01 (0.01)	−0.02 (0.01)	−0.02† (0.01)	−0.03** (0.01)	−0.03** (0.01)	−0.04** (0.01)	−0.04** (0.01)
VC seed funding prior to market entry	0.65* (0.29)	0.61* (0.25)	0.65* (0.25)	0.59* (0.27)	0.06 (0.25)	0.20 (0.25)	0.27 (0.23)	0.40 (0.28)	0.77** (0.22)
Breadth of market entry	−0.33 (0.32)	−0.06 (0.29)	−0.03 (0.30)	−0.16 (0.30)	−0.31 (0.27)	−0.19 (0.28)	−0.15 (0.26)	−0.19 (0.31)	−0.07 (0.25)
Number of firm founders	0.28** (0.10)	0.28** (0.08)	0.29** (0.08)	0.19* (0.09)	0.14† (0.08)	0.16* (0.08)	0.16* (0.07)	0.09 (0.10)	0.05 (0.07)
Prior entrepreneurial experience	−0.33 (0.37)	−0.46 (0.29)	−0.48 (0.29)	−0.45 (0.30)	0.37 (0.28)	0.33 (0.28)	0.25 (0.26)	0.44 (0.31)	0.16 (0.25)
Management experience	0.15 (0.19)	0.03 (0.17)	0.03 (0.17)	0.13 (0.17)	−0.05 (0.16)	−0.17 (0.17)	−0.16 (0.15)	0.06 (0.18)	0.13 (0.15)
Marketing experience	0.15 (0.19)	0.21 (0.17)	0.20 (0.17)	0.17 (0.18)	0.07 (0.17)	0.14 (0.17)	0.18 (0.16)	−0.05 (0.19)	−0.08 (0.15)
Technological experience	−0.05 (0.19)	0.05 (0.17)	0.10 (0.18)	0.01 (0.18)	−0.27 (0.16)	−0.23 (0.17)	−0.15 (0.16)	−0.25 (0.18)	−0.10 (0.15)
Total costs in Year 1	0.09 (0.18)	0.06 (0.16)	0.01 (0.16)	0.11 (0.17)	#	#	#	#	#
Total costs in Year 2	#	#	#	#	0.40* (0.18)	0.32* (0.15)	0.28† (0.14)	0.37* (0.17)	#
Dummies for technological fields	Included	Included	Included	Included	Included	Included	Included	Included	Included
Constant	10.71*** (3.06)	8.61** (2.38)	9.24*** (2.45)	7.87** (2.58)	5.73* (2.66)	7.29** (2.33)	7.28** (2.15)	7.83** (2.56)	12.11*** (0.99)
Observations	83	83	83	83	83	83	83	83	83
R-squared	0.52	0.64	0.63	0.60	0.52	0.55	0.60	0.47	0.49

Notes. Robust regression results. †$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, #not included, two-tailed tests.

in more conventional start-ups, and will become a more meaningful measure in later stages of growth-oriented ventures.

6. Discussion

We have argued that the market choice is a profound organizational decision in emerging firms. Against a background of sparse prior research, this study has produced several interesting results that have novel implications for the organizational, strategy, and entrepreneurship literatures, and for practice.

6.1. Theoretical Implications

Opportunity identification and exploitation are seen as the core of the entrepreneurial process (Shane and Venkataraman 2000). Although opportunity identification plays a major role in conceptualizations of firm creation, the notion of multiple opportunity identification prior to entry has yet to be acknowledged in the research literature. By showing that multiple market opportunity identification matters, this study suggests that the literature needs to better reflect the difference between identifying a single opportunity or multiple ones and the related idea of choosing the most favorable market conditions for new firm creation (a notion that evolutionary biologists commonly refer to as "habitat selection").

Because there are multiple demands placed on the limited attention of entrepreneurs, the identification of market opportunities requires that entrepreneurs

allocate time and attention away from other, perhaps more routine, activities to search the market opportunity landscape and gather new information (Radner 1996, Gifford 1998). This allocation of attention comes at an opportunity cost, or cost of delay, in that less time and energy, or none at all, is available to exploit the first identified opportunity. However, there is also an opportunity cost, and as our findings suggest an important one, in not seeking to identify additional markets. Thus, researchers may want to develop a more nuanced understanding of a "speeding products to market" approach suggested by earlier studies, as entrepreneurs run the risk of rushing products to inferior markets when they neglect to explore alternative options.

The findings also add to our knowledge on the effects of prior entrepreneurial experience, because it is not only experience in establishing a new firm but also in opportunity identification that has a key impact on new firm performance. Our results provide an important complement to recent research by Baron and Ensley (2006) that indicates that serial and novice entrepreneurs apply different criteria when assessing a business opportunity. We add to this top-level picture by revealing that serial entrepreneurs also identify a larger number of market opportunities than novices do, and thus are in a position to choose the most promising market. This view also extends McGrath and MacMillan's (2000) characterization of the entrepreneurial mindset exhibited by serial entrepreneurs.

Furthermore, we find that teams possessing a mix of prior entrepreneurial experience and experience in technology (or marketing) identify a larger number of opportunities than teams with technology (or marketing) experience only.[8] Although we do not observe information flows within teams, the uncovered pattern indicates that serial entrepreneurs influence the market search behavior of other team members. Whereas recent research suggests that it "is not the selection of people that determines the degree of exploration, but what they are asked to do" (Taylor and Greve 2006, p. 736), the present findings thus indicate that both aspects matter for exploration: selecting people with the requisite level of knowledge (e.g., high levels of technological experience) and engaging them in an exploratory search.

Along these lines, our study has additional implications for the search literature. First, most studies in this area focus on technology search (Fleming and Sorenson 2004). We add to this body of work by investigating search efforts for market opportunities for technological resources. Second, prior studies have devoted only scant attention to the key aspect of alternative generation (Knudsen and Levinthal 2007). Our study provides evidence of alternative generation regarding a major organizational decision, and shows the empirical relationship between the number of alternatives generated and performance. Finally, evidence on the value of path-creating search has been an important desideratum. As the beginnings of paths are more clearly visible in new firms, our research setting provides a vantage point from which to observe path creation. The results suggest a nonlinear value of path-creating market search.

6.2. Implications for Practice

Most generally, our findings indicate that technology entrepreneurs should "look before they leap." Although market search activities involve some challenges and costs, the consequences of not identifying a market that offers more favorable founding conditions can be profound. It is thus unfortunate that current business-planning handbooks typically fail to offer guidelines on opportunity identification and selection, because they assume that an opportunity has been identified. We are aware of only two books in this area that address the issue of opportunity identification and selection (Mullins 2003, McKnight 2004).

As for investors, VCs may suffer from biases in evaluating new firm proposals, or may not be able to detect when such proposals suffer from entrepreneurs' perceptual biases. Insofar as biases prevent the consideration of alternative market opportunities, we suggest that investors should emphasize an evaluation of technological cross-application opportunities in their due diligence.

6.3. Limitations

In interpreting the results of this study, certain limitations must be kept in mind. First, our analysis is based on a sample of VC-backed firms, an elite category. On the one hand, this sample has advantages for a study of market opportunity search, because these firms are begun with high professionalism. Because just 28% of firms in this sample considered more than one market opportunity, we believe that this fraction would have been smaller in samples of more conventional new firms, thus making it more difficult to

[8] Whereas these effects are not addressed in the present paper, we will provide a brief discussion of this pattern. We find that technological experience is negatively related to market search. Following prior research in entrepreneurship and innovation (cf. Dougherty 1992), it seems that a primary reason for this finding is that people in technology tend to show less appreciation for market-related topics. There may also be multiple reasons for the negative effect of marketing experience, but it seems likely that individuals with such a background are well trained to craft and execute sophisticated marketing plans, and less so in the earlier stage of market opportunity identification. A thorough analysis of how human and social capital endowments shape market opportunity identification in technology firms can be found in our companion paper (Gruber et al. 2007, 2008).

examine the phenomenon. On the other hand, our results could be biased toward a specific type of new firm. Second, our study faced common challenges associated with measuring the generality of technological competences. Whereas prior research stresses resource fungibility (Penrose 1959, Jolly 1997), some technological competences may be more easily adaptable to additional markets than others. In an attempt to parcel out this type of variation, we employed three different kinds of control variables for the emerging technologies, and also controlled for the availability of financial resources. Although we consider this approach to be a viable if imperfect solution to a very complex problem, we also sought to increase confidence in our results by using instrumental variables regression and by employing a lagged dependent variable. The results offered consistent support for our hypotheses. Third, data from privately held technology ventures—and, in particular, from VC-backed ventures—is hard to obtain. In the light of our empirical results it seems that such a sample of highly professional ventures is required to address the research questions examined in our study. However, we also note that the sample used for the empirical analyses is relatively small. Fourth, our study is based on performance data covering the first two years after market entry, which is a particularly critical period in the life of new firms. Although we cannot rule out that new firms that underperformed in the first two years may become outperformers at some later point, we believe that early-stage performance is a major achievement in new firm creation. For example, early-stage performance will signal to investors, potential customers, and other stakeholders that the new firm is on a solid track to become an established entity. Nonetheless, future research needs to explore longer term performance. Further, given the discussion about appropriate measures of new firm performance, we note that this study used data on sales revenues as a performance measure. Although the achievement of substantial sales revenues is an important performance outcome for VC-backed technology firms, future studies should also investigate the relationship between market search and other success measures.

6.4. Further Research and Conclusion

The findings from this study suggest several interesting opportunities for future research. Because our results indicate that repeat entrepreneurs possess special insights on technology-market linking, we suggest that future studies should develop a better understanding as to why repeat entrepreneurs have learned to identify multiple market opportunities prior to deciding which market to enter. For example, we believe that repeat entrepreneurs have learned not only that market conditions are of high importance, but also that technological fungibility opens up opportunities for resource leveraging. Along these lines, researchers may also want to study the capability needed to perform an effective market opportunity search. As our companion study suggests, the knowledge repertoire of the founding team and its social network seem to play a major role in the development of this capability (Gruber et al. 2007, 2008). Given the broader importance of market opportunity identification for firm emergence, firm evolution, and the exploitation of the value inherent in resources, we believe that further studies investigating the nuances of the market search activity are crucial to understanding entrepreneurship, resource leveraging, decisions on organizational scope, growth, and related phenomena.

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References

Abell, D. F. 1980. *Defining the Business: Starting Point of Strategic Planning*. Prentice Hall, Englewood Cliffs, NJ.

Armstrong, J. S., T. S. Overton. 1977. Estimating nonresponse bias in mail surveys. *J. Marketing Res.* **24** 396–402.

Baron, R. A., M. D. Ensley. 2006. Opportunity recognition as the detection of meaningful patterns. *Management Sci.* **52** 1331–1344.

Boeker, W. 1989. Strategic change: The effects of founding and history. *Acad. Management J.* **32** 489–515.

Bresnahan, T. F., M. Trajtenberg. 1995. General purpose technologies: "Engines of growth?" *J. Econometrics* **65** 83–108.

Brews, P. J., M. R. Hunt. 1999. Learning to plan and planning to learn: Resolving the planning school/learning school debate. *Strategic Management J.* **20** 889–913.

Brüderl, J., P. Preisendörfer, R. Ziegler. 1996. *Der Erfolg neugegründeter Betriebe*. Duncker and Humblot, Berlin.

Cyert, R. M., J. G. March. 1963. *A Behavioral Theory of the Firm*. Prentice Hall, Englewood Cliffs, NJ.

Danneels, E. 2002. The dynamics of product innovation and firm competences. *Strategic Management J.* **23** 1095–1121.

Danneels, E. 2003. Tight-loose coupling with customers: The enactment of customer orientation. *Strategic Management J.* **24** 559–576.

Danneels, E. 2007. The process of technological competence leveraging. *Strategic Management J.* **28** 511–533.

Delmar, F., S. Shane. 2006. Does experience matter? The effect of founding team experience on the survival and sales of newly founded ventures. *Strategic Organ.* **4** 215–247.

Dierickx, I., K. Cool. 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Sci.* **35** 1504–1511.

Dougherty, D. 1992. Interpretive barriers to successful product innovation in large firms. *Organ. Sci.* **3** 179–202.

Eisenhardt, K. M., C. B. Schoonhoven. 1990. Organizational growth: Linking founding team, strategy, environment, and growth among U.S. semiconductor ventures, 1978–1988. *Admin. Sci. Quart.* **35** 504–529.

Fleming, L., O. Sorenson. 2004. Science as a map in technological search. *Strategic Management J.* **25** 909–928.

Fox, J. 1991. *Regression Diagnostics: An Introduction*. Sage, Newbury Park, CA.

Gagné, R. M., R. Glaser. 1987. Foundations in learning research. R. M. Gagné, ed. *Instructional Technology: Foundations*. Lawrence Erlbaum, Hillsdale, NJ, 49–84.

Galunic, D. C., S. Rodan. 1998. Resource recombinations in the firm: Knowledge structures and the potential for Schumpeterian innovation. *Strategic Management J.* **19** 1193–1201.

Gavetti, G., D. Levinthal. 2000. Looking forward and looking backward: Cognitive and experimental search. *Admin. Sci. Quart.* **45** 113–137.

Geroski, P. A. 1998. Thinking creatively about markets. *Internat. J. Indust. Organ.* **16** 677–695.

Gifford, S. 1992. Allocation of entrepreneurial attention. *J. Econom. Behav. Organ.* **19** 265–284.

Gifford, S. 1998. Limited entrepreneurial attention and economic development. *Small Bus. Econom.* **10** 17–30.

Glick, W. H., G. P. Huber, C. C. Miller, D. H. Doty, K. M. Sutcliffe. 1990. Studying changes in organizational design and effectiveness: Retrospective event histories and periodic assessments. *Organ. Sci.* **1** 293–312.

Greene, W. 2003. *Econometric Analysis*. Prentice Hall, Upper Saddle River, NJ.

Greve, H. 2003. *Organizational Learning from Performance Feedback*. Cambridge University Press, Cambridge, UK.

Gruber, M., I. C. MacMillan, J. D. Thompson. 2007. A tale of four genes: How human capital endowments shape the identification of subjective market opportunities in technology start-ups. Working paper CDM-EPFL & Sol C. Snider Entrepreneurial Research Center, Wharton School, University of Pennsylvania, Philadelphia.

Gruber, M., I. C. MacMillan, J. D. Thompson. 2008. The role of social capital in market opportunity identification for emerging technologies. Working paper CDM-EPFL & Sol C. Snider Entrepreneurial Research Center, Wharton School, University of Pennsylvania, Philadelphia.

Halford, G., W. Wilson, J. Guo, et al. 1994. Connectionist implications for processing capacity limitations in analogies. R. W. Gayler, J. Wiles, J. E. M. Stewart, eds. *Advances in Connectionist and Neural Computation Theory*, Vol. 2, Ablex, Norwood, NJ, 363–415.

Hamilton, B. H., J. A. Nickerson. 2003. Correcting for endogeneity in strategic management research. *Strategic Organ.* **1** 51–78.

Hausman, J., B. H. Hall, Z. Griliches. 1984. Econometric models for count data with an application to the patents-R&D relationship. *Econometrica* **52** 909–938.

Heckman, J. J. 1979. Sample selection bias as a specification error. *Econometrica* **47** 153–161.

Helfat, C. E., M. B. Lieberman. 2002. The birth of capabilities: Market entry and the importance of pre-history. *Indust. Corporate Change* **11** 725–760.

Huber, G. P., D. J. Power. 1985. Retrospective reports of strategic-level managers: Guidelines for increasing their accuracy. *Strategic Management J.* **6** 171–180.

Janis, I. L., L. Mann. 1977. *Decision Making: A Psychological Analysis of Conflict, Choice, and Commitment*. Free Press, New York.

Jolly, V. K 1997. *Commercializing New Technologies: Getting from Mind to Market*. Harvard Business School Press, Boston.

Katila, R., G. Ahuja. 2002. Something old, something new: A longitudinal study of search behavior and new product introduction. *Acad. Management J.* **45** 1183–1194.

Knight, F. H. 1921. *Risk, Uncertainty and Profit*. Houghton Mifflin, New York.

Knudsen, T., D. A. Levinthal. 2007. Two faces of search: Alternative generation and alternative evaluation. *Organ. Sci.* **18** 39–54.

March, J. G. 1991. Exploration and exploitation in organizational learning. *Organ. Sci.* **2** 71–87.

March, J. G., H. Simon. 1958. *Organizations*. Wiley, New York.

McGrath, R. G., I. C. MacMillan. 2000. *The Entrepreneurial Mindset*. Harvard Business School Press, Boston.

McKnight, T. 2004. *Will It Fly? How to Know If Your Business Idea Has Wings . . . Before You Take the Leap*. Prentice Hall, Englewood Cliffs, NJ.

Miller, D. J. 2006. Technological diversity, related diversification, and firm performance. *Strat. Management J.* **27** 601–619.

Miller, D. J., M. J. Fern, L. B. Cardinal. 2007. The use of knowledge for technological innovation within the diversified firm. *Acad. Management J.* **50** 308–326.

Mitchell, W. 1992. Are more good things better, or will technical and market capabilities conflict when a firm expands? *Indust. Corporate Change* **1** 327–346.

Mullins, J. W. 2003. *The New Business Road Test: What Entrepreneurs and Executives Should Do Before Writing a Business Plan*. FT/Prentice Hall, London.

Nerkar, A., P. W. Roberts. 2004. Technological and product-market experience and the success of new product introductions in the pharmaceutical industry. *Strategic Management J.* **25** 779–799.

Osborn, A. F. 1957. *Applied Imagination: Principles and Procedures of Creative Thinking*. Scribner, New York.

Pelled, L. H., K. M. Eisenhardt, K. R. Xin. 1999. Exploring the black box: An analysis of work group diversity, conflict, and performance. *Admin. Sci. Quart.* **44** 1–28.

Penrose, E. T. 1959. *The Theory of the Growth of the Firm*. Oxford University Press, Oxford, UK.

Peteraf, M. A., M. E. Bergen. 2003. Scanning dynamic competitive landscapes: A market-based and resource-based framework. *Strategic Management J.* **24** 1027–1041.

Peters, T. J., R. H. Waterman. 1982. *In Search of Excellence*. Harper and Row, New York.

Prahalad, C. K., G. Hamel. 1990. The core competence of the corporation. *Harvard Bus. Rev.* **68**(3) 79–91.

Radner, R. 1996. Bounded rationality, indeterminacy, and the theory of the firm. *Econom. J.* **106** 1360–1373.

Rosenkopf, L., A. Nerkar. 2001. Beyond local search: Boundary-spanning, exploration, and impact in the optical disk industry. *Strategic Management J.* **22** 287–306.

Roy, P. 2005. Leveraging existing technology: The role of alliances in the cross-application across technology domains in high-tech entrepreneurial firms. Working paper, Wharton School, University of Pennsylvania, Philadelphia.

Shane, S. 2000. Prior knowledge and the discovery of entrepreneurial opportunities. *Organ. Sci.* **11** 448–469.

Shane, S. 2004. *Academic Entrepreneurship: University Spinoffs and Wealth Creation*. Elgar, Cheltenham, UK.

Shane, S., S. Venkataraman. 2000. The promise of entrepreneurship as a field of research. *Acad. Management Rev.* **24** 217–226.

Simon, H. A. 1982. *Models of Bounded Rationality*. MIT Press, Cambridge, MA.

Stuart, T. E., J. M. Podolny. 1996. Local search and the evolution of technological capabilities. *Strat. Management J.* **17**(Summer Special Issue) 21–38.

Taylor, A., H. R. Greve. 2006. Superman or the fantastic four? Knowledge combination and experience in innovative teams. *Acad. Management J.* **49** 723–740.

Westhead, P., M. Wright. 1998. Novice, portfolio, and serial founders: Are they different? *J. Bus. Venturing* **13** 173–204.

Wiersema, M. F., K. A. Bantel. 1992. Top management team demography and corporate strategic change. *Acad. Management J.* **35** 91–121.

Wooldridge, J. M. 2002. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge, MA.