

AN EXAMINATION OF THE ROLE OF SOCIAL NETWORKS IN THE  
COMMERCIALIZATION OF ENTREPRENEURIAL  
INNOVATIONS

by

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## ABSTRACT

Through the extension of Seibert, Kraimer, and Liden's (2001) social capital framework to the field of entrepreneurship, this paper develops and tests a theoretical model focusing on how an entrepreneur's social network structure and resources combine to impact the commercialization attempts of entrepreneurs regarding their innovative products and services. By drawing an analogy between an entrepreneur's social network and an organization's absorptive capacity, the model I propose predicts how the structure of an entrepreneur's social network and the resources embedded within that network may lead to the acquisition of essential resources and information, and ultimately, impacting the successful commercialization of their opportunity. This model bridges a gap in the entrepreneurship literature by testing long standing beliefs and assumptions regarding the role of social networks, including that a large network is always better and weak ties are necessarily more beneficial than strong ties.

## DEDICATION

This Dissertation and all the work that went into it is dedicated to my mother, Cynthia Noble, the bravest person I know. I want the moon, and you continue to help me try to get the lasso around it.

“Each man’s life touches so many other lives. When he isn’t around he leaves an awful hole, doesn’t he?”-Clarence the Angel. My committee chair, K. Michele Kacmar embodies this quote. Micki deserves a piece of this dedication because of the way she has touched my life.

## LIST OF ABBREVIATIONS AND SYMBOLS

$\alpha$	Cronbach's index of internal consistency
N	Sample size
$p$	Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value
<	Less than
s.e.	Standard Error
=	Equal to

## ACKNOWLEDGEMENTS

I would like to take this opportunity to express my appreciation of my entire committee who allowed me to remain true to myself throughout this project, and in the process, I was able to find parts of myself that were hidden. I could not have completed my studies without the continued support of the Department of Management, specifically, department heads Diane Johnson and Rob Morgan, the Jans, Mary, and Courtney. I want to thank the many students that have played a role in my time at Alabama because I did this so that I could dedicate my life to their education.

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To all the pirate hookers I've loved before...no matter for how long, I acknowledge your role.

With all of those people playing a role in Alabama, they don't begin to cover the impact that my family has had. I could not have done this without the support of my family. There are no words to express my gratitude for my mother, Cynthia, my father, Big Jim; and my sisters, Amy and Erin. I love you all, and I take you on all my adventures with me in my heart.

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## **CHAPTER 1**

### **INTRODUCTION**

The impact of the entrepreneur's social network on the success of a new enterprise has been the subject of great interest to entrepreneurship scholars. A social network is the structure of ties that link a defined set of persons or actors (Seibert, Kraimer & Liden, 2001), and in this research I focus on those persons or actors who influence the entrepreneur in his/her attempts to commercialize an entrepreneurial opportunity. Over the last 25 years, social network research has become a significant part of the entrepreneurship literature (Bartajagal, 2003; Birley, 1985; Kim & Aldrich, 2005; Stam & Elfring, 2008). However, critical research necessary to build on this particular framework through the incorporation of a social capital theory of entrepreneurship has not effectively been conducted. To assure the continued development of this stream of research it is necessary to develop a theoretically based framework that can make sense of the diverse sets of literature. I propose to extend the theoretical framework developed by Seibert et al. (2001). This extension is modified to incorporate the realities surrounding research in the entrepreneurial context, as well as address an existing shortcoming of this framework, to investigate the specific question of why social capital may help an entrepreneur to successfully commercialize an opportunity.

#### **Social Networks and Social Capital**

The investigation of phenomenon impacted by one's social network can not be limited to the network's structure alone. I propose that the social network is far more dynamic than links between individuals, and its value is heavily influenced by 1) the structure, 2) the resource within the network, and 3) the process the individual uses to extract those resources from the network.

A major contribution of this dissertation is that it incorporates existing literature into a more holistic model of how an entrepreneur uses his/her network through the commercialization process.

In this dissertation, I am clarifying the process by which the entrepreneur uses his/her social network to obtain critical resources necessary for the commercialization of the opportunity that they are attempting to exploit, while defining and investigating a potential negative consequence of such use of the social network. In the field of entrepreneurship, I am not aware of any research that has combined multiple social network theoretical approaches to tackle phenomenon of interest to scholars.

Throughout the social network and social capital literature the types of ties that link actors have been central to the research conducted. Ties can be seen as either weak or strong (Granovetter, 1973). Strong ties are those relationships that often exist between persons within the same clique; whereas, weak ties are relationships that exist between a member of a clique and someone outside of that clique (Granovetter, 1973). It is argued that weak ties are the source of new and novel information because actors who share strong ties often have redundant ties that lead to the recycling of information (Granovetter, 1973). This theoretical approach is furthered through an understanding of dormant and activated ties (Stevenson & Greenwood, 2000). Essentially, ties can be created then remain dormant for periods of time, only gaining importance upon the activation of that tie (Stevenson & Greenwood, 2000). A strong or weak tie is only of value for an instrumental purpose if one of the parties make an attempt to secure the resources embedded within those ties.

Another structural characterization of interpersonal ties exists when two actors are linked indirectly through an intermediary actor; this is referred to as a structural hole (Burt, 1992). The

greater the number of structural holes that a person connects, the more potential value that network has (Seibert et al., 2001; Burt, 1992). Burt (1992, 1997) provides three explanations for this value: 1) more access to unique and novel information; 2) increased leverage through bargaining; and 3) greater visibility for the actor throughout the network. Recently, this conception of structural holes has been challenged, such that value can be generated by the actor through the connection of those parties who were previously unconnected by the individual who fills the structural hole (Obstfeld, 2005). Rather than keeping the others apart to generate value, the position of filling a structural hole is leveraged through facilitating the tie between the others, and in so doing, creating value for the person who filled the structural hole.

Furthermore, there is another existing school of thought, social resource theory, which claims that the nature of the resources found within the network is the actual value of the social network (Lin, Ensel & Vaughn, 1981a, 1981b). This focuses on relationships that can provide the person with the resources necessary to reach his/her goals (Seibert et al., 2001). Therefore, different actors can provide greater or lesser value to a social network depending upon the particular resources within their control.

A more holistic approach to social capital is the integration of these three (weak tie, structural hole and structural resource) theoretical approaches to generate the person's total social capital (Seibert et al., 2001). Through the integration of network structure and resources, researchers are better able to determine the value of a particular person's network with respect to their goals, rather than trying to work within the realm of only one approach. Social capital theory scholars in entrepreneurship have not yet followed this method, instead focusing on either a structural or resource based view respectively. The literature is beginning to recognizing that a conversation about one without the other is not only unfruitful, but potentially dangerous (Jack,

2010). Through this dissertation I intend to incorporate this integration into the entrepreneurship literature in an effort to further understand the importance and role of social capital in entrepreneurship research.

### **Conceptual Model**

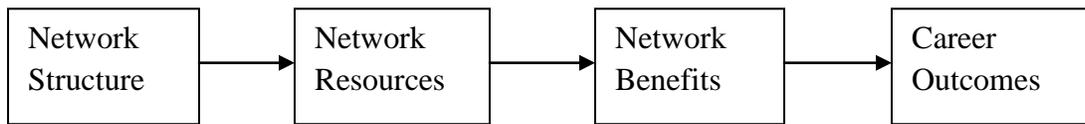
Figure 1 shows the general conceptual model that will be tested in this study and the differences between it and the Seibert et al. model. Seibert et al. (2001) advanced social capital theory beyond a singular perspective of networks based on one of the three distinct dominant theories (weak tie, structural hole, and social resource theories), and instead incorporated the three prior conceptualizations of social capital that were once considered mutually exclusive. This advancement provides scholars a more holistic theoretical framework to investigate social capital in a multitude of settings, including entrepreneurship. Generally speaking, social capital has been described as a collection of social network research that brings together a multitude of concepts ranging from social support to social resources (Borgatti & Foster, 2003). For the purposes of this research project, I define social capital as the net value that results from the individual's network structure and such resources embedded within that network, whether such value is negative or positive. The model that I propose shares the same generalizable concepts and definitions in the first two boxes of the Seibert et al. (2001) model. In the first box of both models is network structure, and this is defined as the pattern of ties, strength of such ties, and placement within such pattern (Seibert et al., 2001). Network structure leads to network resources, and network resources can be defined as the wealth, status, power, and the ties of the alter (Lin, 1981a). I add the information, education, and experiences possessed by such alter to any definition of network resources for the purposes of this dissertation. According to Seibert et

al. (2001), network resources lead to network benefits, but this is the point where the current model begins to diverge.

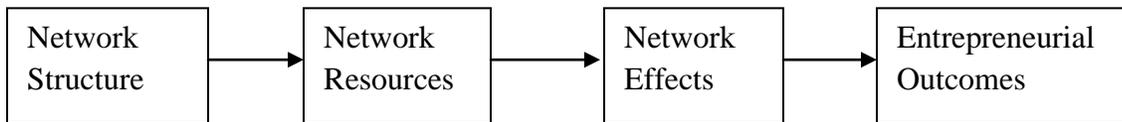
Figure 1:

Conceptual Comparison between Seibert et al. (2001) Model and Proposed Model

SEIBERT ET AL (2001)



PROPOSED MODEL



One conception of social capital is that it consists as a part of the social structure that creates value and eases the actor's ability to take advantage of the opportunities provided by that structure (Coleman, 1990). Entrepreneurship research concerning social networks has almost solely focused on the concept of social capital as a necessarily positive value resulting from a social network or relationship, and, has effectively ignored negative consequences related to social networks. The negative consequences of social networks and networking, such as network overload, need to be accounted for to fully understand the impact on the entrepreneurial process of network effects. Thus, further research needs to be conducted in this area (See Stam & Elfring, 2008). Therefore, I addressed this shortcoming of the Seibert et al. (2001) model by including restraints on action resulting from one's network structure and resources, and changed the nomenclature from network benefits to network effects reflecting my conceptualization of

social capital as a net value of the network. Although, this conceptualization is not without precedent (Hansen, Podolny, & Pfeffer, 2001), it has not been adopted into the mainstream entrepreneurship literature. By changing the framework to include network effects rather than network benefits, we are able to adopt the Seibert et al. (2001) model to the realities of human interactions in the world in which they exist.

The conceptual model that I propose finally leads from network effects to entrepreneurial outcomes. This modification to the model was necessary to reflect the realities of the application of this model to the field of entrepreneurship, as opposed to career advancement, because the fields have different indicators of success. At the counsel of my committee, I have chosen to focus on exploitation as the entrepreneurial outcome of interest, but this model could be used to explore opportunity identification and evaluation as well. Opportunity identification is defined as the belief that an idea to provide a new good or service, or a new means to provide an existing good or service, is valuable and achievable by the entrepreneur (Shepherd, McMullen & Jennings, 2007). Entrepreneurial evaluation has been described as a judgment as to whether the entrepreneur should invest further resources and time in the opportunity (Ardichvili, Cardozo, & Ray, 2003). I differ in my approach to evaluation; I consider it a process as to how an entrepreneur makes such a judgment. The judgment is the result of such an evaluation. Finally, opportunity exploitation is defined as the attempt to bring the innovation in the form of a new good or service, or the new means to produce such a good or service into the market place and derive a profit from the sale of the output incorporating such innovation.

### **Theoretical Model**

Figure 2 is the theoretical model that demonstrates how the social network constructs interact to influence the commercialization of the innovation. This model depicts the constructs

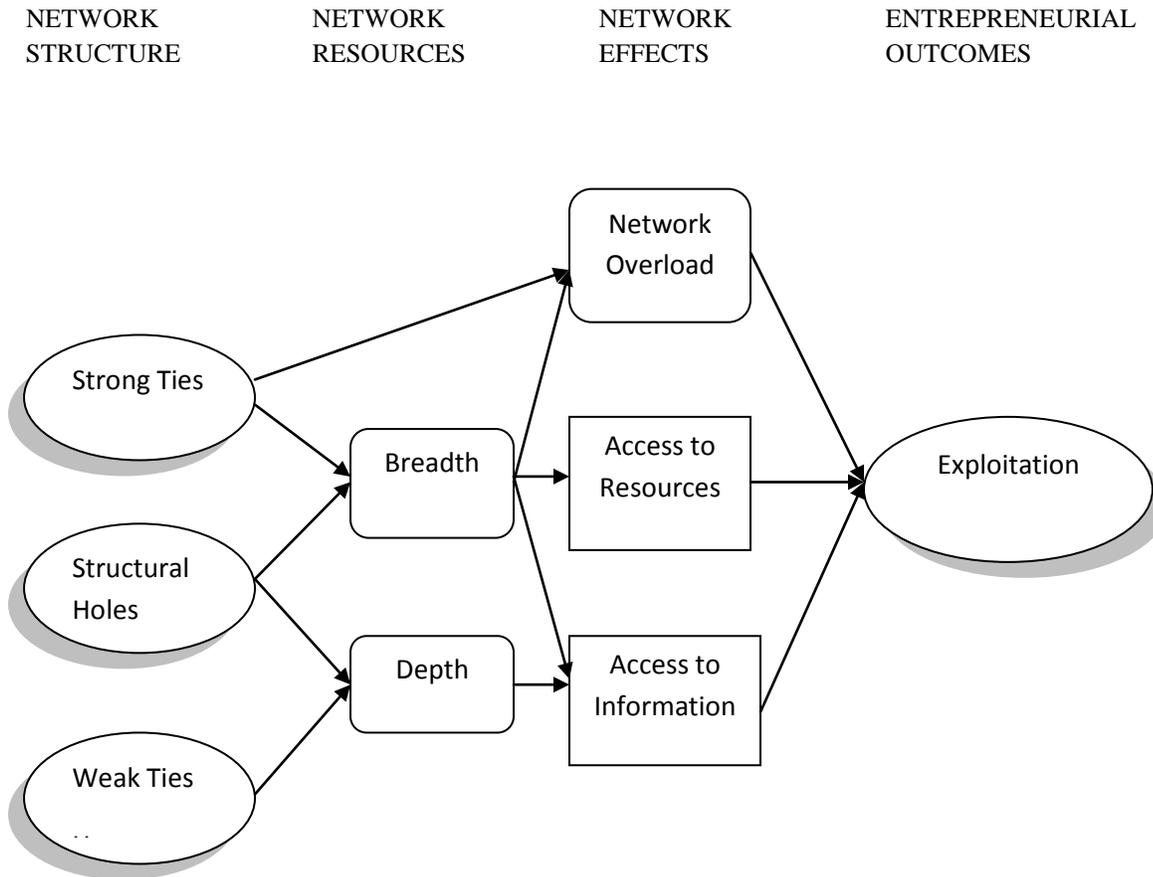
that fit into the generalized categories found in Figure 1. Similar to the model developed by Siebert et al., network structure constructs include both weak ties and structural holes, but I have added strong tie relationships to the entrepreneurial model because these ties play important roles in the entrepreneurial process (Nicolaou & Birley, 2003). Strong tie relationships have been conceptualized as those relationships that are characterized by intimate relationships that are the result of numerous and consistent contacts between the parties (Granovetter, 1973). This characterization concludes by assuming that parties to a strong tie relationship share much of the same knowledge and that because of the nature of the tie these relationships are less valuable than weak ties. The initial research that led to this conceptualization regarded information concerning job searches, and while that may remain unquestioned; these relationships are different in the development of an entrepreneurial venture because the information needed in a job search is much more explicit in nature.

A more useful understanding of shared knowledge in a strong tie relationship is that the ego (self) will know what its strong tie alter (other) knows about, rather than precisely what the strong tie knows. For example, I know my alter is an expert in international equity finance, but I do not know what my alter knows about international equity finance. Therefore, these types of ties can contribute significantly more novel information than previously conceptualized, especially if the knowledge sought is more specialized than information about potential employment opportunities. Using a similar conceptualization Nicolaou and Birley (2003) were able to demonstrate a relationship between nonredundant strong ties and academic exodus.

Figure 2:

Theoretical Model

A Social Network Theory of Entrepreneurial Opportunities



In my model strong ties, weak ties, and structural holes lead to certain network resources. This study focuses on network resources possessed by the other as the human capital that the other has developed as a result of working in a particular industry. The construct of network depth consists of resources possessed by those contacts that come from within the same industry as the entrepreneur. The alter may have a different expertise within that industry from the entrepreneur, but will have a shared understanding of the industry from which the entrepreneur is

emerging and will likely have access to different types of resources within that industry than ego. Furthermore, the construct of network breadth is conceptualized by the resources of those contacts that come from an industry other than the entrepreneur. These extra-industry contacts will likely have unique and varied experiences that lead to different perspectives, but they also may allow for the entrepreneur to comfortably extend his/her venture beyond the industry from which they have emerged. Although weak ties and structural holes lead to both breadth and depth, strong ties lead only to breadth because of the unlikely event that someone will have numerous strong ties among individuals with whom they have a professional relationship.

In Figure 2, breadth of resources leads to the network effects: access to information, access to resources, and restraints on action. Furthermore, depth of resources leads to access to information. The construct of breadth is the mediator of the partially mediated relationship between strong ties and restraints on action. I do not model a relationship between depth and restraint because the relative low investment needed to maintain weak tie relationships combined with the resources sought by the entrepreneur pursuant to these types of ties make it unlikely that the relationships will impact the entrepreneur's ability to act. Finally, information and resources have been identified as necessary elements of a successful entrepreneurial venture (Shane & Venkataraman, 2000). Therefore, I also propose access to information and resources will lead to opportunity identification, evaluation, and exploitation behaviors.

### **Entrepreneurial Opportunity Paradigms**

One of the more interesting aspects of entrepreneurship research are the questions of how, when, and why certain people take advantage of entrepreneurial opportunities and others do not (Shane & Venkataraman, 2000). Our model attempts to answer the how and why certain people use their social networks to find and take advantage of opportunities. Currently,

entrepreneurship research has two major competing theories as to how opportunities exist: whether they are created (Alvarez & Barney, 2007a) or discovered (Shane & Venkataraman, 2000). For the purposes of this dissertation, I take a discovery theory approach to entrepreneurial opportunity.

Informational asymmetry is identified as the antecedent of opportunity discovery, and it is defined as the unique prior knowledge that the entrepreneur possesses either through education or experience (Shane, 2000). Discovery theorists offer informational asymmetry not only as the reason people find opportunities, but also why certain persons are willing to pursue an entrepreneurial venture (Shane & Venkataraman, 2000; Kirzner, 1997). An entrepreneur's willingness to bear risk has consistently been argued to be important in why a person will attempt to exploit an opportunity, but, from the earliest work in entrepreneurship research, this relationship has not been empirically substantiated (Brockhaus, 1980). Shane and Venkataraman (2000) use informational asymmetry to explain these insignificant results. It is argued that informational asymmetry allows the entrepreneur to more accurately perceive the level of risk in a particular entrepreneurial venture, because they have information that others do not have, even though the venture may appear too risky to others.

This informational asymmetry can arise from both their stock of prior knowledge related to the opportunity (Shane, 2000) and the unique knowledge they gain through the opportunity evaluation. At the same time, however, the development of the literature in opportunity discovery has far outpaced the literature in opportunity evaluation. Therefore, I believe that there is a lot to be gained through the further refinement and study of the construct of opportunity evaluation, in addition to opportunity discovery.

Notwithstanding the difficulties in designing and conducting a study to investigate entrepreneurial evaluation, it is essential that the research keep pace with opportunity discovery because the paradigm integrates the two as essential steps in the entrepreneurial process, i.e. each literature should inform the other. Investigations concerning opportunity discovery that fail to account for the role of evaluation may lack certain validity because such study fails to consider an equally plausible alternative explanation for the same outcome.

Creation theory is an umbrella term for a number of subtly different understandings which do not allow for the existence of the opportunity without the interaction of the entrepreneur (Alvarez & Barney, 2007a; Baker & Nelson, 2005; Sarasvathy, 2001). Creation theory expands the conceptualization of the entrepreneurial process to account for situations where the opportunity does not exist without the specific actions of the entrepreneur (Alvarez & Barney, 2007a). Defining entrepreneurship as the process of discovery or identification, evaluation, and exploitation of situations in the market where new goods, services, raw materials, and organizing methods can be introduced and sold for a profit or a larger profit than was available before allows us to view entrepreneurship as a clear event for purposes of study (Casson, 1982, Shane & Venkataraman, 2000), but it fails to account for the role of the entrepreneur in the evolution of the opportunity (Alvarez & Barney, 2007a). Specifically, the entrepreneur plays an important transformative role in the development of some opportunities.

Creation theory differentiates between risk and uncertainty, such that entrepreneurial action may be viewed as uncertain, but not necessarily risky (Alvarez & Barney, 2007a). Differentiating between risk and uncertainty allows us to understand why some entrepreneurs choose to act, and it further captures why entrepreneurs use different stakeholders to help navigate through the uncertainty caused by his/her actions (Sarasvathy, 2001). This is an

important concept that contradicts the tenet of discovery theory that claims that a potential entrepreneur will not act until they have been able to judge that the risk in an opportunity has been sufficiently reduced by providing an alternative logic for why some people choose to pursue entrepreneurial opportunities. Although not explored through the hypothesis testing in this, qualitatively, I will attempt to see how approaching this phenomenon from the creation paradigm will effect my analysis.

### **Social Networks and Entrepreneurial Process**

As I noted above, social capital is not a new construct in entrepreneurship research (Aldrich & Zimmer, 1986; Shane & Cable, 2002; Nicolau & Birley, 2003; Batjagal, 2003; Wiklund & Shepherd, 2008), but still, there was a recent call to develop our understanding of entrepreneurship as a social process rather than the work of a single actor (Dimov, 2007). An entrepreneur not only seeks resources, such as equipment, money, and work space, but also needs advice, information, and guidance from his/her network to survive and succeed (Birley, 1985). It is through the provision of these different benefits embedded within the entrepreneur's social network, that the network can function to assist the entrepreneur in the creation of the new venture.

The fields of social networks and entrepreneurship have developed over the last twenty years, but they have not necessarily developed congruently. Social network scholars have made considerable theoretical and empirical gains, which I will bring to bare on my dissertation. My dissertation will bring the extant entrepreneurship literature in line with the extant social network literature, through the extension of Seibert et al.'s (2001) model; the enactment literature that states the actor must actually use the structure to their advantage or attempt to capture the resources within that network (Stevenson & Greenberg, 2000) for the social network to benefit

the actor; and, finally, that the structure could provide limitations on the actor's ability to take action because of their relationships with other members of the network (Brass & Burkhardt, 1993). Also, through this research, I am able to investigate the role that breadth and depth of ties has on the entrepreneurial process, which needs further development (Stam & Elfring, 2008). To further examine the role of social networks in the entrepreneurial process, I will now draw an analogy between absorptive capacity and social networks.

### **Absorptive Capacity**

Separate from the social network and entrepreneurship literature, organizational learning scholars have developed the concept of absorptive capacity. Absorptive capacity is defined as the firm's ability to "recognize the value of new, external information, assimilate it, and apply it to commercial ends..." (Cohen & Levinthal, 1990). It has been further conceptualized that a firm possesses potential absorptive capacity and realized absorptive capacity, differentiating the two constructs by arguing that a firm needs to exploit the knowledge and information for it to be realized and beneficial, otherwise it remains dormant and unhelpful until such time that it is exploited (Zahra & George, 2002). Prior research has conceptualized an individual level absorptive capacity that relies on the individual's prior related knowledge and diverse experiences (Cohen & Levinthal, 1990).

Through analogy with absorptive capacity, in this dissertation I am able to demonstrate how the entrepreneur's social network functions during the start-up phase of the commercialization process. The conceptualization of the role of social networks in the entrepreneurial process adopted by this paper is similar to how absorptive capacity works within an organization, and the entrepreneur's social network is viewed as part of the entrepreneur's "absorptive capacity," together with that entrepreneur's own prior knowledge. The use of

dormant and active strong ties further exemplifies the conceptual similarity between strong tie networks and absorptive capacity. Simply stated, I demonstrate that the resources embedded in the strong tie network operate in a similar manner as a firm's absorptive capacity, but at a different level of analysis.

### **Overview of this Project**

This study will rely on field data collected from entrepreneurs who are located in the Cambridge Innovation Center at the time of the initial data collection. Through the collection of social network data, I will map the relationships that they have used to benefit their entrepreneurial venture, as well as the relationships that they maintain despite no apparent benefit to this venture. Although, to complete this dissertation, I use a cross-sectional approach collecting all of the data at one time, I will return after a year lag and collect other data with regard to commercialization outcomes. The time-lag analysis will serve multiple functions, including the reduction of common method bias which is discussed in the Chapter 5 of this dissertation.

Through this exploration of the role of the social networks in the entrepreneurial process, I contribute to the literature by developing a model of how social networks can benefit the exploitation of opportunities (i.e., commercialization) at the individual level. The analysis of social network structure and resources, while allowing for differences in networking process, in a test of a single conceptual model will provide the field with a more holistic understanding of how social networks effect the successful commercialization of opportunities. Through this research, it may be possible to determine strategies with respect to networking that will better allow the potential entrepreneur to improve the environment within which he/she operates and more effectively pursue an entrepreneurial venture to commercialization.

In addition to this approach, both the positive and negative effects of the entrepreneur's social network and networking activities will be evaluated. Despite recent attention to this topic (Stam & Elfring, 2008), the literature remains underdeveloped. An *ex ante* conceptualization, as well as an empirical test, will aid the development of social network research in entrepreneurship beyond the application of social capital as it is used in current research. The extension of this literature will allow for the development of a more realistic theoretical approach to the interaction between social networks and entrepreneurial opportunities.

Finally, the development of an analogy between social networks and absorptive capacity will allow for a greater understanding of why entrepreneurs are able to act with regard to certain opportunities that appear to be outside of the scope of their own specific knowledge and experience. Addressing this shortcoming of discovery theory, the results from the analyses should allow for the further refinement of discovery theory, as well as a process explanation as to how opportunities are created. This further helps to expose the importance of the individual entrepreneur's actions to the development of the opportunity. Dynamic capabilities of the firm are theorized to create a competitive advantage for firms (Eisenhardt & Martin, 2000), and I extend this theory to include dynamic capabilities of the individual entrepreneur that will allow for more thorough understanding of how that entrepreneur influences the entrepreneurial process.

## CHAPTER 2

### THEORETICAL BACKGROUND AND HYPOTHESES

Within this dissertation I will use the terms ego and alter to describe individuals based upon their place in the structure of the network. Ego network analysis is where an individual is the focal point of the network analysis; this is common for social capital research and entrepreneurship network analysis (Borgatti & Foster, 2003). Ego will refer to the entrepreneur who is the focus of the network analysis, whereas alters are the individuals identified as being connected to such an ego (Borgatti & Foster, 2003).

Figure 3 contains the operationalized model with the specific variables being measured and tested through this dissertation, as well as the propositions put forth but not tested. The first set of constructs include the number of ego's strong ties and weak ties, which are all structural in nature. There are so many difficulties with quantifying structural holes in an ego network as noted below, that I have chosen to develop propositions and explore these relationships through qualitative means, but not test the relationships in hypotheses. Strong ties are connections between ego and alter where the relationship between the two is characterized by high levels of intimacy and intensity, are relatively long in duration, and have experienced a great deal of reciprocal exchanges; whereas, weak ties would be characterized as relationships experiencing low levels of intimacy, intensity, and reciprocal exchanges, as well as, having been relatively short in duration (Granovetter, 1973). Structural holes are artifacts that are said to exist when the ego is the only connection between two separate alters (Burt, 1992).

The testing of hypotheses with regard to structural holes in this type of research is problematic. First, the use of ego networks means that the ties will not be surveyed as to whether they are tied to the others. The generally accepted method of structural hole measurement is to

ask the respondent if his/her ties are connected to each other. There are facial validity problems with this measurement method, i.e. the ego may not be aware of the relationship or strength of relationship between the others, especially in weak tie cases. Also, the alters will clearly be bridged to other ties whom the entrepreneur may be referred to but have a significant possibility that they will escape measurement. Therefore, in my dissertation, I will develop propositions surrounding structural holes, but I will not test the relationships between structural holes and the other proposed constructs.

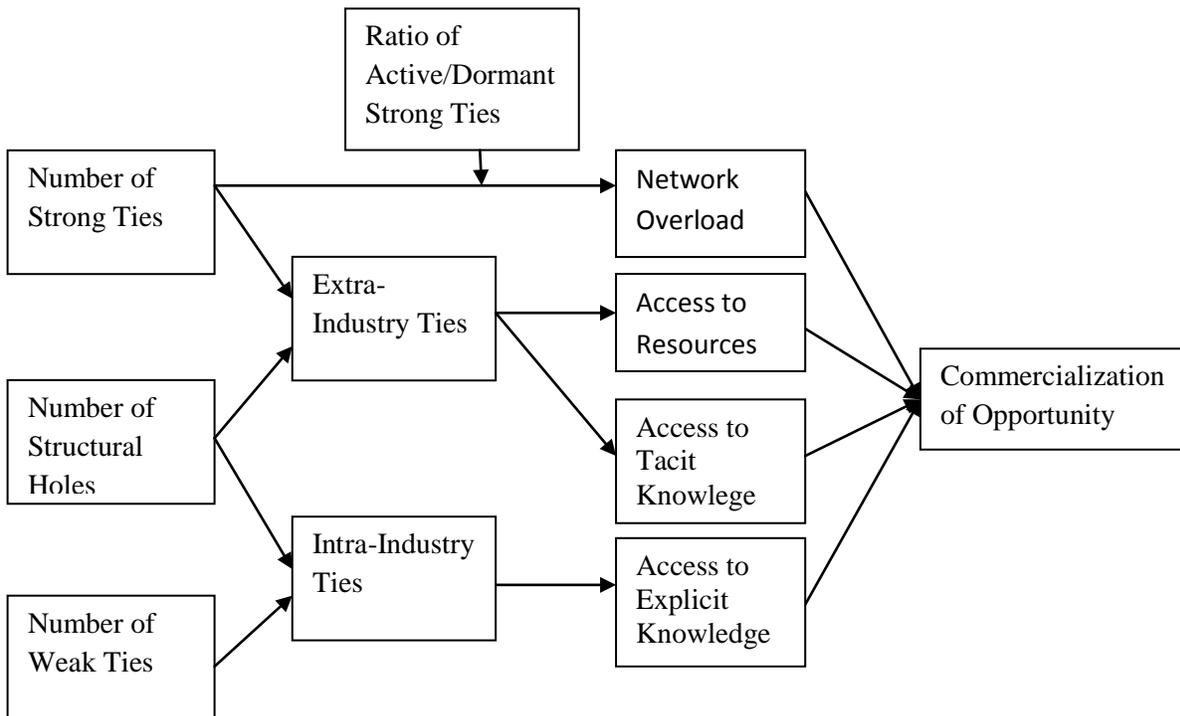
Pursuant to my model, the number of strong ties and structural holes are related to the number of extra-industry ties that are activated during the entrepreneurial process. Extra-industry ties exist when ego is connected to an alter who works in an industry other than the industry that ego has been working in before beginning the entrepreneurial process. The number of weak ties and structural holes are related to the number of intra-industry ties activated during the entrepreneurial process. Intra-industry ties exist when ego is connected to an alter who works in the same industry that ego has been working in before beginning the entrepreneurial process. To support these structural to resource connections, I rely on weak tie theory. Weak tie theory explicitly states that relationships from the work environment are more likely to be weak in nature. Conversely, familial and other strong tie relationships are more likely to be based on commonalities other than work (Granovetter, 1973). The number of extra-industry ties activated during the entrepreneurial process leads to greater access to resources and greater access to tacit knowledge, as well as, network overload. Access to resources consists of the entrepreneur's perception of his/her ability to gather the material and financial resources, as well as intangible resources, necessary to support the entrepreneurial venture. Access to tacit knowledge refers to the entrepreneur's perception of his/her ability to obtain or possess the necessary experiential

knowledge regarding the industry in which the entrepreneur will focus the new venture.

Network overload is the feeling that responsibilities created through the management of one's social network becomes overwhelming, and begins to impact the ability of ego to perform other necessary actions because of these responsibilities. The number of intra-industry ties activated during the entrepreneurial process leads to greater access to explicit knowledge. The relationship between the number of strong ties and network overload will be moderated by what percentage of those strong tie relationships that ego activates versus leaves dormant. I rely on the previous social capital theory? in the entrepreneurship field to draw these connections between certain types of knowledge and the source of such knowledge (Anderson, Park, & Jack, 2007).

In Figure 3 access to resources, access to tacit knowledge, and access to explicit knowledge will each impact the success of the entrepreneurial venture in commercializing the opportunity.

Figure 3  
Operationalized Model-



## **Structural Theories**

*Weak tie theory.* Social capital theory has developed over the last 40 years in a manner that has not always been consistent (Brass & Burkhardt, 1993; Burt, 1992; Burt, 1997; Coleman, 1990; Granovetter, 1973; Lin, 1981a; Lin, 1981b). From a historical perspective, weak tie theory as described by Mark Granovetter developed first (Granovetter, 1973; Granovetter, 1982). Granovetter relied upon the strength of the tie as the key concept. Tie strength is defined as the time, intensity, intimacy, and reciprocity which characterize the relationship between two persons (Granovetter, 1973). Weak ties are characterized by low levels of these definitional constructs, whereas high levels would lead the researcher to describe the relationship as a strong tie. Weak tie theory challenged the predominate understanding of social networks by suggesting that a diverse network with a large number of weak ties is a more advantageous network structure for the acquisition of unique and novel information than networks with large numbers of strong ties and few weak ties (Granovetter, 1973).

Early research in social network theory focused on strong ties, but this led to limited applicability because only networks that were small and well-defined could be investigated (Granovetter, 1973). Interpersonal relationships that are characterized as weak ties have generated great interest in the literature especially with regard to the careers specialty, but empirically the evidence that weak ties allow for greater diffusion of information or career success has been mixed (Bridges & Villemez, 1986; Granovetter, 1973; McPherson, Popielarz, & Drobnic, 1992; Murray, Rankin, & Magill, 1981; Seibert et al., 2001). This inability to answer all of the relevant social capital questions led to the development of structural hole theory (Burt, 1992; Burt, 1997).

*Structural hole theory.* Structural hole theory emerged in the last years of the twentieth century, and is heavily reliant on an imperfect market model where inefficiencies in the market leave certain people at an advantage because of their place in the network structure (Burt, 1997). A structural hole is the gap between two ties that are considered nonredundant; such that in an ego network if two alters are tied to ego but not each other, ego is said to fill a structural hole (Burt, 1992; Burt, 1997) Burt (1997) lists certain benefits to filling a structural hole in a network: access, timing, and referrals.

A network rich in structural holes should provide ego with access to information before other individuals are able to gain access to that same information (Burt, 1997). An entrepreneur can benefit from such a network structure because he/she is able to leverage information and relationships so that he/she will be able to identify opportunities more quickly, more thoroughly evaluate the potential of such opportunities, and take advantage of such opportunities to generate entrepreneurial profits. Structural hole theory has furthered our understanding of network structure, but has not proven to be the end of network inquiry (Borgatti & Foster, 2003; Seibert et al., 2001).

Structural hole theory is furthered with arguments about efficiency and effectiveness (Burt, 1992). Effective use of a network allows for single or reduced contacts to clusters of individuals because maintaining multiple contacts within that cluster is redundant, while effective use of a network offers that sometimes when the need is strong enough ego must maintain multiple contacts within a cluster to ensure that information flows from/to the different members of that cluster (Burt, 1992). Without delving into the accuracy of this conceptualization, I am able to draw significant parallels to the reasoning behind examining the role of active and dormant strong ties (Stevenson & Greenberg, 2000) as they may effect levels

of network overload experienced by an entrepreneur. To the entrepreneur strong ties are necessary to be able to get “expensive” information and resources at a reduced cost than if they have to obtain them on the free market. The maintenance of strong tie relationships may be costly from intangible perspectives of time and commitment to other less important tasks. I posit that effective use of the network of strong ties is to discriminately activate such ties only when necessary to benefit the entrepreneur or maintain the relationship, and thereby reduce the maintenance costs associated with such ties. This logic is in line with Burt’s approach to efficiency and effectiveness of networks.

*Activation of ties.* Essential to certain of the hypotheses developed in this dissertation is the difference between active and dormant ties. These concepts were clearly articulated in the work of Stevenson and Greenberg (2000), through the use of agency theory, they approached the question of how networks were used to exert influence over environmental policy within a city. This approach included the concept of activation of ties, and it posited that network structure alone was not enough to explain how social networks effect outcomes (Stevenson & Greenberg, 2000). Ego is unable to use the resources within the network based on the existence of a tie, rather there must be an attempt to exploit the tie to ego’s benefit. This concept is applicable to entrepreneurship research because resources and information are not going to be useful to an entrepreneur unless he/she can access them. Therefore, a tie must be engaged during the entrepreneurial process to provide benefits to the entrepreneur. A passive ego will receive fewer benefits than an active ego with regard to his/her social network, but will require less output from ego to manage. It would therefore be essential to know which ties can provide the proper information and/or resources to the entrepreneur at that time, and activate/deactivate such ties when appropriate.

## **Structural Variables**

*Strong ties.* A strong tie is defined as the tie between ego and alter that is characterized by high levels of intimacy and intensity together with a large amount of interaction and reciprocity (Granovetter, 1973). Intuitively, we can informally define a strong tie as a relationship where the parties communicate frequently about items of importance to them, and the interaction between them is shared between each other. Generally, strong ties develop outside of the work place through family and friendly relationships with those people whom you share other characteristics, such as hobbies, volunteer activities, or children who play together (Granovetter, 1973).

Strong tie relationships have not garnered much interest in the careers literature, but even Granovetter acknowledges that the strength of the tie between ego and alter make the strong tie a much more likely source for people trying to obtain information and/or resources, as opposed to a weak tie. (Granovetter, 1982). In examining an entrepreneurial model of social capital, we recognize that access to greater amounts of information is necessary to the entrepreneur's success, but the alter may have very little incentive to share such information with the entrepreneur. Strong ties are a means for overcoming this obstacle because of the reciprocal nature of the relationship (Nicolaou & Birley, 2003). Furthermore, it is argued that individuals who have a network that consists of a large number of strong ties and a high level of network diversity (extra-industry ties) are more likely to experience a career change (Nicolaou & Birley, 2003; Higgins & Kram, 2001). I argue that the information embedded within an entrepreneur's strong tie network is essential to understanding why an entrepreneur will attempt to exploit a venture without personally possessing the prerequisite prior knowledge of the industry because

the costs associated with gaining this knowledge make it possible for the entrepreneur to gain the knowledge without having to experience the new industry.

*Structural holes.* In so far as they constitute the only means for information to flow through networks from one clique to another, structural holes are structural placements of significance (Granovetter, 2005). Structural holes are said to exist when ego is the only connection between two separate alters (Burt, 1992). This placement as a connection between two different alters allows ego to access information from both sources, and as a result, ego is able to act in a different manner than either of the alters with their information alone. Arbitrage of the resources embedded in a social network is the means to which a structural hole is exploited (Burt, 1992).

Our understanding of entrepreneurial opportunities is enhanced when we consider the role that this structure places in the identification, evaluation, and exploitation of opportunities. Inherently, it can be seen how an entrepreneur can use structural holes to discover or create opportunities through the greater understanding that can be gained through connecting two diverse alters.

*Weak ties.* Intuitively, we can tell if a tie is weak or strong, but there are degrees to the weakness or strength of a tie (Granovetter, 1973). Weak ties are people who are less similar to us than strong ties (Granovetter, 2005). Ties that are less similar to us are more likely to contain truly novel information that will lead to insights in the entrepreneurial process. In the entrepreneurial context, it is argued that asymmetrical information diffusion allows the entrepreneur to act in a manner that is innovative or novel (Shane & Venkataraman, 2000). In scientific or learning communities, more information is diffused through weak ties than strong ties (Granovetter, 2005). Many high growth, high technology entrepreneurial opportunities are

related to scientific or learning-based discoveries, and the application of those discoveries to the world. Therefore, it is likely that these types of ties are essential to scientific-type breakthroughs and opportunity identification, but may be less important in the context of commercialization of an entrepreneurial opportunity.

Weak ties consist of contacts between ego and alter that are relatively short in duration and more formal in orientation. There are low levels of intimacy and intensity, and weak ties are more likely to result from working relationships, than friendly or family relationships (Granovetter, 1973). Theoretically, ego will have less in common with weak ties, and it will be more difficult for ego to obtain large investments of time and support from weak ties. Therefore, we can predict that weak ties will not only come from different places than strong ties, but will also lead to different types of information.

### **Social Resource Theory**

When ego interacts with alters in his/her network for instrumental purposes, the resources possessed by alter impacts the benefits received by ego (Lin et al., 1981a). It is suggested that the greater resources that an individual has at his/her disposal, the greater impact the network will have upon his/her instrumental purposes (Lin et al., 1981a). Some social contacts only will be able to provide information to an individual, whereas other contacts will be able to provide influence in the job seeking process (Lin et al., 1981b). Wealth, status, power, and information are resources that a social contact is able to lend to an individual linked to him/her, and these resources are able to advance the instrumental purpose of that individual (Lin et al., 1981b). It is likely that an individual who uses his/her social contacts for instrumental purposes will do so to obtain resources that he/she does not have under his/her personal control (Lin et al., 1981b).

Strong ties are often based upon certain similarities in social class, neighborhood, upbringing, education, etc., such that many of ego's strong ties will have similar levels of resources (i.e., a highly educated ego will have strong ties with other highly educated individuals). This is the "like-me principal" (Lin et al., 1981b). The like-me principal also leads to the assumption that a contact with greater resources under his/her control connects to others with access to similar levels of resources (Lin et al., 1981b).

### **Network Resource Variables**

Casson and Della Giusta (2007) adopt the following definition of social capital "the capitalized value of improvements in economic performance that can be attributed to high-trust social networks." This definition of social capital fails to consider value provided in economic performance from social networks that are not characterized as "high-trust." My extension of the Seibert *et al.*(2001) framework looks beyond "high-trust" networks, and therefore, my definition of social capital has to take this into account.

Different types of networks are required for the identification of opportunities as compared to the acquisition of resources (Casson & Della Giusta, 2007). Pursuant to the literature on absorptive capacity, an organization's ability to learn and creatively solve problems is enhanced by having a diverse workforce (Cohen & Levinthal, 2000). Similarly, an entrepreneur's ability to store knowledge and innovate can be enhanced through the diversity of his/her social network. This relates to how I conceptualize network resources. For the purpose of this study, I conceptualize network resources as the human capital that a person has developed as a result of working in a particular industry. Regardless of the resources of interest to the researcher, resources can be characterized through the constructs of network breadth and network depth.

*Network breadth.* When examining the resources embedded in a network, I have conceptualized these resources based upon how diverse the resources are within that network. The more diverse the network resources, the more the entrepreneur is able to obtain through the expenditure of social capital as he/she attempts to exploit the entrepreneurial opportunities available to him/her. For example, if an entrepreneur has a number of subject matter experts, individuals with access to investment capital, and other entrepreneurs with process expertise located within his/her network, he/she will be able to obtain more resources via his/her social network than an entrepreneur with a social network that only consists of individuals with subject matter expertise in one area and very little access to investment capital.

*Network depth.* Diversity of options and opinions may help the entrepreneur through the entrepreneurial process. Network depth is conceptualized as numerous individuals with similar, but not the same, resources at hand. Through multiple ties with persons of similar resources, the entrepreneur may be able to gain access to information that s/he would otherwise not know, because of the complimentary attributes of the overlap. For example, a rich network with multiple ties that allow an entrepreneur to test the marketability of a new product or service at multiple different points within a given area (geographic, industry, or otherwise), could be beneficial because of the input and information that is accessible from the variation in these sources.

### **Intra- and Extra-Industry Ties**

It is argued that a firm's performance is optimized through a fit between the strategic posture of that firm and the configuration of the intra- and extra-industry ties of that firm (Stam & Elfring, 2008). I am applying a similar argument to the level of the individual entrepreneur, and using these types of ties as an example of the resources embedded within the entrepreneur's

network. Although, this measurement may not capture all of the different resources embedded within a network, it does provide a general differentiation between types of resources that an alter may be able to offer an entrepreneur in the commercialization process. The entrepreneur can use the resources provided by ties to individuals in different industries in a manner different from the resources provided by ties to individuals in the same industry. I define intra-industry ties as the extent to which an entrepreneur can obtain information and access to firms within the industry that he/she has previously experienced. Whereas, extra-industry ties are defined as the extent to which an entrepreneur can obtain information, resources, and access to firms from industries in which he/she does not have prior experience.

In choosing to define network resources as that industry where the alter works vis-à-vis the industry in which the entrepreneur has previously worked, we make an assumption that the ego and alters have certain and novel knowledge and experiences that are a direct result from his/her experience in his/her respective industry. This rationale also may be used to explore why an entrepreneur may have veered into an industry in which he/she has not previously worked. I suggest that the work experience of the alters and the possible diffusion of information and resources from the alters to ego, because of the alters' role in such an industry, is a plausible explanation for this phenomenon. While this is an important aspect of intra- and extra-industry ties, it is more important to this research that the entrepreneur will have to begin bridging new markets or methods of production, etc. while attempting to commercialize their chosen opportunity. Their success at commercialization will be impacted by their access to information and resources located throughout the industries to which they are tied. Therefore, I have chosen to study the current industry aspect of the alters as the network resources of interest which are embedded in the social network.

## **Integration of Network Structure and Network Resources**

The approach of integrating network structure and resources is not without precedent (See Stevenson & Greenberg, 2000; Nicolaou & Birley, 2003; Podolny & Baron, 1997; Seibert et al., 2001; Sparrowe & Liden; 2005). It is becoming the standard by which social network research should be conducted (Jack, 2010). This integration has been conducted in the career advancement literature (Podolny & Baron, 1997), and examining such phenomenon as, environmental policy influence (Stevenson & Greenberg, 2000), influence networks (Sparrowe & Liden, 2005), and the university spinout context (Nicolaou & Birley, 2003). The integration of network structure and content is most thoroughly refined by the conceptualization of social capital theory as a holistic theory through the development of a framework that allows us to view the dominant theories as one (Seibert et al., 2001). It is based upon the methods of Seibert et al. (2001) that I have developed my model of the effects of social capital on the entrepreneurial process.

Although precedent exists for integration of network structure and resources, much of the current social capital research, especially in the field of entrepreneurship, focuses on either a structuralist (structure) or connectionist (resources/content) approach to test hypotheses (Borgatti & Foster, 2003). The structuralist approach focuses on the benefits of occupying a certain position in a network or developing a certain network structure, whereby the actor is able to take advantage of the benefits through his/her own volition (Borgatti & Foster, 2003). Whereas, the connectionist research approach concentrates on the particular benefits that a network can provide based upon the resources controlled by the persons in that network to determine how the network is effecting the phenomenon in question (Borgatti & Foster, 2003). Although, these theoretical approaches seem to be directly contradictory to each other, this is not the case and we

can develop paradigms that adapt to allow both a structural and connectionist approach to solving questions revolving around the impact of social networks in many different areas of the entrepreneurship process.

One of the first attempts to empirically integrate network structure and network resources in testing a model was conducted in the context of intra-organizational mobility (Podolny & Baron, 1997). This work is heavily cited in Seibert et al. (2001), and provides much of the early support for integrating the different theories that were previously thought to be divergent. Specifically, they found that by disaggregating ties by categorizing them as either rich or poor in resources that they were much more likely to be able to show the effects of the type of ties on career mobility (Podolny & Baron, 1997).

Although their model was not based on Seibert et al. (2001), Sparrowe and Liden (2005) were able to test both the LMX relationship and social network effects on a particular member's influence within his/her own organization. The results of their research provided strong support that the structure and content of the social network were significantly related to the level of influence that the member was able to exert on the organization (Sparrowe & Liden, 2005). Without specifically delineating it as such, this method resulted in both an integration of structure and content (Sparrowe & Liden, 2005).

In Nicolaou and Birley's (2003) study of university spinouts, they integrated both network structure and network content into their model. The strong tie relationships also were considered vital to the study because in the entrepreneurial context relationship strength was necessary to being able to acquire the necessary resources for the venture through the entrepreneur's strong tie network (Nicolaou & Birley, 2003). Again, their findings were consistent with the general hypothesis that network structure and network resources were

additively responsible for the university exodus of nascent entrepreneurs (Nicolaou & Birley, 2003).

There has been limited work conducted on researching social networks in this fashion, but the findings seem to compel a greater effort to explore questions through this analytic approach. Recently, Jack (2010) has argued that these more sophisticated and advanced questions need to be addressed to keep social network research in the field of entrepreneurship relevant.

### **Hypotheses and Propositions about Network Structure and Network Resources**

There are benefits and drawbacks for an entrepreneur to both strong ties and weak ties (Elfring & Hulsink, 2007). Much of the diffusion research that followed Granovetter (1973) was based on the assumption that strong tie relationships are characterized by redundant information because of the intimacy and intensity of the contacts between the persons, but this research is limited to the specialized knowledge of the strong tie that does not take into account factors other than the novelty of information for the purpose of finding a job.

The entrepreneur has multiple reasons for acquisition of knowledge. Among other reasons the entrepreneur may acquire knowledge to identify an idea that is ripe for entrepreneurial intervention or to evaluate an idea's potential as an entrepreneurial opportunity. It is likely that the entrepreneur would look to multiple types of sources depending upon the different types of information needed. Unlike Elfring & Hulsink (2007), where they examined the networking behaviors of entrepreneurs of different time frames of the entrepreneurial process, I examine the type of information that an entrepreneur cultivates during and in furtherance of the commercialization of the entrepreneurial opportunity. The type of information that leads to an entrepreneurial idea is often fleeting or passing. The entrepreneur may hear of

this information through casual conversation or in conjunction with the performance of his or her work duties. Often times this information will operate like a trigger where some information comes to the entrepreneur's attention and combining this information with the prior knowledge of the entrepreneur, the entrepreneur realizes the potential of an idea.

On the other hand, strong tie relationships may provide the entrepreneur with a more consistently reliable source of information. The strong tie relationship is characterized by a relatively large number of reciprocal exchanges; therefore, the entrepreneur is more likely to exploit this relationship to obtain expensive or complex information. Also, when the entrepreneur needs a more in depth set of information as to how things work in an industry that he/she is not familiar with, the nature of the strong tie will allow the entrepreneur to be more comfortable sharing his/her entrepreneurial idea, as well as asking for more substantial help and information.

As a function of the nature of tie strength, strong tie alters tend to be family and friends from outside of the workplace that share many of the same interests as ego (Granovetter, 1973). Ego's family and friends may have varied and diverse educational and work backgrounds that will likely result in such ties being classified as extra-industry. Extra-industry ties are those ties that ego has with alters from industries other than the industry that ego worked in prior to the start of his/her entrepreneurial venture. The low levels of intimacy and intensity that are present in weak tie relationships suggest that they are more of acquaintance type relationships, often resulting from the work place (Granovetter, 1973). As a result of the like-me principal, individuals tend to develop stronger ties with friends and families through social situations; and because they do not necessarily get to choose with whom they work, develop more professional relationships with those people with whom they do work. These formal, professional ties are

more likely to be with those persons involved in the same industry as ego, i.e. customers, suppliers, and co-workers. Therefore, I hypothesize that:

*Hypothesis 1: The number of strong ties the entrepreneur engages in the commercialization process will be positively related to the number of extra-industry ties the entrepreneur will have within his/her active entrepreneurial network.*

*Hypothesis 2: The number of weak ties the entrepreneur engages in the commercialization process will be positively related to the number of intra-industry ties the entrepreneur will have within his/her active entrepreneurial network.*

Burt (2001) argues that people who are more successful are somehow better connected, and most importantly, have structural advantages to their network that others do not. Structural hole theory provides that redundant ties are more likely to carry the same information to ego; therefore, structural holes are the most important structural benefit in that they link people from different social groups who are sources of novel information (Burt, 1992). The like-me principal would lead to the conclusion that structural holes are generally between weak tie alters, but in the case of entrepreneurial activation it may be that the entrepreneur fills the structural hole between a strong tie and a weak tie (Burt, 1997). Therefore, it stands that the activated ego centric network that is rich in structural holes will be likely to connect alters without regard to their relationship strength.

Theoretically, it has been argued that structural holes must be between weak ties only, because a strong tie will be constrained with regard to ego's ties (Burt, 1992). This position has been contested through a number of different studies considering agency (Stevenson & Greenberg, 2000) and innovation (Obstfeld, 2005). Obstfeld (2005) considers the value of these types of relationships to innovation, and posits that brokerage is not the only source of advantage, but that bringing together different ties will help foster innovation. It may be that at the outset of the entrepreneurial process a strong tie alter and weak tie alter are not connected,

but through the entrepreneurial process they become connected. This would be more consistent with the initial theoretical assumptions of structural hole theory, and would allow for the inclusion of a structural hole between a strong tie and a weak tie (Burt, 1992; Burt, 1997; Obstfeld, 2005). Also, there is no theoretical reason that would justify an assumption that the entrepreneur's extra-industry alters would be connected to the intra-industry alters at any different rate than the entrepreneur's intra-industry alters would be connected amongst themselves. The entrepreneur would be expected to have an random distribution among different industries with regard to the numbers of structural holes amongst those contacts that they have activated in the commercialization process.

Theoretically, Burt has argued that with more ties, there will be more structural holes (1992). Although this may be impossible to test in the current research and in most ego-centric research, it is possible to conceptualize that structural holes may play an important role in the commercialization process allowing entrepreneurs to access and capitalize on discrepancies in knowledge between different partners to the betterment of the venture. In the commercialization process the entrepreneur as a connector between contacts that are in both intra- and extra-industry roles would seem to provide the entrepreneur with benefits as they attempt to develop, innovate, and sell their innovative product on the marketplace. Thus, it is likely that the sheer number of structural holes activated in the entrepreneurial process will have a relationship with both the extra-industry ties and the intra-industry ties. Therefore, I hypothesize that:

*Proposition 1: The number of structural holes filled by the entrepreneur in his/her active entrepreneurial network will be positively related to the number of extra-industry ties that the entrepreneur engages within his/her entrepreneurial network.*

*Proposition 2: The number of structural holes filled by the entrepreneur in his/her active entrepreneurial network will be positively related to the number of intra-industry ties that the entrepreneur engages within his/her entrepreneurial network.*

## **Entrepreneurial Absorptive Capacity**

Absorptive capacity has been defined as the “routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce dynamic organizational capability” (Zahra & George, 2002). Firm-level absorptive capacity is developed through investments in the research and development process, the production process, and in advanced training for the firm’s personnel (Cohen & Levinthal, 1990). Prior knowledge is a key element to the development and expansion of firm-level absorptive capacity (Cohen & Levinthal 1990), but if a firm lacks the necessary prior knowledge regarding an opportunity that it is attempting to exploit many times it will reach outside the organization to import this knowledge. The nature of the knowledge that is required can be important to the firm’s ability to learn (Vega-Jurado, Gutierrez-Garcia, & Fernandez-de-Lucio, 2008).

Although the firm is the basic unit of analysis in absorptive capacity research (Zahra & George, 2002), I am extending this concept to help illustrate how the entrepreneur’s social network operates in the process of commercializing an entrepreneurial opportunity. Entrepreneurial opportunity, according to the discovery theory, is also strongly based upon prior knowledge, as we have discussed above (Shane & Venkataraman, 2000). Yet, discovery theorists have yet to approach entrepreneurs as informal organizationalists who will delve through their network in search of the information they need when they recognize that they lack the exact knowledge to capitalize on an entrepreneurial opportunity. The application of an absorptive capacity analogy to the entrepreneurial context allows us to envision the manner in which an entrepreneur may discriminately select which contacts to activate according to his/her own specialties, while attempting to cultivate his/her opportunity.

Diversity in the entrepreneur's network is important because entrepreneurs are unlikely to learn new and valuable information from people with the same background and experiences as them (Casson & Della Giusta, 2007). Entrepreneurs, like firms, can not exploit any knowledge if they have not previously acquired the knowledge and transferred it into the processes of the entrepreneurial venture (Zahra & George, 2002). Pursuant to the literature on absorptive capacity, an organization's ability to learn and creatively solve problems is enhanced by having a diverse workforce (Cohen & Levinthal, 2000).

Similarly, an entrepreneur's ability to acquire and store knowledge can be enhanced through the effective use and building of his/her social network. For example, an accountant ego with a strong tie to a computer programming alter will be more likely to notice an opportunity in the computer industry than an ego without a computer programming alter. Entrepreneurs may be able to leverage their social network to acquire the necessary prior knowledge through communication with alters in their network structure that are most likely to have and share tacit knowledge that they do not have access to otherwise. This is similar to the acquisition of knowledge by the firm when it is developing its absorptive capacity.

Entrepreneurial absorptive capacity is different from traditional absorptive capacity in that it cannot be created through training and selection of alters, but an entrepreneur does share a similarity with a firm in that he/she does have the same control over contractors to the extent that he/she is able to find the people with the tacit knowledge and compensate them for their knowledge. The process for adding strong tie relationships to the network is long and complicated, and oftentimes can not be done based upon a search of possible resources that the alter may possess. Therefore, the entrepreneur's ability to actively grow his/her absorptive capacity is limited in regard to how quickly he/she can grow the relevant strong tie network.

Considering the complexity with actively growing a strong tie network, the entrepreneur will benefit from a lifetime of building a large, diverse strong tie network.

Existing human capital and strong tie relationships play a strong role in the entrepreneur's ability to develop a weak tie network. They will be able to build on their own prior knowledge by developing relationships with persons who have information that is unique to their experience because they can share their own knowledge with potential ties. Entrepreneurs also will have the ability to discriminately add resource-rich ties to their network because they already have an existing base of knowledge which allows them to understand the experiences of their ties as they are communicated. This is similar to the firm's ability to grow its absorptive capacity more rapidly when it already has a high level of absorptive capacity (Mangematin & Nesta, 1999). The more knowledgeable an entrepreneur is, the more likely the entrepreneur is to add ties with similar and stronger capabilities through the use of existing ties within his/her network. For example, if I have basic knowledge of the real estate industry, and through a strong tie relationship I am able to become more specialized with regard to that knowledge, I am able to build more ties within that industry because I have the knowledge to discuss issues that surround that industry with new alters already in the real estate industry. The entrepreneur can keep adding to his/her social network in such a way that he/she can access the information stored in the network and receive the benefits alluded to by prior research.

Entrepreneurs need to be able to recognize the value of new information, and use that information to identify and evaluate entrepreneurial opportunities; just as firms need to recognize the value of new information, and apply it to commercial ends (Cohen & Levinthal, 1999; Newey & Zahra, 2009). As exogenous information is needed for firms to develop new products and services, the entrepreneur also needs to obtain external information for the development of

ideas and opportunities (Newey & Zahra, 2009). The more successful entrepreneurs are going to be able to manage their network relationships in such a way that they are extracting the most possible information and resources at the appropriate times.

The process by which an entrepreneur extracts this information from the environment is a key issue in this paper, and it allows us to answer such questions as how does the entrepreneur attempt to exploit an opportunity in an industry that he/she has no prior unique experience or knowledge. I posit that the entrepreneur's strong tie social network operates in a very similar manner as a firm's organizational capacity. Strong ties are believed to be redundant sources of information, but this overlooks a significant aspect of learning (Granovetter, 1973; Granovetter, 2005). For example, Ego A has a close relationship with Alter B, a commercial real estate broker. Ego A has not been a commercial real estate investor, but Ego A knows about Alter B's job through their existing relationship. Ego A does not know all of the same information as Alter B, but Ego A knows Alter B can be used to obtain knowledge that Ego A needs. Ego A finds out that a particular parcel of land will soon be for sale. This knowledge is not necessarily an opportunity unless Ego A has the skill and the resources to derive a profitable use from this parcel. Under most conventional interpretations of discover theory, Ego A will likely do nothing and the information will not be exploited. If we take a view of the strong tie to Alter B serving in a similar manner as an organization's absorptive capacity, when activated that tie becomes crucial because it adds to Ego A's pool of knowledge that will allow him/her to evaluate and exploit the opportunity at hand. I posit that if Ego A does believe that s/he can take advantage of this opportunity and chooses to pursue it, Ego A will do so because of the information and resources that can be extracted from Alter B.

Shane (2000) provides that social networks will allow the flow of information to entrepreneurs to aid their decision processes. This paper contends that it is possible for an entrepreneur to develop a portfolio of relationships that makes it possible for the greater accumulation of knowledge by the entrepreneur than could be accomplished alone (Shane, 2000); this is similar to building potential absorptive capacity (Zahra & George, 2002). The entrepreneur would then have to activate the tie in the social network to actually access information from such alters in his/her social network at the appropriate times; this is similar to the concept of realized absorptive capacity (Zahra & George, 2002). The entrepreneur would not have to have specific knowledge, but rather would be able to know where to find certain information within his/her social network. Conceptually, this is quite different from the scenario where the entrepreneur relies on his/her own prior knowledge to identify opportunities. An entrepreneur's social network is not only a means of information and resource transfer, but it is also a cache of knowledge that functions to increase his/her ability to identify, evaluate, and exploit opportunities based upon the extent of his/her social network.

### **Hypotheses about Network Resources and Network Effects**

*Access to information and resources.* The benefits of a social network, “include greater and more timely access to information, greater access to financial or material resources, and greater visibility, legitimacy, or sponsorship in a social system” (Seibert et al., 2001). The alters that ego ties to can provide him/her with the benefits necessary to accomplish his/her goals. This is among the most basic notions of social capital.

The alters who are present in a social network have access to “things” that ego does not. Research regarding social networks in entrepreneurship seeks to determine how access to these “things” influence entrepreneurial outcomes. The “things” that entrepreneurs seek are very

similar to those things that effect career advancement and mobility. For example, someone seeking to advance his/her career hopes to tie to those individuals who his/her organization views as legitimate thereby obtaining a sense of legitimacy by virtue of tie. In the same vein, entrepreneurs desire to be affiliated with persons or organizations viewed by their customers and suppliers as legitimate to demonstrate that their new venture is legitimate in the eyes of such persons or organizations. Resources can include intangible items such as the use of alters' names and reputations, but they also can include money, real estate, or other connections. These resources are necessary to exploit opportunities in the entrepreneurial context, especially when the entrepreneur does not possess them individually. Lack of such resources can contribute to a feeling of powerlessness, and, in the entrepreneurial context, abandonment (Spreitzer, 1996).

An entrepreneur seeking resources is likely to attempt to obtain them from those individuals that he/she has close contacts with and where the alter has high levels of trust in the entrepreneur (Hite, 2005; Smith & Lohrke, 2008). Also, intra-industry ties are unlikely to invest resources in ventures that may become competitive in nature, but ties from industries outside of the entrepreneurial venture will not be threatened by the opportunity that the entrepreneur is hoping to exploit. Based on the uncertainty of entrepreneurial outcomes, the investments required by alters, and the effects upon the industry in question, the strong tie/extra-industry linkage will be related to the entrepreneur's attempt to gain valuable resources in the entrepreneurial process.

For the purposes of this study, I have split access to information into two measurable constructs. First, access to tacit knowledge consists of ego's ability to gain knowledge that is intended to be explanatory in nature, such as in circumstances when ego does not know the exact information that is needed. Burt (1997) states, that one's social network "provides access to

information well beyond what he or she could process alone.” Tacit knowledge needs to be transferred intimately and, often times, through an exchange process (Anderson et al., 2007). For example, ego is generally aware of regulations regarding the sale of securities, but does not know what, how, or when such regulations may apply. The teaching of such knowledge can be difficult and require great costs to explain. Whereas, access to explicit knowledge is defined as ego’s ability to gain knowledge that is precise and codified in its application. For example, ego wants to find out who the buyer is at a particular company, this knowledge has the “character of a public good, and can be transferred at low cost” (Alvarez & Busenitz, 2001). The passing of such information is easy and can be done through the most basic methods of communication.

Tacit knowledge is most needed when the entrepreneur does not completely understand the environment in which he/she is considering the pursuit of an idea. The entrepreneur who activates more strong tie relationships is able to gather more tacit knowledge about areas in which he/she is not knowledgeable because his/her past experiences are from different industries. As a result of the intimate nature and the reciprocal exchanges present in strong tie relationships, the entrepreneur is able to safely and economically gather tacit knowledge that is necessary to the identification and evaluation of opportunities in industries with which he/she is not familiar through the organization of alters’ experiences in this industry (Anderson et al., 2007).

Explicit knowledge is necessary when the entrepreneur is attempting to pursue a venture in an industry with which he/she is familiar, but may lack the necessary connections to thoroughly exploit an opportunity. This type of information is safely obtained through a network rich in weak ties throughout the entrepreneurial process, and, because the relative investment of the alter in transferring such knowledge is low, easily accessible through weak tie relationships

(Alvarez & Busenitz, 2001). Explicit knowledge may be transferred through the formal communication methods (Anderson et al., 2007). Therefore, I hypothesize:

*Hypothesis 3a: The number of extra-industry ties that the entrepreneur engages in the commercialization process will be positively related to the entrepreneur's access to resources with regard to the entrepreneurial opportunity*

*Hypothesis 3b: The number of extra-industry ties that the entrepreneur engages in the commercialization process will be positively related to the entrepreneur's access to tacit knowledge with regard to the entrepreneurial opportunity.*

*Hypothesis 3c: The number of intra-industry ties that the entrepreneur engages in the commercialization process will be positively related to the entrepreneur's access to explicit knowledge with regard to the entrepreneurial opportunity.*

*Network Overload.* Generally speaking, all of the integrated social capital theories view social networks as a means to a positive end (Seibert et al., 2001). It is usually overlooked that the ego's social network can have negative effects on their career, venture, or other instrumental outcomes. Although, if the entrepreneur is seeking to establish legitimacy through connections to others, being connected to someone viewed as illegitimate may hurt the entrepreneur's chances of success. Career mobility has been shown to be negatively effected by connections to those outside of the organizational trust structure (Podolny & Baron, 1997). Through this generalized conceptualization of negative network effects, I propose to put forth a new construct in the social network literature: network overload. As noted above, I define network overload as the feeling that responsibilities created through the management of one's social network becomes overwhelming, and begins to impact the ability of ego to perform other necessary actions because of these responsibilities.

A careful review of the literature related to role overload has convinced me that these topics are significantly related. The conceptualizations advanced by Seashore, Lawler, Mirvis, and Cammann (1982) provided the background to further this concept. Much like role overload,

network overload creates a feeling in entrepreneurs that they are not able to accomplish all of things that they need to accomplish. Instead of too many roles or too ambiguous of a definition of one's role, this feeling comes from all of the time and responsibilities that are generated from managing the entrepreneur's social network. As I have stated, the relationships in this social network are reciprocal in nature and, therefore, obtaining information or resources from a social contact may have an unintended cost. Finally, this feeling may result from the entrepreneur's lack of skill in networking, i.e. some people are more natural networkers than others.

This general idea is brought to the forefront of the strategy literature in a study where exploration and exploitation tasks were examined in the context of new product development teams (Hansen et al., 2001). In this study, it was found that teams who were performing tasks related to exploration were greatly benefited by numerous non-redundant strong tie relationships; although, when they were performing exploitation tasks they worked much more slowly because new information was essential to the task at hand, but they still needed to maintain these strong tie relationships (Hansen et al., 2001). In this context, it only slowed down their development of the product, but slowing down a high growth entrepreneurial firm in its formative stages could be tantamount to creating a situation where the entrepreneur never gets the product into the marketplace. Theoretically, this work provides a basis in the literature for the importation of the ideas into the field of entrepreneurship, while demonstrating the real life phenomenon of interest.

*Hypothesis 4: The number of strong ties that an entrepreneur has in his/her network is positively related to network overload.*

Network overload is another area of the model where the activation of ties becomes essential to our understanding of how social networks work within the entrepreneurial process. Previous hypotheses related to strong ties have relied on the number of activated ties. However, I argue that the skill in networking can be exemplified by the entrepreneur in only activating

those network ties that are essential to the instrumental purposes of the entrepreneur (Stevenson & Greenberg, 2000). The more strong ties that an entrepreneur keeps active, the more reciprocal obligations the entrepreneur will be responsible for during their day-to-day upkeep. Therefore, it follows that lower ratios of active strong ties provide for the more efficient management of ego's network.

*Proposition 3: The positive relationship between the number of strong ties and network overload is moderated by the percentage of active to dormant strong ties in that network such that the relationship is weaker when the percentage is low.*

### **Entrepreneurial Process and Commercialization**

Defining entrepreneurship as the discovery or identification, evaluation, and exploitation of entrepreneurial opportunities allows us to view entrepreneurship as a clear event for purposes of study (Shane & Venkataraman, 2000). Entrepreneurial opportunities are situations in the market where new goods, services, raw materials, and organizing methods can be introduced and sold for a profit or a larger profit than was available before (Casson, 1982; Shane & Venkataraman, 2000). This specific articulation of what entrepreneurship is allows researchers to be more precise with their research in this specified domain (Venkataraman, 1997). Shane and Venkataraman's (2000) paradigm does not conceptualize where and when social networks function in the entrepreneurial process, rather it allows for flows in and out of information to the entrepreneur.

Central to any research done under the Shane and Venkataraman (2000) conceptualization of entrepreneurship is the assumption of market disequilibrium, and it is through this disequilibrium that entrepreneurial opportunities are created and, therefore, discoverable. Informational asymmetry is identified as the antecedent of opportunity identification, and it is a stated assumption that informational asymmetry is the sole result of unique prior knowledge and experiences that the entrepreneur possesses (Shane, 2000). This

approach is supported by Austrian economics, and it challenges the assumption that anyone can discover any particular entrepreneurial opportunity and that market information is distributed on a perfectly competitive basis by arguing that each person has a unique prior knowledge and that they view the world through the lens of that prior knowledge, such that they may or may not be capable of identifying a particular entrepreneurial opportunity (Shane, 2000; Venkataraman, 1997; Kirzner, 1997).

Although knowledge may be the necessary condition to the entrepreneurial process, the ability to make the connection between this knowledge and the opportunity are necessary for the development of a successful venture (Venkataraman, 1997). Often times, this connection results in the creation of a new venture to pursue the identified opportunity (Gartner, 1985; Katz & Gartner, 1988; Katz, 1993). Although the discovery framework does not require the creation of a new venture, it complements the study of new venture creation (Shane & Venkataraman, 2000).

This view of entrepreneurial opportunities suggests that each potential entrepreneur has unique experiences and knowledge that allows him/her to assign different values to a potential opportunity (Shane, 2000). The concept of informational asymmetry provides the basis as to why some people discover entrepreneurial opportunities, and it helps to explain why cognitive and trait approaches to the discovery of entrepreneurial opportunities have had mixed success (Stewart & Roth, 2007; Baron, 1998). Furthermore, this approach explains why entrepreneurial firms alter the market status quo by including new information as to how to add value to the allocation of resources in new or old markets (Eckhardt & Shane, 2003).

Commercialization is a necessary step of the entrepreneurial paradigm as put forth by Shane and Venkataraman (2000) falling under the exploitation of the opportunity. The bringing of information to bear on value-added innovations is the essence of technological

commercialization, and it is at the core of this study, while being one of the critical outcomes of entrepreneurship (Wright, Hmieleski, Siegel, & Ensley, 2007). This study chooses to focus on firms that generally are attempting to venture within the realm of technological innovation and commercialization. As technological innovations bring goods and services to the market, they have the ability to radically destabilize and grow the economy.

### **Hypotheses about Network Effects and Commercialization of Entrepreneurial Opportunities**

In this following sections, I develop the final sets of hypotheses. The teleological theories, discovery and creation, are concerned with the concept of predicting entrepreneurial behavior (Alvarez & Barney, 2007a). The dependent variable that I chose to examine in this dissertation is commercialization of the entrepreneurial venture, and I do so under the discovery framework.

*Opportunity exploitation.* Commercialization has been defined as “acquiring ideas, augmenting them with complimentary knowledge, developing and manufacturing saleable goods, and selling the goods in a marketplace” (Mitchell & Singh, 1996). The application of this definition to entrepreneurship research is problematic. First, the acquiring ideas and augmentation with complimentary knowledge is assumed in the entrepreneurial context. The firm was not in existence, and, therefore, did not have existing ideas or knowledge. As such, you need to look at the individual entrepreneur. Second, the definition only relates to saleable goods. The definition of entrepreneurship extends beyond goods, to the development of services or new means/end relationships (Shane & Venkataraman, 2000). Therefore, for the purposes of this dissertation, I define commercialization as the development and preparation for sale of a new product (good or service) or new means to prepare for sale an existing product, and actually selling such product. With that said, my definition assumes that the entrepreneur believes that

he/she will be able to realize returns from the investment of time and resources in the process of commercialization that justify such an investment (Nekrar & Shane, 2007).

This sale of a product is not necessary for exploitation of an opportunity. Entrepreneurial ventures in the high technology areas may commercialize their innovations through the licensing of their technology. This licensing can achieve the necessary returns to justify the costs of exploiting the opportunity.

Access to resources and access to tacit knowledge will both influence the entrepreneur's ability to commercialize the product or alter the means of producing the product. Resources are necessary for bringing a product to the marketplace whether the product is a service or good. Resources also provide the entrepreneur with the means necessary for the research and development of innovations such that they become suitable for the market place. The innovation must actually be developed to the point that someone is willing to buy or license the new technology. If the entrepreneur has ample resources, it is likely that he/she will be able to do so in a shorter amount of time vis-à-vis entrepreneur's who do not have ample resources. This allows for a quicker and more successful commercialization. Tacit knowledge is also necessary for the commercialization of innovations. The entrepreneur must have or bring together the necessary experiential knowledge to create a good that is useful in the existing industrial structure. Furthermore, in the alteration of the status quo or development of services that require innovative technological changes, the entrepreneur must have access to the necessary know-how of not only the current status quo, but in the future of the industry that venture attempts to innovate.

Explicit knowledge, such as who may be the appropriate person at firm X to whom to try to sell a product, is also necessary to the development and commercialization of innovative

opportunities. As the entrepreneur attempts to sell and gain market share, the entrepreneur will need the specific information regarding competitors, suppliers, customers, complimentary technological innovations and uses that will allow the sale of the innovation in the market.

It follows that I hypothesize that:

*Hypothesis 5a: An entrepreneur's access to resources will be positively related to his/her ability to exploit new opportunities through the successful commercialization of his/her venture.*

*Hypothesis 5b: An entrepreneur's access to tacit knowledge will be positively related to his/her ability to exploit new opportunities through the successful commercialization of his/her venture.*

*Hypothesis 5c: An entrepreneur's access to explicit knowledge will be positively related to his/her ability to exploit new opportunities through the successful commercialization of his/her venture.*

Network overload is conceptualized as a negative effect of social networking. In theory, this construct should take away from the entrepreneur's time and efforts that could be focused on commercializing an entrepreneurial opportunity, while the entrepreneur focuses on issues regarding the maintenance of the relationships causing this feeling. If the entrepreneur is experiencing anxiety from the burdens of these relationships and the costs of association, then it only stands to reason that his/her performance of tasks relating to the commercialization of the opportunity shall suffer. As this overload increases, the commercialization of the opportunity will begin to become more and more difficult. Therefore, I hypothesize that:

*Hypothesis 5d: Network overload will be negatively related to an entrepreneur's ability to exploit new opportunities through the successful commercialization of a product.*

## CHAPTER 3

### RESEARCH DESIGN

#### Sample and Data Collection Procedures

This dissertation began with a data collection strategy where a sample of entrepreneurs would be taken from business incubators located throughout Virginia and North Carolina. There are 63 incubators located within these two states. Each of the individual incubator directors were contacted as to their willingness to allow their tenants to participate in the survey. Although numerous incubator directors expressed interest in having their tenants take part, only 5 incubators chose to participate. This resulted in 14 usable surveys. Based on low response rates, I expanded my research to include incubators in Southern Ohio, Kentucky, and Tennessee. I still only had 17 usable surveys from the 9 incubators that chose to participate. After site visits to incubators in Greensboro, NC and Cincinnati, OH, I was able to obtain a total of 36 usable surveys. At this time, I chose to abandon this data collection strategy and focus on large, high-growth focused incubators that had hundreds of tenants in one location.

Cambridge Innovation Center in Cambridge, Massachusetts is an innovative community of entrepreneurs that are generally speaking part of the MIT entrepreneurial ecosystem. This community combines an excellent address (located across the street from the Sloan School of Business), first rate office space with all technological necessities for starting a high growth startup, and the flexibility in office space required for new ventures as they grow. It also has a vibrant entrepreneurial atmosphere that allows for interaction among many different entrepreneurs attempting to exploit opportunities in a varied collection of high growth industries.

An initial on-line survey (using Qualtrics software) was developed and distributed through email, through the director of the Cambridge Innovation Center. Two weeks after the

initial request to participate in the survey, a reminder to the potential participants who had not responded was emailed. Paper surveys also were generated, and were delivered to numerous entrepreneurs through on-site visits. During these multiple on-site visits, I used participatory observation, surveys, and directed interviews to collect data and to provide a level of richness to my understanding of the research participants and phenomenon that is not necessarily clear from surveys alone.

At CIC there are just over 300 tenants, and I provided the following definition of entrepreneur/founder to the director of the CIC, “Ventures (1) where the main decision-maker is located at CIC, and (2) where the venture is attempting to commercialize an innovative product, service or good.” Based upon privacy considerations of the tenants, I was not given the exact names of every tenant emailed the survey, but was told that roughly 250 entrepreneurs were invited to participate in the survey. From that initial sample, 68 usable surveys were received through email and written surveys conducted during my onsite visits. This is a 27.2% response rate. After the surveys were received, they were coded and data was entered for analyses, removing any identifying statement regarding the entrepreneur, venture, or contacts. The average age of the respondents was 40.5 years old, with a range from 23 to 63 years old. The sample was heavily skewed to the male with almost 84 percent being men, while 56 percent of the respondents had completed an advanced degree, and 78 percent of the sample being white. Of the ventures, 16 percent of them had outside members on their board of directors. All of these ventures would be considered connected to high growth or high technology industries.

The data were collected and the analyses were conducted at the individual level, whereby one founder from each venture responded to the survey with regard to his/her own personal contacts. I provided a definition of the founder in the instructions that consisted of the individual

who identified the opportunity, took the initial steps of organizing the venture, and is still attempting to exploit such venture. This individual level of analysis is essential to the question of how social networks are used, and if a team may have been constructed, they will have been done so at the request of the founder.

Ventures located within business incubators provide many natural advantages as a population for research. First, in entrepreneurship research it is difficult to locate and identify a group of potential or actual entrepreneurs. Business incubators create an actual location where entrepreneurs are able to operate their venture from a very early point in the entrepreneurial process. Second, many of the methods for identifying a population of entrepreneurs presuppose a level of investment by the entrepreneur that indicates that the venture is in the final stages of the corporate development, i.e. applications for business licenses, incorporations, etc. Finally, there are many natural control variables built into the incubator, such that research there is almost quasi-experimental, because these ventures are started with a large number of similar environmental factors, such as contacts with the incubator director, availability of similar office arrangements, location, etc.; and a clearly identifiable, valid, and reliable dependent variable (successfully progressing out of the incubator) can be captured after a period of time.

### **Participatory Observation**

I spent three different afternoons in the Venture Café at CIC watching different entrepreneurs meet with business associates, a potential new hire, clients, investors, and other entrepreneurs. They were discussing everything from random current events to the compensation package for the new CFO of a software start-up. One of the common events relevant to social network scholars that I observed was how often and easily some people bridged ties. It did not appear that they were doing it for a direct benefit, rather it seemed that those entrepreneurs who

introduced people to each other in the Café did so because it was a possible way of building idiosyncratic credits amongst the different entrepreneurs.

It also was apparent to me that those people who were performing bridging activities were doing so often and repeatedly. They seemed to have a greater interest in bringing people together. Less social people within the Café environment, used the Café simply as a means of acquiring food and drinks and then moved on to whatever else they were doing. Upon questioning, two of the entrepreneurs whom I talked to said that they liked to introduce people to others because “other entrepreneurs appreciated the ability to meet people with similar interests.” The entrepreneurs tended to take longer for lunch and spend more time loitering. It was as if they were looking to meet new people and/or introduce people they new to others.

I watched one particular well connected individual strike up a conversation with another entrepreneur. He started by asking about the subjects educational background. When they did not share anything in this arena, he started talking about sports. Eventually, they found that they both liked competitive cycling. After 5 or 10 minutes on this topic, the entrepreneurs began discussing their businesses. Upon questioning, the well connected individual responded that these types of contacts “were absolutely necessary for me to find out what my potential clients are looking for in new products.” The entrepreneur is attempting to build a number of innovative tools for the biotech/pharma industries.

Another form of participatory observation that I took part in were the Thursday evening social networking events at CIC’s Venture Café. The CIC provides free beer and wine to members of the MIT entrepreneurial community visiting the CIC, the entrepreneurs whose firms are at CIC, and their employees. With the vast entrepreneurial community at MIT and some of

the Harvard Business School people tagging along, there are between 120-200 individuals at these meetings. It is much more a social event, but if you listen closely, you can hear many different groups talking business. It is not a sales-centered network event. It is a friendly gathering of people where many different things are running on the sidelines, such as a presentation for those interested by the director of the Cantana Singers Chamber Series on the importance of Bach's Mass in B Minor or a venture capital roundtable is held for invited participants. The conversations were often exploratory with probing questions to find similar interests in the same manner that was described in the previous paragraph.

## **Interviews**

Interviews were conducted during mornings on the days that I made on-site visits. I interviewed 8 entrepreneurs for 30 minutes each. One entrepreneur was a female art student at UCLA, who moved to Cambridge to attend Harvard Business School. She had started 3 different ventures by her 25<sup>th</sup> birthday. Each of these ventures were started because of her interests in software and art. She was able to use her connections with professors at UCLA to “gain the necessary knowledge to obtain a \$250,000 grant. Without, that grant this project would never have gotten to the market.” She used two professors whom “she had very close relationships with because of having worked for them in the past.” If she had not worked for them, it “would be unlikely that they would have spent the time necessary to help me write the grant proposals.” These interviews provided me with support that at least anecdotally indicated that my initial hypotheses were grounded in the reality of how entrepreneurs use their social network, as well as the background from social network theory.

Throughout much of the interviews, I was repeatedly told about the importance of referrals. Although not included within the hypothesized model, I considered the importance of referrals in the research design phase of this project, and I collected static data about whether a contact was a source of referrals. Based upon the content of the interviews, “some people are so well connected, that they can help you in so many different ways...from finding investors to knowing which software designer to talk to...and may know where the best deal on computer paper is...”, I believe that I found an important phenomenon for future study in social network research. The data that I collected is not rich enough to really get at the type of role that the “referrer” plays. Essentially, I now believe that there are some people within an entrepreneurial ecosystem that once tapped into for assistance, can be game changers because you then gain access to their extensive social network. The role of the “referrer” is one that has not been thoroughly investigated in the entrepreneurship literature.

### **Measures-Independent Variables**

*Social capital variables.* Respondents (Ego) were asked to list the first name and last initial of each person who helped their venture. There were four such questions to stimulate their ability to recall the assistance that these contacts provided. One example of a question was to provide the name of persons “who have helped your venture by providing information that allowed you to identify opportunities, new uses for your product or service, and/or new products or services that you could provide.” Ego were limited to 15 individuals whom they could list, but no Ego listed more than 12 individuals. These descriptions of network relations were chosen based upon theoretical considerations that the most important aspect of the network structure in entrepreneurial ventures are others (i.e., alters) who have been active in the entrepreneurial process.

Ego was asked how close he or she was to each individual listed on a scale of 1, 2, or 3; where 1 is distant, 2 is less close, and 3 is especially close. Distant relations or 1 were defined as persons with whom he/she either didn't know or didn't interact with unless it is necessary prior to the start of his/her venture. Less close relations or 2 were defined as persons with whom they are on good terms, but probably don't count among his/her closest contacts. Especially close relations or 3 were defined as persons with whom he/she counts among his/her closest contacts. *Active weak ties* is the sum of alters that ego responded on this scale as 1 or 2. Ego also was asked to list the initials of individuals "who you are in regular contact with and that you consider to be especially close from whom you have not received any help, resources, or information with regard to this venture." The contacts listed pursuant to this question were added to those contacts that ego classified on the preceding scale to create the variable of *active strong ties*.

*Dormant strong ties* is the sum of the individuals ego lists pursuant to the question, "list those persons that you consider to be especially close... that you DO NOT currently keep in regular contact with that would be willing to provide you with information, resources, and/or other types of support if you asked them." The survey provided a number of different situations where the individual might have built this relationship, such as during their education, prior work experiences, volunteer experiences, or family members.

With regard to each tie listed by Ego that has provided the venture assistance, the respondent was asked to state the industry affiliation of the alter. *Extra-industry ties* is the sum of ties that ego reports the specific alter as being from an industry other than ego. *Intra-industry ties* is the sum of ties that ego reports the specific alter as being from the same industry as ego.

*Network overload*. Network overload is the perception of the entrepreneur that the requirements of building, maintaining, and organizing his/her network take away from and

hinder his/her ability to accomplish instrumental tasks related to the entrepreneurial venture. The network overload scale was developed for this project pursuant to the best practices in scale development. Deductively, I created 12 items from the theoretical definition of this construct. After an expert review, one item was dropped because it was not meaningfully related to the definition. I then tested this measure with a separate sample of 58 entrepreneurs located in various business incubators, students in a new venture creation class who were in the process of starting a venture, and executive level employees at various firms. The factor analysis conducted was a principle components analysis with a varimax rotation using a minimum eigenvalue of 1.0. The factor analysis results indicated that 3 items double loaded and were dropped, resulting in an 8-item scale loading on a single factor (See Table 1 for factor loadings). The reliability of this measure was checked (Cronbach  $\alpha=.88$ ). The measure was retested for validity and reliability with the data used to test the hypotheses in this study. The CIC data was tested using factor analysis conducted was a principle components analysis with a varimax rotation using a minimum eigenvalue of 1.0 again, confirming a unidimensional construct (See Table 1 for factor loadings). This factor analysis resulted in dropping two further items, due to double loading on two factors, from the scale resulting in a reliable six-item scale (Cronbach  $\alpha=.85$ )The content validity and reliability appear to support that I have properly operationalized the network overload construct.

Table 1 Results of Exploratory Factor Analysis using Principal Factors

Item	Test 1	Test 2
I never seem to have enough time to get everything done because I have to build my network.	.876	.878
I spend too much of my time networking to do everything else well.	.863	.781
I spend too much of my work day managing my networks.	.853	.794
My work suffers from my networking activities.	.791	.744
When I am managing my network, I feel anxious that I should be doing other things.	.705	.680
The size of my network is manageable enough that my work doesn't suffer.	.698	.619
It takes too much effort to maintain the necessary business relationships to accomplish all of my duties.	.655	DL
The amount of networking that I need to do is reasonable and allows me to complete other tasks efficiently.	.534	DL
My network is the right size for the accomplishment of all my goals.	DL	
When I need resources or information to benefit my venture, I am able to obtain them from my network in a timely manner.	DL	
I am able to keep people in my network happy, so that I have sufficient time left to do my work.	DL	
Sample Size	58	68

*Access to resources.* Access to resources consists of the entrepreneur's perception of his/her ability to gather the material and financial resources, as well as intangible resources, necessary to support the entrepreneurial venture. The access to resources scale is a 3-item measure (Cronbach  $\alpha$ =.94) first validated by Spreitzer (1996).

*Access to tacit knowledge.* Access to tacit knowledge refers to the entrepreneur's perception of his/her ability to obtain or possess the necessary experiential knowledge regarding the industry in which the entrepreneur will focus the new venture. The scale used to measure access to tacit knowledge was developed specifically for this project after a review of the access to knowledge literature in the entrepreneurship domain, and based upon the definition used in this dissertation. The scale initially contained five items, but after an exploratory factor analysis was performed, one of the items loaded on a second factor. After dropping this item, the

remaining four items satisfactorily loaded on a single factor and produced an acceptable Cronbach alpha ( $\alpha = .72$ ).

*Access to explicit knowledge.* Access to explicit knowledge is defined as ego's ability to gain knowledge that is precise and codified in its application. The scale used to measure access to explicit knowledge was developed specifically for this project after a review of the access to knowledge literature in the entrepreneurship domain, and is based upon the definition used in this dissertation. The scale contains four items, and had a Cronbach alpha of .69. While low, this level of reliability can be viewed as acceptable in exploratory studies such as this one (Nunnally, 1978).

### **Measures - Dependent Variables**

*Commercialization.* I have chosen to use a subjective measure of commercialization. Measuring commercialization in early stage ventures is a difficult proposition because sales numbers can become skewed based upon numerous factors, such as price, market, or industry. Therefore, a subjective measure of commercialization based upon how the entrepreneur believes they are performing vis-à-vis their self-defined competition is not without practical or theoretical basis. Using a modified scale first developed by Stam and Elfring (2008) to measure new venture performance, respondents were asked, "relative to your principal competitors, rate your firm performance over the past year on the following items." There were four items total, including "innovation in products/services; speed in developing new products/service; quality of new products/services; and customer use and acceptance of new products/services. The respondent was given five options: much worse, worse, equal, better, and much better. This scale had a Cronbach  $\alpha = .75$ . This reliability measure is similar to that found in Stam and Elfring (2008)

who reported an alpha of .80. Stam and Elfring's (2008) performance measure also had significant correlation with sales growth

### **Measures - Control Variables**

Although some control variables, such as geography, are taken into account by the sample selection, i.e. every entity being based out of the same address in Cambridge, Massachusetts, there are a number of variables that could theoretically impact the results of this study unless they are controlled for within study itself. I have identified a number of potential control variables that will be essential to establishing the validity of this study. The impact of incorporation on new venture survival has shown at least partial support in a study by Dahlgvist, Davidsson, and Wiklund (2000), and as such should be controlled for in this study to count this out as an alternative explanation to success in commercialization. Amount of initial capital and founder gender both were found to have an effect on venture growth in multiple studies, and as such venture capital involvement and founder gender were measured as control variables (Dahlgvist et al., 2000; Cooper, Gimeno-Gascon, & Woo, 1994). The role of outside members on the board of directors can operate to extend the social network of the founder beyond its own inherent limitations, therefore, effecting the results of this study. Finally, the personality of the entrepreneur could also play a role in the success of the firm or the impact that a large network would have on the entrepreneur's ability to cope with the requirements of that network while attempting to commercialize innovations, therefore, I measured personality I collected Core Self Evaluations for each of the entrepreneurs (Judge, Erez, Bono, & Thoresen, 2006). Although not used in this dissertation because of lack of degrees of freedom, I have collected such variables for use in the development of any manuscript as the data collection grows to include a sufficient sample size to allow the use of multiple control variables.

## **Analytical Methods**

To test the individual hypotheses, I used partial correlations holding the other constructs constant to mimic results that would be found if the number of respondents was suitable for Structural Equation Modeling. These partial correlations will be reported as between construct loadings. As a result of the small number of respondents, I have determined an exploratory significance level for .10 will be used to determine support for my hypotheses.

## Chapter 4

### Analyses

#### Hypotheses Testing

I tested the hypotheses using partial correlations to mimic the results of Structural Equation Modeling (SEM), which I would have used had there been enough respondents to use this method of analysis. Because we only had 68 usable respondents, SEM software programs such as LISREL would not be interpretable. The partial correlations tested the loadings between two constructs, where each of the others variables were held constant. The three propositions were not tested. Table 2 presents the means, standard deviations, and correlations of the constructs measured in this model.

Table 2. Means, Standard Deviations, and Correlations

Variable	Mean	Std Dev	1	2	3	4	5	6	7	8
1. Strong Ties	7.28	3.81								
2. Weak Ties	3.32	1.95	0.04							
3. Depth	2.60	1.98	0.08	0.67***						
4. Breadth	4.56	2.56	0.53***	0.27*	-0.18					
5. Network Overload	2.33	0.67	-0.06	0.07	0.29**	-0.20				
6. Access to Resources	3.46	1.11	0.03	0.08	0.07	0.03	-0.20			
7. Access to Tacit Information	3.60	0.78	-0.17	-0.03	-0.09	-0.10	-0.31**	0.13		
8. Access to Explicit Information	3.49	0.87	-0.07	-0.14	-0.05	-0.16	0.00	0.11	0.61***	
9. Commercialization	3.71	0.84	-0.22*	-0.14	-0.21*	0.02	-0.12	-0.08	0.34**	0.27*

N = 68

\*(p<.05); \*\*(p<.01); \*\*\*(p<.001)

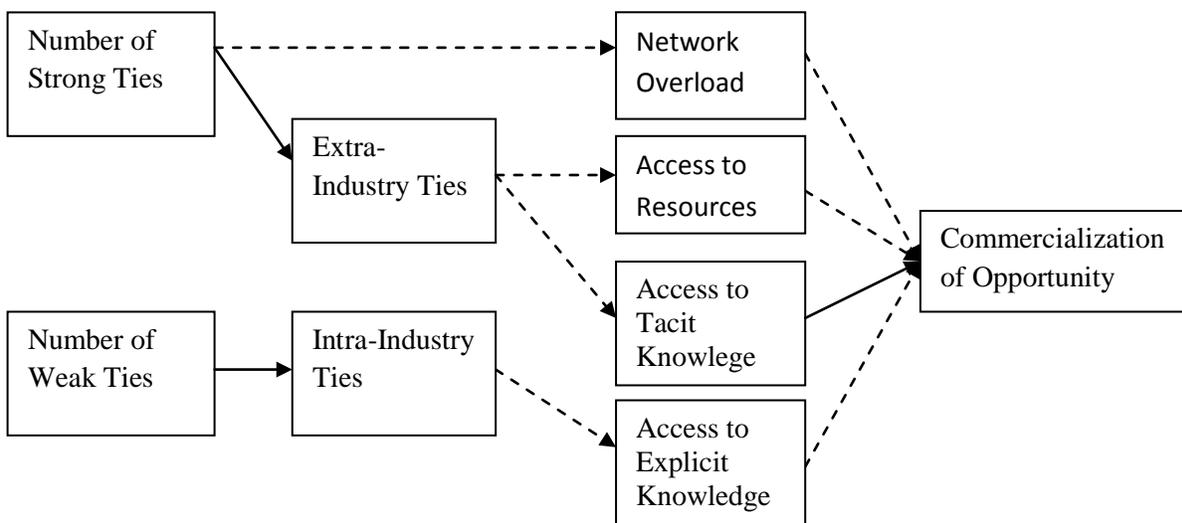
The results as reported in Table 2 are interesting in a number of ways. First, both the correlation between strong ties and breadth, and weak ties and depth, as theoretically supported, were significant and strong. Second, the significant and strongly overlapping correlation between access to tacit and explicit information, lead us to question whether these constructs are

separate from each other or whether entrepreneurs with access to one type of information generally have access to both types of information. Third, the relationship between both commercialization and strong ties and commercialization and access to resources was negative. This counterintuitive relationship begs for further inquiry and discourse. Finally, the relationship between both access to explicit and tacit knowledge and commercialization is promising.

Based upon the low standard deviation values for access to explicit knowledge and access to tacit knowledge, I examined the skewness statistics for these variables. Both access to explicit knowledge (skewness=-.733, s.e. .291) and access to tacit knowledge (skewness=-.740, s.e. .291) were found to be skewed to the right, which means the data collected for these variables is not distributed normally. This is problematic for the interpretation of these results, but because transformations of the variables do not significantly change the results, nor do they tend to normalize the data, we will continue with the analysis. I have the option of removing some of the statistical outliers, but I believe that this is disingenuous because I would not expect this variable to be normally distributed in theory or in practice.

Figure 4

Supported Hypotheses in the Tested Model



The significant pathloadings representing supported hypotheses are reported in Figure 4 and identified with a solid arrow, while the insignificant pathloadings representing unsupported hypotheses are represented by dash arrows. The path loadings between the constructs in the hypothesized model lend support that there are some relationships that will be worth pursuing upon completion of the CIC data collection. Hypothesis 1 was supported. The relationship between strong ties and breadth was significant ( $p < .001$ ), and the path loading was .674. Hypothesis 2 was strongly supported as the relationship between weak ties and depth had a path loading of .800 ( $p < .001$ ).

Hypotheses 3a, 3b, and 3c were all unsupported. The relationship between breadth and access to resources (-.04, n.s.). Breadth was also insignificant with regard to access to tacit information (-.083, n.s.). Finally, depth was not related to access to explicit information, with a path loading of -.014, which was not significant.

Hypothesis 4 was also unsupported. Strong ties were not related to network overload, path loading of -.092 was insignificant. Hypothesis 5a was not supported. The relationship between access to resources and commercialization approached significance ( $p = .16$ ), but that relationship had a path loading of -.130. Hypothesis 5b was supported. The hypothesized relationship between access to tacit knowledge and commercialization was both significant and in the hypothesized direction (.183,  $p < .10$ ). Hypotheses 5c and 5d were unsupported. The hypothesized relationships between access to explicit knowledge (.122, n.s.) and network overload (-.026, n.s.) were not significant with regard to commercialization.

These results lead me to believe that the model as a whole is improperly specified, and that the theoretical background needs to be further explored. With that said, the data analysis

and correlations between many of the variables with this low number of respondents, leads me to believe that there is some interplay amongst these constructs.

## **Chapter 5**

### **Discussion**

#### **Data Collection**

The results of the initial data collection were very disheartening, and this made the completion of this dissertation far more difficult. Many of the firms in the initial sample, although contained within an incubator, were very traditional small businesses. After looking at these results, I took a new direction with the data collection. The Cambridge Innovation Center and Atlanta Technology Development Center were contacted about their possible interest in participating in this study. Although, ATDC chose not to participate, CIC did. I made an initial visit to the incubator to meet with the director, and develop a data collection plan. I was allowed two waves of data collection via email requests for online surveys, as well as multiple visits to acquire paper surveys, and to interview survey participants. It resulted in a much higher response rate, but still only 68 usable surveys. I will need to collect more data, but based upon what I have learned, I believe that I will be more effective and efficient in future attempts. I also believe greater attention to mixed methods studies will be more fruitful in high-tech entrepreneurship research.

#### **Theoretical Significance**

This research looks at entrepreneurship research involving social networks in a new way. By moving beyond the traditional social capital approaches and integrating them into a holistic approach I was able to more fully examine the role that different aspects of a social network play in the entrepreneurial process. The findings in hypotheses 1 and 2 suggest that the ties that entrepreneurs do use in their venture are strongly related to what they need from such ties. Entrepreneurs who need information from outside of their own background rely more heavily on

strong tie relationships, because these types of ties extend beyond their previous work experience. It is a likely assumption that entrepreneurs are comfortable pursuing ventures that they have not been previously associated with or bring their business into new markets because of these strong ties.

Also, the relationships between weak ties and depth leads me to believe that entrepreneurs are much more comfortable reaching out to weak ties from within their previous industry than from different industries. The implications of this are theoretical in nature because they suggest that the literature on strong and weak ties developed over the last 40 years applies similarly to job search characteristics, as well as entrepreneurial ventures. It also suggests that entrepreneurs are generally limited as to how they are able to gather extra- and intra-industry information and resources. There are certain limits upon what an entrepreneur can expect to receive in the way of assistance from these different types of ties because of the nature of the underlying relationships that these ties represent.

There were no significant relationships found between the network resource level and the network benefits identified by previous literature. I can speculate that some of these relationships would become significant as the power in the sample increases. Interestingly, it seems that if I were to guess at which relationships would become significant, it would be from both depth and breadth to access to explicit information. This suggests two things. First, that entrepreneurs likely use their social network to access explicit information that has a lower acquisition cost than tacit information. Theoretically, this provides an alternate explanation of how an entrepreneur obtains such information when needed. Second, it is quite possible that I made a mistake in my measurement of access to resources and/or information. Instead of measuring access to needed resources or information that the entrepreneur does not himself/herself possess,

I measured the belief of the entrepreneur to obtain this information or resources, without regard to whether s/he actually already possesses that information or resources. In future studies, I will attempt to develop a more proper measure for these items that may lead to more fruitful and interesting results.

The connection between the different network benefit variables and commercialization is promising. Although, the explicit knowledge construct was not significant, it appears that with sufficient power in the study they may have helped to explain variance in entrepreneur's ability to commercialize their products/services according to the hypothesized relationships. Access to tacit knowledge was significantly related to commercialization. This is not surprising because this experiential knowledge is absolutely necessary to getting a product to market. Surprisingly, the access to resource construct, although approaching significance in its relationship with commercialization, appears to have the opposite effect than hypothesized. This would be an important contribution to the literature if it held true in a larger study. There are a number of reasons that this may be the case. The way that commercialization was operationalized, such that the entrepreneurs stated how they were faring with regard to innovation, quality, speed, and customer use of the offered products/services, leads me to wonder whether access to resources allows an entrepreneur to act with less urgency and concern for how well the initial products/services are received. An entrepreneur with limited resources would need to get a revenue stream up and running quicker and more efficiently than an entrepreneur who has the slack necessary to survive in a less productive environment.

The results surrounding the network overload variable were disappointing. The network overload variable was not interacting with the hypothesized construct in any manner that is consistent with how I initially thought it would. The significant correlation as described in Table

2 with depth was positive. After further statistical investigation, I found that the number of weak ties that the entrepreneur used had a significant and strong reduction in the amount of network overload when all of the other variables were held constant (.266,  $p < .05$ ). This led me to consider whether network overload is not related to the number of ties or types of relationships, but rather the need and resulting difficulty in gathering such information because of a lack of pertinent strong ties. When the entrepreneur is unable to access information or resources from strong ties, they may move to looking for these benefits from weak ties. Theoretically, the entrepreneur will know less about weak ties (and weak ties may be less willing to share the network resources), requiring the entrepreneur to spend significantly more time searching for network benefits than if they could be found within strong tie relationships. Therefore, it may be that an entrepreneur may experience a frustration over the inability to gather such information and resources.

At this juncture, it is also worthy to note that I may have misconceptualized network overload. It may be necessary to look at different possibilities with regard to what is causing the overload. If the anxiety is from too much time spent networking, it may not necessarily be related to only the number of ties. It could be effected by the lack of information and the necessary networking that a person has to do to acquire that information. Whereas, they may be another dimension of network overload which is specifically effected by the number of strong ties that a person is managing within a network. I believe that the dimensionality of network overload would need to be further addressed in future research.

I am confident that there is something going on with the constructs measured in this study. At this point, with a limited sample and corresponding power, it is hard to say exactly what it is. The limited data analysis suggests that we correctly mapped how entrepreneurs

attempt to capture extra-industry or intra-industry information and what types of contacts that they use in doing so, but that without a larger sample will not be able to understand the implications of this strategy.

### **Practical Implications**

This study provides us with numerous practical implications that should help entrepreneurs in the future. First, entrepreneurs with greater information and resources within strong tie contacts that they can call on to assist them with their ventures will experience less network overload. Potential or aspiring entrepreneurs should invest in their networks, much like they would invest in their education or work experience.

Entrepreneurs may not wish to spend tremendous amounts of time networking. Networks are only one tool in the entrepreneur's bag. Although potentially powerful, if networking takes away from the entrepreneur's ability to do other necessary functions it may be a net loss. There is likely a pre-existing reason as to why the entrepreneur has not developed a network structure leading to profitable uses of network resources. This may be something that the entrepreneur can acquire from associating with or hiring someone who does have a strong existing network rather than trying to build that network post hoc. Taking a resource based view approach to the entrepreneur's time limitations, the entrepreneur should focus on those activities that s/he can do best, while hiring or partnering with someone to do those activities at which s/h is not as strong.

### **Strengths**

The theoretical development explored in this research is a major strength of my dissertation. I take a perspective that has been overlooked in entrepreneurship research by extending an approach used in other domains surrounding social network theory where structural and resource approaches are taken into account in the same model. To date, entrepreneurship

scholars have not brought these seemingly divergent, but actually complementing approaches to the same study. Employing multiple theoretical perspectives to theoretically explain the aspects of interest in the entrepreneurial process allows this dissertation to add significant value to the existing literature base. This approach allows us to more holistically understand what is happening with phenomenon concerning entrepreneurship.

The measurement instrument employed in the data collection of this research is predominately sound, and developed to accurately measure the constructs of interest (with the possible exception of access to resources/information). We also measure constructs that could provide alternative explanations so that we may test their implications, while capturing many potential control variables. The instrument was rigorously tested before being used, and as a result, was changed significantly from the instrument that was initially proposed. In areas where the instrument was limited because of quantitative issues, I was able to collect further data through the use of directed surveys which allowed me to further test the validity of the instrument itself.

The extension of social network effects to potential negative consequences is an extension that is underused in the field of both social networks and entrepreneurship. This research opens the door to a more meaningful analysis of the entrepreneurial process because without considering negative effects, researchers may be missing important phenomenon in the entrepreneurship domain. Although I am not the first researcher to take this view, I am further extending the literature and developing theory as to why negative effects need to be considered when conducting research in the domain. As time progresses, more negative consequences will be identified and our understanding of the entrepreneurial process may be more fully extended.

I also provide a framework that will allow future research to begin to investigate strategic use of time, contacts, and portfolio networking. Prior to this research, most scholars and popular media have contextualized social networks in a way that says “more is better.” Either a structural approach, where more contacts or more structural holes are better, or a resource approach, where more resources of any nature are always better, has been the overriding assumption of the field. My framework allows for social networks to be viewed from a strategic sense in that there may be optimal levels of particular resources within a network, or that there may be a particular structure that will work better in different circumstances. Prior to this research, it would be hard to make that leap to thinking that a complex network strategy may consist of fewer ties with plenty of more diverse resources and something that entrepreneurs should strive for in their network. This practical implication is also a theoretical breakthrough that has not begun to be explored until this dissertation.

### **Limitations**

The limitations of this research are manifold. First, the research is cross-sectional in nature and limits my ability to investigate causation. The data collection was done all at one time, and therefore the impact of each of the constructs on the next may not be as I describe it. This issue will be addressed in the future by collecting dependent variable measures after a six month and one year time delay, but until that is completed I will be unable to fully evaluate the impact of the independent variables on the entrepreneur’s ability to commercialize his/her product or service. This limitation is also considered as I have conducted directed interviews of a number of members of the sample, which allow me to understand in a “real” sense how entrepreneurs use their social networks to effect commercialization.

Second, the data are subject to common method bias as all of the measures are self-reported through the use of a survey at the same time. However as Conway and Lance (2010) mention, the use of self-reports is not only appropriate but necessary in certain circumstances and for multiple reasons. For instance, individual network data, as well as perceptions of such constructs as access to resources and information or success in commercialization, can not accurately be determined through the use of archival data. The sample consists of entrepreneurs starting ventures in an incubator, and success in commercialization is not necessarily equal to sales or revenue. Also, huge discrepancies in early stage sales may exist depending upon the product or service and may not be objectively comparable when it comes to successful commercialization of such product or service. The sample consists mostly of new or very young ventures, some of which are still in the research stage, and they may have made huge breakthroughs in commercializing their product, but have not yet made it to the market. My research is perception driven from the entrepreneur's view point. The entrepreneur's perceptions, although may be incorrect, inform decision making and behavior in significant ways and are therefore interesting to entrepreneurship scholars.

Another defense of my data collection not leading to common method variance or bias is that the constructs that have not been validated previously have been subjected to rigorous review as to their validity. As discussed in the methods section, the steps taken by the author to determine the construct validity of these measures have been done according to best practices, and I am confident that the measures approximate within reason the constructs that they purport to measure. Also, the items in the different constructs do not overlap. Therefore, even though they are reported by the same people on the same instrument, they are not necessarily subject to common method bias. For example, there are some scales used in the instrument, as well as, a

number of single-item sociometric measures that are often used in network research. As I designed this project, steps were taken to minimize the effects of common method bias despite the use of the self report survey measures, including directed interviews with select members of the sample to help determine the accuracy of their responses with regard to commercialization and access to resources.

Third, the results of this dissertation may not be generalized outside the very specific sector of high-tech, high-growth entrepreneurs. This is a common issue arising out of entrepreneurship research. There is great difficulty in selecting an appropriate population and sample for entrepreneurship research, and the researcher must make certain trade-offs. In this instance, I have determined the importance of high-tech high-growth companies to local, national, and international economies because of their impact on job growth that I have decided to limit the scope of this study to this population.

This research is also unlikely to be generalizable to ventures not located in incubators. Firms that start their life-cycle in an incubator are different than other firms. They have access to different levels of resources, including venture capital, intellectual capital and stimulation, and economic incentives, such that the experience is wholly different than firms that started outside of an incubator. Again, with the growth of incubators in the world, I have determined that the incubated venture is of significant enough concern that I have limited my sample in such a manner, because large amounts of public and private money are marshaled into this arena in the hopes that these types of environments are having an impact on the regional, national, and international economies.

Finally, one of the major theoretical approaches to social network research is Burt's (1995) structural hole theory, but this research does not empirically measure or test hypotheses

from this theoretical approach. The nature of the research and the means of collecting data did not allow for a valid measure of structural holes. Although, the theoretical development of the hypotheses acknowledges that structural holes may play a role in the impact of the commercialization of the entrepreneur's opportunity, we only investigated this using qualitative methods. Essentially, we asked entrepreneur's to describe how they use their ties and look for anecdotal evidence suggesting the importance or lack of importance of structural holes. Until a method of validly identifying and measuring structural holes in a quantitative manner is developed, most social network in the domain of entrepreneurship is going to be limited by either the use of an invalid measure or by not measuring structural holes at all. I chose the latter because I felt confident that we could explore the importance of these relationships through the use of directed interviews and obtain information that allows me to judge the validity of my research without the measure in the operational model. From anecdotally examining the results of the surveys, most entrepreneurs find that they benefit much more from bridging structural holes than leveraging those non-redundant ties.

### **Future Research Directions**

This dissertation leaves a number of avenues to further explore in the future. First, the construct and measurement of network overload needs to be more thoroughly evaluated and developed. The full extent of the nomological network surrounding this construct needs to be drawn, while its role as an important socio-psychological variable in the organizational sciences needs to be explored. For instance, how does the impact of network overload fit into other domains that use social network variables to explain outcomes, such as organizational behavior. As the network overload construct is broadened, it will be valuable to analyze whether there are key differences between the effects of entrepreneurs and other business professionals, i.e. does

your role within the organization effect how you experience network overload. As already mentioned, the dimensionality of this construct needs to be further explored.

This research can be expanded in the future to look at other important entrepreneurship outcome variables, such as new venture creation. Commercialization of the good or service is the outcome that I selected to study in this dissertation, but if the interpretation of my model is correct, it would follow that these same variables will have an effect on most traditionally psychology driven outcomes in the field of entrepreneurship research now dominated by entrepreneurial cognitions.

An entrepreneurial firms perceived legitimacy is an often discussed topic in the extant literature (See Busenitz et al. 2003, Suchman, 1995). It is theorized that social network variables play an important role in helping to legitimize early stage ventures, and in doing so contribute to the initial success of the venture. It is not hard to imagine that legitimacy also will play a role in a new venture's ability to commercialize its innovative product or service. As such, future research needs to explore the impact of legitimacy through the contacts to individuals other than the entrepreneur. For sake of discussion, I refer to this as borrowing legitimacy. An entrepreneur who lacks legitimacy within an industry can borrow such legitimacy from those contacts who already have established reputations through their inclusion or connection to the entrepreneurial venture. Although outside the scope of this research, I feel that such research is necessary to fully understand the social network effects upon commercialization and other outcome variables.

The model and supporting arguments regarding activation of ties lend themselves to an investigation as to whether there is an issue of network skill. Although network skill is a construct that is included within political skill (Ferris et al., 2005), this aspect of the construct needs to be specifically examined within the domain of entrepreneurship. If we can flesh the

construct out through redefining it as it applies to entrepreneurship, then it will be possible to explain how entrepreneurs with this skill set can improve their chances for success. It also will allow researchers to investigate patterns of success among entrepreneurs despite lacking this skill set. As this knowledge progresses, model clarification and accuracy will be improved across the entrepreneurship domain.

Also, the mechanisms with which the entrepreneur attempts to access resources and information from his/her network provides ample opportunity for future research. Following in the footsteps of Lavie, Lechner, and Singh (2007), one could examine the timing surrounding the entrepreneur's attempts to add new members to their network or the timing of interaction with existing members of the network. Also, we know that entrepreneur's need to employ some method to acquire resources and information from the their network (Starr & MacMillan, 1990), so this leaves us to consider, within the context of network overload, whether some methods of social resource acquisition are more effective and/or efficient than others.

Future research should consider what other possible negative consequences may exist with regard to social networks. In this dissertation, I explore, define, and conceptualize one specific consequence, network overload. The field would benefit greatly from a more thorough identification and conceptualization of all of the possible negative consequences surrounding social networks. Social networks provide entrepreneurs with significant benefits as they attempt to commercialize entrepreneurs, but they also have unintended negative effects. One possible negative effect could be "negative legitimacy," whereby a contact or a portfolio of contacts actually negatively impacts the legitimacy of the entrepreneur or the venture.

## **Lessons Learned**

Data collection in the field of entrepreneurship is difficult. Identifying a population of interest is not going to satisfy the needs of the researcher in collecting data, although it is a difficult first step. Entrepreneurs by nature fall into two categories, 1) they are too busy to do anything that does not directly impact the success of their venture or 2) they are very willing to talk about their venture, but unwilling to respond to unsolicited attempts to collect information. Both of these categories are difficult for junior researchers to crack as they attempt to build a meaningful sample to test their hypotheses. I have consistently run into issues with low total responses, low response rates, and difficulty contacting the entrepreneur of interest directly. The plan to obtain data needs to be ready and specific to the situation. Also, I have learned that you should have multiple instruments and projects ready to go for data collection, because when the opportunity arises you need to be ready to strike quickly.

I have learned that you can not replace the exercise of writing. The output with regard to research is the written word. Although, the axiom that something writes itself may be true with regards to sections, if you do not actually start writing then it will not appear. This is simple, but many times through this process I have underestimated the number of issues that will arise while I am writing. This has continually pushed this project back, luckily, my completion of this project was timed with the job market rather than unrealistic goals that I may have set. Also, I am new to this profession, and even though I have spent my whole life writing, I am working within a new system with new ways of doing things. This takes practice to learn rather than relying on previous success.

The ability to take guidance and to collaborate with people more knowledgeable than yourself are necessary for a junior researcher to conduct high quality research. It is simply

unrealistic to think that you hold all of the answers. There is a reason that the process is designed this way. I have found that my willingness to allow the process to unfold, rather than forcing it, has allowed me to grow and become more skilled at the research that I want to conduct. Inquiry is necessary but not sufficient, and that the follow through is the key to working well with others. Communication has allowed me to build relationships that will last a long time, and I have thoroughly enjoyed the process. This is an important lesson in both life and research. Good research is the result of strong collaboration, and understanding one's limitations allows you to perform better research.

## REFERENCES

- Aldrich, H. E., & Zimmer, C. 1986. Entrepreneurship through social networks. In D. Sexton, & R. Smilor (Eds.), *The Art and Science of Entrepreneurship*. Cambridge, MA: Ballinger.
- Alvarez, S. A., & Barney, J. B. 2007a. Discovery and creation: Alternative theories of entrepreneurial action. *Strategic Entrepreneurship Journal*, 1: 11-26.
- Alvarez, S. A., & Barney, J. B. 2007b. The entrepreneurial theory of the firm. *Journal of Management Studies*, 44: 1057-1063.
- Alvarez, S. A., & Busenitz, L. W. 2001. The entrepreneurship of resource-based theory. *Journal of Management*, 27: 755-775.
- Anderson, A., Park, J., & Jack, S. 2007. Entrepreneurial social capital: Conceptualizing social capital in new high-tech firms. *International Small Business Journal*, 25: 245-272.
- Ardichvili, A., Cardozo, R., & Ray, S. 2003. A theory of entrepreneurial opportunity identification and development. *Journal of Business Venturing*, 18: 105-123.
- Baker, T., & Nelson, R. E. 2005. Creating something from nothing: Resource construction through entrepreneurial bricolage. *Administrative Science Quarterly*, 50: 329-366.
- Baron, R. A. 1998. Cognitive mechanisms in entrepreneurship: Why and when. *Journal of Business Venturing*, 13: 275-294.
- Batjargal, B. 2003. Social capital and entrepreneurial performance in Russia: A longitudinal study. *Organization Studies*, 24: 535-556.
- Birley, S. 1985. The role of networks in the entrepreneurial process. *Journal of Business Venturing*, 1: 107-117.
- Borgatti, S. P., & Foster, P. C. 2003. The network paradigm in organizational research: A review and typology. *Journal of Management*, 29: 991-1013.
- Brass, D. J., & Burkhardt, M. E. 1993. Potential power and use: An investigation of structure and behavior. *Academy of Management Journal*, 36: 441-470.
- Bridges, W. P., & Villemez, W. J. 1986. Informal hiring and income in the labor market. *American Sociological Review*, 51(4): 574-582.
- Brockhaus, S. R. H. 1980. Risk Taking Propensity of Entrepreneurs. *Academy of Management Journal*, 23: 509-520.
- Burt, R. S. 1992. *Structural Holes: The Social Structure of Competition*. Cambridge, MA: Harvard University Press.

- Burt, R. S. 1997. The contingent value of social capital. *Administrative Science Quarterly*, 42: 339-365.
- Burt, R. S. 2001. Attachment, decay, and social network. *Journal of Organizational Behavior*, 22: 619-643.
- Casson, M. 1982. *The Entrepreneur: An Economic Theory*. Totowa, NJ: Barnes & Noble Books.
- Casson, M., & Giusta, M. D. 2007. Entrepreneurship and social capital: Analysing the impact of social networks on entrepreneurial activity from a rational action perspective. *International Small Business Journal*, 25: 220-244.
- Cohen, W. M., & Levinthal, D. A. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1): 128-152.
- Coleman, J. S. 1990. *Foundations of Social Theory*. Cambridge, MA: Harvard University Press.
- Dimov, D. 2007. Beyond the single-person, single-insight attribution in understanding entrepreneurial opportunities. *Entrepreneurship: Theory & Practice*, 31: 713-731.
- Eckhardt, J. T., & Shane, S. A. 2003. Opportunities and entrepreneurship. *Journal of Management*, 29: 333-349.
- Eisenhardt, K. M., & Martin, J. A. 2000. Dynamic capabilities: What are they? *Strategic Management Journal*, 21: 1105-1121.
- Elfring, T., & Hulsink, W. 2007. Networking by entrepreneurs: Patterns of tie-formation in emerging organizations. *Organization Studies (01708406)*, 28(12): 1849-1872.
- Gartner, W. B. 1985. A conceptual framework for describing the phenomenon of new venture creation. *Academy of Management Review*, 10: 696-706.
- Granovetter, M. 1982. The strength of weak ties: A network theory revisited. In P. V. Marsden, & N. Lin (Eds.), *Social Structure and Network Analysis*: 105-130. Beverly Hills, CA: Sage.
- Granovetter, M. 2005. The impact of social structure on economic outcomes. *Journal of Economic Perspectives*, 19: 33-50.
- Granovetter, M. S. 1973. The strength of weak ties. *American Journal of Sociology*, 78: 1360-1380.
- Hansen, M.T., Podolny, J.M., & Pfeffer, J. 2001. So many ties, so little time: A task contingency perspective on corporate social capital in organizations. *Vol. Research in the Sociology of Organizations*, 18: 21-57.

- Higgins, M. C., & Kram, K. E. 2001. Reconceptualizing mentoring at work: A developmental network perspective. *Academy of Management Review*, 26: 264-288.
- Hite, J. M. 2005. Evolutionary processes and paths of relationally embedded network ties in emerging entrepreneurial firms. *Entrepreneurship: Theory & Practice*, 29: 113-144.
- Jack, S. L. 2010. Approaches to studying networks: Implications and outcomes. *Journal of Business Venturing*, 25: 120-137.
- Katz, J., & Gartner, W. B. 1988. Properties of Emerging Organizations. *Academy of Management Review*, 13: 429-441.
- Katz, J. A. 1993. How satisfied are the self-employed: A secondary analysis approach. *Entrepreneurship: Theory & Practice*, 17: 35-51.
- Kim, P., & Aldrich, H. 2005. *Social Capital and Entrepreneurship*. Hanover, MA: now Publishers Inc.
- Kirzner, I. M. 1997. Entrepreneurial discovery and the competitive market process: An Austrian approach. *Journal of Economic Literature*, 35: 60-85.
- Lavie, D. Lechner, C., & Singh, H. 2007. The performance implications of timing of entry and involvement in multipartner alliances. *Academy of Management Journal*, 50: 578-604.
- Lin, N., Vaughn, J. C., & Ensel, W. M. 1981a. Social resources and occupational status attainment. *Social Forces*, 59: 1163-1181.
- Lin, N., Vaughn, J.C. & Ensel, W.M. 1981b. Social resources and strength of ties: The structural factors in occupational status attainment. *American Sociological Review*, 46: 393-405.
- Mangematin, V., & Nesta, L. 1999. What kind of knowledge can a firm absorb? *International Journal of Technology Management*, 18: 149-172.
- McPherson, J. M., Popielarz, P. A., & Drobnic, S. 1992. Social networks and organizational dynamics. *American Sociological Review*, 57: 153-170.
- Mitchell, W., & Singh, K. 1996. Survival of businesses using collaborative relationships to commercialize complex goods. *Strategic Management Journal*, 17: 169-195.
- Murray, S. O., Rankin, J. H., & McGill, D. W. 1981. Strong ties and job information. *Sociology of Work and Occupation*, 8: 119-136.
- Nekrar, A. & Shane, S. 2007. Determinants of invention commercialization: An empirical examination of academically sourced inventions. *Strategic Management Journal*, 28: 1155-1166.

- Newey, L. R., & Zahra, S. A. 2009. The evolving firm: How dynamic and operating capabilities interact to enable entrepreneurship. *British Journal of Management*, 20: S81-S100.
- Nicolaou, N., & Birley, S. 2003. Social networks in organizational emergence: The university spinout phenomenon. *Management Science*, 49: 1702-1725.
- Nunnally, J. (1978). *Psychometric Theory*. New York, NY: McGraw-Hill.
- Obstfeld, D. 2005. Social networks, the *tertius jungens* orientation, and involvement in innovation. *Administrative Science Quarterly*, 50: 100-130.
- Podolny, J. M., & Baron, J. N. 1997. Resources and relationships: Social networks and mobility in the workplace. *American Sociological Review*, 62: 673-693.
- Sarasvathy, S. D. 2001. Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review*, 26: 243-263.
- Seashore, S. E., Lawler, E. E., Mirvis, P., & Cammann, C. 1982. *Observing and Measuring Organizational Change: A Guide to Field Practice*. New York: Wiley.
- Seibert, S. E., Kraimer, M. L., & Liden, R. C. 2001. A social capital theory of career success. *Academy of Management Journal*, 44: 219-237.
- Shane, S. 2000. Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, 11: 448-469.
- Shane, S., & Cable, D. 2002. Network ties, reputation, and the financing of new ventures. *Management Science*, 48: 364-381.
- Shane, S., & Venkataraman, S. 2000. The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25: 217-226.
- Shepherd, D. A., McMullen, J. S., & Jennings, P. D. 2007. The formation of opportunity beliefs: overcoming ignorance and reducing doubt. *Strategic Entrepreneurship Journal*, 1: 75-95.
- Smith, D. A., & Lohrke, F. T. 2008. Entrepreneurial network development: Trusting in the process. *Journal of Business Research*, 61: 315-322.
- Sparrowe, R. T., & Liden, R. C. 2005. Two routes to influence: Integrating leader-member exchange and social network perspectives. *Administrative Science Quarterly*, 50: 505-535.

- Spreitzer, G. M. 1996. Social structural characteristics of psychological empowerment. *Academy of Management Journal*, 39: 483-504.
- Stam, W., & Elfring, T. 2008. Entrepreneurial orientation and new venture performance: The moderating role of intra- and extra-industry social capital. *Academy of Management Journal*, 51: 97-111.
- Starr, J.A. & MacMillan, I.C. 1990. Resource cooptation via social contracting: Resource acquisition strategies for new ventures. *Strategic Management Journal*, 11: 79-92.
- Stevenson, H. H., Roberts, M. J., Grousbeck, H. I., & Bhide, A. 1998. *New Business Ventures and the Entrepreneur*. New York, NY: McGraw Hill/Irwin.
- Stevenson, W. B., & Greenberg, D. 2000. Agency and social networks: Strategies of action in a social structure position, opposition, and opportunity. *Administrative Science Quarterly*, 45: 651-678.
- Stewart, W. H., & Roth, P. L. 2007. A meta-analysis of achievement motivation differences between entrepreneurs and managers. *Journal of Small Business Management*, 45: 401-421.
- Vega-Jurado, J., Gutiérrez-Gracia, A., & Fernández-de-Lucio, I. 2008. Analyzing the determinants of firm's absorptive capacity: Beyond R&D. *R&D Management*, 38: 392-405.
- Venkataraman, S. 1997. The distinctive domain of entrepreneurship research. Katz, J. (Ed.), *Advances in Entrepreneurship, Firm Emergence, and Growth*, vol. 3. JAI Press: Greenwich, CT. pp. 119-138.
- Wiklund, J., & Shepherd, D. A. 2008. Portfolio entrepreneurship: Habitual and novice founders, new entry, and mode of organizing. *Entrepreneurship: Theory & Practice*, 32: 701-725.
- Wright, M., Hmieleski, K.M., Siegel, D.S., & Ensley, M.D. 2007. The role of human capital in technological entrepreneurship. *Entrepreneurship: Theory & Practice*, 31: 791-806.
- Zahra, S. A., & George, G. 2002. Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27: 185-203.