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Meryl Rosenblatt MBA
Molloy College, mrosenblatt@molloy.edu

Jacqueline Bassey
Molloy College, jbassey@lions.molloy.edu

Alexa Guerica
Molloy College, aguercia@lions.molloy.edu

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Jacqueline Bassey
Molloy College
1000 Hempstead Ave.
Rockville Centre, NY, US
516-512-9102
jbassey@lions.molloy.edu

Alexa Guercia
Molloy College
1000 Hempstead Ave.
Rockville Centre, NY, US
516-761-1411
aguercia@lions.molloy.edu

Meryl Rosenblatt
Molloy College
1000 Hempstead Ave.
Rockville Centre, NY, US
516-323-3089
mrosenblatt@molloy.edu

ABSTRACT
There is a vast body of research that demonstrates how entrepreneurs mobilize different networks (business, professional, family and friends) as sources of knowledge, new ideas, financing and support. Both network relationships and network structure will influence the likelihood of entrepreneur's success during the establishment and growth stages of the new enterprise. The entrepreneur's ability to acquire resources needed is influenced by network characteristics such as network size, diversity, density, cohesiveness, and the position of the entrepreneur within the social network. This paper proposes a mixed-method approach, combining survey research and network data analysis, to gain a deeper understanding of entrepreneurial networks.

Keywords: Entrepreneurship, resources, social networks, network analysis, tie strength, LinkedIn

1 INTRODUCTION
There is broad acceptance that the entrepreneur is embedded in a social network, the set of "actors" (individuals and organizations) to which the entrepreneur has a relationship (links or ties). The network plays a critical role in the entrepreneurial process, as it provides the entrepreneur with access to resources that can facilitate the likelihood of the firm's emergence and growth. Aldrich and Zimmer (1986) conceptualize the formation of new businesses as "a function of opportunity structures and motivated entrepreneurs with access to resources", and that entrepreneurship is a dynamic process that helps explain how new organizations "come to exist in a specific environment" (1986:10). Entrepreneurs will enlarge their networks to obtain information and resources, and they may position themselves within a network to facilitate reachability and connectedness to others to gain access to what is needed. Entrepreneurs often mobilize different networks, such as networks of family and friends, or networks of business contacts, investors and strategic partners. Ties that enable or influence the firm's economic choices on the basis of the relationship are "relationally embedded". Often the initial opportunities and resources available to the entrepreneur are relationally embedded ties of the entrepreneur's social network, such as family and close friends, which influence economic actions of the

newly emerging firm (Granovetter, 1985; Larson & Starr, 1993; Uzzi, 1996; Hite & Hesterly, 2001).

The major theoretical foundation for this paper includes the influence of cohesive, embedded networks (Granovetter, 1985; Coleman, 1990; Uzzi, 1996) and Burt's (1992) arguments for the advantages of structural holes. Granovetter's (1973) discussion of the strength weak ties, and the concept of embeddedness, argues economic behavior is embedded in a social context, or a network of relationships. It is both the context and the nature of relationships that influence the entrepreneur's ability to obtain resources needed for firm growth and survival (Hite and Hesterly, 2001; Hoang and Antoncic, 2003; Jack, Dodd and Anderson, 2008; Slotte-Kock and Coviello, 2010).

2 SOCIAL NETWORK ANALYSIS
Social network analysis is the set of methods that have emerged to study networks and network characteristics. Specifically, it is the analysis of the patterns of connections within the network, and how they relate to one another. A network is a set of relationships between "objects" or "nodes" which can be people, organizations or countries. A social network is one in which the nodes are social entities or individuals, also referred to as actors, who are linked to one another by relationships, or social ties.

2.1 The Network Perspective
The network perspective was popularized by Mark Granovetter in his highly influential article, "The Strength of Weak Ties" (1973). Embodied in Granovetter's theory is the notion that society consists of highly connected clusters comprised of people or groups (nodes), and relationships between them (links or ties). Strong ties are characteristic of relationships with friends and family. They are a source of trust, support and frequent interaction. Weak ties are more distant and can provide a source of new, novel and non-redundant information. Weak ties play a critical role in our ability to communicate with the outside world. The structure of society then is made up of a collection of clusters – where each node is connected to all the other nodes within the cluster, and clusters are linked to other clusters by weak ties
.

2.1 The Strength of Weak Ties

Granovetter's seminal theory (1973) is perhaps the best known and most significant theoretical contribution in the field of network analysis (Freeman, 2004). In this article, Granovetter focuses on one aspect of network interaction – the strength of interpersonal tie. Granovetter proposes that close relationships have three characteristics: frequent interactions, an extended history, and some degree of intimacy and mutual confiding. He argues that our acquaintances (weak ties) are less likely to be socially involved with one another than our close friends (strong ties). The stronger the tie between two individuals the more similar they are likely to be, and the more redundant the information that they share. Importantly, strong ties are often also imbued with a high degree of trust, reciprocity, and are a ready source of advice and support for the entrepreneur. Weak ties are more useful for the diffusion of novel information and new ideas, and facilitate the flow of information throughout the network. These ties are considered very effective in helping the entrepreneur gain access to resources. Without weak ties, or with too few, social systems will become fragmented and information spreads more slowly. Granovetter's work stimulated the development of new theories, and a large body of research. Most important was Ronald Burt's research on structural holes (1992).

2.2 Structural Holes

Structural holes signify network patterns where parts of the network are widely unconnected so that existing connections may be the only route through which information and other resources flow. Ronald Burt (1992) used the term *structural hole* to indicate the separation between non-redundant and redundant contacts. He extends the "weak ties" argument by emphasizing the competitive advantages of those actors that bridge structural holes, in that they become a source of new and novel information, which improves likelihood of innovativeness and discovering opportunities. Finding and exploiting structural holes provides the entrepreneur with competitive advantages.

2.3 Multiplexity

Multiplexity is the number of separate social connections between any two actors. It is the interaction of exchanges within and across the specific tie or relationship. A single tie between individuals, such as a shared workplace, is a uniplex relationship. A tie between individuals is multiplex when those individuals interact in multiple social contexts, such as the office and gym (Uzzi, 1997: Borgatti, Everett & Johnson, 2013).

2.4 Other Network Measures

The essence of social network theory and analysis must also consider the individual's entire network, which can be be analyzed (and visualized) using computer-based software programs and the availability of digital network data sets. Networks have several useful properties for entrepreneurs, and a variety of measures are used to uncover patterns within the social structure. The most intuitive network measure is *network size*, defined as the number of direct links between actors. Analyses of network size can often measure the extent to which resources can be accessed at the level of the entrepreneur. Entrepreneurs enlarge their networks to get crucial information and other resources from those they see as more knowledgeable. *Density* is the number of connections contained within the network – and its opposite, *structural holes*, which signifies the lack of connections. *Network constraint* describes the extent to which your network spans different groups (i.e. bridging structural holes) or is concentrated in one or two areas. *Betweenness* represents the number of structural holes, or bridging opportunities, to which the entrepreneur has exclusive access. Exclusive access to a structural hole exists if you lie on the shortest path between two contacts in the network.

3 METHODOLOGY

The main goal of this study was to develop a model to help researchers examine relationships between network structure at various stages of the entrepreneurship process. Using a combination of traditional survey research methods and network data analysis, this research design aims to obtain in depth information regarding the entrepreneur's interrelationships, and add a quantitative perspective using whole network analytic tools via LinkedIn data.

3.1 We have developed a structured script that allows us to capture information concerning the strength of relational ties, and in which ways these ties support the entrepreneur's activities. As a result of our data collection, we are able to compare the macro-network structure and micro patterns of relationships. The appeal of a mixed method designs lies, in part, in the promise to use the strengths of quasi-qualitative and quantitative methodologies in one study. Recent mathematical developments and user-friendly computer programs for visualizing and measuring networks have led to significant advances in quantitative social network analysis. However, there have been arguments for the inclusion of survey-based/qualitative approaches not necessarily to replace quantitative methods, but to complement them. Quantitative approaches map and measure networks by simplifying social relations into numerical data, where ties are either absent or present. But they do not consider questions that may be of importance to understanding human interaction in networks studied by social scientists.

A cross-sectional survey enables analysts to consider issues relating to the contextual and relational aspects of social ties. For the survey research, participants were asked to reflect on up to five relationships that have influenced their business activities. In specific they were asked if the individual or organization they had an established relationship with was an entrepreneur, and if they offered business advice, financial support or information and other resources. Within each relationship, participants are asked to describe the strength of ties

related to the setting and context of the relationship. The setting referring to the frequency of interaction and length of relationship, and the context was described in terms of the specific tie; if they are strangers versus family members or if they are in your social circle versus business circle, using a continuum scale of 0-5 points.

3.2 The quantitative phase of this research is possible because of access to network mapping software via Sociolab.com, an open source project that utilizes LinkedIn network data, and is intended for personal or academic use. LinkedIn is the most important social network site for reaching out to, and connecting with, businesses and professionals. LinkedIn operates the most comprehensive database that most entrepreneurs need to utilize (www.socialmediatoday.com/socialnetworks). The goal of the Sociolab site is to help educate people about their social network data, and make analysis more accessible for everyday users. It has been used at over 20 universities across the world to teach students about the power of social network analysis as part of undergraduate and MBA curricula. This makes it an ideal tool for this research project.

4 FINDINGS
Survey responses and key LinkedIn network metrics were analyzed for the four respondent cases. Findings are summarized below.

4.1 Survey Data
Respondents volunteered top relationships consisting of family (5), friends (7), and business partners/associates (5). Eleven of the relationships reported were also entrepreneurs. Across all relationships, access to multiple resources was made available:
• 10 provided business advice, this included moral support, encouragement, helpful feedback and business experience.
• 5 provided financial support.
• 11 provided information/other resources, which included business ideas, specifically marketing/marketing communications and new product-related, as well administrative advice. Among these respondents, three reported relationships that were consistent with network concepts presented earlier, family and friendship were close/strong, while business relationship ties appeared to be weaker. One respondent however, had a business partner who was also a close family relation.

4.2 LinkedIn Measures
For the reporting of these data, percentiles are used because they are more informative than the raw values. Given that online networks are much larger and more disperse than those reported in network surveys, the raw values appear to be very low, as these measures were initially calibrated for smaller networks. Because of the small sample size of the research presented in this paper, the analysis is intended as a framework to be employed in future, larger scale studies.

Table 1: Linkedin Network Measures

Case	Network Size	Network Constraint	Density	Betweenness
	%	%	%	%
(a)	11.2	8.9	7.8	9.6
(b)	12	18.8	17.5	19
(c)	51.6	51.1	51.8	56.6
(d)	52.8	54.1	48.5	54

Respondent cases (a) and (b), are small ecommerce merchants while (c) and (d) are larger service-related organizations. The two smaller firms display networks with connections lower than the average Linkedin users while the larger firms appear to make extensive use of their Linkedin accounts, and network size would indicate that these entrepreneurs actively accept and send invitations to "connect" using this platform. For all entrepreneur respondents, network measures are proportionally in-line, so that none exhibit stronger degrees of *constraint*, *density* or *betweenness*. In instances where percentage of network betweenness is higher than network constraint, the entrepreneur may have greater opportunity to bridge other portions of their network and tap into diverse resources

Whole network measures alone may be interesting but appear to provide little practical insight into entrepreneurial relationships. Aside from the visual maps which help to "picture" our social networks, the comparative analysis is in relation to all Linkedin users. Therefore, the scope of analysis is broad but not necessarily deep. Combined with the survey data however we gain additional perspective which lends support to network research that has demonstrated a strong relationship between tie strength and access to different types of entrepreneurial resources. Further research that includes more qualitative, exploratory interviews can provide deeper insight and a more robust picture of entrepreneurial networks that will help build on the existing knowledge.

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