Network of networks: Uncovering the secrets of entrepreneurs' networks

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CHAPTER 3

The Diversity of Entrepreneurs’ Online Social Networks

Abstract

This chapter is based on a pilot study undertaken during the data collection process. The purpose of this chapter is to test the methodology introduced in the previous chapter. We first study network diversity for entrepreneurs in the gaming industry. Based on our results, we decided to examine the structure of the online social networks of these entrepreneurs’ in terms of their network size and the diversity of different online SNSs. In particular, we investigate the structure of entrepreneurs’ social networks by analysing the diversity of their online network in relation to the industries in which their contacts are involved and their location. When we started this analysis, the data collection process was still continuing. Therefore, we used part of the data to explore the characteristics of entrepreneurs’ online social networks. In total, data from 184 entrepreneurs was used in the analysis. Our findings suggest that entrepreneurs use multiple online social networks that form their NoN, which is consistent with the theory we presented in the previous chapter. We also examine the entrepreneurs’ network size and diversity to gauge their impact on performance in terms of survival. We hypothesize that both the network size and its diversity are strongly related to the survival rate of entrepreneurs. Our findings suggest that the LinkedIn network size has a positive relationship with entrepreneurial survival, the size of an entrepreneurs Facebook network is not related to survival, while the size of their Twitter network has a negative relationship to entrepreneurial survival. We did not find any obvious influence of network diversity on venture survival. We then visualized the entrepreneurs’ LinkedIn network using industry diversity, and reflect on the implications for future research on the structure of entrepreneurs’ online social networks.

1 This chapter is based on a paper which was published in a special issue of International Journal of Organisational Design and Engineering, ‘Entrepreneur online social networks – structure, diversity and impact on start-up survival’, Vol. 2, No. 2, 2012.
3.1 Introduction

Social network analysis aims to uncover the complex relationships between groups and communities. As introduced in the previous chapter, social networking sites and recently online social networks such as LinkedIn, Facebook and Twitter are attracting the attention of many users. Entrepreneurs in particular are using different online social networking sites to share information and ideas with other people in their network as well as seek opportunities and resources. The increasing use of the internet means that the use of online social networks is becoming ubiquitous, making it an opportune time to study them. Meanwhile, the internet is also becoming a necessary platform for entrepreneurs to use in building their own networks (Baum, Calabrese, & Silverman, 2000; E. L. Hansen, 1995; Larson, 1991; Nann et al., 2010). Thus, it becomes possible to investigate their interactions and collaborations using data gathered from their online social networks. However, we need to know more about the structure of entrepreneurs’ online social networks and the extent to which social networking contributes to their business success, if at all.

Entrepreneurs are connected with and embedded in a small number of stable exchange relationships, which can be understood as a network involving other entrepreneurs and potential collaborators. These relationships collectively form small yet dense networks of ties integrating a handful of firms. The individuals and companies in these networks provide critical information and resources required for the start-up period of entrepreneurial ventures. Thus, the nodes that entrepreneurs connect to tend to be those useful in accessing valuable information and resources at different stages of the start-up process.

Previous research suggests that economic opportunities are more likely to come from contacts outside a tightly knit local friendship group (Eagle, Macy, & Claxton, 2010). In other words, the diversity and composition of a nascent entrepreneur’s social network will affect their access to information and resources and influence the likelihood of successfully starting a business (Renzulli, Aldrich, & Moody, 2000). In order to understand whether the structure of entrepreneurs’ networks matters to entrepreneurship, in particular whether the diversity of entrepreneurs’ social networks is relevant to entrepreneurial survival, we need to move beyond mere descriptive accounts to more in-depth explanations. Thus, we analysed the online social network data collected using the methodology we introduced in Chapter 2.

This chapter is based on a pilot study undertaken during the data collection process. The purpose of this chapter is to test the methodology introduced in the previous chapter. We first studied the diversity of the networks of entrepreneurs involved in the gaming industry.
Our pilot study showed that entrepreneurs in the gaming industry tend to have very diverse networks. Therefore, we continued to test the structure of entrepreneurs’ online social networks in terms of network size and the diversity of their different online SNSs. In particular, we analysed the diversity of their online networks in relation to the industry in which their contacts were involved and the location of these contacts.

In the following, we first present the theory relating to network size and network diversity. We then introduce the results of our survey of the LinkedIn networks of entrepreneurs in the gaming industry and visualize this network. We further analyse the size and diversity of entrepreneurs’ networks in relation to multiple online social networking sites, attempting to determine the effect of network diversity on entrepreneurial survival. In addition, we then compare the diversity of entrepreneurs’ use of the online social networks, LinkedIn, Facebook and Twitter. Finally, we visualize the entrepreneurs’ network across different industries.

3.2 Network measurement

3.2.1 Network size

Network size refers to the number of network actors (Burt, 1983). The larger the network is, the greater the amount of information that circulates in it. Previous studies have shown that the size of the network has a positive influence on entrepreneurial success (Baum et al., 2000; E. L. Hansen, 1995). It is suggested that smaller companies overcome some of the disadvantages of their limited size (information, resources, range within the network) by having an extensive network (Doloreux, 2004).

3.2.2 Network diversity

Network diversity refers to several dimensions and there are several definitions of diversity (Harrison & Klein, 2007). Diversity is a unit-level, compositional construct which can be used to describe the distribution of differences among members of a unit with respect to common attributes, such as tenure, ethnicity, gender, conscientiousness, task attitude, or pay (Harrison & Klein, 2007). The diversity of networks includes the diversity contributed by the nodes within a certain network. Diverse networks help people contact other social realms and restrict the amount of redundant information gathered (Renzulli et al., 2000).

The conclusions of previous work on the impact of network diversity on entrepreneurial performance are not unanimous. On the one hand, it is argued that entrepreneurs tend to
become more successful if they gain access to diverse information and resources in their network (Brüderl & Preisendörfer, 1998). The resulting diversity of ideas expressed and the tolerance of competing viewpoints should, over time, facilitate group creativity and divergent thinking which would assist the generation of new business ideas (Goncalo & Staw, 2006). In other words, the diversity of a social network can enhance the breadth of a perspective, cognitive resources, and the overall problem-solving capacity of the group (Hambrick, Cho, & Chen, 1996) and thereby enhance entrepreneurial performance in relation to specific ventures and performance throughout the entire network. On the other hand, it has also been found that the diversity of demographic features can have a negative effect on team output (Harrison & Klein, 2007). Diverse social networks may contribute to communication problems and conflicts among different actors and thereby also decrease the performance of the networks.

Granovetter (1973) elaborated on the diversity of networks by distinguishing between strong ties, consisting of relationships with high levels of emotional underpinning, and weak ties, meaning relationships with a small emotional component but with greater rationality. In other words, weak ties are the source of network diversity. Network diversity describes the degree to which contacts are structurally ‘non-redundant,’ and there are both first-order and second-order dimensions of redundancy (Aral, Muchnik, & Sundararajan, 2009). The non-redundant nodes are connected by a structural hole. Individuals whose network is rich in structural holes have access to more opportunities, information and resources (Burt, 1992). Our research on network diversity will help us understand the configuration of entrepreneurs’ online social networks as well as whether these kinds of structures can be of benefit to entrepreneurial survival.

### 3.3 The LinkedIn network for the gaming industry

Our first empirical study was based on the data collected from entrepreneurs in the gaming industry in the Netherlands. This section aims to test the methodology we developed in the previous chapter. To investigate the structure of entrepreneurs’ online social networks, we used LinkedIn data to conduct our first test. We selected 63 entrepreneurs from our dataset, all from the gaming industry. This is because this industry is relatively unknown and young. The level of entrepreneurial activity of the firms involved in the gaming industry is very high, while more than half of the revenue derived from the industry comes from developing, producing, publishing or promoting games. There are many potential opportunities for entrepreneurs in the gaming industry.
All 63 entrepreneurs including their connections make up the network. In total, we found 23,067 unique nodes within the entire gaming industry network. The average number of employees is 12, and most of the firms were founded recently (young entrepreneurial ventures). As shown in Figure 2, we mapped the entrepreneurs’ online social network by industry. We used Gephi (Bastian, Heymann, & Jacomy, 2009) for graph visualization and layout. Gephi is an open source software for exploring social networks especially for large amount of network data. Figure 3 colour-codes and lists the percentage involvement of an industry. As we can see, the gaming industry has a huge potential market, attracting connections from both gaming industry firms and firms in other industry fields. The graph of the entrepreneurs’ online social networks implies that they have very diverse networks. In the next section, we will test these hypotheses with regard to both network size and network diversity.

Based on the visualization in Figure 2, the gaming industry is very heterogeneous. Within the industry there are several different kinds of companies active in different places within the value chain, with two distinctive kinds of company to consider in particular. On the one hand, we have companies who develop and produce games, and on the other, we have publishers who deliver the games to the market. Developers have a different online social network compared to publishers, and even within the developers’ branch there are differences among the links within their networks. Previous research has shown that the personal social networks of people are influenced by socio-demographics, behaviour and other characteristics (McPherson, Smith-Lovin, & Cook, 2001).
3.4 Multiple networks and entrepreneurial survival

3.4.1 Hypotheses

When we started the analysis of this chapter, the data collection process was still continuing. Therefore, we used part of the data to explore the characteristics of entrepreneurs’ online social networks. In total, data from 185 entrepreneurs was used in the analysis. Each entrepreneur was involved in different online social networking sites. We tested the network diversity and entrepreneurial survival based on data from multiple online social networks. Before we start our analysis, we will review the literature on venture survival.
According to Geroski (1995), the survival rate for most market entrants is low, and a successful entrant may take more than a decade to achieve a size comparable to that of the average incumbent. Furthermore, the literature also suggests that the entry of innovative firms is more common but less successful than entry by diversification. Studies of offline social networks have shown that entrepreneurs who are well connected are more successful (Baum et al., 2000; Raz & Gloor, 2007; Schilling & Phelps, 2005; Uzzi, 1997; Uzzi & Spiro, 2005). There is empirical evidence for the importance of social networks for entrepreneurial performance in offline settings. We aim to investigate if the same holds true in the online realm, by comparing online social network structures and entrepreneurial performance. We need to take into consideration that measuring the performance construct is difficult, given its multidimensional nature (Cameron, 1978; Chakravarthy, 1986). Furthermore, in the context of entrepreneurial start-ups, general performance measures, such as profit, are somewhat misleading, given initial (sunk) costs that need to be regained (Bosma, van Praag, Thurik, & de Wit, 2004).

Our data included a snapshot view at one particular point in time rather than longitudinal data. In cases where revenue information over time was not available, indirect performance measures such as the percentage change in revenues and number of employees was used. Network structure is one of the most frequently used approaches to evaluating the network role in entrepreneurship. We derived a set of hypotheses using network size and network diversity as proposed by Witt (2004).

Small social networks are effective in conserving resources, while large networks enable the acquisition of new resources (Garton et al., 1997). A high number of links means the possibility of obtaining diverse information (Arent Greve, 1995). In other words, larger social networks exhibit more heterogeneity in the social characteristics of the network members and more complexity in the structure of these networks. Hence, the first two hypotheses concern network size and network diversity:

- **Hypothesis 1a:** Entrepreneurs’ online network size is positively related to the survival of their new venture.

- **Hypothesis 1b:** Entrepreneurs’ online network size is positively related to network diversity.

If the network actors have similar backgrounds and work experience, they can share information and their experiences more easily. However, this will also limit the information and resources that they can obtain from their network. A variety of differences with respect to relevant
dimensions (e.g., sex, age, race, occupation, talents) can assist the entire network to obtain new resources, which can contribute to entrepreneurship and innovation (Burt, 1983). Entrepreneurs with better and more diverse interpersonal connections tend to earn more income and are more frequently promoted (Burt, 1997; M. Granovetter, 1985). Organizations and entrepreneurs start networking with each other to gain access to critical resources, but they also rely on information from the industry network to determine whom to approach for any critical resources and the possibility of establishing new relationships (Gulati & Gargiulo, 1999).

Entrepreneurs, active agents who organize resources, are a critical element in the formation and viability of innovative industries and clusters (Feldman, Francis, & Bercovitz, 2005). According to Feldman et al. (2005), industrial clusters can best be defined as an agglomeration of mutually reinforcing ventures and aligned interests that play an important role in the development of entrepreneurial ventures. Several studies have found significant evidence of the positive impact of industrial clusters on entrepreneurship, with a high number of linkages with industry-related businesses (strong industrial clusters) having a positive influence on a venture’s performance in the early stages by providing better access to valuable resources that assist in commercializing products and services (Delgado, Porter, & Stern, 2010; Feldman et al., 2005; Raz & Gloor, 2007). To further understand the structure of entrepreneurs’ online social networks and whether entrepreneurs are also clustered in online social networks, we tested the following hypothesis regarding industry diversity:

- **Hypothesis 2a:** The industry diversity of entrepreneurs’ LinkedIn networks is positively related to their entrepreneurial survival.

Entrepreneurs tend to become more successful if they gain access to most of the information and resources in their network (Brüderl & Preisendörfer, 1998). There is a common opinion that people share information with the people who are close to them. In offline networks, geographical proximity facilitates information sharing. We tested the following hypotheses on the relationship between the geographical diversity of online social networks and their performance in terms of survival. Most importantly, we investigated whether the geographical diversity of different online social networks influences their entrepreneurial survival. Thus we propose:

- **Hypothesis 2b:** The geographical diversity of entrepreneurs’ LinkedIn networks is positively related to their entrepreneurial survival.

- **Hypothesis 2c:** The geographical diversity of entrepreneurs’ Facebook networks is positively related to their entrepreneurial survival.
• **Hypothesis 2d: The geographical diversity of entrepreneurs’ Twitter networks is positively related to their entrepreneurial survival.**

Diversity is often used in research in the fields of sociology, ecology and most areas of communication. We adopted the Blau Index of Variability (Blau, 1977) to measure the diversity of entrepreneurs’ online social networks. The Blau diversity index is defined as:

$$1 - \sum p_i^2$$

where $p$ is the proportion of categories in a given category and $i$ is the number of different categories of the feature across all groups. For example, if an entrepreneur has 100 connections from 50 different countries, then $p$ is the proportion of the entrepreneurs coming from the city $i$ ($i$ is from 1 to 50). A perfectly homogenous network will have a diversity index of 0 (e.g. all entrepreneurs coming from the same city), and a perfectly heterogeneous network will have a diversity index of 1 (e.g. all entrepreneurs come from different cities). As the number of categories increases, the maximum value of the diversity index increases. Table 6 summarized our hypotheses.

Our data was collected using the methodology described in the previous chapter. In total, 345 respondents participated in our survey. We filtered out non-entrepreneurs and respondents from outside the Netherlands. We selected 185 entrepreneurs who shared their LinkedIn

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Overview of hypotheses</th>
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<tbody>
<tr>
<td><strong>Measurement</strong></td>
<td><strong>Hypotheses</strong></td>
</tr>
<tr>
<td>Size</td>
<td>Online Social Network Size</td>
</tr>
<tr>
<td>Hypothesis 1a: Entrepreneurs’ online network size is positively related to the survival of their new venture</td>
<td></td>
</tr>
<tr>
<td>Hypothesis 1b: Entrepreneurs’ online network size is positively related to network diversity</td>
<td></td>
</tr>
<tr>
<td>Diversity</td>
<td>Industry Diversity</td>
</tr>
<tr>
<td>Hypothesis 2a: The industry diversity of entrepreneurs’ LinkedIn networks is positively related to their entrepreneurial survival</td>
<td></td>
</tr>
<tr>
<td>Geographic Diversity</td>
<td>Hypothesis 2b: The geographical diversity of entrepreneurs’ LinkedIn networks is positively related to their entrepreneurial survival</td>
</tr>
<tr>
<td>Hypothesis 2c: The geographical diversity of entrepreneurs’ Facebook networks is positively related to their entrepreneurial survival</td>
<td></td>
</tr>
<tr>
<td>Hypothesis 2d: The geographical diversity of entrepreneurs’ Twitter networks is positively related to their entrepreneurial survival</td>
<td></td>
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</tbody>
</table>
network information with us. We assume that the LinkedIn network would be more relevant to our study and thus we only selected entrepreneurs who had LinkedIn accounts. Of these 185 entrepreneurs, 114 had both a LinkedIn network and a Facebook network, while 78 used all three online social networks. Table 7 presents a detailed breakdown of our data.

Entrepreneurs’ online social networks are highly heterogeneous, with an average industry diversity index of 0.65 and an average geographical diversity index of 0.67–0.97. Our data suggests that using multiple online social networks (NoNs), increases an entrepreneur’s network heterogeneity, with a diversity index of 0.97. About 58–61% of entrepreneurs used two online social networks, while 42% used three online social networks, which suggests that entrepreneurs do not limit themselves to one online network but tend towards an NoN.

<table>
<thead>
<tr>
<th>Table 7</th>
<th>Network data description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LinkedIn</td>
</tr>
<tr>
<td>Number of Respondents</td>
<td>185</td>
</tr>
<tr>
<td>Average Network Size (Nodes)</td>
<td>316</td>
</tr>
<tr>
<td>Average Industry Diversity Index</td>
<td>0.65</td>
</tr>
<tr>
<td>Average City Diversity Index</td>
<td>0.87</td>
</tr>
</tbody>
</table>

3.4.2 Entrepreneurial survival

As we reviewed in Chapter 1, building a new company is a highly competitive and risky endeavour (Stuart et al., 1999), hence, entrepreneurs who start new ventures need to continuously seek opportunities and mobilize resources (Aldrich & Auster, 1986). According to Geroski (1995), the survival rate for most entrants is low, and a successful entrant may take more than a decade to achieve a size comparable to that of the average incumbent. Furthermore, the results suggest that the entry of innovative firms is more common but less successful than entry by diversification.

There are three kinds of possible measurements to evaluate the success of an entrepreneurial endeavour (Witt, 2004). The first is based on self-evaluations by entrepreneurs of the success of their business. However, this is a somewhat subjective measure as different entrepreneurs are not equally satisfied about their performance, and therefore it is not suitable to study the success of start-ups (Chandler & Hanks, 1993). The second measure considers the survival year of new start-ups. The difficulty of taking firm survival into account is the determination of a
minimum time period for survival. A short survival period might only cover a small part of the initial entrepreneurial phase and a long survival period might include established, developed companies instead of start-ups. Previous studies use a three to five year time frame when using survival as a parameter of entrepreneurial performance (Brüderl & Preisendörfer, 1998; Gartner, Starr, & Bhat, 1999). The third measurement of success is the growth rate of the company (Brüderl & Preisendörfer, 1998; Witt, 2004). The most commonly used growth rates are sales growth (Brüderl & Preisendörfer, 1998) and employment growth (Baum et al., 2000).

Studies of offline social networks have shown that entrepreneurs who are well connected are more successful (Baum et al., 2000; Raz & Gloor, 2007; Schilling & Phelps, 2005; Uzzi, 1997; Uzzi & Spiro, 2005). There is empirical evidence for the importance of social networks for entrepreneurial performance in offline settings. We aim to investigate whether the same holds true in the online realm by linking online social network structures to entrepreneurial survival. However, we need to take into consideration that measuring the performance construct will be difficult given its multidimensional nature (Cameron, 1978; Chakravarthy, 1986). Furthermore, in the context of entrepreneurial start-ups, general performance measures, such as profit, are somewhat misleading given initial (sunk) costs that need to be regained (Bosma et al., 2004).

In this chapter, we used non-financial entrepreneurial performance measures (Bosma et al., 2004; Bouchikhi, 1993; Gimeno, Folta, Cooper, & Woo, 1997; Lumpkin & Dess, 1996; Singh, 1997), namely ‘survival’ to represent the performance of a new venture. In the context of this study, survival refers to the hazard of business ownership. Information was available on the survival time of the start-ups in our study. On this basis, we constructed a variable measuring the number of years that a firm had been active.

Our data included a snapshot view at one particular point in time rather than longitudinal data, which would have supported the use of Compound Annual Growth Rate (CAGR) as a performance measure and allow the results to be compared between the ventures. In cases where revenue information over time is not available, indirect performance measures such as the percentage change in revenues and in the number of employees can be used. However, this study focuses solely on survival as a measurement of performance. In the following section we will present the results of our analysis of the effect of the entrepreneurial network structure on performance in terms of survival.
3.5 Results

All the entrepreneurs in our study use LinkedIn. In the first step in the analysis, we performed a one-way ANOVA for LinkedIn industry diversity and company age to test the similarities among different groups (Table 8). We grouped the industries into ten categories. The respondents belonged to six of these – industrial materials, service, health, financial, IT and telecommunication industries – though their networks were linked to nodes in all ten categories. We found that respondents in each of the categories had distinctively different levels of industry diversity ($F_{(5,183)} = 4.786, p < 0.001$). They were also are significantly different in terms of company age ($F_{(5,183)} = 3.968, p = 0.002$). Among the groups, those in the service industry had the lowest industry diversity in their online social networks, with the rest of the groups being at the same level. The health industry had the highest company age, with the rest of the groups being at the same level.

We propose that the size of an entrepreneur’s network is related to performance. In Table 9 we present the results of the second step of our analysis, a regression analysis testing the correlation between online social network size and venture survival.

Table 8  ANOVA

<table>
<thead>
<tr>
<th>Industry diversity</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>.228</td>
<td>5</td>
<td>.046</td>
<td>4.786</td>
<td>.000*</td>
</tr>
<tr>
<td>Within Groups</td>
<td>1.698</td>
<td>178</td>
<td>.010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1.926</td>
<td>183</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>418.065</td>
<td>5</td>
<td>83.613</td>
<td>3.968</td>
<td>.002*</td>
</tr>
<tr>
<td>Within Groups</td>
<td>3,750.668</td>
<td>178</td>
<td>21.071</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4,168,734</td>
<td>183</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9  Regression coefficients with survival as the dependent variable

<table>
<thead>
<tr>
<th>Predictors</th>
<th>P-value (Std. 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LinkedIn network size</td>
<td>.01 (0.28)*</td>
</tr>
<tr>
<td>Facebook network size</td>
<td>.83 (0.02)</td>
</tr>
<tr>
<td>Twitter network size</td>
<td>.03 (-0.20)*</td>
</tr>
<tr>
<td>The age of entrepreneurs</td>
<td>.00 (0.43)*</td>
</tr>
<tr>
<td>$R^2 (R_{adj}^2)$</td>
<td>38% (34%)</td>
</tr>
</tbody>
</table>
The results suggest that the LinkedIn network size is significantly related to entrepreneurial performance in terms of survival (Hypothesis 1a). However, Facebook network size has no correlation with performance in terms of survival, while Twitter network size is negatively related to entrepreneurial performance in terms of survival. The results of this study suggest that the entrepreneurial survival rate will increase as the LinkedIn network size increases, while an entrepreneur’s survival rate will decrease as their Twitter network increases. This model as a whole explained 34% of the variance in entrepreneurial performance in terms of survival and implies that LinkedIn network size has a positive relationship to entrepreneurial survival. A plausible explanation is that entrepreneurs might use Facebook for purposes other than business. Twitter, which is a directed network, has both friends and followers. Twitter, which had a negative effect on survival rate, may require more ‘online time’ and if this is indeed the case, it may impact on entrepreneurs performance. In this chapter, we did not include measurements for the time spent by entrepreneurs on each of their online social networks. This may be an interesting topic for future research.

These results indicate that an entrepreneur’s use of LinkedIn, in terms of LinkedIn network size, is positively correlated to a venture’s survival. However, there was no causality found between network size and venture survival in this study. A future study should address the question of whether online social network size is the cause or the consequence of new ventures.

No relationship was found between online social network diversity and entrepreneurial performance in terms of the number of employees and revenue growth. We conducted a regression analysis with regards to the diversity in the network and found that entrepreneurs’ online network diversity has no relationship with performance in terms of survival (Hypothesis 2a-Hypothesis 2d). This could be due to the data on survival not being strong enough to explain entrepreneurs’ performances in terms of survival.

In order to explore future steps for this research project, we carried out a correlation analysis on all of the study variables we used. We found that industry diversity is correlated with network size (Hypothesis 1b), while geographical diversity also demonstrates a significant correlation with network size. Similar to our result for Hypothesis 1a, there was no causality found between geographical diversity and online social network size. Due to the lack of longitudinal data, we aim to explore the causality between online social network size and entrepreneurs in the next phase of our study, which will take place in the future.

We examined the degree of centrality relative to the network map generated based on the entrepreneurs’ LinkedIn accounts using Gephi (Figure 4) (Bastian et al., 2009). The dataset
includes 185 respondents and a network of more than 58,000 nodes. The circle size depicts an entrepreneur’s importance in terms of degree of centrality and network size. The different colours of the nodes represent different industries. The industries in which entrepreneurs have networks showing a higher degree of centrality (larger networks) are business services, IT and the financial industries.

### 3.6 Discussions and conclusions

In this chapter we first explored and mapped the entrepreneurs’ LinkedIn networks. We selected 63 entrepreneurs from the gaming industry from our database. We found that entrepreneurs tend to build a very diverse network when starting up their businesses. Based on our first analysis, we continued to test our hypotheses by analysing online social network data from LinkedIn, Facebook and Twitter. We included 185 entrepreneurs, of which 114 used LinkedIn and Facebook, and 78 used LinkedIn, Facebook and Twitter. Our dataset...
includes more than 58,000 nodes. Although our method was used in this chapter to generate a snapshot view of the networks, it can also be used for longitudinal studies, in which the dynamics of the networks can be explored over time. As mentioned in the previous chapter, our method improved the quality of the data in comparison to self-reported data used in previous studies of social networks.

We used the data to study the structural diversity of entrepreneurs’ networks and conducted an analysis of the impact of the networks on entrepreneurial performance in terms of survival. We found that the LinkedIn network size is positively correlated with performance in terms of a venture’s survival. In other words, entrepreneurs who survive longer have more online connections than other entrepreneurs. This result further confirms that entrepreneurs’ online social networks are important (Nann et al., 2010). However, we did not find a clear causal link in this research. In other words, it was not clear whether the entrepreneurs survive because of the online social network degree, or whether the online social network degree results in a higher survival rate. This remains a question for future research.

Our research also found that network diversity is not related to a venture’s survival. Previous studies have shown that the nature and effects of diversity remain uncertain (Harrison & Klein, 2007). Although previous studies have also shown that diversity in an individual’s relationships is strongly correlated with the economic development of communities (Nathan Eagle et al., 2010), the effect of network diversity does not seem to be relevant in our study. One of the reasons for our result might be that entrepreneurs tend to use their online social networks for multiple reasons, as mentioned in Chapter 1, such as information exchange, social support, friendship, recreation, common interests and technical support (D’Andrea et al., 2010; Ridings & Gefen, 2004).

This chapter makes several important contributions. First, it demonstrates the feasibility of a novel approach to accessing and collecting online social network profiles and network information. The results suggest that the structure of online social networks in terms of network diversity differs from what had been expected. Entrepreneurs tend to have very diverse networks. However, not all of the networks are related to each other, which can be interpreted to mean that entrepreneurs do not use all of their online social networks for business purposes, or that the purposes for which entrepreneurs use online social networks differs.

Secondly, as a contribution to the literature on online social networks, which has primarily focused on private use, our study provides new insights into the use of online social networks by entrepreneurs and the effect of this on entrepreneurial survival. In relation to the literature on entrepreneurship, we thus provide some initial insights into aspects of online social
network structures that positively influence performance and how this influence may differ from that of offline social networks. The literature shows that within the online communities, the similarities are extremely high (Bisgin et al., 2010), which means that network homophily theory (McPherson et al., 2001) holds true for online social networks. However, this conflicts with our dataset, with the study in this chapter revealing that the online social networks of entrepreneurs in the gaming industry are very diverse.

Thirdly, in this chapter we found that LinkedIn seems to be more relevant to entrepreneurship in terms of network size. However, this does not mean that we suggest that entrepreneurs use the LinkedIn network more than other social media. The Facebook network has a small-world effect and six degrees of separation, as confirmed on a truly global scale according to a previous study (Ugander et al., 2011). In other words, individuals on Facebook potentially have distant borders for their networks. Due to the large number of friends of friends, individuals might have more connections, but they are very weak ties. This may be an interesting aspect for entrepreneurs using Facebook networks in the future. The Twitter network did not appear important in our study, especially with respect to the Twitter network size. One of the reasons for this is that Twitter is used more for micro-blogging than social networking. Thus, the content of the networks might be interesting for future research.

However, we cannot overlook the importance of online connections for the formation of weak ties, since most of the entrepreneurs identify opportunities through their weak ties (Elfring & Hulsink, 2007). Even though this chapter could not explain the underlying causes of the conflicting results, the characteristics of the internet allow individuals, in particular entrepreneurs, to connect with people in distant places. Although online community users generally have a trusting attitude towards others in terms of fairness, trust and helpfulness, this attitude is not transferred to specific individuals they meet online, indicating that the online community lacks the capacity to create the deeper relationships or attachments between its members which are naturally formed in physical communities (Junghee Lee & Hyunjoo Lee, 2010). This difference between offline and online relationships suggests that trust among nodes in online social networks would be a worthwhile topic for future research.

Last but not least, empirical research on entrepreneurial network dynamics has been limited by a lack of longitudinal and process-oriented data. Consequently, the research addresses neither the emergence or dynamics of networks over time, nor provides links to venture performance. The study discussed in this chapter showed that it is possible to collect entrepreneurs’ behavioural data automatically. It also implies that it is possible to collect online social network data longitudinally for a dynamic network analysis.
As mentioned above, in this chapter we studied entrepreneurs’ online social networks from the perspective of network characteristics such as network size and network diversity. In order to further study the underlying mechanisms of online social networks, in the following chapter we will investigate the structure of entrepreneurs’ online social networks and their distribution.