Marketing Strategy Formation in the Commercialization of New Technologies

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ABSTRACT

This research contributes significantly to the current marketing strategy literature by examining the effective formation of marketing strategies for new technologies outside traditional organizational boundaries. This important question must be addressed considering that at any given time roughly 10.1 million adults in the U.S. are attempting to create new ventures, yet the rate of new venture failures is approximately 70 percent. Therefore it is important to step away from examining innovation and marketing strategy formation within traditional domains (i.e. large organizations) and instead focus on innovations outside organizational boundaries that generate 60 to 80 percent of new jobs annually. In particular, considering the high rate of new venture failure, what characteristics increase the likelihood of success in the commercialization of new technologies? This research seeks to answer these compelling questions, and provide a more process-based approach to studying the effective development of marketing strategies for new technologies.

Using a dynamic capabilities framework, the role of internal and external capabilities in driving marketing strategy effectiveness for inventions developed in university labs is explored. The key to building a conceptual framework based upon the dynamic capabilities perspective is to identify the building blocks upon which competitive advantages can be formed, sustained, and improved. One such foundation is knowledge transfer, or learning. The focus of this research is on two distinct components of knowledge transfer: network ties and absorptive capacity. Past research has shown that network ties provide access to information that can be beneficial to performance outcomes (Tsai and Ghoshal 1998; Tsai 2001). In addition to this external source of information, an internal learning capacity must also be present in order to absorb and utilize the information coming in. Both network ties and absorptive capacity have been found to play a key role in both innovation and superior performance outcomes (Cohen and Levinthal 1990; Tsai 2001). Therefore it is expected that both network ties and absorptive capacity will have a complementary impact on marketing strategy effectiveness (marketing strategy performance, marketing strategy creativity, and marketing strategy improvisation).

The sample for this research comes from a unique multidisciplinary program within the university setting. Technological Innovation: Generating Economic Results (TI:GER) is a two-year team based program that focuses on integrating science and engineering research with the other components (business and law) necessary for commercialization. The teams' primary objective is that of developing a commercialization strategy for research developed within university laboratories. This study will collect data from pre-startup teams throughout their participation in the program. In addition, objective outcome measures for marketing strategy effectiveness will be collected from outside industry experts and team supervisors. The longitudinal panel data thus collected will be analyzed using random effects and generalized method of moments (GMM) modeling to account for the dependencies inherent to panel data.

There has been very little empirical research on the formation of strategies at the team level and furthermore, even less research examining the formation of strategies for technologies that were developed outside traditional organizational boundaries and without a predefined market application. Overall, this research will not only contribute significantly to the current innovation and marketing strategy literature, but will also open up new avenues of research in marketing entrepreneurship.

Introduction

At any given time there are approximately 10.1 million individuals attempting to create a new venture (Reynolds et al 2002). In other words, about 6.2 in every 100 U.S. adults are engaged in trying to take a new idea to market. Furthermore, over fifty percent of these ideas are commercialized by teams of individuals, representing over 5.6 million potential new businesses within the U.S. economy. Despite the astounding number of new ventures being created, the percentage of those actually succeeding in their commercialization efforts is relatively small (only 30 percent survive their first 5 years in business). Perhaps one of the most cited reasons behind this high failure rate is a lack of planning or direction for the venture. Moreover, high technology start-ups are particularly prone to this failure because they are technology driven and tend to ignore the market (www.glocalvantage.com).

How do inventors of new technologies determine their strategy to market? While marketing strategies are recognized as being of vital importance to organizations, very little research has addressed how marketing strategies are actually formulated, and in particular how marketing strategies are developed for breakthrough technologies that may not occur within a traditional organizational context. The sample for this research comes from a unique panel of prestart-up teams focusing on the commercialization of new technologies.

Marketing strategy development often occurs within teams. The use of teams within organizations charged with new product development has proven to be a critical resource for the development of strategic outcomes (Bharadwaj and Menon 2004). Teams provide organizations with a means of achieving learning and creativity, as well as knowledge dissemination throughout the organization. While cross-functional teams

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have received some attention within the marketing literature, the majority of the research has either focused on individual or organizational level outcomes (e.g. Ancona and Caldwell 1990; Keller 1994; Moorman and Miner 1998; Sarin and Mahajan 2001; Sethi, Smith and Park 2001). This research aims to extend the current literature and enhance our understanding of the role of the team itself in the development of marketing strategy effectiveness.

Why are Strategies Important?

Strategy can be defined as a firm's positioning to gain a competitive advantage in the marketplace (Teece et al 1997; Juga 1999). The primary objective of a strategy is to secure organizational effectiveness by performing the right activities at the right time. The central focus of a strategy is for the organization to achieve the right fit with the external environment. Building upon this, a marketing strategy allows firms to develop a plan that enables them to offer the right product to the right market with the intent of gaining a competitive advantage. In other words, a marketing strategy provides an overall vision of how to correctly position products in the marketplace while accounting for both internal and external constraints.

Marketing strategy research has primarily been focused in either one of two arenas: marketing strategy formulation or marketing strategy implementation. Marketing strategy formulation research examines the impact of certain variables on the development of marketing strategies themselves. In addition, this stream of research tends to focus on what should be done in practice or what role strategy plays in practice (Mintzberg 1994). On the other hand, marketing strategy implementation research treats the strategy as a given and examines the outcomes attributed to successful

implementation of the strategy. The focus of this research falls within the marketing strategy formation domain and concentrates on the ability to effectively formulate marketing strategies for new technologies. Effectiveness of marketing strategy formulation is comprised of three components: (1) marketing strategy performance, (2) marketing strategy creativity, and (3) marketing strategy improvisation.

Marketing strategy performance is defined as the extent to which a team is able to develop a comprehensive marketing strategy for their technology. This is a global measure of performance at the team level. *Marketing strategy creativity* is defined as the extent to which the strategic plan developed by the team in an effort to commercialize a new technology represents a meaningful difference from marketing practices within the industry (Andrews and Smith 1996). The process of creativity has been shown to enhance performance through a focus on identifying problems, developing hypotheses, open communication of ideas with others, and challenging the status quo (Gilson and Shalley 2004). *Marketing strategy improvisation* is defined as the degree of change in the marketing strategy formulation over time and is built around an earlier definition by Brown and Eisenhardt (1997) that describes improvisation as a means of creating while simultaneously adapting to changing markets and technologies. Improvisation occurs when an organization (or in this case, a team) faces a situation that it perceives as being unexpected and without a preplanned course of action and yet is perceived as requiring a course of action (Moorman and Miner 1998a, 1998b; Weick 1993, 1998). Thus, improvisation is influenced by both environmental uncertainty and real-time information flows. In uncertain environments, individuals may find improvisation necessary in order

to survive. Individuals that maintain access to internal and external information are more likely to be exposed to unexpected real-time information that may trigger improvisation.

The objective of this research is to address the following gaps in the marketing strategy literature. First, very little empirical research has focused on the formation of marketing strategies outside traditional organizational boundaries. Secondly, this study focuses on the unique challenges of effective marketing strategy formation for new technologies, including technologies that may have been developed without a target market in mind. Finally, this paper is able to examine for formation of marketing strategies over time using a panel of commercialization teams that stay in tact over a period of two years. The paper is organized as follows. First, I present a discussion of a theoretical model based on the dynamic capabilities framework focused on the role of network ties and absorptive capacity on the effective formation of marketing strategies. From this discussion, seven hypotheses are developed illustrating the impact of network ties and absorptive capacity on marketing strategy effectiveness. Finally, the method by which I test these hypotheses is presented followed by a discussion of the contributions of the study to the literature.

A Dynamic Capabilities Framework

The term dynamic capability refers to the ability to integrate, build, and reconfigure both internal and external competencies to address rapidly changing environments (Teece et al 1997). The key to building a conceptual framework based upon the dynamic capabilities perspective is to identify the building blocks upon which competitive advantages can be formed, sustained, and improved. One such foundation is

considered to be that of effective knowledge transfer. The focus of this research is on two distinct components of knowledge transfer: (1) network ties and (2) absorptive capacity. Past research has demonstrated that network ties provide access to information that can be beneficial to performance outcomes (Tsai and Ghoshal 1998; Tsai 2001). In addition to this external source of information, an internal learning capacity must also be present in order to absorb and utilize the information coming in. Both network ties and absorptive capacity have been found to play a key role in both innovation and superior performance outcomes (Cohen and Levinthal 1990; Tsai 2001). Therefore it is expected that both network ties and absorptive capacity will have an impact on marketing strategy effectiveness. Furthermore, because both an internal and external capability is necessary for effective knowledge transfer, an interaction between network ties and absorptive capacity is also expected (See Figure 1).

Figure 1: Dynamic Capability Framework
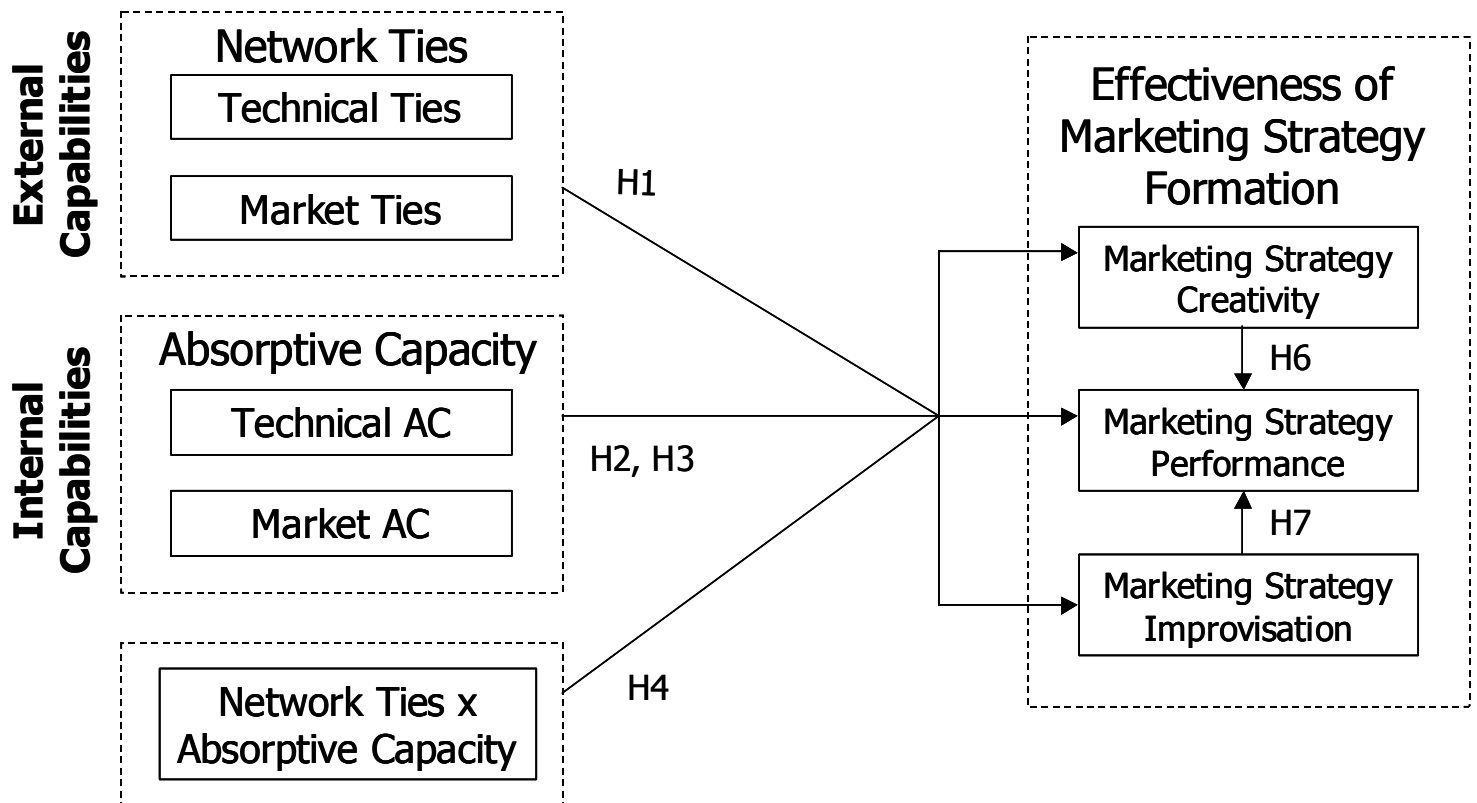
Network Ties

Network theory is focused on the exchange of knowledge and information among a defined set of persons, objects or events. Networks can provide individuals with a key component of the learning process whereby individuals discover new opportunities and acquire new information through interpersonal interaction. Relationships serve as the building blocks of networks (Knoke and Kuklinski 1982). The importance of these relationships has been documented throughout the literature. In fact,

> "the structure of relations among actors and the location of individual actors in the network have important behavioral, perceptual, and attitudinal consequences for the individual units and for the system as a whole" (Knoke and Kuklinski 1982, p. 13).

Relationships provide organizations and individuals access to information that otherwise would be unavailable.

Most of the research conducted with regards to the importance of networks in key performance outcomes has utilized the strength of ties perspective as set forth by Granovetter (1973). An individual's network of contacts varies in terms of the strength of the interpersonal relationship. The strength of a tie is defined by the frequency of interaction, emotional intensity, intimacy, and reciprocal services comprising the relationship. It is also plausible for network ties to be absent as well.

Distinguishing between strong and weak ties becomes important when examining the information flow between parties. Network members that are close or spend a great deal of time together (strong ties) are more likely to have similar ideas and access to the same set of information. On the other hand, network members that are not close friends (weak ties) are more likely to differ from one another. Weak ties provide access to a

diverse set of information and resources and therefore contain less redundant knowledge than strong ties (Granovetter 1973).

In addition to differentiating among network relationships by their strength, it is also possible to categorize networks in terms of their information content. For the purpose of this research, I distinguish between network ties that are *technical* in nature and those that are used to gather *market* information. This is the first study to distinguish these two types of ties. This distinction becomes very important in the context of technology commercialization. Technical network ties are those members of an individual's network with which they discuss the technical components of their technology. This can include gathering both general technical information or seeking advice regarding the actually technology being commercialized. Market network ties are those relationships with which the market applications of the technology are discussed. In the commercialization of new technologies, it is imperative that teams have access to both types of information: market and technical. Therefore, it is expected that teams with network ties that are both market and technical in nature should have increased levels of marketing strategy performance due to exposure to relevant market and technical information. Market and technical ties provide increased access to information that is relevant to both the technology and potential market applications. Information about both the technology and the market and will aid in the development of a superior and more comprehensive marketing strategy for the technology.

Recall that tie strength is the frequency of interaction, emotional intensity, intimacy, and reciprocal services defining the relationship and that weak ties often serve to provide individuals with a diverse set of information. Strong ties lead to increased

knowledge sharing (Ahuja 2000). Network theory traditionally suggests that strong network ties foster the transmission of redundant information (Perry-Smith and Shalley 2003). Therefore, it is through weak ties that performance and creativity are increased due to exposure to diverse ideas that may trigger alternate solutions. However, past research has alluded to the fact that there may be moderators to the tie strength-performance relationship (Perry-Smith and Shalley 2003). One such moderator may be the complexity of the information being transferred. In this context, the technology, or innovation, itself is very complex. In order to gain meaningful information from others relating to the technology, ties should have similar knowledge base with regards to the technology. It is unlikely that someone who is from a very different background will be familiar enough with the merits of the technology to provide meaningful technical information. Therefore, it is expected that individuals with strong technical ties will gain access to more relevant information than individuals with weak technical ties, which should positively impact team performance. Contrary to traditional network theory arguments, strong technical ties will have a positive impact on marketing strategy effectiveness.

Hypothesis 1a: Strong technical ties are positively related to performance.

In alignment with the strength of ties perspective, the opposite finding is expected for the relationship between market network tie strength and effectiveness (Granovetter 1973). Teams with weak market ties are likely to have a more advantageous network position than teams with strong market ties. Weak ties provide the team with the ability to conduct searches of nonredundant information (Hansen 1999). Nonredundant

information can comprise one of two types: (1) information relating to potential opportunities, and (2) knowledge regarding the team's current undertaking (Hansen 1999). Weak market ties can provide individuals with a diverse set of information that may increase strategy creativity and improvisation. While weak ties do provide a diverse set of information, the quality of information received and transferred from these ties is likely to be less than market information from strong market ties. Therefore it is hypothesized that strong market network ties will increase performance because of the quality and quantity of information regarding the market that can be obtained from close friends. Based on this argument, the following is hypothesized.

Hypothesis 1b: Strong market ties are (a) positively related to performance and (b) negatively related to strategy creativity and strategy improvisation.

Absorptive Capacity

Absorptive capacity can be defined as the ability to acquire, assimilate, transform, and exploit knowledge to produce a dynamic capability (Zahra and George 2002). A recent review of empirical studies examining the impact of absorptive capacity on organizational outcomes finds that absorptive capacity plays a strategic role in creating a competitive advantage for organizations (Zahra and George 2002). For the purpose of this study, absorptive capacity is defined as the ability to value, assimilate, and apply knowledge (Cohen and Levinthal 1990). Absorptive capacity allows for flexibility and the ability to adapt to changing environments. Since a volatile and uncertain environment characterizes new technology commercialization, it is expected that absorptive capacity will play a large role in the effective marketing strategy formation.

Again I distinguish between the two types of absorptive capacity that are relevant within this context. When developing a marketing strategy for a new technology, it is imperative to consider both *market* and *technical* absorptive capacity. Market absorptive capacity is defined as the ability to value, assimilate, and apply market knowledge, while technical absorptive capacity is the ability to value, assimilate, and apply technical knowledge. One would expect that a team must be able to absorb both types of information in order to increase effective marketing strategy formation. Absorptive capacity requires a learning capability and leads to the development of problem-solving skills (Kim 1998). Technical absorptive capacity allows team members to fully understand and learn about the complex nature of their technology, while market absorptive capacity provides the same benefits with regards to market information. Absorptive capacity allows for the creation of knowledge within the team and furthermore allows the team to deploy the knowledge necessary for the development of a clear and comprehensive strategy. Based on this logic, it is clear that both market and technical absorptive will lead to better marketing strategy performance. The increased ability to approach problems with the necessary technical and market knowledge base also should allow for the creation of novel marketing strategies, as well as provide teams with a means of assimilating real-time information that is relevant for marketing strategy improvisation. More formally, the following is hypothesized:

Hypothesis 2a: Technical absorptive capacity is positively related to (a) performance, (b) strategy creativity, and (c) strategy improvisation.

Hypothesis 2b: Market absorptive capacity is positively related to (a) performance, (b) strategy creativity, and (c) strategy improvisation.

In addition to the direct impact of market and technical absorptive capacity, I expect there to be an interaction between market and technical absorptive capacities. The teams under investigation are focused on developing marketing strategies for the commercialization of new technologies. Therefore, teams that have higher levels of technical absorptive capacity are better equipped to utilize the market knowledge they ascertain. There must be some understanding of the technology in order to utilize market information to its fullest extent. Teams that are not able to assimilate technical knowledge may have high levels of market absorptive capacity, but may not be able to incorporate that market information into a market strategy that is meaningful to the technology. It is expected that teams with high levels of technical absorptive capacity will be better able to value, incorporate, and apply market knowledge within the context of their technology.

Hypothesis 3: The greater the technical absorptive capacity of the team, the stronger the relationship between market absorptive capacity and (a) performance, (b) strategy creativity, and (c) strategy improvisation.

Interaction between Network Ties and Absorptive Capacity

Absorptive capacity has been shown to moderate the impact of network ties on performance (Tsai 2001). While network ties provide individuals with access to knowledge and information, the true impact of this knowledge depends on the ability to absorb the knowledge, or engage in effective knowledge transfer. If a team does not have high levels of network ties then it is not as imperative for the team to have a high level of absorptive capacity to utilize this information. However, teams that have high levels of network linkages need increased levels of absorptive capacity in order to value,

assimilate, and apply the knowledge coming in from these ties. Based on this reasoning, I expect there to be an interaction between network tie strength and absorptive capacity.

Hypothesis 4a: Market network tie strength is more positively related to performance when market absorptive capacity is high.

Hypothesis 4b: Technical network tie strength is more positively related to performance when technical absorptive capacity is high.

Marketing Strategy Formulation Over Time

Past research has outlined four stages of the product development process (Veryzer, Jr 1998). The first phase deals primarily with concept generation and exploration and then progress into the second phase, or technical development and design. The third phase involves prototype construction. The product development process concludes with commercialization. For the purpose of this research, we focus on the first 3 phases of the commercialization process. When the teams are initially formed, they work on issues relating to the technology, including concept generation and exploration. For example, teams prepare an invention disclosure and conduct a patent search of prior art relating to the technology. Some initial market applications of the technology are also considered. After several months, the teams then begin working on a commercialization plan for the technology. It is during this phase that they focus on market applications of the technology as well as further development the technology itself. Finally, teams complete a business plan outlining the value proposition associated with the technology and their strategy for taking the technology to the market. It is during this phase that the technology is reduced to practice.

As teams progress throughout the commercialization process, it is likely that the impact of market network ties and market absorptive capacity on effectiveness will change. Throughout each of these phases, the presence of different capabilities may have a differential impact on performance. Teams with access to market information early on in the development process, and the absorptive capacity necessary to absorb this information, should have superior performance as compared with teams that gain access to this information later on in the commercialization process. Access to market information will aid in the early definition of a market, which is a primary driver of performance. Teams are better able to nail down their target market and tailor their product and offerings to achieve a superior match with the needs of their market. Additionally, the team will be able to gain a greater knowledge base that is relevant to their technology within that domain, thereby increasing their effectiveness. Teams that maintain market network ties throughout the entire process of commercialization will have superior market information. This market information will aid in the development of a comprehensive go-to-market strategy for their technology. Additionally, having market ties and absorptive capacity enables teams to handle new information that is market relevant. New information throughout the entire commercialization process may trigger key marketing strategy changes, or improvisation, in order to address the changing environment. Therefore it is hypothesized that:

Hypothesis 5: Teams that utilize market ties and market absorptive capacity throughout the entire commercialization process will have higher levels of (a) performance, (b) creativity, and (c) improvisation.

Relationships among Outcomes

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In addition to both internal and external capabilities, marketing strategy creativity and improvisation are also drivers of team performance. An inherent part of creativity includes approaching problems from all angles and developing alternative solutions to the task at hand (Amabile 1995). Additionally, improvisation has been shown to increase performance in times of great uncertainty (Moorman and Miner 1998). It should be expected that teams who approach problems creatively by discussing alternative solutions and are flexible enough to respond to both internal and external uncertainty also should have increased levels of performance. It is hypothesized that marketing strategy creativity and strategy improvisation will have a positive association with performance.

Hypothesis 6: Marketing strategy creativity will be positively related to performance.

Hypothesis 7: Marketing strategy improvisation will be positively related to performance.

Methodology

Sample. The sample for this study consists of prestart-up teams participating in a multidisciplinary university program that focuses on the commercialization of university technologies. The teams remain in tact over the course of two years with the primary objective of developing a go-to-market strategy for the new technology. This research will collect data from approximately 20 teams (80 individuals) during their participation in the program and examine the impact of internal and external capabilities on the effectiveness of the marketing strategy formulated for their technology. Each participant will be asked to complete multiple surveys throughout their participation in the program.

In addition, the marketing strategy formulation effectiveness measures will be collected from outside industry experts and program supervisors over the same time frame.

Measures. Existing measures present in the literature are adapted for this study. Although individual team members respond to all items, the majority of the measures are designed to assess perceptions about the team. Thus, it is imperative that the measures conform to the level of analysis of the theory, or in other words, the measures should assess constructs at the team level of analysis, and multiple individual responses must be aggregated to the team level. I will calculate an index of inter-rater agreement (James et al 1984, 1993) that demonstrates the degree of perceptual agreement among the respondents in order to ensure that aggregation is in fact appropriate. See Appendix A for measure items and scale reliabilities.

Network Ties. The measure for network ties was adapted from Smeltzer, Van Hook and Hutt (1991) and Reagans and McEvily (2003). This measure captures the use of network sources for information, the frequency of interaction, the relationship with the source, the quantity and quality of information received from the source, as well as the type of information gained (market or technical).

Several different network indicators needed to test the hypotheses proposed can be calculated from this measure. *Use of technical ties* and *Use of market ties* will be a continuous variable of technical and market ties used by the team. *Technical tie strength* and *Market tie strength* will be calculated as weighted indices. For this calculation, the strength of tie weight will be computed from the relationship of the source to the respondent, where 3=close acquaintance (strong tie); 2=casual acquaintance; and 1=previously not known (weak tie). These weights will be multiplied by the amount of

market and technical information sought. *Use of nonpersonal sources of information* will be a ratio of the use of nonpersonal sources for information over the total amount of information sought. Multiplying the frequency of use of the source of information and the amount of information obtained from that source and summing it up is used to calculate this total amount of information.

Absorptive Capacity. The 6-item measure for both market and technical absorptive capacity is a 7-point Likert scale and was adapted from Szulanski (1996). These measures seek to ascertain the extent to which team members have the ability to value, assimilate, and apply market and technical knowledge.

Marketing Strategy Effectiveness. Performance will be measured using a 19-item measure developed for this study. These items will be collected from team members, *team supervisors*, and **outside experts** and will assess: (1) marketing strategy performance, (2) marketing strategy creativity, and (3) marketing strategy improvisation. Marketing strategy performance is measured with a 7-item scale and includes items such as, "This team has developed a comprehensive plan for commercializing their technology." Marketing strategy creativity will be measured with a 7-item measure adapted from Menon, Bharadwaj, Adidam and Edison (1999). Finally, marketing strategy improvisation will be measured using a 6-item seven-point scale adapted from Moorman and Miner (1998).

Phase of Commercialization Process. Phase of commercialization process will be measured by the duration the team has participated in the technology commercialization program. In addition, respondents will select one of the following to best represent the

phase their technology is currently in: (1) concept generation and exploration, (2) technical development and design, and (3) prototype construction.

Controls. In addition to the primary variables of interest, other variables found to relevant within this context (including the teams and marketing strategy literatures) will also be measured and accounted for in the data analysis. Appendix B provides a description of the control variables.

Analysis Framework

In order to analyze the data at the team level, composite scores for each measure of interest will be calculated using factor scores rather than the unweighted linear composite of the item scores in accordance with the recommendations of Lastovicka and Thamodaran (1991).

This study will conduct the analysis on panel data collected from participants throughout their involvement in the program. Standard OLS regression may yield biased results in this case because they require assumptions that do not hold when repeated measurements of individuals are taken. Therefore, analysis of panel data requires that special attention be given to the covariance structure of the data due to the sequential nature of data collection. This sequential nature arises because data collected close in time can have higher correlations with each other than those collected with further intervals in between.

In order to overcome this interdependence, a random effects model will be estimated to examine the impact of internal and external capabilities on marketing strategy effectiveness. A random effects model is appropriate to use because it assumes

the data describe a hierarchy of different populations whose differences are constrained by that hierarchy (Stock and Watson 2003). The general model is represented as:

$$Y_{it} = X_{it}\beta + \epsilon_{it,}$$

$$\text{where} \quad \epsilon_{it} = \alpha_i + \eta_{it}$$

A random effects model assumes that η_{it} is uncorrelated with X_{it}. In order to test this assumption, a fixed effects model will also be estimated and the Hausman specification test will be used to ascertain whether the measured factors (X_{it}) are orthogonal to the measured covariates (η_{it}). A random effects model also posits that η_{it} varies unsystematically across time and individuals. In addition, α_i represents the effect of the individual in the regression equation. Overall, this equation captures the notion that two observations from the same respondent will be more alike than observations from two different respondents (Johnston and DiNardo 1997).

In performing a random effects analysis, there are two steps that must be completed: (1) derive an estimator of covariance structure and (2) use the covariance structure in the estimation of β. The covariance structure refers to the variances at individual times and to the correlations between measures at different times but on the same individual. Standard OLS cannot be used to estimate a random effects model because of biased estimated standard errors. Therefore GLM will be used to estimate the following equations:

$\text{Perf}_{it} = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_5 x_6 + \beta_8 x_1 x_5 + \beta_9 x_2 x_6 + \beta_{10} creat + \beta_{11} impro + \alpha_i + \eta_{it,}$

$\text{Creat}_{it} = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_5 x_6 + \beta_8 x_1 x_5 + \beta_9 x_2 x_6 + \alpha_i + \eta_{it,}$

$\text{Impro}_{it} = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_5 x_6 + \beta_8 x_1 x_5 + \beta_9 x_2 x_6 + \alpha_i + \eta_{it,}$

x_1 = Use of technical ties
x_2 = Use of market ties
x_3 = Technical tie strength
x_4 = Market tie strength
x_5 = Technical absorptive capacity
x_6 = Market absorptive capacity
creat = Marketing strategy creativity
impro = Marketing strategy improvisation
*perf* = Marketing strategy performance

Table 1 provides a summary of the hypotheses, measures associated with each hypothesis, and the test used for each.

Table 1: Summary of Hypothesis Testing

Hyp	Independent Variable	Dependent Variable	Test
1	Market tie strength Technical tie strength	Performance, Improvisation, and Creativity	$\beta_4>0$ $\beta_5>0, \beta_5<0$
2	Market absorptive capacity Technical absorptive capacity	Performance, Improvisation, and Creativity	$\beta_6>0$ $\beta_5>0$
3	Market absorptive capacity x Technical absorptive capacity	Performance, Improvisation, and Creativity	$\beta_7>0$
4	Technical ties x Technical absorptive capacity Market ties x Market absorptive capacity	Performance, Improvisation, and Creativity	$\beta_8>0$ $\beta_9>0$
5	Use of market ties Use of technical ties	Performance	$\beta_1>0$ $\beta_2>0, \beta_3>0$
6	Creativity	Performance	$\beta_{10}>0$
7	Improvisation	Performance	$\beta_{11}>0$

Data Collection Timeline. Figure 2 provides a timeline for the data collection for this research.

Figure 2: Data Collection Timeline

May 2004	July 2004	Oct 2004	Dec 2004	Feb 2005	April 2005
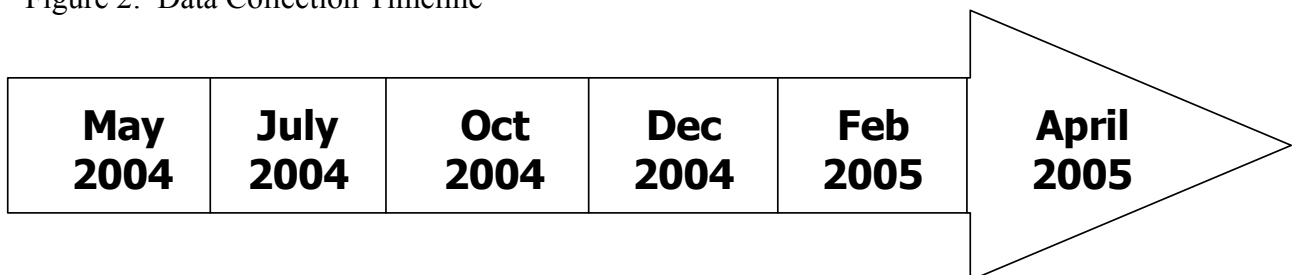
Preliminary Results

This section discusses some preliminary results of this study based on two rounds of data collected from 13 teams. Table 2 provides the descriptive statistics for each of the key variables included in the model.

Table 2: Correlation Matrix and Descriptive Statistics for Key Variables

	X1	X2	X3	X4	X5	X6	Y1	Y2	Y3
Market AC	.9056								
Technical AC	.346	.8688							
Market Ties	-.259	-.406	--						
Technical Ties	.026	-.138	.682	--					
Market Tie Strength	-.058	-.484	.489	.035	--				
Technical Tie Strength	.022	-.201	.703	.799	.467	--			
Performance	.391	.284	-.221	-.414	.028	-.232	.7361		
Creativity	-.087	-.576	.322	.202	.351	.490	.032	.8741	
Improvisation	.354	-.329	.341	-.067	-.484	.091	.009	.132	.7681
Mean	5.42	5.14	33.67	29.67	6.16	5.42	4.39	4.01	5.50
Std. Dev	0.66	0.65	18.31	17.59	2.90	2.41	0.45	0.72	0.84

Cronbach alpha reported on the diagonal. All correlations reported for variables at Time 1.

Network Ties and Marketing Strategy Effectiveness

Strong Technical Ties

Preliminary results indicate that strong technical ties are positively related to marketing strategy performance and thus support Hypothesis 1a (β=2.669, p<.05). Therefore it appears that relying on strong technical ties for information relating to the technology enhances a team's ability to clearly define and develop a comprehensive marketing strategy. Table 3 provides an overview of the results regarding the impact of network ties and absorptive capacity on marketing strategy effectiveness.

Strong Market Ties

While strong technical ties were found to enhance marketing strategy effectiveness, preliminary results indicate that the opposite is true for strong market ties. Strong market ties negatively impact the ability for a team to develop a clear and comprehensive strategy (β=-2.189, p<.05). In addition, strong market ties are found to significantly hinder marketing strategy creativity (β=-2.403, p<.10). This finding is consistent with the past literature regarding the impact of strong ties on creativity outcomes suggesting that access to redundant information does in fact hinder the creative process. Finally, while the relationship between strong market ties and marketing strategy improvisation is not statistically significant (β=-1.438, n.s.), the result is directionally consistent with the hypothesized relationship. Therefore partial support is found for Hypothesis 1b.

Absorptive Capacity and Marketing Strategy Effectiveness

Absorptive capacity is hypothesized to positively impact marketing strategy effectiveness. The ability to value and assimilate new market and technical knowledge will enhance the ability to effectively formulate a marketing strategy. Preliminary results demonstrate that technical absorptive capacity significantly impacts a team's ability to effectively define and develop a clear and comprehensive strategy (β=0.967, p<.05). Therefore it appears that the ability to assimilate technical information leads to more effective strategy formulation. The impact of market absorptive capacity on marketing strategy effectiveness is less clear. Market absorptive capacity is not found to be significantly related to marketing strategy performance, marketing strategy creativity, or

marketing strategy improvisation. This finding may be due to the small sample size and a lack of power to detect the relationship.   Therefore, partial support is found for Hypothesis 2.

Table 3: Impact of Network Ties and Absorptive Capacity on Marketing Strategy Effectiveness

	Marketing Strategy Creativity	*Marketing Strategy Improvisation*	*Marketing Strategy Performance*
Strong Market Ties	-2.403*	-1.438	-2.189**
Strong Technical Ties	2.181	2.119*	2.669**
Market Absorptive Capacity	0.291	0.606	-0.256
Technical Absorptive Capacity	0.392	0.311	0.967**

** $p < 0.05$, * $p < 0.10$.

Longitudinal Performance Effects

Due to the small sample size and number of observations, I am unable to test the model using more sophisticated panel data techniques. Therefore, in order to examine the impact of market and technical ties and absorptive capacity over time, I use standard regression to examine market and technical ties and absorptive capacity at time 1 on marketing strategy effectiveness at time 2. The results are shown in Table 4.

Preliminary results indicate that access to both market and technical information positively impact marketing strategy creativity in subsequent time periods ($\beta=0.023$, $\beta=0.026$, $p < 0.10$ respectively).   In addition, having access to market information and having the ability to process this information (market absorptive capacity) enhances future marketing strategy improvisation ($\beta=0.049$, $\beta=0.052$, $p < 0.05$ respectively) and thus Hypothesis 5 is supported. Technical ties have a negative impact on marketing strategy

improvisation (β=-0.038, p<0.10), while technical absorptive capacity is positively related to strategy improvisation (β=0.344, p<0.05).

While results indicate that network ties and absorptive capacity do impact subsequent marketing strategy creativity and marketing strategy improvisation, they do not have a significant impact on marketing strategy performance in future time periods. Marketing strategy creativity is not significantly related to marketing strategy performance and therefore Hypothesis 6 is not supported. The only variable found to be a significant predictor of marketing strategy performance is marketing strategy improvisation (β=0.605, p<0.05), supporting Hypothesis 7. Therefore it appears as if the impact of network ties and absorptive capacity on subsequent marketing strategy performance is mediated through marketing strategy improvisation. Results are shown in Table 4.

Table 4: Overview of Longitudinal Results

	Marketing Strategy Creativity (T2)	*Marketing Strategy Improvisation (T2)*	*Marketing Strategy Performance (T2)*
Market Ties (T1)	0.023*	0.049**	0.109
Technical Ties (T1)	0.026*	-0.038**	-0.010
Market Absorptive Capacity (T1)	0.251	0.524**	2.866
Technical Absorptive Capacity (T1)	0.182	0.344*	-1.057
Creativity (T1)			0.208
Improvisation (T1)			0.605**

** p<0.05, *p<0.10.

Discussion

The objectives of this paper are to fill three gaps in the marketing strategy literature. There has been very little empirical research on the formation of marketing strategies at the team level and in addition, even less research examining the formation of marketing strategies for technologies that are developed outside traditional organizational boundaries and without a predefined market application. Furthermore, this research will be able to examine for marketing strategy formation process over time utilizing a panel of 20 prestart-up teams. This research approaches the formation of marketing strategies for new technologies from a dynamic capability perspective and focuses on the impact of network ties and absorptive capacity on marketing strategy effectiveness. This study is the first to distinguish between market and technical network ties and market and technical absorptive capacity and examine their differential impact in marketing strategy development. In addition to the direct impact of these internal and external capabilities on effectiveness, this paper also strives to understand the interaction between the two capabilities and how it evolves over time.

Managerial Implications

Are all ties created equal? This research is able to parcel out the role of both strong versus weak ties and tie information content (market versus technical). Conventional wisdom suggests that weak ties are uniformly good. However, this research suggests conditions under which it is beneficial to rely on strong ties, such as discussion about the merits associated with a complex technology. In this case, it is not as beneficial to gather information from as many people as possible. However, when gathering market information it becomes very important to discuss the issue with strangers or those ties

that can provide access to novel information. Therefore, managers must consider the information content desired when seeking out others for knowledge.

Timing of market information is critical. It is imperative for market information to be gathered early on when formulating a marketing strategy. Early market definition allows for more effective development of a go-to-market strategy, which has been shown to increase performance outcomes. Therefore, it is never to early for managers to learn about their market, customers, and environment.

What good is information if you can't absorb it? Finally, it is not enough to simply surround oneself with access to information. This research highlights the need to have both access to information and the ability to process that information in order to yield superior performance outcomes. It is imperative that managers have capabilities in both information gathering and processing.

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Appendix 1: Measures
Network Ties (adapted from Smeltzer, Van Hook and Hutt 1991; Reagans and McEvily 2003)

Source of Information	Did you use this source?	Frequency of Use? [2] (1=Little or none, 5=Very high)	Relationship with Source?	Quality of Information? (1=Poor, 5=Excellent)	Amount of Information? (1=Little or none, 5=Very high)
1. Advisor of PhD student	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
2. TI:GER Faculty	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
3. TI:GER PhD Student 1 (not on your team)	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
4. TI:GER PhD Student 2(not on your team)	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
5. TI:GER PhD Student 3 (not on your team)	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
6. TI:GER MBA Student 1 (not on your team)	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
7. TI:GER MBA Student 2 (not on your team)	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
8. TI:GER MBA Student 3 (not on your team)	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
9. TI:GER JD Students 1 (not on your team)	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
10. TI:GER JD Students 2 (not on your team)	☐ Yes ☐ No	1 2 3 4 5	☐ Close acquaintance ☐ Casual acquaintance ☐ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5

[2]Frequency of use: Where 1=Less than once every 6 months, 2=2-4 times every 6 months, 3= Once a month, 4=2-4 times a month, 5=Greater than 4 times a month

11. TI:GER JD Students 3 (not on your team)	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
12. Peers outside TI:GER Program 1	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
13. Peers outside TI:GER Program 2	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
14. Peers outside TI:GER Program	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
15. Science and Engineering Faculty (other than advisor) 1	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
16. Science and Engineering Faculty (other than advisor 2)	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
17. Business School Faculty (other than TI:GER Faculty) 1	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
18. Business School Faculty (other than TI:GER Faculty) 2	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
19. Law School Faculty (other than TI:GER Faculty) 1	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
20. Law School Faculty (other than TI:GER Faculty) 2	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
21. Industry Sponsor for Research	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
22. Office of Technology Transfer	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5

23. Outside Accountant	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
24. Outside Attorney	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
25. Friend/Relative 1	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
26. Friend/Relative 2	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
27. Friend/Relative 3	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
28. Potential Customer	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
29. Potential Supplier	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
30. Small Business Administration	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
31. Venture Capitalist	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
32. Business Executive 1	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
33. Business Executive 2	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5
34. Other:	❑ Yes ❑ No	1 2 3 4 5	❑ Close acquaintance ❑ Casual acquaintance ❑ Person not previously known	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5

Nonpersonal Sources of Information (created for this study)

Source of Information	Did you use this source?	Frequency of Use? (5=Very high, 1=Little or none)	Quality of Information? (5=Excellent, 1=Poor)	Amount of Information? (5=A lot, 1=Little or none)		
Annual Reports/Company Information	❑ Yes ❑ No	1 2 3 4 5	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5		
Business Press (magazines, newspaper)	❑ Yes ❑ No	1 2 3 4 5	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5		
Academic Journals (Peer-reviewed articles)	❑ Yes ❑ No	1 2 3 4 5	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5		
NERAC	❑ Yes ❑ No	1 2 3 4 5	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5		
Law Databases (Patent/IP)	❑ Yes ❑ No	1 2 3 4 5	1 2 3 4 5	Technical 1 2 3 4 5 Market 1 2 3 4 5 Other 1 2 3 4 5		

Frequency of use: Where 1=Less than once every 6 months, 2=2-4 times every 6 months, 3= Once a month, 4=2-4 times a month, 5=Greater than 4 times a month

Market Absorptive Capacity (adapted from Szulanski 1996)
(Seven point scale, where 7=strongly agree and 1=strongly disagree)
- Have a common language to interpret market information.
- Have a common vision of what it is trying to achieve through the marketing strategy.
- Have the necessary skills to respond to market information.
- Have the competency to absorb market information.
- Have the ability to understand market information.
- Have the overall capacity to absorb market information.

α= 0.9056

Technical Absorptive Capacity (adapted from Szulanski 1996)
(Seven point scale, where 7=strongly agree and 1=strongly disagree)
- Have information on the state-of-the-art developments related to the technology.
- Have the competency to absorb information relating to the technology.
- Have the ability to understand technical information.
- Have the overall capacity to absorb technical information.
- Have a common language to interpret the technology.
- Have a common vision of what it is trying to achieve in regards to the technology.

α= 0.8688

Performance (created for this study)
Supervisor ratings of performance: (Seven point scale where 7=strongly agree and 1=strongly disagree)
- Overall, the marketing strategy developed by this team is likely to be successful.
- This team's marketing strategy will require a great deal of modification before it can be used to commercialize this technology.

- This team has developed a comprehensive plan for commercializing their technology.
- This team is well positioned to capitalize upon protectable intellectual property rights.

α= 0.7361

Marketing Strategy Creativity (adapted from Menon, Bharadwaj, Adidam and Edison 1999; Andrews and Smith 1996) (Seven point scale, where 7=strongly agree and 1=strongly disagree)
- This team's chosen strategy to market is different from others developed in the past in this industry.
- Compared to other technologies in this industry, at least some parts of this team's marketing strategy are bold.
- Compared with other technologies in this industry, this team's marketing strategy is original.
- The technology's value proposition is novel.
- The selection of the technology's served market is unique.
- The strategy proposed to reach this served market is original.

α= 0.8741

Marketing Strategy Improvisation (adapted from Moorman and Miner 1998)
(Seven-point scale, where 7=strongly agree and 1=strongly disagree)
Rate the development of the marketing strategy:
- Our team figured out the marketing strategy for this technology as we went along.
- Our team updated the strategy as information came to light.
- Our team improvised in carrying out this strategy development.
- The marketing strategy developed for this technology was ad-libbed.
- We are making/made changes to our strategy as we go along.
- Our team was willing to make changes to the strategy as information came along.

α= 0.7681

Phase of Commercialization (Veryzer, Jr 1998)
- Which of the following best describes the phase of your team's technology?
  - ❑ Concept Generation and Exploration
  - ❑ Technical Development and Design
  - ❑ Prototype Construction

Appendix A: Control Variables

Ability

- **Absorptive Capacity**
  - **Market**
  - **Technical**
- **Network Ties**
  - **Market**
  - **Technical**
- Potency

Motivation

- Orientation
  - LO, PO

Design

- Composition
- Structure
  - Role/Goal Clarity
  - Task Interdependence
  - Outcome Interdependence

Team States

- Social Capital
  - Cohesiveness
  - Identification
  - Trust

Team Processes

- Routines
  - Task-focused Interaction
  - Conflict
  - Team Citizenship Behavior

Team Effectiveness

- Performance
- Satisfaction
- Commitment

Marketing Strategy Effectiveness

- **Performance**
- **Creativity**
- **Improvisation**

Task

- Complexity
- Environmental Uncertainty

Controls: Openness to experience, Entrepreneurial Orientation, Psychological safety, Past team experience, Personal stakes, Team longevity, Stage of Development