Network of networks: Uncovering the secrets of entrepreneurs' networks

Song, Y.

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CHAPTER 1

Introduction
1.1 Online social network sites

The history of online social networking can be traced back to the late 1990s, with the last decade seeing its full emergence. The increasing popularity of the internet makes it possible for people to interact and communicate with each other through a variety of online social networks. Previous studies suggest that information exchange and social contact are the central reasons why people join and remain in virtual social networks (D’Andrea, Ferri, & Grifoni, 2010). According to a recent report by comScore (2012), more than half of the local online population engages in social networking, with nearly one in five minutes spent online today being allocated to social networking. Social networking sites (SNSs) such as LinkedIn, Facebook and Twitter provide a private online space for individuals and the tools for interacting with others on the internet (Ahn, Han, Kwak, Moon, & Jeong, 2007). It is already a universal phenomenon for human beings to use online social networking sites and an essential part of their social life.

With the growth of social networking and sharing, more and more information is becoming available online about how people interact with each other (Chin & Chignell, 2010). Online social networks help people find others with common interests, establish a forum for discussion, exchange photos and personal news, and much more (Ahn et al., 2007). Online social networks also provide opportunities for individuals to share and organize knowledge through contacts among networks. Previous research on online social networking has primarily examined private interactions (Boyd, 2007; Boyd & Ellison, 2007; Ellison, Steinfield, & Lampe, 2007; Junghee Lee & Hyunjoo Lee, 2010; B. Wellman, Haase, Witte, & Hampton, 2001).

Online social networks contain important sources of information, such as profile information and connections with friends and family. The information included in online social networks can help individuals to build and maintain their formal and informal relationships with other people. Previous research has shown that online social networks, in particular LinkedIn, can also assist entrepreneurs maintain business networks (Nann et al., 2010; O’Murchu, Breslin, & Decker, 2004). Online social networking sites support both the maintenance of existing social ties and the formation of new social connections (Ellison et al., 2007), and thus the influence of social ties can be studied through online social networks (Song & Vinig, 2012; Tchuente et al., 2010). It has also been found that the internet neither increases nor decreases face-to-face engagement but instead supplements social capital (Junghee Lee & Hyunjoo Lee, 2010; B. Wellman et al., 2001).

Online social networking sites have exploded in popularity all over the world, and on this basis, the wide usage of online social networking services is reshaping the organizational
landscape. The ubiquitous usage of the internet has increased human interactions and opportunities for the emergence of social networks, while the power of individuals to interact with others in an online setting now drives the success or failure of many organizations on the internet (Kumar, Novak, & Tomkins, 2010). Previous research has shown that there are different motives for using online social networks, such as information exchange, social support, friendship, recreation, common interests and technical support (D’Andrea et al., 2010; Ridings & Gefen, 2004). In particular, the socially interactive aspect plays a more important role than the entertainment and information-seeking aspects (Junghee Lee & Hyunjoo Lee, 2010). We adapt individual motives for using online social networks from D’Andrea et al. (2010) and Ridings and Gefen (2004). Furthermore, we divide the users into entrepreneurs and non-entrepreneurs. We list the motives for individuals using online social networks in Table 1.

Table 1  Motives for using online social networks (adapted from D’Andrea et al. (2010) and Ridings and Gefen (2004))

<table>
<thead>
<tr>
<th>Category</th>
<th>Users</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information exchange</td>
<td>Entrepreneurs</td>
<td>Obtain and transfer information about a topic</td>
<td>To learn about new technologies for my business</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>To share my knowledge of something with others</td>
</tr>
<tr>
<td></td>
<td>Non-entrepreneurs</td>
<td>Educate about a topic</td>
<td>To learn about new things</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Learn things</td>
<td>To get new ideas</td>
</tr>
<tr>
<td>Social support</td>
<td>Entrepreneurs</td>
<td>Help entrepreneurs’ leverage their business networks</td>
<td>To organize and gain economies of scale through social networks</td>
</tr>
<tr>
<td></td>
<td>Non-entrepreneurs</td>
<td>Obtain and give emotional support</td>
<td>A way for me to express my anger to others who will sympathize with me</td>
</tr>
<tr>
<td>Social Networking</td>
<td>Entrepreneurs</td>
<td>Accessibility to suppliers and consumers</td>
<td>Find international suppliers and consumers</td>
</tr>
<tr>
<td>without boundaries</td>
<td>Non-entrepreneurs</td>
<td>Expand social networks</td>
<td>Find international friends or people with common interests</td>
</tr>
<tr>
<td>Friendship</td>
<td>Entrepreneurs &amp; Non-entrepreneurs</td>
<td>To make friends</td>
<td>To socialize, to talk to people with similar interests and values</td>
</tr>
<tr>
<td>Recreation</td>
<td>Entrepreneurs &amp; Non-entrepreneurs</td>
<td>For entertainment</td>
<td>Because it is fun</td>
</tr>
<tr>
<td>Common Interest</td>
<td>Entrepreneurs &amp; Non-entrepreneurs</td>
<td>Love of the topic of the community</td>
<td>I like talking about sport</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I like talking about baseball</td>
</tr>
<tr>
<td>Technical reason</td>
<td>Entrepreneurs &amp; Non-entrepreneurs</td>
<td>Technical features in the community</td>
<td>The interface is easy to use</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The search function is really cool</td>
</tr>
</tbody>
</table>
Individuals and companies use online social network platforms for social interaction as well as for maintaining and expanding their professional networks. Consequently, many organizations have adopted the use of SNSs for purposes such as relationship building, information exchange and collaborative work. However, despite a growing number of studies of SNSs, their use in organizational contexts, particularly in the context of entrepreneurship, has been largely neglected. As we know, obtaining access to financial, social and other types of resources is crucial, and SNSs might be an important vehicle for obtaining such access.

Online social networking sites contain a large amount of data. Individuals from online social networks connect to each other for different reasons, such as similar interests (Bisgin, Agarwal, & Xiaowei, 2010) or friendship (Ellison et al., 2007). Despite the large amount of research on online social networks (Boyd, 2007; Boyd & Ellison, 2007; Ellison et al., 2007; Junghee Lee & Hyunjoo Lee, 2010; B. Wellman et al., 2001), there is very limited research that focuses on entrepreneurship and online social networking. Understanding the structure of entrepreneurs’ online social networks is important, not only because of the ubiquitous use of the internet and online communications, but also because the online social network may reflect the real behaviour of entrepreneurs. Investigating the theory of online social networks has significant implications, not only with respect to entrepreneurship but also with regard to other social behaviour related to online communication and interaction.

It is now possible to access data from entrepreneurs’ online social networks and analyse their behavioural and longitudinal data. Using a novel approach, this dissertation addresses the challenge of linking online social networks to entrepreneurship. Considering the characteristics of online social networks, we will examine online social networking sites as a tool used by entrepreneurs to engage with others. In the following sections we will introduce our research questions, provide the theoretical framework of our study of entrepreneurship and social networks, discuss the value of social networks and outline the structure of this dissertation. Finally, the chapter provides an assessment of the contribution made by this dissertation.

1.2 Social networks and entrepreneurship

The essential act of entrepreneurship is a new entry into the market, that is, the act of launching a new venture, either by a start-up firm, through an existing firm, or via ‘internal corporate venturing’ (Lumpkin & Dess, 1996). Building a new company is a highly competitive and risky endeavour (Stuart, Hoang, & Hybels, 1999), hence, entrepreneurs who start new ventures need to continuously seek opportunities and mobilize resources (Aldrich & Auster, 1986). Accessing financial, social and other types of resources is an inherently social process,
with resources acquired primarily through relationships with parties beyond the boundaries of these start-ups (Stuart et al., 1999). Entrepreneurship remains as important to the economy as ever (Vinig & van der Voort, 2005). Thus, studying entrepreneurship from the perspective of networks becomes a very important research topic. In particular, studying the structure of online social networks (Kumar et al., 2010; Socievole & Marano, 2012) and linking online social networks to entrepreneurship is a very interesting research topic.

A network consists of a set of actors connected by a set of ties. The actors can be people, teams, organizations, or even concepts. Ties connecting pairs of actors can be directed or undirected and can be dichotomous or valued (Borgatti & Foster, 2003). Social network analysis is based on the assumption of the importance of relationships among interacting units. The relationships, defined by the connections between units, are a fundamental component of network theories. Actors and their actions are viewed as interdependent rather than independent (Wasserman & Faust, 1994).

Previous research on social networking and entrepreneurship has been conducted from three main perspectives. First, from the perspective of collaborations among large numbers of individuals: the more collaborators an individual has, the higher the chances are that he or she will be invited to participate in subsequent collaborations (Barabási, 2005; Raz & Gloor, 2007). Second, from the organizational perspective, social networking affects entrepreneurial performance and actions and thus entrepreneurial networking (E. L. Hansen, 1995; Larson, 1992). In the organizational context, a network is a collection of voluntary agreements between firms, which entail exchanges of information and the sharing of existing knowledge (Gulati, 1998). Third, from the individual perspective, the focus will be on individual entrepreneurs, in other words, the nodes and ties of the networks which consist of every form of communication or exchange between entrepreneurs (Brüderl & Preisendörfer, 1998; M. S. Granovetter, 1973). In addition, research based on social capital and the theories of structural holes and brokerage (Burt, 1992) are still the main topics of research.

Each entrepreneurial firm is a hub organization with a small number of stable exchange relationships that are maintained with favourite external companies (Larson, 1991). According to Bouchikhi (1993), the entrepreneurial outcome is determined neither by the entrepreneur nor by the context, but emerges in the process of their interaction. This view is supported by Sarasvathy and Venkataraman (2011), who suggest that the entrepreneurial process, the interaction, is an important source of opportunities. However, due to the lack of large amounts of data, as well as the sensitive nature of extracting information from entrepreneurial networks, empirical studies focus more on self-reported network data using offline questionnaires, and thereby lack information on the behavioural aspects of networking.
Online social networks can provide a large amount of behavioural data, with the communication and interaction between members of online social networks making it possible to collect an abundant supply of data on the behaviour of entrepreneurs.

1.3 The value of social networks

Social networks are a key component of entrepreneurial networks, generating firm legitimacy and reputation (Burt, 1992; Deeds, Decarolis, & Coombs, 2000). Entrepreneurial social networks play an important role in the start-up period of businesses. According to Brüderl and Preisendörfer (1998), social networks stimulate entrepreneurship by making use of these networks to establish new entrepreneurial ventures. Entrepreneurs attempt to organize and actually benefit from social network resources in terms of their venture’s performance in the start-up period. The findings of Brüderl and Preisendörfer (1998) are supported by several researchers, who argue that entrepreneurs require valuable resources such as information, advice, finance, skills and labour (Arent Greve & Salaff, 2003) when starting business activities to be able to realize entrepreneurial opportunities. A key benefit of entrepreneurial social networks in the start-up period is the access they provide to these resources and in gathering valuable information. In conclusion, entrepreneurs who can rely on a broad and diverse social network and who receive much support from it are more successful (Brüderl & Preisendörfer, 1998).

Based on previous studies, we consider that networks are critical to entrepreneurship. Online social networks, as a special form of entrepreneurial network, provide an opportunity for us to explore entrepreneurs’ behaviour. As mentioned at the beginning of this chapter, the use of online social networks is expected to increase in the future. In order to study how online social networks can affect the entrepreneurial process, as well as the relationship between entrepreneurship and online social networks, we raise the following research questions:

- What methodology can be used to study entrepreneurs’ behaviour?
- What influence do the size and diversity of entrepreneurs’ online social networks have on entrepreneurial survival?
- What patterns are apparent in entrepreneurs’ online social networks?
- What influence does an online social network have on entrepreneurial performance?
In order to address our research questions and fill the gap in research on entrepreneurship and online social networks, this dissertation mainly uses the theory of a Network of Networks (NoN), applying it to online social networking and entrepreneurship. This will be discussed below. In addition, we use two methodologies to analyse entrepreneurs’ online social networks. In this regard, we first had to solve the problem of how to collect the data on entrepreneurs’ behaviour from the online social networks. We developed the novel approach of using the online social network API to extract data on online social networking behaviour, and used this data to address the issue of the influence of online social network size and diversity on entrepreneurial survival. The empirical research not only proved the value of our novel data collection approach but also allowed us to develop a simulation model which can be used to explore the influence of online social networks on entrepreneurial survival. Using this model we can predict entrepreneurs’ maximum survival time based on a given start-up time frame.

The aim of this dissertation is threefold. First, we develop a methodology to analyse entrepreneurs’ online network data that automatically extracts entrepreneurs’ behavioural data. Second, we aim to analyse the structure of entrepreneurs’ online social networks. Finally, we explore how entrepreneurs use online social networks to maintain their entrepreneurial venture. The following section provides an outline of each chapter.

1.4 Dissertation overview

This dissertation is comprised of six chapters. This chapter introduces the motives for studying online social networks and the aims of the dissertation as a whole. In Chapter 2 we will develop a methodology to study entrepreneurs’ online social networks, which includes a methodology for collecting online social network data and a brief introduction to simulation. Chapter 3 and Chapter 4 will present the results of our analysis of network data from different perspectives, while in Chapter 5 we used a simulation model to study the entrepreneurial process based on a given network.

Drawing on the literature on social network analysis, Chapter 2 argues that entrepreneurs are embedded in different kinds of social networks, which can be considered a Network of Networks (NoN). We developed a novel method to extract and compare data on entrepreneurs’ profiles and their online social networks on LinkedIn, Facebook and Twitter. The methodology can also be applied in other fields to study entrepreneurs’ online social networks. We summarize the characteristics of the data collected and, in order to study the influence of entrepreneurs’ networks, we also review simulation models that can be used to further study entrepreneurship and online social networks.
In Chapter 3, we assume that entrepreneurs use multiple online social networks that form their Network of Networks (NoN). We investigate the diversity of entrepreneurs’ online social networks by analysing their online network’s industry and location diversity. We examined network size and diversity to gauge their impact on performance in terms of survival. Our findings suggest that the size of an entrepreneur’s LinkedIn network has a positive relationship to entrepreneurial survival. However, the size of the entrepreneur’s Facebook network is not related to survival, while the size of their Twitter network has a negative relationship with performance. We visualize the entrepreneurs’ LinkedIn network in terms of industry diversity. Finally, we reflect on the implications for future research on the structure of entrepreneurs’ online social networks.

Chapter 4, will primarily analyse the data collected using the methodology introduced in Chapter 2. We merged the data from the three online social networks to study the structure of the entrepreneurs’ NoN. Our analysis suggests that this NoN follows an exponential degree distribution, which implies that weak ties between individual networks play an important role in forming such NoNs. Furthermore, we demonstrate overlaps between an entrepreneur’s neighbours across the NoN, which suggests that entrepreneurs develop and use NoNs to support the entrepreneurial process.

Chapter 5, investigates the growth of entrepreneurs’ businesses in a given network and the impact of the latter on the entrepreneurial process. We assume entrepreneurs are interested in starting up new businesses with others in a given network. They attempt to find information and resources through other entrepreneurs in their networks and decide on whether to collaborate with each other. We develop a simulation model of the entrepreneurial process in terms of growth, identifying the survival rate of entrepreneurs in the network after a certain period. Our results imply that both network degree and start-up wealth positively influence entrepreneurial growth. Our simulation model can also allow us to infer the longest survival time based on a given start-up time frame.

In Table 2, we highlight the main contributions of each chapter.

### 1.5 Contribution

By studying the structure of entrepreneurs’ online social networks, this dissertation contributes to both the entrepreneurship and social network fields.

First, by extending NoN theory to entrepreneurship, we find that entrepreneurs are using multiple online social networks. We suggest that NoN theory is a novel approach to the study
of networks in entrepreneurship. Our methodology for using entrepreneurs’ online social networking data offers a new way of analysing entrepreneurial behaviour. NoN can also be used to explain phenomena in multiple disciplines. We can also infer behaviour patterns and social network structures by focusing on data gathered from the entrepreneurs’ online social networks. The potential value of the online social network in terms of providing resources, opportunities, customers and financing, as well as recruitment, can also be uncovered.

Second, we find that entrepreneurs tend to build a very diverse network during the start-up phase of their business. We use the data we collected to study their network’s structure and diversity, and to conduct an analysis of the network’s impact on entrepreneurial performance, measured by survival. We find that the LinkedIn network size is positively correlated with performance in terms of a venture’s survival and that network diversity does not impact on performance.

Third, by analysing the structure of entrepreneurs’ online social networks, we find that these networks have an exponential distribution and suggest that the networks used by entrepreneurs form an NoN, rather than occurring as individual networks. This entrepreneurial NoN is formed as a random network with an exponential degree distribution. The NoN features a high degree of overlap between individual networks. We were able to identify the communities of networks by removing the edges with the highest betweenness values, which are normally connected through weak ties.

Finally, we present a network simulation model to describe the growth of the entrepreneurial process as dependent on the position of an entrepreneur in a given network. The network
structure we use was extracted from the LinkedIn network. This simulation model can predict an entrepreneur’s maximum survival time based on a given start-up time frame and wealth allocated (capital, resources, etc.). In our model, we found that entrepreneurial growth is not only related to wealth but also to the network degree. Although we are not able to determine the threshold for entrepreneurial survival at a given time, we can still infer the survival probability based on start-up wealth and the time required for start-up. The simulation model can be used to study other potential network structures that might be helpful to entrepreneurship.

In conclusion, this dissertation provides a novel methodology to study entrepreneurship and online social networks. We suggest that online social network data can be used as behavioural data to study entrepreneurial processes. Furthermore, our simulation model can be used as an additional approach to predict the growth of new ventures in a fixed network structure. Using the simulation model, we can also explore the dynamics and impact of online social networks on the entrepreneurial process over time. This study demonstrates that the online social network can be used to study various aspects of entrepreneurship and that it is thus worthy of further investigation in future research.