

**How gender affects collaborative innovation networks performance: The case of the Dutch fashion industry**

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## ***How Gender Affects Collaborative Innovation Networks Performance: The Case of the Dutch Fashion Industry***

### **Abstract**

*The aim of this paper is to study the use of online social networks by male and female fashion entrepreneur's in-order to better understand its structure and how it better leads to collaboration and better performance. In particular, we examine whether gender, diversity, and their combined effects influence the performance of start-ups in the fashion industry. We assume that an entrepreneur's diverse online social network of weak ties and strong ties has a different impact for male and female entrepreneurs on the performance of the start-ups. Our data was collected through industry surveys and from Facebook. It was subsequently analyzed using ANOVA for testing direct and interaction effects of gender and network diversity. The key finding of this study pertains to the interaction effect of gender and network diversity on the performance of a start-up. In general, start-ups established by male entrepreneurs displayed higher performance as a result of the diversity of their online social networks compared to female entrepreneurs.*

**Keywords:** *Entrepreneurs, fashion industry, online social network, strong and weak ties*

# ***How Gender Affects Collaborative Innovation Networks Performance: The Case of the Dutch Fashion Industry***

## **Introduction**

In face of the recent financial crisis and high unemployment rates around the world, specifically in Europe, it is important to better understand collaboration effects on start-up performance (Schott, 2017). Consequently, many people were forced to explore new opportunities to support themselves through self-employment and entrepreneurship. One of the industries which has seen a rapid rise in self-employment and has experienced relative growth despite the financial crisis is the fashion industry (Libanio & Amaral, 2017) as a result of its low entry barriers (Uzzi, 1996). Innovation performance is seen as an important indicator for evaluating a firm's performance (Lai et al., 2011). Much research has focused on the influence of external factors have on firm innovation and have shown its importance on firm performance.

Despite the growth in the number of fashion start-ups, some of these start-ups become incredibly successful while others remain in mediocrity. In order to assess if a start-up is successful, performance indicators of these ventures are needed. However, traditional performance indicators such as return on investment and profitability are less appropriate for start-up companies which are frequently still in the early stages of product development (Hart, 1995). Profitability indicators for start-ups are usually negative or low in the first few years due to initial sunk costs and anonymity (Katzy et al., 2013). However, this may not necessarily mean that a start-up is unsuccessful or will continue to be unsuccessful in the future. Hence, one of the current mandates in the entrepreneurship literature is how to adequately assess performance or success of start-up enterprises, especially as much of its value is socially embedded in social networks and one's abilities (Teunissen, 2011).

This paper will focus on start-ups in the fashion industry in the Netherlands in order to better understand the effect of one's gender in on-line social networks on performance. Fashion and creativity have gained more importance in understanding entrepreneurial activities, especially in the creative industries (Copercini, 2015). In the fashion industry, production underlines the social process of manufacturing goods and its value is determined by its social value of others (Scheffer & Duineveld, 2004). In this paper the

social online entrepreneurial network is seen as the interaction between individual actors and how they relate to each other. It is important to note that in the fashion industry, value creation is not only the result of economic processes, but also the social components that influence and drive its economic activities (Uzzi, 1996).

Beyond challenges associated with measuring performance, another recent mandate in the entrepreneurship literature has been the rise of online social networks, such as Facebook and Twitter in entrepreneurial activity and how it affects performance (Song & Berger, 2017). Although much of the early entrepreneurship research has focused on the link between entrepreneurs' offline social networks and start-up performance, the rise and proliferation of online networking warrants an analysis of the effect of online social networks on performance of start-up ventures (Schoen et al., 2013), especially as gender differences become more apparent. In this paper, we respond to both mandates by theorizing and empirically assessing the role of online social networks on the performance of start-up ventures through an integration of traditional social network theory and online social network theory. Furthermore, we empirically validate a set of recent performance metrics that are appropriate for start-up settings and which have not yet been explored in the context of online social networks.

This study contributes to a better understanding of the impact of popular social networks, such as Facebook and Twitter on entrepreneur's success taking into account one's gender (Ellison 2007). It further sheds light onto a novel dimension of social networks that has been largely overlooked in the traditional social network literature, namely the importance of network size diversity and gender (Choi & Berger, 2010). Online social networks tend to be exponentially larger than offline social networks, with the average online social network user reporting around 350 friends (Song & Berger, 2017). One's networks does not simply become larger, but also become more varied and complex in nature (Solano, 2016). Managing these networks becomes more complex and hence understanding the mechanisms and processes enabling collaborative innovation become more important (Allen et al., 2016).

By opening up online social networks to such diverse stakeholders as customers, suppliers, employees, and distribution partners in addition to personal friends and family, entrepreneurs' online social networks have changed in structure, nature, and reach compared to traditional offline social networks (Burke, 2011; Choi & Berger, 2011). While still firmly rooted in existing offline social networks, online social networks are positively

associated with various forms of bridging social capital highlighting the potential importance of various types of ties, including both strong and weak ties, as one aspect of network diversity in the context of online social networks (Ellison, 2007). Much research has focused on geographic proximity, but we claim that it cannot be analysed by itself and should incorporate additional dimensions such as gender (Allen et al., 2016) as was done in this research.

The Dutch fashion industry built a name for itself during the 1990s, when the government decided to support it through art grants. The general fashion was based on a modernist culture embedded in its cultural traditions, including regional dress and craft ethnicities. This was done in a view to differentiate itself from other fashion centres such as Paris and London. Fashion, is generally accessible to everyone, as long as funds are available. It offers one the opportunity to "fit in" with one's group and emphasize one's individuality. The paper is structured as follows: first, we briefly review the literature on network diversity, gender, and start-up performance; subsequently, we propose a set of three hypotheses and discuss the data collection and data analysis process; and finally, we present the results from our hypotheses testing and discuss implications and limitations associated with this study.

## **Theoretical Framework**

Uzzi (1996) claimed that one's exchange mechanism, be it socially based or arm's length based, defines the opportunities available. The mechanism chosen shapes performance that may equal or surpass market alternatives. The fashion industry is a particularly interesting context for studying the impacts of network diversity as it is a hypercompetitive market with short product life cycles, with low environmental barriers and is socially based (Libanio & Amaral, 2017). Neoclassical theory stipulates that in this case arm's length market exchange mechanism should prevail. Examining the effect of both mechanisms on innovation success is to better understand the formation and success of social networks. Industry-specific challenges and its effect on performance, including challenges associated with fashion sense, seasonality, and timing, make the research more interesting (Saviolo & Testa, 2002). For instance, bringing together customers, suppliers, employers, distribution partners, family, and friends may enable fashion start-ups to better assess market needs and trends (Berger & Gavish, 2015). Hence, in light of the anticipated benefits of network diversification, we explore the direct and interaction effects of the entrepreneur's gender

and the diversity of his or her online social network on their network structure and performance.

### ***Network Diversity***

Entrepreneurs' networks systematically vary by the nature and phase of their start-up, from motivation to planning to the establishment phase (Greve & Salaff, 2003). Specifically, the planning phase of a start-up seems to depend most critically on the benefits of a diverse, yet, stable networks. Although networks have many different characteristics, the most important aspect of network diversity pertains to the networks composition in terms of weak and strong ties (Granovetter, 1983). During the planning stages of a new start-up entering an industry is the establishing and building of a social network, is connecting with people who provide the entrepreneur with direct access to resources that are hard to get through the market (Elfring & Hulsink, 2007). At this stage, strong ties, such as friends and relatives, provide little benefit in terms of knowledge and resources about the industry (Jack, 2005). Therefore, in the case of independent start-ups, the entrepreneur focuses on weak ties representing insiders of the fashion industry to assist in integrating into the industry (Elfring & Hulsink, 2007) .

It is important to keep in mind that not all fashion start-ups are new entrants into the fashion industry. Some are referred to as spin-offs and are seen as start-ups that emerge from ideas and knowledge from insiders within the fashion industry. These insider start-ups are more likely to focus their network on strong ties to existing partners or parent organizations in order to obtain information on opportunities, acquire resources and gain legitimacy (Elfring & Hulsink, 2007). Hence, there is a need to better understand how social structure based on gender assists or impedes economic performance.

Besides these initial founding conditions that impact the ideal mix of strong and weak ties in an entrepreneur's online social network, post-founding processes may further impact network diversity. Again for spin-off start-ups, their relation to already existing organizations reduces the amount of time and resources that need to be allocated to creating brand awareness and reputation. The opposite holds true for independent start-ups, which will spend much of their effort on establishing brand image and legitimacy. These start-ups will further reinforcing the importance of weak ties (Elfring & Hulsink, 2007; Shane, 2000). Depending on the type of start-up, entrepreneurs search and select ties to create the optimal diversity of weak and strong ties to adapt to the changing needs of the start-up over time (Elfring & Hulsink, 2007). Allen et al (2016) claimed that important

communication and signalling happens in an informal way explaining the importance of weak ties and gender differences in business success.

In addition to network diversity, the gender of the entrepreneur is a highly influential variable when considering a start-up's choice of exchange mechanism and businesses success (McManus, 2001; Hansen & Moller, 2017). Gender has been shown to influence both the size of start-up businesses, with female-owned business generally being smaller and success more modest in terms of sales, employment and profitability, which are typically higher for male business owners (Du Rietz & Henrekson, 1995). Reasons for these differences have been attributed to distinct human capital characteristics of male and female business owners (McManus, 2001). Furthermore, it has been shown that male-owned start-ups have more employees than female-owned start-ups, something that has been explained by the fact that female business owners have less access to training that can facilitate the effective transition to self-employment (Carrington & Troske, 1995).

The OECD (2012) report found that there are fewer Dutch female entrepreneurs in relation to male entrepreneurs, that they have lower profits than male entrepreneurs, and that self-employed women work less, earn less, than self-employed men and have less innovative enterprises. We claim that it is not only important to provide empirical evidence of the effect of gender on start-up performance, but also to explore potential interaction effects with network diversity leading to the mechanism of exchange chosen. It is also interesting to examine if the OECD findings hold today. Our reasons for anticipating an interaction effect between gender and network diversity are based on prior research findings that have shown that female business-owners tend to rely more on strong ties than male business-owners, specifically family support, which as aforementioned may be less useful for independent start-ups (Brüderl & Preisendörfer, 1998), specifically during the most critical planning phase (Lai et al., 2011). As a result the following hypothesis was formulated:

***Hypothesis 1: The gender of businesses owner's network size and density will be smaller than men's in network size and number of ties.***

Hypothesis 1 looks at the online social network size and diversity of the entrepreneur and the results will indicate if there is a significant difference between the network sizes of male, female and co-sex entrepreneurs. The network size will be represented by the variable number of *total likes* which represents the total number of likes the entrepreneur

has accumulated on their Facebook company page. To calculate the diversity of the online social network, steps had to be taken to calculate the average weighted degree of the edges. By adapting Burke's (2011) name generator, tie strength data was collected on eighteen Facebook connections from the survey participants. We adapted the survey from Gilbert & Karahalouis (2009) and so no API data was necessary since the name generator provided eighteen different strong, weak and random chosen ties. This ensured that an adequate number of strong and weak ties were available to make up the network model. Through the ranking of the connections of the survey participants, the average weighted degree of the edge (strength of the tie) was calculated through Gephi, to be used as the variable to represent the diversity of the online social network.

### ***Performance***

Measuring start-up performance is challenging as performance is highly multi-dimensional (Bosma et al., 2004; Chakravarthy, 1986; Berger et al., 2015). Recently, Song & Vinig (2012) proposed to focus on survival as the key measure of performance for start-ups as a more valid alternative to traditional performance metrics. In this study, we also utilize survival as the key performance metric. However, given the need for multi-dimensional measurement, we further rely on sales data measured as a snapshot of revenue information. In this study, we focus on the average revenue, first year revenue and last year's revenue as well as their change and growth. Finally, we further measure employment growth rate of the start-up, which can be measured by the number of employees hired since the start of the venture (Baum et al., 2012). As a result the following two hypotheses were formulated:

***Hypothesis 2: Male business owners are more likely than female business owners to report recent growth in revenues and employment in the start-up phase of their new venture***

***Hypothesis 3: Male business owners are more likely to have a higher performance level due to a more diverse online social network.***

Hypothesis 2 focuses on the gender assumptions and their relationship with performance. In order to collect this data Song and Vinig's (2012) measures were used to calculate the level of performance by focusing on survival, employee growth and revenue



growth. Hypothesis 3 will focus on the relationships between all three variables; gender, diversity and the performance of the start-up. The variables are respectively being represented by; the *gender of the entrepreneur, average weighted degree and employee change*.

## Methodology

As evidence of the relevance of the concept of tie strength in online social network research, Gilbert & Karahalouis (2009) used a combination of sociology and computer science to create an API (Application Programming Interface) that uses Facebook tie strength variables in order to create a measurement tool that accounts for an 87.2% reliable calculation of tie strength. Burke (2011) built on the approach used by Gilbert & Karahalouis (2009), but rather focused on the fluctuations of work ties considering social network sites (SNS) and analysed the relationship of tie strength and Facebook activity. In this study, we build on their approaches in order to explore the effect of network diversity—in terms of weak and strong ties—on start-up performance.

The entire Dutch fashion industry consisted of 1087 businesses, which include 782 Dutch start-ups founded between 2006- 2015. 15 of the 782 Dutch start-ups were sampled due to their willingness to participate in the survey. When analysing the data for the overall fashion industry, we found that 0.92% of the dataset (10 of the 1087 companies) had a missing gender variable. A Hotdeck was performed since the missing data was less than 10%, which replaces the missing data with a value of a similar donor. This resulted in the dataset consisting of 67.2% (730) female business owners, 21.40 % (233) males, and 11.4% (124) co-sex gender business owners. The analysis of the entire fashion industry illustrated that the range of years active ranged from 1-176 years, with a mean of 10.72 years of business (see table 1).

**Table 1 Gender distribution overall fashion industry**

	Frequency	Percent	Cumulative Percent
Female	730	67.2	67.2
Male	233	21.4	88.6
Co-Sex	124	11.4	100.0

The businesses that were included in this specific dataset included those whom have not surpassed the nine-year limit, which is part of the definition of a start-up (Greeve & Salaff, 2003). Businesses that failed to meet these requirements were removed from this specific data set. However, they remained in the overall fashion industry statistics. The removal of established businesses from our second data set, changed the characteristics of our data set, now consisting of 72.4% (566) female business owners, 18.8% (147) male and 8.8% (69) co-sex business owners. The average number of years in business has now dropped to 4.14 years. The characteristics of the fifteen survey participants sample specifically focusing on the diversity of strong and weak ties consists of 53.3% female business owners and 33.3% male business owners and 13.3% co-sex business owners. The average years of start-up activity from the sample surveyed was 3.80 years. The average age of the fashion entrepreneurs was 33.20. Hence, compared to the population, the sample is almost identical in terms of the average years of start-up activity, but differs in its gender make-up.

One potential confounding factor that could influence the sample data was the number of participant's who were related to self-employed business owners. Our data collection showed that females were more inclined to have a background with self-employed family members (62.5%) than their male (40%) and co-sex (50%) counterparts. These results gave us an initial indication of how dependent female entrepreneurs were on their entrepreneurial family members compared to male and co-sex entrepreneurs. The second factor that could influence the growth and performance of the start-ups is the location of the start-up (Coperchini, 2005). The results indicated that Amsterdam is by far the largest incubator considering the fashion industry businesses, with five times as many start-ups as the runner up, which was the city of Rotterdam. Simultaneously, when looking at the total number of likes the start-ups received on their Facebook company pages, Amsterdam also seems to inhabit the entrepreneurs whom are most popular on Facebook.

The third factor that could influence the data collected is the current state of the economy. Even though, the fashion industry is not as turbulent as other industries, it is still prone to the consequences of economic recessions. According to our results, none of the co-sex entrepreneurs experienced turbulent economic issues, compared to 37.5% and 25% for female and male entrepreneurs respectively who reported being impacted by the consequences of the recession.

The final factor that influences the dataset includes the total number of company likes the start-ups have received on Facebook. Schoen et al (2013) claim that on-line media

are a widely accepted and reliable source of data for predicting future outcomes based on something called the "wisdom of the crowds". Considering the multitude of benefits of having a large diverse online social network for an entrepreneur, it is no surprising that entrepreneurs artificially boost the actual number of total company page likes through the use of ghost likes that was found to be problematic in many internet trading platforms. Ghost likes are Facebook company likes that are bought through internet companies to increase the number of total likes in order to increase the popularity of the start-up online. Possible reasons for buying these ghost likes include; encouraging investors to invest, faking popularity, and obtaining real page likes because the page appears popular. According to our survey, the purchasing of company likes was also an influencing factor in this dataset, and should be taken into consideration. However, since we do not know how many ghost likes were purchased, the number of total likes will remain the same and will be considered as a limitation of the research.

## **Findings**

### ***Hypothesis 1***

#### **Overall Dutch fashion industry network**

In order to identify if female or males have larger networks we used an ANOVA test to compare the total number of likes based on gender for the overall Dutch fashion industry. The descriptive statistics of the ANOVA test showed that male entrepreneurs have a much higher mean of 10,436 total likes, compared to an average mean of 3,389 total likes for female entrepreneurs and a mean of 4,152 for co-sex couples. The ANOVA results further showed that with an F value of  $F(2, 1084) = 9.141$  and a  $p = 0.000$ , our findings were considered significant. However, the Levene test of the ANOVA descriptive statistics shows (0.00) that the data is significant for unequal variances. This significance indicates that further tests need to be undertaken in order to validate the data. Therefore, the Welch and Brown Forsythe tests were used to test against the unequal variances. The standard deviation statistics also supported the unequal variance claims made by the Levene statistic since, the standard deviation for male entrepreneurs (42,690) is four times as high as those for female (11,955) and co-sex couples (10,815). The results of the Welch and Brown Forsythe test of 0.040 and 0.004 supported the initial findings. Thus, hypothesis 1 is accepted, indicating that male entrepreneurs on average have more total likes on their company Facebook page compared to female entrepreneurs and co-sex

entrepreneurs. This finding supports McManus's (2001) research that there are gender differences in the overall Dutch fashion industry and that these differences are also valid in the context of the Internet, thereby supporting the importance of studying start-up performance in the light of gender.

#### Start-up business network

Similarly to the overall Dutch fashion industry dataset, a one-way ANOVA test was performed to determine the significance of the dataset of the Dutch start-ups. The descriptive statistics identifies that male entrepreneurs, similar to the overall Dutch fashion industry dataset, showed a higher number of total likes per Facebook company page with a mean of 10,894.41. The female and co-sex entrepreneurs respectively lag behind on average with means of 3,586.93 and 5,527.31 considering their total like numbers. Similarly to the Dutch Fashion dataset, there is a statistically significant difference between the gender means as determined by a one-way ANOVA shown by  $F(2, 779) = 5.629$ ,  $p = 0.004$ . The Levene statistic examined was also significant (0.000); therefore the Welch and Brown Forsythe test were performed. Unlike the overall Dutch fashion industry results, the Welch and Brown Forsythe test indicate different p levels of .126 and .058. In this case the Welch test rejects the hypothesis while the Brown Forsythe test barely accepts the hypothesis for this specific dataset. Many researchers indicate that if the two tests produce different results, the results of the Welch test should be favoured over those produced by the Brown Forsythe test (Brown & Forsythe, 1974). Considering the start-up dataset the Welch test rejects the hypothesis that female entrepreneurs have a significantly smaller network size compared to male and co-sex entrepreneurs.

#### Survey Participants Network

Finally, the survey participants' data set and network structures were analyzed. The descriptive statistics provided by the ANOVA test showed that male entrepreneurs had a higher mean number of total likes compared to female and co-sex entrepreneurs. Specifically, the male survey participants had a mean of 8,026.40 company likes, while females average with a mean of 1,112.38 likes, and co-sex couples average at 1,064.00 even though the male standard deviation is much higher at 9015.680 than those of the female and co-sex couples of 952.646 and 905.097 respectively. The Levene statistic of 0.000 indicates that the test is significant for unequal variances and the Welch and Brown Forsythe test should be performed. The results of the ANOVA test indicate that there were no statistically significant differences between the gender means as determined by one-way

ANOVA shown by  $F(2, 12) = 2.885$ , where  $p = .095$ . Because of the significance of the unequal variances in our dataset, the ANOVA insignificance is not as important as the Welch and Brown Forsythe test results. The Welch test indicated a p-value of .411, while the Brown Forsythe test indicated a p-value of .163. Both p-values do not satisfy the  $p < 0.05$  assumption for significance of the hypothesis and data. Therefore, we could not accept the hypothesis proposed, since all the performed tests indicate that there is no statistical significance between the gender means and so was rejected.

The research of McManus (2001) about significant differences in male and female entrepreneur network sizes has been tested through the three fashion datasets. Even though the overall fashion industry dataset supported the assumption that female networks tended to be smaller in size compared to those of male entrepreneurs, the other two datasets rejected any significant difference. Furthermore, we took into consideration that “ghost likes” could affect the results generated by the datasets. Nonetheless, the initial results have not fully supported previous research on possible gender differences, gender will remain an influencing variable and all other variables will be cross-tested based on gender.

In order to study the purpose of social media for the gender (i.e. male and female and co-sex survey participants), we designed questions to identify strong ties and weak ties. A cross tabulation was made for both weak and strong ties, indicating specifically which characteristics each gender groups found important when ranking their own weak and strong ties in their online social network. The weak tie characteristics that proved to be most important for all gender categories included; new customers selected by all male (100%), female (75%) and co-sex (100%) entrepreneurs. Followed by product feedbacks that were selected as representative characteristic by 60% of the male entrepreneurs, 50% females and 100% co-sex entrepreneurs. All the other characteristics did not receive more than half of the fifteen survey participants’ selection; however other medium ranked characteristics included knowledge of owners of a business/business partners, new distribution channels and potential new business partners. The strong tie characteristics selected as representative purposes of strong ties in entrepreneurs’ online social networks included product feedback, new customers, potential business partners, gain of marketing insights, and skills and knowledge gain of a similar industry colleague.

An ANOVA one-way test was performed in-order to examine if female or co-sex couples have a significant higher ratio of family members and close friends in their online social network compared to male entrepreneurs. Levene’s test showed an insignificant result of .342. Therefore, using the ANOVA results of  $F(2, 12) = 2.848$ , and a p-value of =

0.97, we found no significance (0.97) concerning the gender mean and the ratio of family likes. Subsequently, a LSD and Tukey test were performed to look for any significant relationships. The LSD results showed that male entrepreneurs have a 0.84 marginal significance value compared to female entrepreneurs, and a 0.55 marginal significance value explaining its relationship with co-sex couples. These initial results showed that male entrepreneurs do have a tendency to have a lower family ties ratio compared to female and co-sex couples, indicating that they are more likely to have a higher degree of dependence on knowledge from outsiders. In his case, we expected that male entrepreneurs will have more weak ties and strangers in their online social network compared to female and co-sex entrepreneurs.

Finally, all the survey participants were evaluated based on the overall fashion industry, start-up network and their own self-reported network collected through the survey's name generator and the ranking of their own network ties. All survey participants online social network were built by Gephi, at Forceatlas 2, with dissuade hubs and prevent overlap to be able to build the best quality networks. The statistics that were collected from every online social network from the fifteen survey participants included; average degree, average weighed degree, network diameter, radius, average path length, number of shortest paths and graph density. All the edges and nodes were considered to be directed, since the edges represent the connection created by a like on Facebook from the start-up to another business and vice versa, including reciprocated likes that should not be counted as a single like. In absolute terms, the path lengths and diameters for nearly all the online social networks in the overall fashion industry are remarkably short, for the exception of *Business1* (4445), *Business2* (243) and *Business3* (117). Similarly, the start-up businesses also had remarkably short path lengths and diameters with again the exception of *Business1* (2464), *Business2* (209) and *Business3* (97). This property may be a consequence from the high degree of reciprocity within the social networks or the small size of the online social networks of some of the start-ups. To identify the significance of diversity on the different gender groups a one-way ANOVA was performed based on the average weighted degree. Both the overall fashion industry and the start-up industry showed an insignificant result considering the online social network diversity of the survey participants. The results of the overall fashion industry ANOVA test indicate that there was no statistically significant difference between the gender means as determined by one-way ANOVA considering online social network diversity by  $F(2, 12) = .314$  and a p-value = .737. Similarly, the results of the start-up business ANOVA test indicate that no

statistically significant difference could be determined between the gender means and the online social network diversity shown by  $F(2, 12) = 1.197$  and a  $p\text{-value} = .336$ . However, the self-reported networks of the entrepreneurs showed significant ANOVA one-way results showing by  $F(2, 12) = 4.033$  and a  $p\text{-value} = .046$ , showed that indeed male entrepreneurs are more likely to have more weak ties in their online social network compared to female and co-sex entrepreneurs.

The results on the diversity of the online social network of the entrepreneur based on gender showed conflicting support. Based on the research done by Greve & Shalaff (2003) and Renzulli et al (2000), the focus of diversity based on gender is important to this research in order to be able to identify if male entrepreneurs are more diverse in their online social networks compared to female entrepreneurs. For both the overall fashion industry and the start-up data set no significant difference is identified when comparing the diversity of the online social networks. However, the survey participants' dataset showed significant support to indicate that male entrepreneurs were considered to have more diverse networks compared to co-sex and female entrepreneurs.

## ***Hypothesis 2***

### **Employment**

The reason for focusing on employment is due to previous research done by Baum et al (2000) and Song & Vinig (2012). Both of them used employee growth in order to measure the performance and successfulness of the start-up. Our initial results illustrated that 53.33% of the start-ups achieved employment growth in the first years of business. In order to test this hypothesis, the growth was compared to the ratio of female and male business owners. The ANOVA one-way test was performed in order to identify if the gender of an entrepreneur had a significant effect on the change in employment from the founding stage to the current stage of business. The descriptive statistics showed an insignificant Levene statistic of .375, indicating that the ANOVA test is sufficient to test for significance and no unequal variances were reported. The results of the ANOVA test indicated that there was a statistically significant difference between the gender means as determined by one-way ANOVA considering change of employment shown by  $F(2, 12) = 3.691$  and a  $p\text{-value} = .056$ . The ANOVA test indicated that there was indeed a significant relationship between the gender of the entrepreneur and the mean growth of employees employed by the start-ups. This significance indicated that the hypothesis proposed should be accepted when focusing primarily on the employment of entrepreneurs, and that male

entrepreneurs are indeed more likely to report employee growth in the start-up of their new venture.

### Revenue

The second part of the survey focused on the revenues generated throughout the lifetime of the start-up. In this case, three different variables were considered, the first and last year and a mean average of all their accumulated years. To calculate the percentage revenue growth the difference between the first and last year were taken. Together with the self-reported average of revenue growth, the difference between the first and last year was compared by gender as variable change revenues to either accept or reject part of the hypothesis. The descriptive statistics showed similar variances, which was supported by an insignificant Levene's test of homogeneity of variances of .323. The actual one-way ANOVA results indicated an insignificant p – value of .105,  $F = (2,12) = 2.735$ , showing that there was no significant difference between the gender of the entrepreneur and the amount of change in revenues reported by these start-ups in the start-up phase of their new ventures.

The results showed us that there indeed was a significant difference between the gender of the entrepreneur and the performance measures; change in employment and change in revenues. The change in employment displayed a marginal significant relationship between the gender of the entrepreneur and the mean growth of employment. This significant relationship illustrated that the gender of the entrepreneur influenced the level of employment, performance, of the start-up. When focusing on the change in revenue measure, no indication of a significant difference between the gender of the entrepreneur and the amount of change in revenues was identified. This indicates that when measuring the performance based on gender, the amount of change in revenues is not a significant measure. Du Rietz and Henrekson's (2000) research is partly supported by our results, since indeed male business owners were more likely than female business owners to report recent growth in employment, however, there was no significant indication this was also the case for revenue growth.

### ***Hypothesis 3***

Finally, we combined all the hypotheses based on the research by Lee et al (2001), stating that entrepreneurs with a diverse online social network seem to realize higher levels of performance. In order to be able to analyse these different variables and their



relationship and influence on each other we have used a process regression analysis (Hayes et al., 2017). The moderating variable (M) in this model was gender; the gender data used was that of the fifteen survey participants. The independent variable (X) in this model was diversity, which was measured by the average weighted degree of the self-reported network ties of the survey participants. Finally the outcome variable (Y) was performance, which was measured through the level of change in the employment in the fifteen survey participant start-ups.

The results of the regression analysis process test showed a significant model with a p value of 0.0014. Apparent was that both gender and average weighted degree both had an insignificant effect on the performance, respectively .7298 and .3941. While the interaction of both variables together was very significant which was illustrated with a p value of = .0011. The LLCI (.2271) and ULCI (.6874) did not include zero in the range, which indicated that the relationship was indeed significant. The conditional effect of X and Y at values of the moderators illustrated that the relationship between male, female and co-sex entrepreneurs and their effect as a moderator on the diversity on the entrepreneurs online social network and performance. The -.6761 showed that the male gender has a significant (0.0010) effect of diversity on performance. Similarly, the female entrepreneurs represented by .000 in the results indicated that female entrepreneurs did not have a significant effect of diversity on performance with a p value of .3941. Finally, the co-sex entrepreneurs were represented by 0.6761 in the results and show a very close to significant effect on diversity and performance with a p-value of 0.0627. The size of the effect of the male entrepreneurs was shown as -.3747, this indicated that the gender of the entrepreneurs had a negative effect on the average weighted degree which had an effect on performance. The hypothesis was therefore accepted since the lower the average weighted degree, the higher the diversity of the online social network, which in return increased the performance level of the start-up. This supported Lee et al (2001) findings that entrepreneurs with a diverse online social network seemed to realize higher levels of performance. In this case this was significantly true for male entrepreneurs whom have a diverse online social network and therefore achieved higher levels of performance.

## Conclusions

The aim of this research was to study how male and female entrepreneurs use strong and weak ties to enhance the diversity of their online social networks, which in turn positively influences performance. To be able to research the benefits of a diverse network, three different networks were analyzed through samples based on established and start-up businesses (N =156), start-up businesses alone (N =111), and fifteen survey participants. In order to test for significance between the datasets, one-way ANOVA tests were performed leading to finishing with a process regression analysis tying all the hypotheses together and testing the relationships between gender, diversity and performance.

The first part of this study focused on the relationships between gender and diversity, revealing some conflicting results. The results of Hypothesis 1 showed that for both the overall fashion industry and the start-up sample, the results were significant. However, for the survey participants, the results proved insignificant. Hypothesis 2 also tested the relationship between diversity and gender, focusing on the average weighted degree calculated through Gephi. Even though, both the overall fashion industry and the start-up dataset failed to show any significant results, the fifteen survey participants did show a significant difference between them. The different edge weights indicated the type of network tie present in the social network of the entrepreneur; ranging from strong, weak to stranger ties. Therefore, when considering the diversity and gender relationship through the fifteen survey participants, the average weighted degree could be considered a measure of diversity.

Secondly, we focused on the relationship between gender and performance. In the case of hypothesis 3 two different variables were tested, employee change and revenue change to show significant differences in the relationship between gender and performance. The change in employment was significant, and indicated that male business owners are more likely to report recent growth through an increase in employment. However, the change in revenues was insignificant and showed no relationship with gender at all. Therefore, for the final regression analysis performed in hypothesis 4 this performance measurement was eliminated from the performance measurements.

In the last part of this research, the variables gender, diversity and performance were used to test the relationship by means of a process regression analysis. The results indicated that gender was a significant moderating variable for the relationship between diversity and performance. Specifically, male entrepreneurs had a significant effect on

diversity which reported higher performance. In conclusion, understanding the underlying mechanisms of innovative success permits one to identify conditions of success based on strong and weak ties embedded in gender differences.

### **Limitations and Implications**

In order to collect our data, we created a survey which used both Gilbert & Karahalais (2009) tie strength questions and Burke's (2011) name generator. Therefore, our results are based on self-reported data which are claimed to be less dependable since they are subject to multiple problems, such as privacy issues and entrepreneurs being too negative or too positive about their own start-up results. However, this turned out to be a good decision since Facebook changed its privacy settings since the publishing of Burke's (2011) and Gilbert & Karahalais' (2009) research, making it even harder to collect data and entrepreneurs less willing to provide us with all-access to their Facebook accounts and hence allowed the collection of data.

We also experienced some problems with the sample size, due to the low response rate to our survey, due to privacy issues; hence, the results from our second hypothesis need to be treated with caution in terms of generalizability. The sample size for this hypothesis included only fifteen participants.

Another limitation we encountered was the use of total likes as a proxy of network size, which may have been subject to the purchasing of "ghost likes" by some Facebook users. Unfortunately there is no way to assess the genuineness of these likes. 50% of male business owners indicated that they have purchased Facebook likes against 37.5% of the female entrepreneurs while co-sex couples reported no ghost likes. However, the accuracy of self-reports needs to be treated with caution and this information does not offer insight into the number of likes that were purchased.

Finally, this research was cross-sectional in nature. Future research should consider panel data collection, which may also help to mitigate some of the issues associated with self-reported data. Specifically, in the context of entrepreneurship research, three-wave panel data collection could be used to show the growth in performance, represented by an increase of the total number of likes the business has achieved in a specific period of time.

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