The influence of sustainability and female representation on the likelihood of venture capital funding

ABSTRACT

The rapid changing venture capital industry and its potential drivers are topics with an increasing amount of interest in the academic world. Most studies are focused on management aspects, rather than sustainable aspects. In this study the potential link between venture capital (VC) funding, sustainability and female representation is examined, as there seems to be a gap in existing literature. This relationship could be of great importance for future researchers, play a vital role in investment considerations, and influence entrepreneurial activity. Based on data concerning IPO exits, potential VC backing, ESG scores and the representation of females on board of directors' logistic regressions are performed to try to gain more information on this relationship. The data is retrieved from various databases, such as Eikon and Warrington. Even though the results obtained are not statistically significant, the fundamentals of this research still form a good base for future research.

Keywords: *Venture capital, sustainability, female representation, funding*

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1. Introduction

Entrepreneurship is seen as a solution to many social and environmental concerns and has been recognized as a vital conduit for sustainable products and processes (Hall et al., 2010). One of the key players in developing new firms and business is venture capital. As a result, venture capital (VC) may be considered as a critical stimulant for further growth of sustainable ventures. In this context, sustainable business are defined as firms that contribute positively to the environment and society while generating a profit (Bocken, 2015). So, there is emphasis on both the environment-friendly aspect, as well as the social aspect. Venture capital is mainly focused on start-up businesses that are still positioned within the young and growing phase. These firms are often viewed as 'too risky' for private equity or banks, hence turn to venture capital for funding. Therefore, venture capital can help young firms grow faster, create more value and generate more employment than other start-ups. Additionally, studies have shown that venture capital backed businesses tend to be more innovative and yield more and more valuable patents (Keuschnigg, 2004). Their main contribution is through their network, experience and expertise. Venture capitalists act as both a 'scout' and a 'coach'. The scouting facet refers to their capability of identifying and selecting future potential, whereas the coaching facet refers to their capability of realizing the firms potential (Baum & Silverman, 2004). Generally, the goal of a venture capital is to sell their share in the business with a profit, either through initial public offerings (IPO) or mergers and acquisitions. Their exit strategy is determined before the investment (Smith, 2005). These exits plans are not based on early stage exits, but have a long-term vision, which makes them very important. Ordinarily these investments have a life span of up to 10 years between raising money and exiting (Marcus et al., 2013), but sustainable investments can be stretched beyond this.

At the moment, sustainability is often viewed as a business threat rather than an opportunity. However, this is often not the case. Shrivastava (1995) even mentions that sustainability will create an important arena for economic competition and can result in a competitive advantage for firms that make use of these opportunities in the coming century. A survey held by MIT Sloan Management Review and the Boston Consulting Group in 2013 also confirms this statement. Their results overall show that the portion of their 2600 respondents reporting profit from sustainability increased to 37% and that close to 50% of the firms have

changed their business models due to opportunities related to sustainability. The latter represents an increase of almost 20% since last year.

Sustainable ventures are typically focused on both an environment-friendly aspect, as well as a social aspect. This paper will elaborate more on both these features individually. To start with sustainability concerning being environmentally friendly. The World Business Council for Sustainable Development (WBCSD) stresses in their report Vision 2050 published in 2010 the problems concerning the growing world population (WBCSD, 2010). The obstacles mentioned in their report range from doubling the agricultural output without increasing the amount of land or water used to halving carbon emissions worldwide by the year 2050, all these problems are a result of the emerging climate crisis. In their follow-up report, published in 2021, they elaborate further on the role businesses can fulfil in this rather radical worldwide shift (WBCSD, 2021). Businesses play a vital role in transforming markets and society in both short-term and long-term future. Sustainable entrepreneurship is the main driver in this transformation process (Schaltegger et al., 2016).

Secondly, this paper will elaborate more on the social aspect of sustainability and more specifically on female representation. Female representation and more generally gender diversity on higher levels within a firm has shown to have multiple advantages compared to an all-male management. Studies have found that firm performance can actually be increased by diversification, in a way that a firm's strategy is more focused on innovation. This results in informational and social benefits that play a role in managerial task performance (Dezsö & Ross, 2012). Another study suggests that female corporate board representation even indirectly positively affects a firm's value through financial performance and through ethical and social compliance (Isidro & Sobral, 2015). However not all studies suggest a substantial effect. Shrader et al. (1997) shows no direct link between a higher percentage of female top managers and board members and firm performance. They did emphasize that there seems to be a positive relation between large firms with high percentages of female managers and high profitability ratios such as return on investment (ROI) and return on equity (ROE) (Shrader et al., 1997). All in all, most researchers believe that diversification has a positive effect on a venture and should be encouraged.

Current research has focused on many potential sources for a successful venture capital funding round but is mostly focused on management aspects such as team experience, size, and

quality (Greene et al., 2001). However, the particular role of environmentally friendly firms or firms with female participation has yet to be examined. So, for this paper the link between the previously mentioned aspects of sustainability and venture capital funding will be investigated, as there seems to be a gap in existing literature. Taking the previously mentioned advantages of both kinds of sustainability into consideration, the expectation of a relationship seems likely, and this study can possibly expose huge potential for venture capitalists in the nearby future. The main objective of this research is to measure the effect of sustainability and female representation on the possibility of venture capital funding. This will be measured through the number of firms that have exited through IPOs and possibly had venture capital funding, where sustainability and female representation are represented in categorical variables. The analysis will consist of descriptive and frequencies statistics that will mainly be performed in STATA. The data is retrieved from Warrington, Thomson Reuters Eikon, BoardEx and Center for Research in Security Prices (CRSP). Consequentially is the following research question formed:

"Is there a higher likelihood to receive venture capital funding when the firm is either focused on sustainability or has female representation?"

The remainder of this paper unfolds as follows. It starts with an extensive literature review to establish the existing ideas further and consider their empirical result. The paper continues by laying out the used dataset and methodology. Finally, the most important findings will be summarized in addition to the limitations and recommendations for further studies.

2. Theoretical framework

The venture capital industry itself is still considered relatively young compared to other, well-established industries such as investment banking and is still to this day changing rapidly (Gompers & Lerner, 2001). These rapid changes made this industry gain an increasing amount of interest by the academic world. Other topics that have been gaining attention from researchers are sustainable start-ups, female entrepreneurship, and overall factors for venture capital funding. However, the link between these is yet to be fully examined.

2.1   General venture capital

Venture capital firms are ventures that are mainly focused on identifying high-potential start-ups, investing in those firms, and helping realize their potential. So, a venture capital investment can help boost a start-up, which makes them a very desired type of investment (Keuschnigg, 2004). In fact, nearly half of the IPOs in the US are venture-backed firms. Venture-backed firms account for than 75% of market capitalization and are responsible for half of the revenue of publicly traded firms (Janeway et al., 2021). However, a VC investment is seen as a "black swan" event, due to the fact that fewer than 1% of all US ventures ever receive such type of investment (Brush et al., 2018). The timing of a VC investment is often in the early stage of a start-up. This is after the seed stage where the main investments are through Friends, Family, Fools (FFF), angel investors or crowd funding. Additionally, this is before the growing stage where private equity (PE) or banks play a bigger role (Bocken, 2015). PE and banks often prefer start-ups to have a more established role than VCs, because they view them as 'too risky' in this stage. The ultimate goal of the VC is to sell their share of the start-up with a positive return through either IPO or mergers and acquisitions (Gompers & Lerner, 2001). Most VC ventures invest on behalf of and raise money from limited partners (LPs). LPs are for example institutions such as insurance companies, pension funds and universities or just very wealthy individuals (Janeway et al., 2021). The relationship between VCs and LPs is typically for a fixed time frame of 10 years. To conclude, VCs generally invest in high-risk, emerging sectors while looking for the potential 'next big thing' (Petkova et al., 2014).

The rapid changing VC industry has attracted quite some attention in the academic world and there is an increasing amount of literature over the last decades. Most research conducted on VC is focused on the potential qualities a start-up venture must possess to maximize the possibility of a successful exit (Franke et al., 2008). Other studies have been focused on the

trends in the still nascent VC industry and have attempted to analyze those (Gompers & Lerner, 2001). This is mainly where the whole venture cycle has been carefully examined, investigated, and discussed.

2.2   Existing drivers of venture capital

Venture capitalists take the difficult task upon themselves to try to identify businesses, which can possibly generate a positive return in the future. This return can be positive in an economic, environmental, or social way. By taking the triple bottom line approach into consideration, this can form an additional challenge (Jeurissen, 2000). To determine whether a firm will be successful in the future, a lot of potential sources have been researched in literature. General reasons for failure described by Gompers and Lerner (2001) are for instance the high level of uncertainty and information asymmetry compared to more developed firms and undesirable risk levels created by unexperienced managers through raising debt. Another vital factor is the team and the entrepreneur. Franke et al. (2008) found that a trade-off exists between industry experience, educational background and leadership experience for venture capitalists when considering a firm for funding. This entails that one's weaknesses can be compensated through strengths of another team member. However, a strong preference for teams with a heterogeneous field of education was encountered. They also found that more experienced VCs tend to focus more on team cohesion whereas younger VCs focus more on individual qualifications. In other words, older VCs focus on the "forest" rather than the to the "trees" while evaluating potential investments. Mason and Stark (2004) encountered venture capital fund managers that emphasized the quality and skills of management, characteristics of the management team and its track record.

Besides identifying possible promising start-ups, VCs also are particularly good at developing the firm even further. The first task is identified by Baum and Silverman (2004) as a venture capital acting as a "scout" and the second task is identified as acting like a "coach". The VCs main contributions are through their expertise and network, which they use to reduce information gaps. This way the VCs can contribute to shaping and developing the venture further when the investment has been realized.

2.3   Sustainable entrepreneurship

Sustainable investing is the connecting term between venture capital and environmental-friendly firms. Sustainable investing is rooted in cleantech investing and socially responsible

investing. It is a relatively new form of investing and is also known under the name of 'impact investing' (Hebb, 2013). Sustainability investments are defined as "investments that integrate long-term environmental, social, and corporate governance (ESG) considerations into investment processes to achieve both a financial and a social outcome" (Juravle & Lewis, 2009, p. 75).

An important factor that distinguishes sustainable entrepreneurs is their triple bottom line approach. This approach means that these entrepreneurs seek to balance economic health (economy), social equity (people) and environmental resilience (planet) through their behavior (Bocken, 2015). As a result of this method, sustainable entrepreneurs create a win-win situation for all parties involved. The general definition of sustainable entrepreneurship is "entrepreneurial activities that contribute positively to sustainable development and the objectives derived from it" (Kuckertz & Wagner, 2010, p. 525). Another factor that distinguishes sustainable entrepreneurs from conventional ones is their motivation and skillset. Parrish (2010) research resulted in the following principles of organization design that made sustainable entrepreneurs stand out: resource perpetuation, benefit stacking, strategic satisficing, qualitative management, and worthy contribution. According to Hockerts and Wüstenhagen (2010), the main factor that sets sustainable entrepreneurs apart from normal ones is their intention to effect social and environmental change in society. In addition to that, sustainable entrepreneurs follow a pronounced value-based approach. Lastly, a framework for sustainable entrepreneurship traits was developed by Lans et al. (2014), which identified the following key competencies: embracing diversity and interdisciplinarity, systems-thinking competence, normative competence, foresighted thinking, and interpersonal competence.

2.4 Venture capital and sustainability

When looking for sustainable ventures to invest in, VCs often focus on the triple bottom line rather than maximizing the economic returns. This creates an additional challenge for them, as these ventures may have different distinctive characteristics that reveal the quality of their business compared to other start-ups (Mrkajic et al., 2019). According to Berry and Junkus (2013), VCs can either follow an inclusionary approach, which can for instance be in the form of assigning points to positive efforts towards the environment. On the other hand, firms can follow an exclusionary approach where they eliminate firms that for example receive revenue

from dealing in weapons. They also found that environmental issues are considered the most important and that investors have a preference towards the inclusionary approach.

2.4.1 Arguments pro sustainable investing

The literature on why to invest as a VC in sustainable firms has really flourished over the last couple of years. Ambec & Lanoie (2008) summarize a list of reasons in their research why it pays off to invest in sustainable ventures. Starting off by arguing that sustainable businesses can increase revenue due to offering differentiated, innovative products, selling patented sustainable technology and by having better access to certain markets such as the public sector (e.g., transportation and construction). On top of that they list how more sustainable performance leads to cost reduction opportunities such as lower resource costs and labor. Finally they even emphasize the fact that sustainable enterprises have in general a lower cost of capital, which is evidently in line with Porter's hypothesis stating that a competitive advantage can be reached through environmental innovation (Porter, 1995). Next to that, research has shown that venture capital firms are more likely to invest in an emerging sector (potentially environmental-friendly) if the sector is legitimized (Petkova et al., 2014). According to them, there are two requirements for a sector to be legitimized: government support and media attention, which are both met by the environmental-friendly sector. Additionally, Petkova et al. (2014) mention in their paper that reputable firms strive to stay ahead of the competition and to discover the "next big thing" by investing in emerging sectors. This is often eventually copied by other, less reputable firms that simply follow the trend. Other potential reasons for investing in sustainable ventures can be based on ideological or emotional motives (Bocken, 2015). Lastly, the market pull and policy push for sustainable venture is expected to increase over time due to the combination of global warming which stresses the need for environmental regulation and accelerated depletion of natural resources resulting in higher, unstable prices of resources (Mrkajic et al., 2019). This provides a boost in incentives to invest in sustainable technologies.

2.4.2 Arguments against sustainable investing

However, not all research point to the upside of investing in sustainability. There are certain characteristics related to these ventures which make it more unlikely for VCs to invest in them. To start off, most sustainable firms use technology that come with a high rate of complexity. This results in more investment in the early stage and more involvement in late stage technology commercialization (Marcus et al., 2013), which causes the complexity to accentuate

the causes of capital market imperfections. Secondly, the green sector is still in its nascent stage where managerial sloppiness often occurs. In this case, the "coaching" ability of the VC can still be insufficient due to lack of relevant experience in this particular sectot (Baum & Silverman, 2004). Next to this, research has shown that successful sustainable firms require a longer period to become profitable, relative than non-sustainable firms (Wustenhagen & Teppo, 2006). This can cause problems when exceeding the regular timeline from initial investment to return (about 7 years). Additionally, sustainable firms have proven to be more capital intensive (Criscuolo & Menon, 2015). Fourthly, the exit opportunities for sustainable ventures are different than those of other high-tech sectors such as ICT. Petkova et al. (2014) mention that IPOs of sustainable firms are rare and M&A activity has mostly been focused on ventures located in the fossil industry. These risky exit opportunities can result in higher entry barriers as the venture capitalist ultimate goal is to exit (Cumming et al., 2016). Fifthly, governmental regulations play an important role in the potential success rate. Political behavior creates an additional risk factor next to market and technological aspects (Mrkajic et al., 2019). Lastly, it is typical for emerging sectors to have a lack of historical track-record of VCs investments and sustainable investments are no exception. There is a lack of proven framework to evaluate the potential of sustainable businesses (Petkova et al., 2014).

Based on the mentioned arguments both for and against investing in sustainable ventures, it can be concluded that the issue is a very complex one where more research is needed. For this paper the following hypothesis is formulated:

Hypothesis 1. A firm focused on sustainability has a higher likelihood to receive venture capital funding than one not focused on sustainability.

2.5   Venture capital investment and the role of gender

Over the last couple of years, the number of female entrepreneurs has increased. American Express mentions in their annual "state of women-owned business report" that in 2019 42% of all businesses were women-owned, almost 13 million. They are responsible for 9.4 million employees and generate a revenue of $1.9 trillion (American Express, 2019). The Global Entrepreneur Monitor report a rate of women's entrepreneurship activity in the US for 2020 to be at 13.6%, which is historically high but still lower than the men's that is 17% that same year (Elam et al., 2021). This is the highest rate out of all developed economies. Additionally, in the same report was mentioned that approximately a third of all women owning an established firm

wanted to grow for instance, through external financing such as venture capital. Obviously, most ventures are not the ideal fit for the typical venture capital investment profile and women-owned businesses are no exception. Moreover, with the increasing presence of women-owned firms and the emphasis of diversity nowadays, the relation between the two sparks a lot of interest.

2.5.1 Advantages of female participation

The effect of female presence has been well researched over the couple of decades in relation to various subjects such as firm performance and diversity benefits. According to Dezsö & Ross (2012), female representation improves a firms performance with regards to the firm's strategy focus on innovation. More specifically, the informational and social benefits of diversity show to be the most important when it comes to managerial task performance. Additionally, they found that female representation can increase commitment and motivation on both top and lower level within the firm which affect both the individual and the overall firm performance. Isidro & Sobral (2015) investigated both indirect and direct effects of female representation on firm value. Even though they did not find a significant direct effect, they did find numerous significant indirect effects. Firstly, female representation showed to be positively related to financial performance, expressed in return of assets (ROA) and return on sales (ROS). Secondly, a positive relation of the firm's compliance with ethical and social standards is established. Both effects are indirectly linked with the firm's overall performance, whereas the latter also affects the non-financial dimensions of the business. Another study by Erhardt et al. (2003) indicates that female entrepreneurs influence the firms performance through improving the diversity within the venture's labor pool and customer base. All in all, these studies prove that diversifying the team by female presence are beneficial for the firm's overall performance. This indicates that taking female presence within the start-up team into account could be beneficial for VCs when considering funding.

2.5.2 The Diana Project

Female entrepreneurs have experienced significant challenges when trying to acquire venture capital funding. There is even robust evidence that female entrepreneurs attract fewer early stage equity investments, this accounts for both venture capital and angel investments (Brush et al., 2018). The Diana Project is a study that has been conducted in 1999 and is still considered to be the pioneering and most extensive research on the relationship between

women-led ventures and the attraction of early stage equity funding (Greene et al., 2001). In this analysis all equity investments in the US over a 30-year period were investigated, which made it the largest and most detailed study to date related to female access to venture capital. In 1999 the venture capital market was really flourishing, which made the study very relevant. The Diana Project identified three major conclusions: (1) the maximum share of total investments in companies with a woman on the team between 1988 and 1999 was 4%, (2) these companies were most often situated in the software, medical/health or biotechnology sector, and (3) female founders were typically receiving early stage funding (Brush et al., 2008).

The existing perception at that time was that women didn't receive venture capital investments because they weren't motivated and prepared enough to start a high-potential venture and therefore did not qualify for such funding. However, the Diana Project had different findings and actually found that lack of motivation or preparations were not the cause of female entrepreneurs not receiving funding (Brush et al., 2018). The study found that women did possess the skills and experience to launch high-potential firms. It even found that there was a significant number of women qualified, eager to grow their firms and possibly the ideal fit for venture capital funding. The pioneering study identified three major factors for the gender gap in receiving venture capital funding (Greene et al., 2001). First of all, structural barriers. These barriers refer to the venture capital environment mostly being 'male' in nature, when looking for instance at the norms for pitching and the confrontational way of coaching. Secondly, female human capital differs from male human capital in terms of different networks. The venture capital sector is very tightly networked and can be hard to penetrate from the outside (Sorenson & Stuart, 2001). The last major factor identified, is the difference in strategic pacing between men and women. Female entrepreneurs tend to be more conservative, careful and overall more risk-averse compared to men (Cliff, 1998). VCs generally expect a rapid growth in terms of sales and this can be in contrary with their strategic planning. A follow-up research conducted in 2018 identified an additional potential factor, which is stereotypes and homophily (Brush et al., 2018). This implies that the general perception is that successful entrepreneurs are by definition male. Next to this, psychological research shows that people have the tendency to have the preference for people who they can relate to. Since most venture capitalists are male, they could have the preference to invest in a start-up with a male CEO or even an all-male team.

Taking these all these findings into consideration, the following hypothesis is established:

Hypothesis 2. A firm with at least one female on their founding team has a lower likelihood to receive venture capital funding than a firm with an all-male founding team.

2.6   The female view on sustainability

At the end of the twentieth century there was a big increase in interest concerning the impact of gender on views about environmental issues. In earlier works the potential relationship between sex and environmental concern is investigated (Dunlap, 1983). Whereas later works consider this relationship scientifically proven (Jackson, 1993; Xiao & McCright, 2012). Two main arguments for this relationship are found. The first one states that women have an instinct to preserve nature and therefore have a special and close relationship with it, while men don't have this instinct. The second argument claims that women tend to be particularly caring and altruistic about environmental management (Jackson, 1993). A term also associated with this relationship is ecofeminism. Sakellari and Skanavis (2013) suggest that according to ecofeminism men and women differentiate in environmental approach due to a variety of cultural, social and biological reasons. This would imply that gender differences don't come from different priorities but rather from difference in conceptualization of the world. This stronger concern and attitude towards environmental issues by women could possibly be an incentive to start an enterprise focused on sustainability. Outsios and Farooqi (2017) have investigated the difference in perspective of sexes when being a sustainable entrepreneur, including the difference in attitude towards growth and accessibility of growth capital. They found female entrepreneurs to not be more reluctant towards growth than their male counterparts. Both take a generally positive attitude, but keep in mind a cautious and conscious approach. Concerning the accessibility to growth capital, the authors came across financial constraints for sustainable entrepreneurs, but these weren't necessarily linked to gender. They do conclude that sustainable enterprises lead by women are generally more financially complex due to risk aversion which is common under female entrepreneurs.

Based on these finding, I put together the following hypothesis:

Hypothesis 3. A firm that focuses on sustainability and has at least one female on their founding team has a lower likelihood to receive venture capital funding than a firm that has neither of these factors.

3. Data and methodology

3.1 Dataset

For this study quantitative research is conducted, which will be done following an existing database retrieved from Warrington containing data from 1975-2021 about IPO exits and the potential VC backing. The amount of data was excessive, so this was altered to fit this study. The year 2019 was chosen as the focus point, because this was the most recent year that wasn't influenced by the COVID-19 pandemic, which can give a distorted picture. Furthermore, there is a focus on firms founded between 2009 and 2019 to make the study as recent as possible. To check whether the ventures are focused on sustainability the Thomson Reuters Eikon (Eikon) database was used, since the ESG score is mentioned in this database. To confirm whether firms had female representation in their team when the IPO took place the BoardEx database was consulted. Initially this resulted in a sample of 140 firms of which 61 had VC backing (44%). However, a lot of data related to ESG rating was nonexistent, because quite some firms in the database are blank checking companies and those type of companies typically don't have an ESG score. After a lot of research 70 firms were identified who had all data available of which 56 had VC backing (80%). There are 46 firms in the data that had at least one female on the board of directors at the time of the IPO (65%). The variable for sustainability is a dummy variable, where 34 ventures are appointed a high ESG score (34%).

3.2 Variables

3.2.1 Dependent variable

The dependent variable identified for this study is venture capital funding, which states whether this type of funding was provided to the venture. The variable for VC funding is a dummy variable where 1 signifies the venture received funding and 0 that they did not. Within the database there was already a categorical variable for VC backing which had three possible outcomes. A 0 represents no VC backing, a 1 represents 'regular' VC backing and a 2 represents funding by a subset of VC, which was labeled as growth capital. Since this research is focused on all forms of VC backing, the ventures with a value of 2 are also included in this study. The summary statistics are presented in table 1 at the end of this paragraph. The frequency table and correlation matrix of the dataset can be found in the appendix in table 2 and 3. This correlation matrix is included to identify and visualize potential patterns in the dataset, prior to

the regression. Correlation however does not directly imply causality; it can only suggest the possible existence of it.

Table 1 - *Summary statistics for all studied variables*

	Mean	Std.	Min	Max
VC funding	0.80	0.40	0	1
ESG score	0.34	0.48	0	1
Female representation	0.66	0.48	0	1
Country	0.79	0.41	0	1
Founding year	5.89	2.90	0	10
Log (market value)	6.97	1.37	4	11

3.2.2   Independent variables

Female representation and sustainability will be the independent variables used in this study. Female representation will be measured in a dummy variable. This type of variable is the simplest form of categorical variables, where only the values of 0 and 1 are possible. The dummy variable for female representation will be 1 when the venture has at least one female on the board of directors at the time of the IPO and 0 when this is not the case. Since this is a dummy variable the total amount of females on the founding team is not measured, solely whether there was female presence at all, this is in line with The Diana Project (Greene et al., 2001). This variable contributes to investigating hypotheses 2 and 3. The variable for sustainability is a categorical one in the used database. Eikon rates the firms from A to D, where an A-rating is the highest and a D-rating the lowest. This data is transformed to a dummy variable to label which venture has a high ESG score (i.e., more concern for sustainability) and which venture has a low ESG score (i.e., less concern for sustainability). A venture is awarded a high score when the rating concerns an A, B or C and is appointed a low score when the rating is a D. Eikon is a financial markets database that contains information about listed companies and is used for trading purposes. The database contains a general 'ESG score' and an 'Environmental Pillar Score' and after investigation it is decided to use the general 'ESG score' for this study. The

'Environmental Pillar Score' has little to no variation in the mentioned score, which would result in research interpretation difficulties. The sustainability variable is studied in hypotheses 1 and 3.

3.2.3 Control variables

Control variables make a statistical model generally more significant because they control for omitted variable bias. For this study the founding year, the market value and the country where the venture is headquartered are determined as control variables. The founding year variable is transformed to a numerical variable by calculating the difference between the founding year and the year of interest (2019). So, this variable takes a value between 0 and 10. The market value for 2019 is retrieved from the Center for Research in Security Prices (CRSP) database as a default and retrieved from Eikon when there was no information available on CRSP. The CRSP database contains information about NYSE, AMEX and NASDAQ stock markets and is one of the most extensive and complete databases. The market value is the number of common shares outstanding multiplied by the end price that corresponds to the period end date and ranges between 54,97 and 51054,0929 million American dollar. This variable is transformed to the log form to make the values closer to a normal distribution. The last control variable, country, is also retrieved from Eikon and is transformed to a dummy variable. Since most ventures are situated in the US (78,5%), this is indicated with the value of 1, ventures located in other countries (China, Israel, UK and Canada) are indicated with the value of 0.

3.3 Model specification

There are three hypotheses, hence the purpose of this study is three-folded. In the first place, the goal is to establish if sustainability influences the likelihood of receiving venture capital and if so, whether this is a positive influence. The second goal is to determine whether female representation influences the likelihood of receiving venture capital and if so, if this is negative. The third and final purpose of this is study is to verify if a combination of female representation and sustainability affects the likelihood of raising venture capital funding and if so, whether this is a negative effect. When these effects are found to be statistically significant, they will determine if the proposed hypotheses will be confirmed or rejected. The data is analyzed using the statistical software program STATA.

A logistic regression will be used to determine the influence of the independent variables both individually and together on the likelihood of receiving VC funding. Considering both

independent and dependent variables are categorical variables, this is the most appropriate form of regression (Hosmer et al., 2013). This is done by using the command *logit* and using robust standard errors. Contrary to OLS, this type of regression is considered a non-linear estimation method. One of the benefits of using a non-linear estimation method is that a linear estimation method must meet certain conditions (e.g., normal distributed data, means of residuals having to equal 0 and homoscedastic residuals) which in practice can be hard to meet. Another benefit is that a logit regression can reduce the chance of omitted variable problems. Omitted variable problems occur when an unidentified variable influence both dependent and independent variables. The appropriate formula for the logistic regression is the following:

$$\log\left(\frac{\pi_r}{1-\pi_r}\right) = \alpha_0 + \beta_1 F_r + \beta_2 E_r + \beta_3 C_r + \beta_4 Y_r + \beta_5 M_r + \varepsilon_r$$

Where π_r is the likelihood of receiving VC funding for the venture r, F_r represents the female representation related independent variable for venture r and E_r represents the ESG score related independent variable for venture r. C_r represents the control variable for the country where the venture is headquartered, Y_r contains the discussed control variable for founding year, whereas M_r represents the control variable for market value.

4. Results and discussion

4.1   Results

4.1.1   Testing hypothesis 1

For hypothesis 1 the possible positive relation between the likelihood of VC funding and sustainability is investigated. A logistic regression is conducted, where the VC variable is the dependent variable, the ESG score is the independent variable and founding year, market value and country act as control variables. For every step an additional control variable is added, respectively country, founding year and market value. By following this method, the effect of all control variables can individually be observed. The main findings can be found in table 4.

Table 4 - *Logistic regression hypothesis 1*

	(1) VC funding	(2) VC funding	(3) VC funding	(4) VC funding
ESG score	-0.08	0.05	0.09	0.09
	(0.63)	(0.66)	(0.62)	(0.62)
Country		0.95	0.97	0.95
		(0.68)	(0.67)	(0.67)
Founding year			0.04	0.04
			(0.11)	(0.12)
Log (market value) (mil. $)				0.04
				(0.28)
Constant	1.41***	0.67	0.41	0.17
	(0.37)	(0.64)	(0.87)	(1.77)
Observations	70	70	70	70
Pseudo R^2	0.00	0.03	0.03	0.03
AIC	74.04	74.11	75.98	77.95
BIC	78.54	80.86	84.97	89.19

This table presents the output of the logistic regression performed for hypothesis 1. The independent ESG variable is measured in a dummy where 1 represents a high concern for sustainability and 0 a low concern for sustainability. The control variable country is equal to 1 when the venture is headquartered in the US

and 0 if located elsewhere. The control variable founding year is the difference between the founding year of the venture and 2019. The control variable market value is log transformed and expressed in millions of American dollars. Standard errors in parentheses, [*] p < 0.05, [**] p < 0.01, [***] p < 0.001.

The general interpretation of a logistic regression coefficient is the expected change in log odds of having the outcome per unit change in X (Hosmer et al., 2013). Consequently, an important thing to consider when evaluating a logistic regression is that the coefficients must be transformed through the odds-ratio relationship prior to interpretation. This can be done through the following formula:

$$Actual\ \beta = e^{\beta}$$

So, in the case of the most complete model, model 4, the ESG score would have a coefficient of $e^{0.09} = 1.094$. This can be interpreted that a start-up focused on sustainability has a 1.094 higher likelihood to receive VC funding compared to one that is not focused on sustainability. However, this can only be assumed when the coefficient is statistically significant (for example for a p-value < 0.05), which cannot be concluded based on this dataset. All models turn out to be insignificant concerning the coefficients and therefore can't be interpreted. Based on this dataset, hypothesis 1 can be rejected, since no significant relationship between the dependent and independent variable is found. From economical perspective this would mean, that based on these ventures there is no statistically significant relationship between the likelihood of receiving VC funding and a firm focused on sustainability.

4.1.2   Testing hypothesis 2

The second hypothesis claims that a firm where a female was on the founding team has a smaller likelihood to receive VC funding than one with an all-male founding team. A logistic regression is conducted, where the VC variable is the dependent variable, female representation is the independent variable and founding year, market value and country act as control variables. For every step an additional control variable is added, respectively country, founding year and market value. By following this method, the effect of all control variables can individually be observed. The main findings are presented in table 5.

Table 5 - *Logistic regression hypothesis 2*

	(5) VC funding	(6) VC funding	(7) VC funding	(8) VC funding
Female representation	0.83	0.69	0.68	0.70
	(0.61)	(0.64)	(0.64)	(0.64)
Country		0.78	0.80	0.82
		(0.69)	(0.70)	(0.70)
Founding year			0.03	0.03
			(0.12)	(0.13)
Log (market value) (mil. $)				-0.03
				(0.28)
Constant	0.89[*]	0.39	0.21	0.38
	(0.45)	(0.61)	(0.94)	(1.66)
Observations	70	70	70	70
Pseudo R^2	0.03	0.04	0.05	0.05
AIC	72.21	72.92	74.85	76.83
BIC	76.71	79.67	83.84	88.07

This table presents the output of the logistic regression performed for hypothesis 2. The independent female representation variable is measured in a dummy where a value equal to 1 represents at least one female present on the board of directors at the time of IPO and 0 an all-male board of directors. The control variable country is equal to 1 when the venture is headquartered in the US and 0 if located elsewhere. The control variable founding year is the difference between the founding year of the venture and 2019. The control variable market value is log transformed and expressed in millions of American dollars. Standard errors in parentheses, [*] $p < 0.05$, [**] $p < 0.01$, [***] $p < 0.001$

No statistical significance is found for the variables in any of the models and can therefore not be interpreted. This means that, based on this data, hypothesis 2 will be rejected since no relationship between the independent variable and the dependent variable is established. The economical interpretation is that there is no statistically significant relationship between female representation within the board of directors at the time of the IPO and the likelihood of receiving VC funding. If the coefficient of the independent variable in model 8, the most

complete one, would have been significant, the coefficient would have to be transformed. This would give $e^{0.70}$ = 2.014, which means that a start-up that had a female present on the board of directors at the time of the IPO would have a 2.014 times higher likelihood to receive VC funding than one that had an all-male board of directors. Which indicates that there could be a positive relationship, rather than a negative one that was predicted based on the existing literature.

4.1.3   Testing hypothesis 3

For the third and final hypothesis the effect of both sustainability and female representation within the board of directors of a venture on the likelihood of VC funding is researched. A logistic regression is conducted, where the VC variable is the dependent variable, the ESG score and female representation are the independent variables and founding year, market value and country act as control variables. For every step an additional control variable is added, respectively country, founding year and market value. By following this method, the effect of all control variables can individually be observed. The output of the logistic regression is displayed in table 6.

Table 6 - *Logistic regression results hypothesis 3*

	(9) VC funding	(10) VC funding	(11) VC funding	(12) VC funding
ESG score	-0.21	-0.08	-0.05	-0.06
	(0.65)	(0.68)	(0.63)	(0.66)
Female representation	0.86	0.71	0.69	0.71
	(0.62)	(0.65)	(0.65)	(0.67)
Country		0.77	0.79	0.80
		(0.71)	(0.71)	(0.71)
Founding year			0.03	0.03
			(0.11)	(0.12)
Log (market value) (mil. $)				-0.03
				(0.29)
Constant	0.94	0.42	0.24	0.42
	(0.48)	(0.68)	(0.90)	(1.86)
Observations	70	70	70	70
Pseudo R^2	0.03	0.04	0.05	0.05
AIC	74.10	74.90	76.84	78.82
BIC	80.84	83.90	88.08	92.31

This table presents the output of the logistic regression performed for hypothesis 3. The independent ESG variable is measured in a dummy where 1 represents a high concern for sustainability and 0 a low concern for sustainability. The independent female representation variable is measured in a dummy where a value equal to 1 represents at least one female present on the board of directors at the time of IPO and 0 an all-male board of directors. The control variable country is equal to 1 when the venture is headquartered in the US and 0 if located elsewhere. The control variable founding year is the difference between the founding year of the venture and 2019. The control variable market value is log transformed and expressed in millions of American dollars. Standard errors in parentheses, [*] $p < 0.05$, [**] $p < 0.01$, [***] $p < 0.001$

In line with the previous regression outputs, it turns out that none of the models presented above turn out to be statistically significant. The model seems to be similarly adequate as the model presented for hypothesis 2. This is observed in the Pseudo R^2 value. After adding the

control variables, a small change can be observed, but no statistical significance is present. Since no statistical significance can be established for the variables, it is assumed that there is no relationship between the independent and dependent variables. Consequently, hypothesis 3 is rejected. In the economic sense this means that the ESG score and female representation within the board of directors have no statistically significant influence on the likelihood of receiving VC funding for a start-up venture. To give a more complete overview of the results and an easier to interpret outcome the estimated margins for the possible values of the independent variables for all hypotheses are presented in table 7, which is included in the appendix.

Since none of the logistic regressions gave statistically significant results, I checked whether this changed when using a skewed logistic regression. A skewed logistic analysis is an alternative to logit, which stresses less about the distribution of the dependent variable. Considering the dependent variable has an 80/20 distribution of VC backing and no VC backing this could be a good fit for the data. The output of the skewed logistic regression did not give a statistically significant result for any of the hypothesis. The results are presented in the appendix in table 8.

4.2   Limitations, implications, and future research recommendations

The study conducted for this bachelor thesis has several limitations, which can be primarily linked to the data used to test the hypotheses. The data used for this study lead to no statistical significance for any of the proposed hypotheses, so all of them were rejected.

The first limitation is the amount of data used in the study. This data was originally retrieved from Warrington and supplemented with data from Eikon, BoardEx and CRSP. The proposed criteria for the data were that the IPO took place in 2019, as this is the last year not influenced by the COVID-19 pandemic, and the founding year of the venture is between 2009 and 2019 to make the study as recent as possible. After implementing the proposed criteria, it turned out that quite a few ventures had no data available concerning their ESG score, since they were blank checking companies. Eventually 70 ventures were identified that had all required data available and met the proposed criteria. When compared to for instance the Diana Project, where a sample of 4306 investments was used (Greene et al., 2001), there is a significant difference which can explain the variation in outcome. The second limitation concerns the independent variable used for the first hypothesis. This study was meant to be focused on the 'E' of the ESG score, but the Environmental pillar variable had little to no variation in the

presented scores in Eikon due to most scores being D- (the worst score an enterprise can receive). To overcome this, the overall ESG score from Eikon was used. The downside to this is that these scores were heavily influenced by the Social and Governance scores of the firms, so it can be put into question how representable this variable is concerning the environmental friendliness of a firm. The third limitation can be seen in the independent variable used for the second hypothesis. To measure female representation in founding teams the BoardEx database was used. This database contains information about the board of directors of a venture at the time of the IPO. However, the board of directors can differentiate from the founding team of the start-up as it is likely that there has been a shift in team leading up to the IPO. An additional limitation can be linked to the control variables. For this study the country where the venture is headquartered, the founding year and the market value at time of the IPO are chosen. Although, when looking at the correlation matrix presented in the appendix in table 3 it can be observed that only the correlation between female representation and market value is statistically significant and that none of the control variables have an absolute correlation above 0.3. This raises the question whether the chosen control variables are relevant for these dependent and independent variables or that other variables may have been more suitable. For instance, Mrkajic et al. (2019) uses is their research industry dummies as control variables.

Based on the above-mentioned limitations it is concluded that none of the hypotheses have been tested properly or had proper statistically significant outcomes. This has also resulted that providing any theoretical or practical implications has become very challenging. This could be overcome in future research by expanding the sample by applying a broader timeline or using a different database than Warrington. By doing this, current study can still be useful as a basis for future research where statistically significant information on the relationship between VC funding, sustainability and female representation can be obtained. Recommendation is to use a different database and a larger sample. Possible appropriate data sources could be universities (Kuckertz & Wagner, 2010; Lans et al., 2014; Mrkajic et al., 2019), business journals (Erhardt et al., 2003; Isidro & Sobral, 2015) or private databases (Dezsö & Ross, 2012). The fundamentals of this study combined with a more extensive database make reaching statistically significant results with practical and theoretical implications a reachable goal.

5. Conclusion

The main objective of this research was to investigate the potential relationship between the likelihood to receive VC funding, sustainability, and female representation. This three folded relationship has not been fully examined yet in existing literature and can be insightful for future researchers, investors, and start-up founders. In this paper three hypotheses were tested. The first hypothesis stating a positive relationship between the likelihood of receiving VC funding and sustainability, whereas the second hypothesis stated a negative relationship with female representation. The third and final hypothesis combined previous hypotheses and stated a negative relationship between the likelihood of receiving VC funding, sustainability, and female representation. The data used for these hypotheses is retrieved from Warrington, Eikon, BoardEx and CRSP and the method used is multiple logistic regressions, which are performed in the statistical program STATA.

None of the constructed models yielded a statistically significant result. Consequently, all hypotheses were rejected, and no theoretical or practical implications could be made. So, the answer to the research question proposed, for now, is that there is no significant relationship between VC funding, sustainability, and female representation. These limited results were most likely due to the relatively small data base. However, after adjusting for the appropriate data source the fundamentals of this paper can still provide useful insights for future researchers, their studies, and (future) entrepreneurs.

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7. Appendix

Table 2 - *Frequency table*

	VC funding	No VC funding	Total
Female representation	39	7	46
No Female representation	17	7	24
ESG score high	19	5	24
ESG score low	37	9	46
Total number of observations		70	

Table 3 - *Correlation matrix for study variables*

	(1)	(2)	(3)	(4)	(5)	(6)
VC funding (1)	1.00					
Female representation (2)	0.17	1.00				
ESG score (3)	-0.02	0.14	1.00			
Country (4)	-0.17	-0.21	0.14	1.00		
Founding year (5)	0.03	0.06	-0.18	0.06	1.00	
Log (Market Value) (6)	0.06	0.29*	-0.08	-0.20	0.23	1.00

*$p<0.05$, **$p<0.01$, ***$p<0.001$

Table 7 - *Margins at means results hypothesis 1, 2 and 3*

	(1) Margin	(2) Margin	(3) Margin
ESG score = 0	0.81		0.82
	(0.06)		(0.06)
ESG score = 1	0.82		0.81
	(0.08)		(0.08)
Female representation = 0		0.73	0.73
Female representation = 1		(0.10)	(0.10)
		0.85	0.85
		(0.05)	(0.05)

This table presents the output of the margins kept at means of the control variables performed for hypothesis 1, 2 and 3. The control variable for country is kept at its mean of 0.79, the control variable for founding year is kept at its mean of 5.89 and the control variable for market value, after log transforming, is kept at its mean of 6.97. Standard error in parentheses.

Table 8 - *Skewed logistic regression results hypothesis 1, 2 and 3*

	(13) VC funding	(14) VC funding	(15) VC funding
ESG score	1.03		-0.00
	(6.29)		(0.31)
Country	7.15	0.46	0.46
	(5.03)	(0.40)	(0.40)
Founding year	0.24	0.01	0.01
	(1.09)	(0.05)	(0.05)
Log (Market Value) (mil. $)	0.58	-0.03	-0.03
	(2.73)	(0.12)	(0.12)
Female representation		0.39	0.39
		(0.34)	(0.35)
Constant	5.15	-12.72***	-13.01***
	(16.76)	(2.40)	(2.71)
Ln(alpha)	-2.30***	12.75***	13.04***
	(0.18)	(2.68)	(2.91)
Observations	70	70	70
AIC	79.90	78.69	78.69
BIC	93.39	92.18	92.18

This table presents the output of the skewed logistic regression performed for hypothesis 1, 2 and 3. In model 13 all the relevant variables for hypothesis 1 are included, in model 14 all the relevant variables for hypothesis 2 are included and in model 15 all the relevant variables for hypothesis 3 are included. The independent ESG variable is measured in a dummy where 1 represents a high concern for sustainability and 0 a low concern for sustainability. The independent female representation variable is measured in a dummy where a value equal to 1 represents at least one female present on the board of directors at the time of IPO and 0 an all-male board of directors. The control variable country is equal to 1 when the venture is headquartered in the US and 0 if located elsewhere. The control variable founding year is the difference between the founding year of the venture and 2019. The control variable market value is log transformed and expressed in millions of American dollars. Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.