



universität
wien

MASTERARBEIT

Titel der Masterarbeit

„Common reasons for startup failure:
Comparison between failed and successful new
ventures“

Verfasserin

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angestrebter akademischer Grad

Master of Science (MSc)

Wien, 2015

Studienkennzahl lt. Studienblatt:

A 066 915

Studienrichtung lt. Studienblatt:

Masterstudium Betriebswirtschaft

Betreuerin:

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Abstract

The high growth opportunities the technology sector provides and the increased investment availability have inspired the formation of many new companies. Many startups are founded every day, each aiming to change the world. However, the majority of these innovative young ventures do not manage to achieve a sufficient growth rate and fail, indicating that the road to success is full of obstacles. Awareness of this problem has increased recently, and entrepreneurs, as well as investors, are interested in identifying the drivers of success and failure. This master thesis studies the effects of different success factors, categorized as human capital, financial capital and strategic factors, on startup performance. For the purpose, an empirical analysis has been conducted using a sample of 222 startups founded in 2004. The influence of the studied success factors on the performance of these failed and successful tech ventures has been analyzed and compared. The results suggest that the technical university education of the founders plays an important role for avoiding startup failure. In addition, the number of funding rounds is found to have a positive effect on performance. Interestingly, the results indicate that companies established by founders with higher academic titles are less likely to succeed and diversity of the founding team has a negative impact on success.

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1. Introduction

*"It's fine to celebrate success, but it is more important
to heed the lessons of failure."*
Bill Gates

This master thesis is going to address startup failure by studying the reasons for its occurrence. Although there is no one formula for success, entrepreneurs and investors might increase their chances to succeed by avoiding common mistakes. Learning the lessons of failure might point to the right direction by revealing the roads that lead to a dead-end.

1.1. Problem Statement

Academics, policy makers, investors and entrepreneurs have recognized the important role of entrepreneurship as an economic growth driver. Policy makers have been working on creating a favorable business environment and numerous investors have provided various funding alternatives to new ventures. With the increasing number of investors and funding alternatives – from crowdfunding¹ to accelerators² and venture

¹ Crowdfunding - funding an early stage venture by raising smaller amounts of capital from a large number of people;

² Business incubators – business programs, usually funded by the government or university grants, aimed at helping new ventures grow by providing mentorship, advice, networking and connections to investors; accelerators are a special type incubators, which might be privately financed and provide the mentioned above resources, in exchange for equity shares in the company (in addition to financial capital);

capital funds³, new entrepreneurs face lower barriers to entry and, as a result, startup activities have gained in numbers. A lot of new startups are founded every year, but only a few succeed. Depending on how failure is defined, various rates are being reported. According to Paul Graham and other prominent Silicon Valley investors, the failure rate of tech startups is around 90%. And this failure rate is observed even among companies that have been accepted by Y Combinator - a prominent U.S. accelerator, located in California, where startups are selected and guided by experienced investors and the acceptance rate lies below 5%.⁴

Based on the research from Harvard Business School, if liquidation of assets is used as a determinant of failure, then the failure rate is estimated at 30%-40%. If failure is defined as the non-achievement of a projected rate of return, then around 70%-80% of the startups are identified as failures (Nobel, 2011)

Alan Patricof – an American investor and entrepreneur, one of the leading names in the VC industry, has prognosticated that the failure rate of new businesses might increase even further in 2015. The main reason for this concern is that with lower founding costs and easy access to capital, more entrepreneurs enter the market and start business that are rather “imitations” of existing businesses than innovations.⁵

Entrepreneurs and investors have started to realize the importance of failure for learning and gaining experience. Some failed entrepreneurs have started their blogs,

³ Venture capital funds – investment funds managing high risk equity investments in startups and small enterprises with high growth potential;

⁴ Blodget, Henry: DEAR ENTREPRENEURS: Here is How Bad Your Odds Of Success Are: <http://www.businessinsider.com/startup-odds-of-success-2013-5?IR=T>, access date: 09/01/2015

⁵ Roof, Katie: Patricof: Startup Failure Rate is Going to Be “A Lot Higher” <http://www.businessinsider.com/startup-odds-of-success-2013-5?IR=T>, access date: 09/01/2015

motivated by the willingness to share their stories with others (for example the founder of the failed startup 99dresses⁶). The one-day conference FailCon started in 2009 in San Francisco under the slogan “Embrace Your Mistakes. Build Your Success.” It takes place on a yearly basis and welcomes entrepreneurs, investors and developers, willing to learn from their own or from the failures of others. The conference is going global, providing the opportunity to entrepreneurs all over the world to embrace and learn from failure.⁷

On January 20th, 2014, CB Insights compiled a list of “101 Startup Failure Post-Mortems”⁸. Later they published a report of the “Top 20 Reasons Startups Fail”⁹.

These are only a few examples indicating that learning from failure is becoming of greater importance for founders and investors.

1.2. Motivation

In his blog¹⁰, Jason Cohen – founder of four companies, writes about the “survivor bias”, arising from our tendency to learn only from success, without paying attention to the

⁶ Nikki Durkin: My startup failed and this is what it feels like...: <https://medium.com/@nikkidurkin99/my-startup-failed-and-this-is-what-it-feels-like-c5d64b3ae96b>, access date:13/01/2015

⁷ FailCon: <http://thefailcon.com>, access date: 13/01/2015

⁸ CB Insights: 101 Startup Failure Post-Mortems: <https://www.cbinsights.com/blog/startup-failure-post-mortem/>, access date: 13/01/2015

⁹ CB Insights: The Top 20 Reasons Startups Fail: <https://www.cbinsights.com/research-reports/The-20-Reasons-Startups-Fail.pdf>, access date: 13/01/2015

¹⁰ Cohen, Jason: Business Advice plagued by Survivor Bias: <http://blog.asmartbear.com/business-advice-plagued-by-survivor-bias.html>, access date: 09/01/2015

failure stories and the lessons that we can learn from them. The author illustrates the problem by providing a few interesting examples. The first story that he tells is about the English bombing raids that were sent to Germany in the World War II. Many of the planes did not make it home, while others returned successfully, but highly damaged by the bullets of the German fighters. In an attempt to increase the survival rate, English engineers inspected the damaged planes that successfully returned to England. They identified a common pattern between the planes – the bullet holes were concentrated in the wings, tail and rear gunner's station. Based on this observation, the engineers concluded that these plane parts had to be armoured, so that the survival rate of the raids might increase. However, a very important point was left out of their consideration. The planes, that did not make their way home, were damaged mostly in the areas of the fuel tanks and cockpits and this is where the planes had to be strengthened.

The “survivor bias” has a similar effect in the area of entrepreneurship. Although we hear a lot of success stories, the stories about failure should be those that transmit the most valuable information to entrepreneurs. By learning what not to do, they could identify the right thing to do.

Jason Cohen writes about how business advice is affected by the “survivor bias”. The author discusses the results of the investigation of Steven Levitt – coauthor *Freakonomics*, who questioned the assumptions and conclusions made in two popular business advice books. In *Good to Great*, Jim Collins tells the stories of eleven poorly performing companies, which made their way to success by adopting a “culture of discipline”. Levitt made the observation, that the portfolio of these eleven companies, among which the later failed Fannie Mae and Circuit City, would have eventually underperformed the market. The same conclusion was drawn after the investigation of the book *In Search of Excellence* written by Thomas J. Peters. So the questions arise – how have the authors selected those companies and why did not the companies achieve continuous success. Cohen and Levitt conclude that these books are “mostly backward-

looking” and, although the selected companies had good performance in the past, it would be hard to predict if they could have continued succeeding in the future.

This example once more illustrates that learning from success might not be sufficient. This is why it is important to keep in mind the presence of the “survivor bias” in success stories in the media, books and other teaching materials and to start paying more attention to failure.

Failure might be beneficial in terms of learning and gaining experience, but one should not underestimate the negative consequences for the individual entrepreneur, defined by the financial, social and psychological cost of failure (D. Ucbasaran, Shepherd, Lockett, & Lyon, 2012). For many entrepreneurs, a failure might represent an obstacle for the initiation of further projects, because investors might refuse providing capital to previously unsuccessful founders. In addition, failure might be very costly not only for the entrepreneur, but also for investors, who might not be able to refund their initial investment.

In order to be able to learn from failure and to avoid its negative consequences, it is important to understand why startups fail. Knowing and understanding the reasons for new venture termination, might be beneficial for both entrepreneurs and investors. On the one hand, entrepreneurs might be able to avoid certain mistakes and increase the probability of success. Investors, on the other hand, would be able to better evaluate new investment opportunities and enhance their screening processes.

1.3. Methodology

In this master thesis the critical success factors for new entrepreneurial ventures will be studied. A literature research will be conducted for the purpose of identifying common human capital, financial capital and strategic factors, which are hypothesized to influence the performance of new ventures. In the context of this master thesis,

performance will be defined as the outcome of the business being either success or failure.

Using a representative sample of startups in the tech industry, I will conduct a regression analysis aiming at identifying the effect of each factor on startup performance. I plan to use the dataset provided by CrunchBase, consisting of more than 650k profiles of people and companies.¹¹ Incomplete data, which might be of relevance for the analysis, will be filled in from secondary sources, such as company homepage, LinkedIn profiles of entrepreneurs, articles and blog posts.

At the end of this thesis, the results of the empirical analysis will be presented and a discussion of the implications for entrepreneurs and investors will be provided.

2. Startups and the Importance of Growth and Financing

For the purpose of this thesis it is important to understand the definitions of the terms *startup* and *failure*. In the following chapter, the meaning of these terms will be clarified. In addition, the typical lifecycle of a successful startup will be illustrated, as well as the financing alternatives for entrepreneurs throughout the stages of the venture existence. Different measures of performance will be presented and assessed based on their applicability in the startup context.

2.1. Characteristics of startup companies

The term startup, despite being widely used in the media and academic literature in the last decades, has no universal definition. Some define a startup as a small company with limited resources, earnings and duration of operation. Others use the term in the context

¹¹ <https://info.crunchbase.com/about/>, access date 17/05/2015

of an early stage of the operation of a business, in which the entrepreneurial idea is being utilized and financing is being secured.

Practitioners have provided slightly different definitions, pointing to characteristics of startups, which differentiate them from other companies. Steve Blank explains the main organizational difference between startups and enterprises and its implications for innovation activities. While a startup is described as a “*temporary organization designed to search for a repeatable and scalable business model*”,¹² companies are organizations, which focus on the execution of an existing business model. Because enterprises design their strategies and structures in such means that their proven business models can be efficiently executed, innovation within these organizations is more difficult than in a startup structure, where there are less structural and strategic restrictions yet.¹²

Paul Graham defines a startup as a company that is designed to grow fast. Potential growth is what distinguishes startups from other small businesses like restaurants and barbershops. According to the investor, two conditions have to be fulfilled so that a startup can grow into a successful company. First, there should be a big market for the product or service, and, second, the company should be able to serve this market. Aiming for a bigger market increases the growth potential of a startup, however there also is the threat of being confronted by a bigger number of competitors. That is why, it is essential for startups to grow fast. And this is one of the reasons why so many startups are founded within the technology sectors – technology changes rapidly, thus improving and motivating the generation of new ideas and potential growth.

According to Paul Graham, the growth function of a successful startup consists of three phases. In the first phase the startup has not yet clarified its business model and

¹² Steve Blank: Why Companies are Not Startups: <http://steveblank.com/2014/03/04/why-companies-are-not-startups/>, access date 20/01/2015

performance increases only slightly or does not improve. In the second phase, the startup has developed the product and starts delivering it to the market, which is why that is a stage of rapid growth. Eventually, the startup grows into a company and reaches the third stage, in which performance declines because the market constraints have been reached. These three phases can be visualized in a S-curve, whereby successful startups are expected to have a longer and steeper growth function in the second phase, compared to other businesses.¹³

In their paper, (Aulet & Murray, 2013) define the difference between the two types of entrepreneurship – SME (small and medium enterprises) and IDE (innovation-driven enterprises). According to the authors, SMEs are small businesses, such as restaurants, targeting mostly local markets. These enterprises are risky, but have a higher probability of success than innovation-driven enterprises. In addition, both types of businesses have different capital requirements. SMEs have usually lower capital requirements, which is why these businesses are mostly managed as sole proprietorships. Growth of SMEs is mostly linear and revenue increase is achievable in the short-term.

On the other side, IDEs aim at serving global markets by developing new innovative products or services and creating significant competitive advantage. Under innovation one could understand the development of products with new functionalities, but also business model innovations, changing the way, in which these products are delivered to the customer. Innovation is essential for being able to expand into new markets, but this innovation has to be protected, so that the competitive advantage of the IDE is maintained globally. IDEs are usually founded in tech industries and are associated with high potential growth in the long term. Innovation-driven enterprises are much more risky than small business, which is why failure rates of such companies are very high.

¹³ Paul Graham: Startup = Growth: <http://www.paulgraham.com/growth.html>, access date 20/01/2015

Because of the high capital requirements of these businesses and due to the high potential growth, external investors are interested in funding IDEs, which leads to different ownership structures than those of SMEs. In addition, IDEs differ from SMEs in terms of their growth functions. At the beginning IDEs often operate at a loss, but later revenues start to increase exponentially. That is why, revenue growth can be illustrated with a convex function, similarly to the description of Paul Graham.

For the purpose of this master thesis, the innovation-driven type of entrepreneurship will be of higher relevance. The focus will be set on tech ventures, which are usually characterized by high innovation activities.

2.2. Growth

Growth is recognized as an important element of the entrepreneurial process. That is why a significant part of the literature is focused on analyzing the growth process of firms, as well as the determinants and implications of growth.

2.2.1. Growth stages of new ventures

In the literature, two basic definitions of firm growth can be distinguished. Growth might be defined as an increase in amount (e.g. sales, output) or as an increase in size, resulting from the development process (Davidsson, Achtenhagen, & Naldi, 2005).

Many researchers have studied and analyzed the lifecycle of new ventures, observing a similar pattern in the stages of growth. While the number and names of stages might vary in different scientific articles, the same sequence of events is adopted and the same S-shaped growth function is applied (e.g. (Leach & Melicher, 2014), (Lewis & Churchill, 1983)).

Figure 1 illustrates the five stages in the life cycle of successful new ventures according to (Leach & Melicher, 2014).

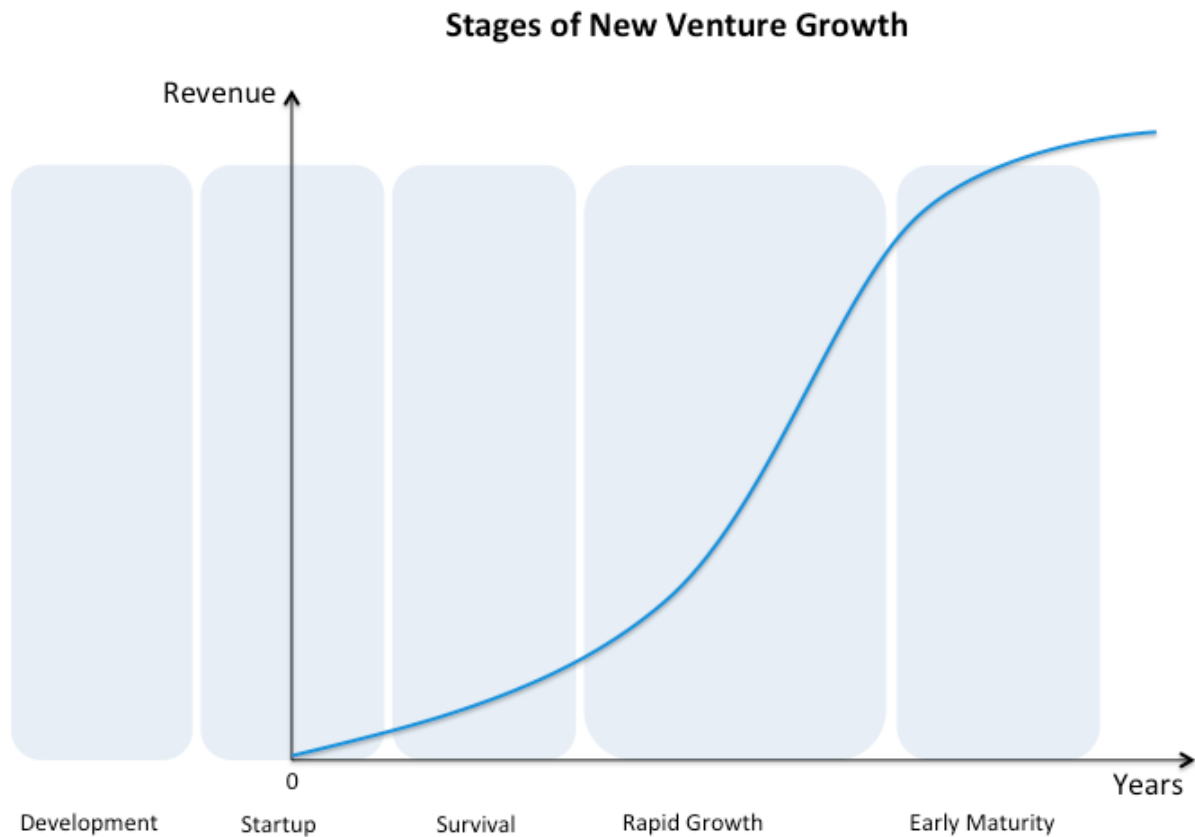


Figure 1: Stages of New Venture Growth, based on (Leach & Melicher, 2014)

- During the **development stage**, an idea is generated and tested by the entrepreneur and feedback is requested from friends, family or/and trusted business professionals. The duration of this change might vary across different ideas and sectors.
- In the **startup stage** of a successful new venture, the venture is organized and developed and first sales of the product or service take place. The duration of this stage highly depends on the physical and intellectual capital necessary for the business. (Lewis & Churchill, 1983) argue that capital insufficiency, absence of demand and lack of other resources might lead to failure in this stage.
- The **survival** stage is characterized by increase in revenues, which however often might not be sufficient to cover all expenses. As a result, entrepreneurs might consider raising additional capital from debt or equity investors.

- In the stage of **rapid growth**, revenues and cash flow start growing rapidly, the value of the venture and its market share increase significantly as well. According to (Lewis & Churchill, 1983), it is essential that the entrepreneurs find enough resources to finance and manage this growth, otherwise the business might fail.
- During the **early-maturity** stage in the lifecycle of successful ventures, revenues continue growing, but at much lower rate compared to the rapid-growth stage. In this stage, investors and entrepreneurs might decide to exit their investments through a sale or merger.

These stages form the life cycle of a successful new venture. However, not all newly founded firms with high growth potential manage to go through all phases. Capital insufficiency, absence of demand and other resources, inability to finance and manage growth might be some of the drawbacks for startups in achieving success. A lot of companies do not manage to increase their performance and, as a result, they either continue operating at a low growth rate or fail. Such ventures, which continue to exist, but do not achieve the necessary growth rate to be recognized as successful startups, are often referred to as “walking dead” or “zombies” by venture capitalists (VCs)¹⁴.

Although growth models provide an intuitive overview of the evolution of small businesses and the stages they go through, these models are also criticized in the literature. (Davidsson et al., 2005) discuss some of the main arguments against these models. Growth models are described as rather deterministic and based on the unrealistic assumption that all companies have to go through certain phases. These models might not be applicable for some new ventures, which could prefer to employ different innovative organizational structures and principles, for example.

¹⁴ Silicon Valley's culture of failure ... and 'the walking dead' it leaves behind: <http://www.theguardian.com/technology/2014/jun/28/silicon-valley-startup-failure-culture-success-myth>, access date 01/02/2015.

2.2.2. Growth Measurement

Growth can also be defined as a change in amount rather than as a development process (Davidsson et al., 2005). Here the questions arise how growth should be measured and which indicators should be used to assess the growth of firms. In past studies various indicators have been examined, of which the most frequently applied are sales, employment, assets, physical output, market share and profits. Some industry-specific growth measures might also be defined and applied. Depending on the industry or research purpose, researchers might choose to create a multiple indicator index, use alternative measures of growth separately or choose and apply one indicator that is best suited given the company's specifics (Davidsson et al., 2005). There has been high variation of growth indicators used in previous studies, as well as differences in growth formulas that have been applied and in the time frame that has been used. As a result, current research findings are hardly comparable. Some recommend finding one or a few best applicable growth measures, so that research on the subject becomes more focused and results would have higher comparability. However, (Delmar, Davidsson, & Gartner, 2003) argue, firms grow differently and the application of different growth indicators cannot be avoided given the multidimensionality of firm growth. What is more, applying various growth measures can provide a better insight in the firm's growth process.

Sales and employment are the growth indicators used by most researchers, who have studied new venture growth (Davidsson, 2006). According to (Davidsson, 2006), the preference towards these indicators may be motivated by data availability. What is more, these indicators are better accepted in the literature compared to market share or performance, for example, which are perceived as rather subjective and not well suited for cross-industry studies.

Sales are a commonly favored growth indicator because of their applicability for most firms, their accessibility and low dependence on capital intensity. What is more, many other growth indicators used in studies are, to some extent, dependent on sales. An increase in sales could result in higher employment, profits or market share, for

example. If a study is focused in the managerial implications of growth or job creation, employment can be the more appropriate indicator to examine. However, it should be taken into consideration that the firm might grow in terms of output or sales even if employment remains unchanged. This might result from the decision of the firm to outsource or from an increase in productivity. As a result, correlation between sales and employment might not always be high (Delmar et al., 2003).

(Chandler, McKelvie, & Davidsson, 2009) study the relationship between sales growth and employment growth in the context of transaction cost theory. The results of their study suggest that employment increases with sales if there is high human asset specificity and the costs and uncertainty of hiring new employees are lower than the costs that would arise from outsourcing. This relationship holds only in a resource scarce setting, meaning that firms are more likely to make resource efficient choices if there is lack of resources. From the confirmed relationship between sales growth and employment growth, the authors infer that firms, which require higher company and product specific knowledge and skills, are more likely to hire new employees instead of subcontracting.

(Delmar et al., 2003) point out that although sales might be the most preferred growth measure by researchers, it might not be the most appropriate indicator if high-tech startups or firms with start-up activities are analyzed. The main argument in favor of this statement is that in startups, employment and assets might start to grow if the company does not have any sales yet. The authors also underline the importance of the choice of absolute or relative growth measure, depending on the size of firms, being studied. If absolute measures are used, higher growth is attributed to larger companies in the sample. If, however, relative measures are applied, smaller firms could reach much higher growth rates. The results of the research conducted by (Davidsson, 2006) suggest that in more than 50% of the reviewed 55 studies relative growth measures have been used. Absolute measures have been favored by approximately 29% of studies.

(Davidsson, 2006) also studied the time frame used in research, studying the growth of small firms. Most frequently, a time interval of 5 years has been chosen, followed by 1 and 3 years. Most researchers do not provide an explanation for their choice of a time span, and the implications of this choice and its effect on the outcome of the analysis have not been studied in the literature yet.

2.2.3. Growth and Profitability

Although researchers agree on using growth as an indicator of success, often the question is asked about how growth relates to profitability – is growth the result of profitability or is profitability a necessary condition for growth. (Davidsson, Steffens, & Fitzsimmons, 2009) argue that success in terms of high growth and profitability is more likely to be achieved by firms, which initially have low growth and high profitability. On the other hand, firms who grow fast before securing a certain level of profitability, are more likely to eventually become less successful, having low growth and low profitability. The main argument behind this hypothesis is that, by first securing profitability, firms gain competitive advantage. This advantage and the secured financial resources allow firms to invest in and sustain growth. Although the authors empirically support their hypothesis, it is important to point out, that their sample consists of small and medium enterprises. That is why, it is questionable whether these results would hold for a sample of innovation-driven enterprises, or startups, which rely on fast and high growth to secure competitive advantage.

2.3. Financing

It is of great importance for startups to achieve rapid growth in order to gain competitive advantage and develop a scalable business. Thus, the question arises of how entrepreneurs finance the growth of their ventures.

Acquiring sufficient funding and making the right choice regarding the capital structure of a startup might be essential for establishing an operational and successful new

venture. Entrepreneurs might choose to use internal equity for financing a startup, however this decision highly depends on the personal liquidity constraints of the founder and the investment requirements of the new business. Outside equity and debt represent other funding alternatives, which an entrepreneur might choose from. Each form of financing has its benefits and consequences, which should be carefully considered.

Finding an investor, who is willing to provide funds to a startup, might represent a huge challenge for the founder. On the one hand, the high risk of new entrepreneurial ventures might represent a high-return opportunity for investors, who have more diversified portfolios, e.g. venture capital funds. On the other hand, the high failure risk of startups might represent an obstacle for obtaining funding from debt investors, e.g. commercial banks.

2.3.1. Debt vs Equity

(Carpenter & Petersen, 2002) study the effect of capital market imperfections on high tech firms. Because of the high uncertainty of investment, potential asymmetric information problems between firms and investors and the limited collateral value of high tech investments, the high tech industry is considered to be more vulnerable to capital market imperfections than other sectors, such as retail and wholesale. These imperfections, observable in the financing constraints and funding gaps that high growth firms face, result in decreased use of debt and increased use of equity financing. The authors analyze the reasons why debt financing might be inappropriate in the high tech industry. First, the high uncertainty of projects may lead to negative expected returns to lenders. Second, because of the possibility of adverse selection problems, credit rationing may be applied by lenders, which would reduce the level of capital, provided to the business. Third, potential moral hazard problems often result in highly restricting covenants attached to debt. In addition, the low collateral value of assets, due to intangible or firm-specific investments, might limit the access of the firm to debt

financing. And finally, financial distress costs, arising from loss of important employees or abandonment of critical projects, should be very high in the tech industry. Because of all these factors, the marginal cost of debt is expected to rapidly increase with leverage, which, in turn, should result in lower levels of debt in the capital structures of new tech firms. The authors analyze 2.400 U.S. tech firms and find that most small firms have low debt levels in their capital structures. They argue that new equity finance is of great importance for high growth firms in the tech industry and that, with imperfect capital markets, venture capital (VC) should be well suited for such young firms.

In a qualitative study, (Paul, Whittam, & Wyper, 2007) review the capital finance preferences of 20 Scotland-based entrepreneurs, in order to find out whether the Pecking Order Hypothesis¹⁵ applies to the financing preferences of startups. The results of the study suggest that startup founders finance their new ventures with internal resources first. However, if external financing is necessary, entrepreneurs have a clear preference for external equity rather than debt, which is in contradiction with the Pecking Order Theory. When choosing the financing source, entrepreneurs face a trade-off between giving up ownership in the business and making use of the value adding benefits of external equity. Because of the low collateral values of early stage ventures, entrepreneurs often have to pledge their personal assets as collateral in order to obtain bank financing. Thus, bank financing results in a personal liability for the entrepreneur. In addition, debt financing might negatively affect the startup's cash flow. External equity, on the other side, could limit the drawbacks of debt financing. Private equity investors can add value to the business by providing guidance, competencies, business skills and social capital, required for effectively managing a high-growth business. In addition, high tech and growth firms, which usually have high cash burning rates, might

¹⁵ According to the proposed by (Myers, 1984) pecking-order-theory, firms prefer to finance their operations internally. If they are not able to do so, they will issue debt. Only as a last instance, equity is issued.

require additional funding to finance growth. Private equity investors might improve the chances of obtaining additional capital by providing access to networks with investors and other entrepreneurs.

The funding gap for early stage high-risk businesses, which arises from the restricted access to debt financing, is filled by venture capital investors. Venture capitalists usually provide equity financing to high-risk ventures with high return potential. Because of the high uncertainty of these investments, VCs mitigate potential moral hazard and adverse selection problems by carefully selecting their portfolio startups, monitoring the performance of the ventures and providing advice and managerial guidance. In addition, staged financing is a common practice in the VC industry. Often financing is provided in different stages, and additional funding is dependent on performance. This allows for further reduction of risk. (Gompers & Lerner, 2001)

(Fischer & Rassenfosse, 2011) study venture debt as another funding opportunity for new high-growth ventures which often face difficulties in obtaining bank loans because of their lack of tangible assets and often – negative cash-flows. Facebook, Amazon and Youtube are among the companies that have relied on venture debt as financing source. (Fischer & Rassenfosse, 2011) argue that venture debt might be beneficial for entrepreneurial high-growth ventures, because it can provide the necessary resources for a startup to hit more milestones, and raise external equity at a later point of time, when the venture valuation should be much higher. As a result, dilution to managers and investors can be reduced. (Fischer & Rassenfosse, 2011) study the determinants of venture debt use, which are repayment capacity, collateral and equity warrants. Since new ventures often have negative cash flows, VC backing is often considered as a substitute for cash-flow. Thus, being VC backed increases the chances for obtaining venture debt. Since high-growth startups often lack tangible assets, they can offer patents as collateral, which should increase the probability of getting venture debt, because of the positive signaling effect of patents. Equity warrants, which are similar to convertible debt, also have a positive effect on venture lending.

2.3.1. Funding Alternatives

At the early stages of the ventures, the founders, their friends and families might provide internal equity for development of the new business (Leach & Melicher, 2014)..

In the last years, crowdfunding has gained significant importance as a source of initial capital for new ventures. Crowdfunding is defined as the process of raising small financial contributions from a large number of individuals on the Internet (Mollick, 2014). A number of crowdfunding platforms have been developed for the purpose of connecting entrepreneurs and funders. Examples of such platforms are Kickstarter and Indiegogo, which themselves are successful VC-backed startups. The amounts raised by entrepreneurs on these platforms vary significantly. The most funded campaign on Kickstarter at the time being is the second campaign of the smart watch maker Pebble, who raised \$20,3 million in 2015, which is 4.067% of their initially stated goal.¹⁶ However, crowdfunding is not only a great fundraising alternative. The outcome of a campaign might provide information to other investors, such as venture capitalists, regarding the demand for a product or service. Pebble is a great example of a venture that has benefited from the signaling effect of crowdfunding. Although numerous venture capital investors had initially rejected funding for the Pebble smart watch, Pebble managed to raise \$15 million venture capital after a highly successful Kickstarter campaign.¹⁷

¹⁶ Nina Zipkin: "The 10 Most Funded Kickstarter Campaigns Ever", <http://www.entrepreneur.com/article/235313>, access date 19/02/2015

¹⁷ Charles Luzar: "Pebble raises \$15 Million From Charles River Ventures", <http://www.crowdfundinsider.com/2013/05/15688-pebble-raises-15-million-from-charles-river-ventures/>, access date 19/02/2015

Incubators and Accelerators are business programs providing necessary initial resources and support to startups during the initial stages of their development. Incubators are usually university or privately funded non-profit organizations, offering shared office space, discounts on office services and employee-focused services such as health insurance. In addition, incubators offer business advice and might connect entrepreneurs with wealthy individuals and angel investors, who might provide additional funding. Accelerators are usually for-profit programs, which provide mentoring, expertise, small financing amounts and connections to major investors (angels investors or VCs). In exchange they require a portion of the startup equity, typically around 7%. The main objective of business accelerators is to help entrepreneurs build successful high growth businesses (Sherman, 2012). One of the major accelerators is Y Combinator, which has invested in successful ventures such as Dropbox and Airbnb.

Another funding alternative for newly founded ventures are angel investors, who are wealthy individuals, investing in a small number of new ventures with high growth potential. Business angels usually invest in risky, early-stage businesses and these investments are often not publicly disclosed. While angel investors do not provide mentoring services to the extent that VCs do, they play an important role in helping entrepreneurs to acquire subsequent funding by VCs. Venture capital investors are usually interested in later stage ventures and contribute larger investments. They monitor the companies in their portfolios and provide strategic advice and mentoring, which help startups achieve comparative advantage. However, the control rights of the entrepreneur are often contractually restricted, so that agency problems between the investors and founders are mitigated. ((Denis, 2004), (Wong, Bhatia, & Freeman, 2009))

2.3.2. Stages of Financing

With increasing age and size of new ventures, risk and information asymmetry tend to decrease. As a result, funding alternatives change throughout the growth stages of the firm.

In the **development stage**, the founders, their families and friends (3F) are usually the primary source of funds. Entrepreneurs might sell their personal assets or use them as a collateral for obtaining a bank loan. Business angles might also be interested in investing in early-stage new ventures. Development-stage financing is often referred to as “seed financing” (Leach & Melicher, 2014).

Financing in the **Startup stage** (Startup financing) refers to the investments obtained for financing growth up to the point of initial production and first sales. Venture capital firms and angel investors are the major investors targeting firms in this stage (Leach & Melicher, 2014). Incubators and early stage venture capital represent other funding alternatives in the startup stage (Wilson & Silva, 2013).

Since expenses in the **Survival stage** often exceed revenues, obtaining funding is essential for the success of the venture. First-round financing is external equity that is usually provided by VC investors to ventures in the Survival stage for covering excess expenditures and investments. During this stage, the startup might also obtain financial support from government assistance programs. In addition, ventures might rely on trade credit from suppliers, allowing for delayed payment of liabilities (Leach & Melicher, 2014).

The **Rapid growth stage** is associated with increased investments, necessary to achieve a certain growth rate. Second-round financing is usually provided by VCs and is used to support working capital expansion. Another alternative for entrepreneurs is Mezzanine financing, which is provided in the form of debt with an attached option to buy stock at a pre-specified price within a pre-specified time period. In the Rapid growth stage, the

venture might offer shares to the general public (in an IPO), which should result in increased liquidity. (Leach & Melicher, 2014)

During the Rapid-growth stage and **Maturity stage**, ventures can more easily obtain financing from commercial banks, because of their track record, availability of financial statements and collateral. In addition, business operation should represent a major source of financial resources. (Leach & Melicher, 2014)

The table below summarizes the funding alternatives for startups throughout their life-cycle:

Growth Stage	Financing Stage	Sources of Financing
Development	Seed	Founders, Family & Friends; Crowdfunding; Business Angels;
Startup	Startup	Founders, Family & Friends; Business Angels; Incubators & Accelerators; Early stage VC;
Survival	First round	Business operation; Incubators; VC funds; Trade credit; Commercial banks; Subsidies;
Rapid growth	Second round, Mezzanine financing	Business operation; VC funds; Trade credit; Commercial banks; Investment banks;
Early maturity	Seasoned financing – Issuing Bonds & Stock; Obtaining bank loans;	Business operation; Commercial banks; Investment banks;

Table 1: Financing Sources for New Ventures, modified from (Leach & Melicher, 2014), (Wilson & Silva, 2013)

2.4. Failure

In order to be able to define startup failure, it is important to first understand what startup success is. As previously discussed, the ability to grow is what defines a startup. This would suggest, that even if the operations of a startup become profitable at a certain point in time, profitability would not be a sufficient condition for defining the startup as a successful one.

Because of the large variety of financing alternatives and the low costs associated with founding a new firm and starting a business, a lot of new startups start operating each day. New founders are often motivated purely by the idea of profit generation and, as a result, the quality of new ideas and their implementation are often insufficient.¹⁸ A lot of these businesses cease to operate for a variety of reasons that will be discussed later in this thesis. Some of the ventures manage to survive, but do not achieve a sufficient growth rate to be able to raise additional funding or have a successful exit such as IPO or acquisition. These companies, despite continuing to exist, are not recognized as successful startups by investors, who are willing to remove “walking dead” startups from their portfolios as early as possible.¹⁹

According to the OECD definition, a high growth firm is an enterprise “with average annualized growth greater than twenty percent per annum, over a three-year period, and with ten or more employees at the beginning of the observation period”, whereby growth is measured in terms of employees or turnover. A slightly more different definition is provided for a gazelle company, which is referred to as an enterprise with

¹⁸ Roof, Katie: Patricof: Startup Failure Rate is Going to Be “A Lot Higher”, <http://www.businessinsider.com/startup-odds-of-success-2013-5?IR=T>, access date: 22/03/2015

¹⁹ Randy Thompson: The Problem with Zombies, <http://www.vaangels.com/the-problem-with-zombies/>, access date: 22/03/2015

“up to five years old with average annualized growth greater than twenty percent per annum over a three-year period, and with ten or more employees at the beginning of the observation period”. Gazelle companies are younger high-growth companies and thus represent a subset of high-growth companies.²⁰

Another approach to identify high-growth companies is proposed by (Moreno & Casillas, 2007). The authors define high-growth firms as companies with a three-year growth rate, lying more than 100% above the median growth of the firms in the industry. Industries have different growth rates and high growth-firms in one industry could have much lower growth rates than high-growth firms in another. That is why it might be reasonable to consider relative growth measurement and, thus, avoid cross-industry differences.

The initiation of an IPO is often used as a performance measure by researchers (Folta, Cooper, & Baik, 2006), (Hsu, 2006). A sale of the venture, despite representing business discontinuance, may be interpreted as a successful exit (Folta et al., 2006). Recently, Facebook acquired the messaging service WhatsApp for \$19bn and the mobile photo sharing app Instagram for \$1bn.²¹ Nest was acquired by Google for \$3.2bn, Beats by Apple for \$3bn, Minecraft by Microsoft for \$2.5bn²². These examples further motivate a positive interpretation of venture sale as an exit.

²⁰ Eurostat-OECD Manual on Business Demography Statistics: <http://www.oecd.org/industry/business-stats/eurostat-oecdmanualonbusinessdemographystatistics.htm>; access date: 23/03/2015

²¹ Alex Wilhelm, Jordan Crook: “Facebook’s \$19-Billion WhatsApp Acquisition, Contextualized”, <http://techcrunch.com/2014/02/19/facebook-19-billion-whatsapp-acquisition-contextualized/>, access date 15/05/2015

²² Jacob Mullins: “2015 Will Be The Year Of The Tiny Tech Acquisition”, <http://www.businessinsider.com/the-year-of-the-tiny-tech-acquisition-2015-1?IR=T>, access date 15/05/2015

In this master thesis, startup success is defined as one of the following:

- Exit through an IPO

However it should be kept in mind, that although an initiation of an IPO will be considered a success in the context of this master thesis, this might not always be the case. For example, the online retailer Pets.com had raised \$82.5 million in an IPO and went out of business nine months later.²³

- Exit through acquisition

Here it should be noted as well, that a sale of the venture might now always be interpreted as a success. Whether an acquisition is a success or a failure highly depends on the acquisition price. In addition, an interpretation of the outcome might also be dependent on the initial objective of the entrepreneur. If the founder has a preference for remaining in control of the business but sells the venture due to an inability to reach this goal, this might also be perceived as a failure.

- Ongoing business with a high growth rate

How fast should a company growth in order to become successful?

Techcrunch studied the growth rates of 70 companies that went public in the last four year prior to their IPOs. They found that the median company with revenues in the range \$0 - \$25 million had a growth rate of 133% p.a.. The growth rate declined to 38% p.a. as the companies had revenues between \$150 million and \$500 million. At the year

²³ Tom McNichol: "A Startup's Best Friend? Failure", http://money.cnn.com/magazines/business2/business2_archive/2007/03/01/8401031/?postversion=2007022807, access date 19/05/2015

of the IPO, 69 of the 70 companies had a growth rate above 20% and 54 of them had a growth rate even above 30%.²⁴

Failure represents the inability of a startup to achieve success. That is why, the term startup failure comprises the following outcomes of a new venture:

- Liquidation/Closure;
- Ongoing business with a low or absent growth rate (“zombie startup”);

2.5. Industry Overview

According to a report prepared by Ernst and Young about the trends in venture capital, information technology has been the sector with highest VC investment in US, Canada and Israel in 2013. The subsectors mostly preferred by investors have been software and consumer information services, with Software representing approximately 70% of the Information Technology sector. In Europe, China and India, investment was concentrated in the consumer services sector. In mature markets, the health care industry, as represented by fast-growing sectors like life science, biotech and medical device technology, has become increasingly appealing to VCs.²⁵

As reported by Gust, of all filed funding applications in Q4/2014, 16.5% came from startups in the Internet Web Services sector, 12.4% - from Consumer Products and Services sector and 12.2% from the Healthcare sector. As illustrated in Figure 2, 7.2% of

²⁴ Jules Maltz and Parsa Saljoughian: “How Fast Should You Be Growing?”, <http://techcrunch.com/2013/08/24/how-fast-should-you-be-growing/>, access date 19/05/2015

²⁵ EY: “Adapting and Evolving, Global venture capital insights and trends 2014”, [http://www.ey.com/Publication/vwLUAssets/Global_venture_capital_insights_and_trends_2014/\\$FILE/EY_Global_VC_insights_and_trends_report_2014.pdf](http://www.ey.com/Publication/vwLUAssets/Global_venture_capital_insights_and_trends_2014/$FILE/EY_Global_VC_insights_and_trends_report_2014.pdf), access date: 28/03/2015

the applications were registered from companies in the technology sector, while only 5.7% were filed from Software startups.

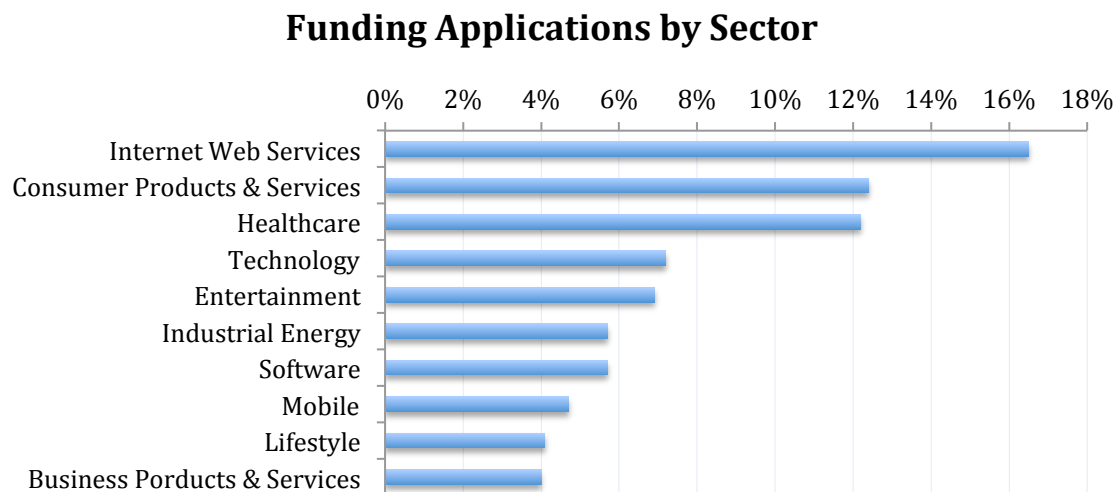


Figure 2: Funding Applications by Sector²⁶

CB Insights have published a report on startup mortality, in which they illustrate the number of tech-startup deaths by sector for the period 2010-2013. The majority of startup deaths have been registered in the Internet sector, in which more than 70% failure rate has been reported in each of the years. The high failure rate may be to some extent a result from the high investment and entrepreneurial activity in this sector, which could have led to higher competition and an increased number of imitation-businesses.

²⁶ Justin Cina: "Old and new: Global startup activity continues to thrive": <http://startupbeat.com/2015/03/11/old-and-new-global-startup-activity-continues-to-thrive-id5047/>, access date: 28/03/2015

Dead Tech Companies By Sector, 2010 - 2013 (CB Insights)

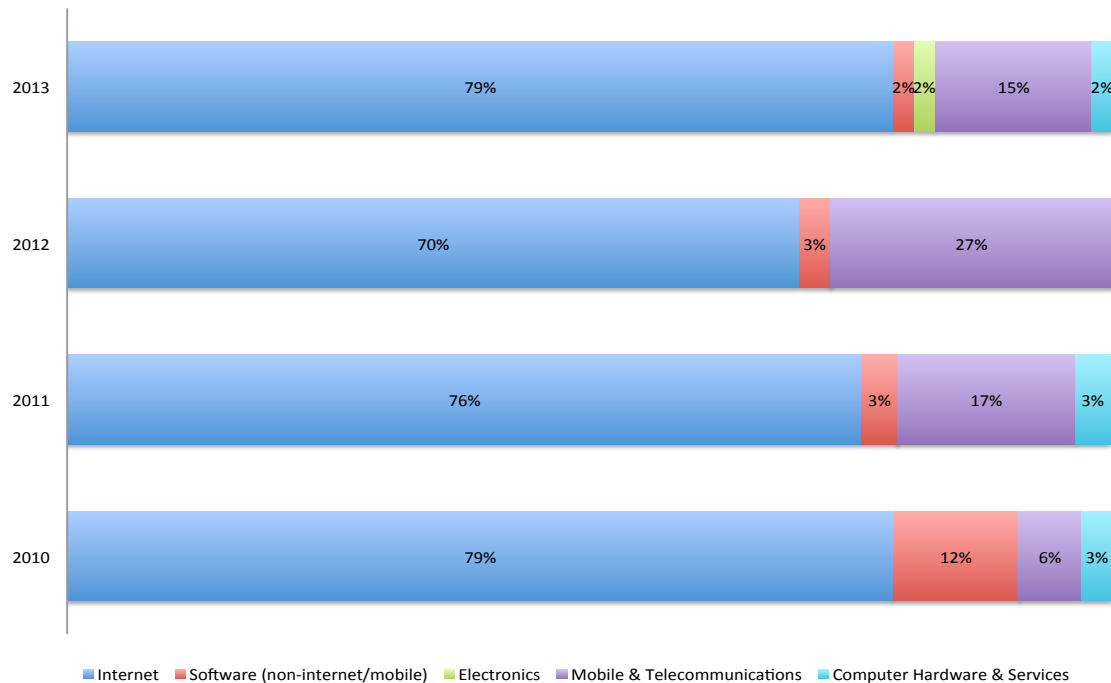


Figure 3: CB Insights: The R.I.P Report - Dead Tech Companies by Sector²⁷

In the second chapter of this master thesis, a brief overview of the “startup world” has been provided. The importance of growth for the successful outcome of a new venture has been underlined. In addition, various alternatives for financing the growth of high potential firms have been discussed. Based on these insights, the terms *success* and *failure* were defined.

In the following chapter, common factors hypothesized to have an influence on the outcome of tech ventures will be presented.

²⁷ CB Insights: “The R.I.P. Report – Startup Death Trends”, <https://www.cbinsights.com/blog/startup-death-data/>, access date: 28/03/2015

3. Critical success factors for startups

In this chapter, various factors, which might have an effect on new venture performance, will be presented and analyzed. In the first section – human capital, the individual characteristics of the entrepreneurs, such as gender, age and experience, will be analyzed. In the second section – financial capital, the financing choice, in terms of selection of funding alternatives and capital structure, will be discussed. And the third section – strategic factors, will comprise of the factors, such as team size and choice of location. Based on the discussion regarding these critical success factors, hypotheses will be formulated, which will be tested later in this thesis.

3.1. Human Capital

Researchers have recognized the important role of human capital for the performance of new high-growth ventures. Human capital is often defined by the demographic characteristics of the entrepreneur, as well as their experience and education.

In the following, the gender of the founders, as well as their age, experience and education will be discussed as determinants of success.

Gender

According to the U.S. Small Business Administration, 36% of all small businesses in 2014 have been founded by women.²⁸ (Koellinger, Minniti, & Schade, 2013) found out that in

²⁸ Professors Candida G. Brush, Patricia G. Greene, Lakshmi Balachandra, and Amy E. Davis: Diana Report, <http://www.babson.edu/Academics/centers/blank-center/global-research/diana/Documents/diana-project-executive-summary-2014.pdf>, access date: 31/03/2015

all of the 17 countries that participated in their survey, female entrepreneurs are significantly fewer than male entrepreneurs, with a men to women ratio of 1.9. This ratio is 2.15 among all established entrepreneurs, which are defined by the authors as part- or full owners of the business who had paid wages for longer than 42 months prior to the survey. On average, there has been no significant difference between the survival probability of male and female entrepreneurs, as measured by the ratio of established to nascent entrepreneurs. In 6 of the countries, the data even suggested higher survival chances of female entrepreneurs. The analysis of the authors suggests that the gender gap is mainly due to the lower propensity of women to engage in entrepreneurial activities and not because of gender related differences in survival chances. The authors argue that the main reasons for this lower entrepreneurial propensity of women are subjective perceptions. Women are more likely to have lower confidence in their skills, to be more afraid of failure and to be less connected to other entrepreneurs. All these perceptions have a significant negative effect on the entrepreneurial propensity of females.

Previous studies have provided evidence for the presence of significant differences between men- and women-owned ventures. The results of most studies suggest that businesses founded by female entrepreneurs are more likely to perform worse in terms of profits, sales and number of employees (Fairlie & Robb, 2009). A possible explanation for this underperformance is that women tend to have less prior experience in the business sector and use less startup capital. Another factor contributing to the underperformance of businesses founded by women is that female entrepreneurs tend to be more active in the service industries, in which companies have relatively fewer employees and lower revenues compared to firms in the high technology sector (Anna, Chandler, Jansen, & Mero, 2000).

(Fairlie & Robb, 2009) argue that businesses run by female entrepreneurs are less successful than ventures founded by male entrepreneurs. Although these findings are supported by other researchers, there are studies, which do not find a significant

relationship between the gender of the entrepreneur and the likelihood of success. (Cooper, Gimeno-Gascon, & Woo, 1994) argue that women-owned businesses might be less likely to grow, but their survival chances are equal to those of men-owned ventures.

(Coleman & Robb, 2009) compare women- and men-owned businesses using data from the Kauffman Firm Survey. They show that there are significant differences in the financing choices of male and female entrepreneurs. The analysis suggests that women prefer financing their businesses from personal sources instead of raising outside capital. This choice can be explained by a higher risk aversion of female entrepreneurs, resulting in their preference for increased control over their businesses. That is why, women might have an incentive to start smaller businesses, which do not require high investment capital and are more easily manageable. However, the research conducted by Babson College suggests, that although many female entrepreneurs had the necessary skills to manage a high growth venture, they did not receive funding by VCs. Thus, the problem of financing of ventures run by women might not be because of the entrepreneurial preferences of the founder, but because of a gender bias of VCs. Research showed that 97% of all VC-funded ventures had male CEOs, and 86% of all VC-backed companies had no women in management positions.²⁹

Based on this research I hypothesize that startups founded by female entrepreneurs are more likely to perform worse and fail.

H1: Startups, founded by female entrepreneurs, are more likely to fail.

²⁹ Professors Candida G. Brush, Patricia G. Greene, Lakshmi Balachandra, and Amy E. Davis: Diana Report, <http://www.babson.edu/Academics/centers/blank-center/global-research/diana/Documents/diana-project-executive-summary-2014.pdf>, access date: 31/03/2015

Experience and education

A lot of researchers have studied the role of human capital for new venture performance and survival. There have been two alternative explanations of how human capital affects the performance of new ventures. Previous studies have found a positive relationship between human capital and the personal wealth of an individual. Because the access to capital is restricted for new ventures, the personal wealth of the founder might improve the survival chances of their startup. That is why, according to financial economics, the positive effect (referred to as “wealth effect”) of human capital on performance might be explained with the increase in personal wealth of the founder. The competence-based view suggests that the capabilities and performance of new ventures are contingent on the skills and knowledge of the founder, which in turn depend on their education and prior experience. This effect is referred to as the “capability effect” (Colombo & Grilli, 2005).

(Colombo & Grilli, 2005) analyzed the relationship between the founders’ human capital and the growth of new high tech ventures, using a sample of 506 Italian firms. The results provide evidence of the positive effect of human capital on growth, which might be explained by the competence-based view. Growth of new ventures is found to be dependent on the founder’s education and experience. The years of university education in managerial, economic, scientific and technical fields positively affect growth. Prior technical experience in the same industry and previous entrepreneurial experience also have a positive effect on growth. Another finding of the study is that complementary capabilities, present in the founding team, can result in a synergy. Synergistic effects might arise from a combination of education in economic-managerial and technical-science fields and technical and commercial work experience in the same industry as of the new venture. However, as the authors admit, it should be kept in mind, that the results might be affected by the survivorship bias, present in the sample.

Motivated by the insights of human capital theory and signaling theory, (Gimmon & Levie, 2010) studied the effect of human capital on attracting external investors and on

the survival of high-tech startups. The human capital of entrepreneurs, measured by their technical expertise, business management expertise and academic status, was hypothesized to have a positive signaling effect in attracting external investments and to enhance the chances of survival of new high-tech ventures. Business management expertise was found to significantly increase the chances of both obtaining external investment and new venture survival. Academic status was found to send a positive signal to investors. Having one of the academic titles - PhD or Professor, increased the probability of obtaining external finance even further. However, the hypothesis that academic status affects the odds of startup survival was not empirically supported. General technical expertise was not found to be a significant factor for attracting external investors, although it significantly increases the probability of survival. The authors suggest that the divergent effects of technical expertise and academic status might be because of investors attributing higher value to factors that affect high growth and expected value at exit instead of factors enhancing early survival. Although the authors suggest that there might be a relationship between external investment and survival, this is not in the focus of their work. (Colombo & Grilli, 2010) showed that there is an indirect effect of human capital on new venture growth. Because human capital improves the chances for obtaining VC-financing, and due to the performance-enhancing role of VC, it can be concluded that human capital has an indirect impact on performance. Further discussion on the role of investment for startup success and survival will be provided later in this master thesis.

(Davidsson & Honig, 2003) studied the effect of human and social capital on entrepreneurial discovery and exploitation. In this study, human capital was not recognized as determinant of success, with success being defined as first sale or profitability. However, human capital was found to increase the probability of engaging in entrepreneurial activities. This would suggest that individuals with higher-quality human capital might be better at identifying good opportunities, or that they might have higher self-confidence, resulting in a perception of higher success chances.

While (Colombo & Grilli, 2005) found a positive relationship between previous startup experience and new venture growth, it might be interesting to distinguish between successful and not-successful prior entrepreneurial experience. There is a whole stream in the literature studying serial entrepreneurship and performance. (Gompers, Kovner, Lerner, & Scharfstein, 2010) found that VC backed entrepreneurs who have succeeded in a venture, have a higher success probability for their next venture. Failed entrepreneurs on the other side, have almost the same success chance as first-time entrepreneurs. These results suggest that there is performance persistence in the case of previous success, but not in the case of failure. The worst entrepreneurs are less likely to become serial entrepreneurs because they might face difficulties in obtaining VC financing. (Gompers, Kovner, Lerner, & Scharfstein, 2006) argue that the skill of the entrepreneur plays an important role for success. One of the arguments supporting this statement is the performance persistence of successful entrepreneurs. In addition, the authors found that funding from experienced VC firms increased the success odds for first-time entrepreneurs and previously unsuccessful entrepreneurs, but not for successful entrepreneurs. Thus previous success might be interpreted as a quality signal regarding the entrepreneur's skills.

Although research suggests that entrepreneurs could benefit from their previous experience and should be able to better identify new opportunities because of the lessons learned, (Cassar & Craig, 2009) argue that entrepreneurs suffer from hindsight bias, which is why they are not able to recall their experience and initial risk perceptions correctly. Failed entrepreneurs, for example, would recall lower predicted success probability, than the true ex-ante predicted probability. This would suggest that if overoptimistic entrepreneurs are not able to learn from their past experiences, they would continue to overestimate the success chances of their future entrepreneurial activities. (Deniz Ucbasaran, Westhead, & Wright, 2011) came to the same conclusion, although they provide a different explanation for this phenomenon. They suggest that entrepreneurs do not learn from their past experiences and remain overoptimistic because of the "attributional bias", implying that the negative emotions arising from

failure might provoke the entrepreneur to blame external events for the negative outcome rather than themselves.

In general, research has found a positive effect of experience and education on performance. Based on the research findings, I formulate the following hypotheses :

H2a: Previous business management or technical university education of the founders decreases the failure probability of a startup.

H2b: Higher academic titles of the founders have a positive effect on the success probability of a startup.

H2c: Lack of previous entrepreneurial experience in the tech industry decreases the success probability of a startup.

H2d: Previous unsuccessful entrepreneurial experience increases the failure probability of a startup.

Age

Another subject of discussion among entrepreneurs, investors and researchers is the role of the entrepreneur's age for the success of a startup. Private equity investors often express their preference for funding startups founded by younger entrepreneurs³⁰, although several studies have shown that older entrepreneurs might actually be more successful. According to the research of the Founder Institute, an increase of age up to 40 improves the success probability of an entrepreneur. Age higher than 40 has only

³⁰ Christina Farr: "What's the best age to launch a startup? Founders young and old tell us", <http://venturebeat.com/2013/04/09/whats-the-best-age-to-launch-a-startup-founders-young-and-old-tell-us/>, access date: 10/04/2015

limited or no effect.³¹ The research of Vivek Wadhwa, a professor at the Duke University, showed that 40 is the average and medium age of an successful entrepreneur in the fast growing industries. Another interesting finding of the study is that there were twice as many entrepreneurs aged higher than 50 compared to those under 25. Vivek Wadhwa argues that young entrepreneurs might have an advantage in the Web and mobile technology sectors because they have better understanding regarding how these industries work. As a result they should be able to more easily identify new business opportunities and come up with new ideas. However older entrepreneurs might have better capabilities when it comes to idea implementation.³²

In an interview with US News, Dennis Ceru, a professor at Babson College, points out the advantages of higher-aged entrepreneurs. Older age provides the benefit of more experience, more financial resources and more business connections compared to younger entrepreneurs.³³ In empirical studies the age of the entrepreneur is often used as a proxy for experience, or generic human capital. And researches find that experience plays an important role for entrepreneurial success.

Although the average age of the entrepreneurs of startups in incubators has slightly increased in the last years, it is still relatively low – from 28 in Y Combinator, to 32 in TechStars. Contradicting to the research results discussed above, the average age of the

³¹ Adeo Ressi: “Is There A Peak Age for Entrepreneurship?”, <http://techcrunch.com/2011/05/28/peak-age-entrepreneurship/>, access date: 10/04/2015

³² Vivek Wadhwa: “Why Older Entrepreneurs are Crucial, Even in Silicon Valley”, <http://www.pbs.org/newshour/making-sense/why-older-entrepreneurs-are-cr-1/>, access date: 10/04/2015

³³ Philip Moeller: Older Entrepreneurs Active, But Pace is Down, <http://money.usnews.com/money/blogs/the-best-life/2012/08/28/older-entrepreneurs-active-but-pace-is-down>, access date: 14/04/2015

founders of the 10 best performing startups in Y Combinator (among which Dropbox Inc. and Airbnb Inc.), is reported at 24.³⁴ This observation suggests that investors might be biased in favor of younger entrepreneurs. Although higher-aged entrepreneurs might face difficulties in raising external funding, it should be taken into consideration that they might have lower liquidity constraints. In addition it might be possible that the financing decisions of younger entrepreneurs differ from those of older entrepreneurs because of differences in their risk attitude.

Several works study the effect of age on risk attitude. Although it is generally accepted that younger individuals have higher risk tolerance, some researchers have failed to empirically confirm this finding. (Hallahan, Faff, & McKenzie, 2004) found an inverse non-linear relationship between age and risk tolerance, supporting the view that older individuals are more risk averse. (Hvide & Panos, 2014) provide empirical evidence in favor of the theory that more risk tolerant individuals are more likely to start up a new business. In addition, the authors study the effect of the founder's risk tolerance on the performance of the new firm and find out that founders with higher risk aversion tend to achieve better performance. Self-selection of risk tolerant individuals with poor ideas is suggested as possible explanation for the high failure rate among newly started businesses. (Caliendo, Fossen, & Kritikos, 2010) find that there is an inverse U-shaped relationship between the risk attitude of the founder and the survival probability of the firm, meaning that individuals with very high risk-aversion or very high risk-tolerance are more likely to fail than individuals in the middle-level risk range.

Assuming that risk aversion increases with age, this finding would suggest that entrepreneurs in the middle age bracket should have higher probability for success.

³⁴ Jessica E. Lessin: "Age Rises for Some Tech-Firm Founders", <http://www.wsj.com/articles/SB10001424127887324000704578389103697378458>, access date: 10/04/2015

Based on the research of the Founder Institute, performance increases with the age of the entrepreneur up to 40. Based on these findings, I formulate the following hypotheses:

H3a: An increase of the founder's age up to 40 increases the survival chances of a startup.

H3b: An increase of the founder's age after 40 decreases the survival chances of a startup.

3.2. Financial capital

During the initial stages of a new venture, funds are acquired mainly in the form of internal equity provided by the founder, his friends and family. However, these financial resources are often not sufficient for investing in and supporting the growth of startups. Having more financial resources may give more flexibility to the entrepreneur to develop and undertake more ambitious strategies and maintain a certain growth rate (B. A. Gilbert, McDougall, & Audretsch, 2006). The information opacity of high growth ventures limits their financing alternatives. Since access to debt is limited for high-risk startups, these ventures might receive funding from other sources, such as venture capitalists or angel investors. Small firms founded in sectors with high growth and high risk, are more likely to be financed with external equity, while ventures with steady income have higher odds of being debt financed (N. Berger & F. Udell, 1998).

In the following, the role of the financing source for startup growth and success will be discussed. In addition, the effect of the investment amount on new firm survival will be examined.

Financing source

(Davila, Foster, & Gupta, 2003) study the effect of venture capital funding on startup growth. They show that start-ups tend to have higher growth in the months prior to the funding, measured by the increase in the number of employees. The growth rate accelerates even more after the funding event. These results suggest that there is a

positive signaling effect of venture capital funding, providing information about the quality of the venture. In addition, the authors find evidence that VC firms do not rely on the growth of startups prior to funding as a selection criterion. The authors confirm the positive effect of VC funding on growth using the increase of equity value as an alternative measure for growth. The finding of the study further underlines the importance of better access to financing for high growth startups, which might otherwise have to delay growth because of liquidity constraints.

(Fischer & Rassenfosse, 2011) found that VC backed entrepreneurial ventures have greater chances of obtaining venture debt. Venture debt is beneficial for startups because it is equity-efficient, meaning that it reduces dilution of equity shares.

(Hsu, 2006) found evidence that the probability of an IPO is higher for VC backed firms, particularly if the VC firm has a great reputation. Reputation of VC firms is measured differently in studies. Some of the measures used by researchers are: VC's market share of all VC-backed IPOs in the last three years; the number of completed IPOs in the last 3 years in relation to number of companies invested in; age of the VCs; total investment of the VCs (Krishnan & Masulis, 2011). (PURI & ZARUTSKIE, 2012) find that VC backed firms have higher growth rates than non-VC-backed firms. In addition, they find, that the cumulative failure rate of VC-backed firms is lower, mainly driven by a lower failure rate in the first years after funding. VC-backed firms are found to achieve higher growth, higher IPO and acquisition rates and lower failure rates.

H4a: Non-VC-backed startups are more likely to fail.

H4b: Startups funded by VCs with better reputation (measured as the total number of funding rounds in the period 2000-2004) have higher success chances.

(J. J. Lee & Zhang, 2011) study the role of financial capital for startup survival. Their findings suggest that the choice between formal equity financing (angel investors, VC investors corporations, government) and formal debt financing (banks, government, non-bank financial institutions) affects the survival chances of new ventures. While debt

financing is found to improve the survival odds of new businesses, equity financing is shown to have a negative effect. The opposite impacts of debt and equity are assumed to arise due to the difference in the risk preferences of fund providers. Banks are usually interested in projects with lower risks. However (J. J. Lee & Zhang, 2011) show that the positive impact is not only because of the selection of safer projects, but also due to the monitoring expertise of lenders. The negative effect of equity financing is explained by self-selection. Equity investors are more likely to invest in high risk/high return projects, which might explain the high failure rates of equity financed businesses. In addition, founders of risky ventures might also prefer equity financing, based on their liquidity preferences.

These findings suggest that debt financed ventures more likely pursue less risky ideas. It may be the case, that these businesses are less innovative or pursue imitation strategies. A variety of studies have found a positive relationship between innovativeness and success (Rosenbusch, Brinckmann, & Bausch, 2011).

H4c: Debt financed ventures are more likely to be ongoing businesses without a successful exit (defined as either acquisition or an IPO).

In addition to the source of financing, the financing amount might affect the outcome of a new venture. Because of the high level of novelty of startup ideas, it may be difficult to exactly estimate the capital requirements of the project. This could result in either underinvestment or overinvestment, which might have important implications for the outcome of the project.

Underinvestment

After analyzing 101 startup post-mortems, CB Insights identified and summarized the top 20 reasons for startup failure.³⁵ 29% of the failed startups had run out of cash, which is reported as the second most common reason for startup failure.

Research suggests that young small ventures are financially constrained and their growth depends on the availability of financial resources (Aghion, Fally, & Scarpetta, 2007). Internal finance is often not sufficient to finance the growth of innovative new ventures (B. A. Gilbert et al., 2006). In addition, debt financing is difficult to obtain by new risky firms. External equity funding, and in particular, access to venture capital financing, might relax the financial constraints of high-growth ventures (Hall, 2002).

(C. Lee, Lee, & Pennings, 2001) find evidence that new high tech firms, that have sufficient financial resources at disposal during the development period, achieve better performance than liquidity constrained startups. The advantage of startups with better initial financial resources arises from their ability to invest in product development, advertisement and recruitment of high-quality human capital. As a result, they can acquire valuable assets and target a resource-rich market niche, thus achieving competitive advantage.

(Cooper et al., 1994) study financial capital as a factor predicting the outcome of a new venture. The authors provide empirical evidence that the amount of financial capital positively affects marginal growth and survival of startups. They argue that a higher level of capitalization allows entrepreneurs to undertake more ambitious strategies and finance growth. In addition, a high level of capitalization might suggest that the new venture has greater potential that has been identified by investors and lenders.

³⁵ CB Insights: "The Top 20 Reasons Startups Fail", <https://www.cbinsights.com/blog/startup-failure-reasons-top/>, access date: 17/04/2015

(GOMPERS, 1995) empirically studies the methods used by VCs to monitor their investments. Staged financing, which is typical for the VC industry, helps mitigate asymmetric information problems. Venture capitalists monitor the performance of their portfolio startups and, depending on the information that they gather, a decision is made regarding whether the startup should receive additional funding. If VCs receive a negative signal, they will reject additional financing and, that is why, poorly performing startups are likely to be liquidated. (GOMPERS, 1995) find evidence that successful firms (that go public) receive higher total funding in a greater number of rounds.

Based on these findings, I hypothesize the following:

H5a: The probability of new venture success increases with the initial funding amount.

H5b: The probability of new venture success increases with the total funding amount.

H5c: The probability of new venture success increases with the number of funding rounds.

Overinvestment

While many entrepreneurs face difficulties finding investors, others have the problem of receiving more funding than necessary. Having too much financial capital at disposal might lead to irrational behavior. Boris Wertz – a successful entrepreneur and investor, admits of having been confronted with the problem of excess funding and shares the potential drawbacks that might arise. Since best ideas are generated in times of necessity, the startup team might lose its creativity as soon as it has abundant resources at disposal. In addition, entrepreneurs might lose focus and get involved in too many projects, some of which might be secondary. Another consequence of overinvestment is the adoption of the “we’ve done it”-culture, which might result in loss of enthusiasm and

hard-working, entrepreneurial spirit. What is more, it might result in unnecessary excess spending.³⁶

(Marmer M., Herrmann B.L., Dogrultan E., Berman R., Eesley C., 2011) use a sample of more than 3200 high growth technology startups, studying the effect of premature scaling on success. 70% of the startups are defined as inconsistent startups, meaning that they have scaled prematurely and have not followed the typical growth function of a successful startup. Premature scaling is defined as raising too much funding and making yet unnecessary investments in employees, products, customers. Inconsistent startups are characterized by higher growth rates in the first stages of their lifecycles, but flat growth during the high-growth stage. The results, reported in the “Startup Genome Report Extra: Premature Scaling”, suggest that 74% of high growth Internet startups fail because of premature scaling. It is shown that inconsistent startups raise on average three times more in the third stage than consistent startups. According to the report, startups that raise more funding than average in the first three stages (prior the high-growth stage), are more likely to be inconsistent.³⁷ Figure 4, adapted from the Startup Genome Report, illustrates the difference between consistent and inconsistent startups as measured by the amount of funding raised throughout the stages of growth.

³⁶ Boris Wertz: “What’s the problem with too much funding?”, <http://versionone.vc/whats-problem-much-funding/>, access date: 17/04/2015

³⁷ The stages in the lifecycle of a startup are named differently in the Startup Genome Report than in this master thesis. The names of the stages Discovery/Validation/Efficiency/Scale correspond to the stages, defined in this master thesis Development/Startup/Survival/Rapid growth.

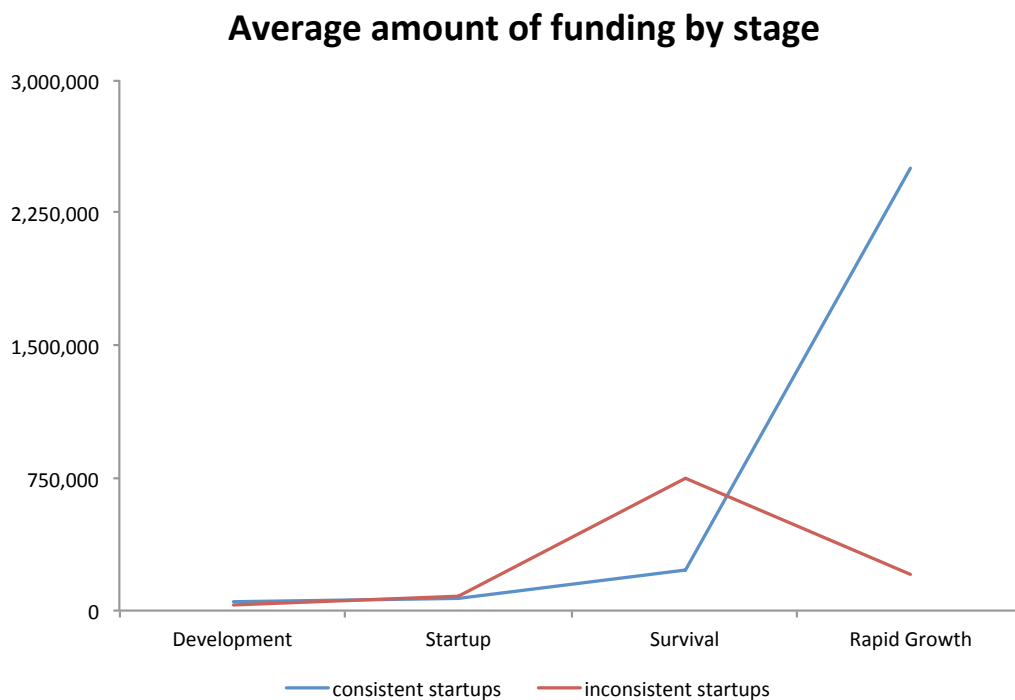


Figure 4: Premature scaling - average amount of funding by stage (based on Startup Genome Report)

According to the Startup Genome report a first-round investment, that is too high, may result in premature scaling and failure.

H6: An increase of first-round funding above the average for the sector increases the probability of failure.

3.3. Strategic factors

Other factors that might influence the performance of a startup are the composition of the founding team and the choice of location.

Team

In the development stage of a new venture, the entrepreneur has to make a decision whether he/she would prefer to be a solo-founder or would like to work in a team with

cofounders. According to practitioners and academics, the “solo vs team” decision has important implications for the outcome of a business.

In his blog article - “18 Mistakes That Kill Startups”, Paul Graham argues that startups, founded by a single founder are more likely to fail. According to the cofounder of Y Combinator, one-man startups send a negative signal because one would assume that the founder had not been able to persuade their friends to join them in the entrepreneurial process and to commit to their idea. What is more, founding and running a new venture represents a high effort commitment that might be too much for a single founder. Founding teams are able cope with the hard work, make better decisions through collaborating and motivate each other in turbulent times.³⁸

The decision to remain a single founder might be optimal if the founder possess all the necessary resources and the business is not intended to grow fast and support multiple cofounders. However, the reasoning behind the choice of being a single founder might not always be rational. The choice of solo-entrepreneurship might be motivated by the willingness to remain in control of the business, even if giving up full control might improve the chances of achieving higher growth and better valuation. In addition, overconfidence and underestimation of the efforts required to start up a new business might mislead the founder in his preference not to work in a team. (Wasserman, 2012)

There are many arguments in favor of establishing a team of cofounders. Adding more founders to the founding team can be beneficial if there is a lack of resources in terms of human, social and financial capital. As previously discussed, human capital is found to have a positive effect on new firm growth and survival. A bigger team size would suggest that there are more individuals with unique capabilities. Complementary skills of the

³⁸ Paul Graham: “18 Mistakes That Kill Startups”, <http://paulgraham.com/startupmistakes.html>, access date 10/05/2015

cofounders can help filling in gaps in knowledge and experience. For example, a founder with technical expertise and experience might lack financial or industry-related knowledge. That is why, adding someone with these capabilities might add to the total human capital of the team. In addition, the new venture might benefit from the social capital input of additional cofounders, who might have important connections. Relationships with potential investors or partners might be very beneficial for the startup and could improve the access to additional resources. Cofounders might also financially contribute to the startup by investing their personal resources. This can be helpful for mitigating potential financial resource scarcity problems. (Wasserman, 2012)

Academic research has found evidence, supporting the idea that startups with more than one founder tend to perform better. (Eisenhardt & Schoonhoven, 1990) found a positive relationship between the size of the founding team and sales growth of new semiconductor ventures. (Miloud, Aspelund, & Cabrol, 2012) analyze the factors that venture capitalists consider when evaluating a startup in the early stages of the life cycle. The findings of their empirical study suggest that new ventures founded by a team are significantly higher valued by venture capitalists than one-man startups.

(Eisenhardt & Schoonhoven, 1990) and (Colombo & Grilli, 2005) found that the diversity of capabilities within the founding team has a positive effect on new firm growth. (Beckman, Burton, & O'Reilly, 2007) find that functional diversity increases the chances of success, measured as obtaining VC financing and going public. (Miloud et al., 2012) also find empirical evidence that new ventures with more complete management teams receive higher valuation from venture capitalists.

H7a: New ventures founded by a single founder are more likely to fail.

H7b: New ventures founded by multiple founders with different backgrounds are more likely to succeed.

Although researchers and practitioners recognize the important role of founding teams for the success of new ventures, it should be kept in mind that too big teams might face

bigger coordination problems and that conflicts between the team members might arise. The increasing complexity and costs arising due to the addition of cofounders should be traded off against the contribution that these new team members can make in terms of human, social or financial capital. An underestimation of the costs and overestimation of the benefits of adding more co-founders to the team can result in irrationally large teams. (e.g. (Wasserman, 2012)).

Location

The concentration of tech ventures and equity investors within certain geographical regions such as Silicon Valley and Boston in the U.S., London and Berlin in Europe suggests that entrepreneurs might recognize some benefits of agglomeration. Geographical entrepreneurial clusters are found to be beneficial particularly to young technology firms that have limited internal resources and restricted access to external resources such as financial capital and social networks (Almeida & Kogut, 1997). Because of the increased investment activity in entrepreneurial clusters, these firms might find it easier to obtain funding. In addition, due to the presence of other entrepreneurial entities in close proximity, building strategic alliances and being part of social networks might become less of a challenge for newly founded startups. Access to human capital and suppliers might be other benefits of founding a new venture in an entrepreneurial cluster. Furthermore, firms in the tech sectors might benefit from improved access to information and knowledge, referred to as knowledge spillover or knowledge-exchange, which might enhance the technology development process (Almeida & Kogut, 1997), (Folta et al., 2006).

However, with the increasing size of clusters, the benefits might decrease due to higher agglomeration costs. These costs might be either congestion costs, such as higher costs of labor, higher prices of real estate because of housing shortage, or costs arising because of higher competition (Prevezer, 1997).

Several studies have tested the effect of location on new firm performance and there is no consensus on whether the benefits of agglomeration exceed the costs of agglomeration.

(Brett Anitra Gilbert, McDougall, & Audretsch, 2008) found a positive effect of industrial clusters on growth and innovation performance. They did not identify technological spillover as a factor directly influencing performance, however their results suggest that firms within industrial clusters have improved access to knowledge. The authors argue that tech ventures in clusters are more likely to pursue innovative ideas in order to achieve advantage in a more competitive environment, which leads to improvement in performance.

(Folta et al., 2006) study the effect of cluster size on the performance of biotechnology firms. They use different performance measures – attracting strategic partners, attracting equity partners, patenting, initiation of IPOs and business discontinuance (sale or bankruptcy). They find that economies of agglomeration provide the benefit of entering strategic alliances, raising external equity and engaging in innovative activities as measured by patenting. However, the positive effect of agglomeration is found to decrease with cluster size, suggesting that as clusters evolve the costs of agglomeration increase and offset the benefits. No effect of cluster size on the initiation of an IPO is identified. (Folta et al., 2006) find that cluster size has a positive but declining effect on sell-offs and that firms within bigger clusters are more likely to fail. The authors argue that the higher failure rate might be due to a difference in performance thresholds of entrepreneurs in smaller and larger clusters. Given that in large clusters there are lower barriers to entry, an entrepreneur in these clusters might have higher performance requirements and be more willing to discontinue the business if these requirements are not met. On the other side, entrepreneurs in smaller geographical locations might prefer to stick to their businesses for a longer time and be pleased with lower performance. (Shaver & Flyer, 2000) studied foreign direct investments in the U.S. in multiple industries and identified a similar relationship between location and failure. Their

results imply that businesses founded in states with a higher number of ventures within the same industry, are more likely to fail. They argue that businesses with improved resource bases should prefer locations outside geographical clusters so that they maintain their competitive advantage and do not bear the consequences of knowledge spillover. Thus, the higher failure rate within clusters might be explained through a self-selection of weaker ventures.

Startup Genome has ranked the world's top 25 startup ecosystems. Among them are Silicon Valley, New York City, London, Toronto and others.³⁹

Based on the findings that geographical clusters provide better access to various resources for entrepreneurs and that entrepreneurs in clusters are more likely to pursue more innovative ideas, I formulate the following hypothesis:

H8: Startups founded in world's top 25 tech clusters have higher success probability than startups in other regions.

In this chapter major startup performance determinants have been analyzed. A discussion of the effects of these factors has been provided and hypotheses have been formulated.

In the following, a regression analysis will be conducted and the formulated hypotheses will be tested.

³⁹ Rip Empson: "Silicon Valley, London, NYC: Startup Genome Data Reveals How The World's Top Tech Hubs Stack Up", <http://techcrunch.com/2012/04/10/startup-genome-compares-top-startup-hubs/>, access date 19/05/2015

4. Comparison between failed and successful startups

In this chapter, an overview of the hypotheses is provided, as well as a description of the dataset. In addition, a regression analysis is conducted for the purpose of identifying factors that might have a significant effect on the outcomes of the startups in the sample.

4.1. Hypotheses

The table below provides an overview of the hypotheses formulated in the previous chapter:

Gender	H1: Startups, founded by female entrepreneurs, are more likely to fail.
Education/Experience	H2a: Previous business management and technical university education of the founders decreases the failure probability of a startup. H2b: Higher academic titles of the founders have a positive effect on the success probability of a startup. H2c: Lack of previous entrepreneurial experience in the tech industry decreases the success probability of a startup. H2d: Previous unsuccessful entrepreneurial experience increases the failure probability of a startup.
Age	H3a: An increase of the founder's age up to 40 increases the survival chances of a startup. H3b: An increase of the founder's age after 40 decreases the survival chances of a startup.
Type of Financing	H4a: Non-VC-backed startups are more likely to fail. H4b: Startups funded by VCs with better reputation (measured as the total number of funding rounds in the period 2000-2004) have higher success chances. H4c: Debt financed ventures are more likely to be ongoing businesses without a successful exit (defined as either acquisition or an IPO).
Financial Capital	H5a: The probability of new venture success increases with the initial funding amount. H5b: The probability of new venture success increases with the total funding amount. H5c: The probability of new venture success increases with the number of funding rounds. H6: An increase of first-round funding above the average for the sector increases the probability of failure.
Team	H7a: New ventures founded by a single founder are more likely to fail. H7b: New ventures founded by multiple founders with different backgrounds are more likely to succeed.
Location	H8: Startups founded in world's top 25 tech clusters have higher success probability than startups in other regions.

Table 2: Hypotheses

4.2. Dataset

For the regression analysis I have used the Crunchbase dataset per 20th April 2015. Crunchbase is a platform, which provides information on innovative companies, their

founders and investors. It has been founded in 2007 as a crowd sourced database for the purpose of tracking startups that have been covered on TechCrunch.⁴⁰

I have selected all 293 tech startups founded in 2004 in the following tech sectors: Hardware, Software, Information Services, Information Technology, Internet, Internet Service Providers, Mobile, Mobile Analytics, Mobile Commerce, Mobile Emergency & Health, Mobile payment, Mobile Social, Networking, PaaS, SaaS, Web Development and Web Tools. I have chosen 2004 as a founding year in order to make sure that the companies in the sample (or at least the majority of them) have had enough time to go through the phases of development and growth. In addition, the selection of companies founded in the same year would allow to assume that these companies have existed under similar economic and market conditions. However, it might still be possible that the performance of the startups in the sample is affected by other external factors. One of the reasons for that could be the geographic dispersion in the sample.

The dataset provided by Crunchbase has information on current status, funding rounds, funding amounts, investors and location. It is important to keep in mind that the data in the sample might be incomplete or inaccurate. Since the sample companies are founded 3 years earlier than Crunchbase, data has been filled in retrospectively. As a result, important information might be missing. What is more, it might be possible that only data on companies has been added, which have been still operating in 2007 (when Crunchbase was created). This might suggest the presence of survivorship bias in the sample.

Because the available data in the dataset was not sufficient for testing all hypotheses, I had to conduct additional research and fill in information on the number of founders, their gender, age, previous work experience, education and previous entrepreneurial

⁴⁰ CrunchBase: <https://info.crunchbase.com/about/>, access date 08/08/2015

experience. I have used secondary sources such as the websites of the companies, the LinkedIn profiles of the founders, Bloomberg, diverse articles and blog posts. It should be kept in mind, that there is a possibility that information published online might be incomplete. During my research I have found several inaccuracies in the original sample. I have found information about the status of several companies being either “acquired” or “closed” despite having a status “operating” on Crunchbase. For these companies, I have changed the status in the dataset. In addition, it has turned out that several companies in the sample have not been founded in 2004, but either earlier or later. I have removed these companies from the sample. Unfortunately, I was not able to find necessary information about some companies, which is why I had to remove them from the sample as well.

71 companies have been removed from the sample because of missing information or varying founding date. As a result, the final sample consists of 222 companies.

4.3. Variables

For the statistical analysis I have used STATA. First, I have inserted and formatted the sample data in Excel so that it can easily be imported in STATA. After I have imported the Excel file, I had to define the variables as binary, categorical/ordinal or continuous/discrete. Because the purpose of this analysis is to study the effect of various factors on startup outcome, I defined *Outcome* or *Status* as dependent variables. The variable *Outcome* is coded as a (categorical) binary variable, taking the value 1 for success and 0 for failure. *Status* is coded as a categorical variable with the following 4 categories: IPO, acquisition, operating, closed. Because of the nature of the dependent variables, I have conducted logistic regressions and multinomial logistic regressions.

I had to transform the categorical explanatory variables into multiple dummy variables. This transformation is common when using logistic regression, because it allows the usage of categorical variables without losing important information carried by the variable.

In the theoretical part of this master thesis, growth has been identified as an important performance indicator and success requirement. Because there is no information on the growth rates of the startups on Crunchbase, I have adjusted the variables *Status* and *Outcome*. I made the assumption that companies that are still operating, but do not have a successful exit and have not obtained additional funding in the last 4 years have not managed to fund and achieve a sufficiently high growth rate. As a result I have marked all ongoing business that have not received funding in the last 4 years as “closed”.

For defining the variable *Cluster* I have used the Startup Genome list of the top 25 tech hubs in the world.⁴¹ For the binary variable *VC_rep*, indicating whether the investing VC firm has a high reputation, I have generated a list of the top fifty VC companies on Crunchbase with the highest number of funding rounds in the period 2000-2004.

For the founders, whose age was not available, I have estimated an approximate age based on the first year of university (if available). For this purpose I have assumed that founders have graduated from high school at the age of 18 and have immediately started their university education.

Hypothesis **H7b** states that startups founded by multiple founders with different backgrounds have higher success chances. In order to test this hypothesis, I had to define a new variable indicating the diversity of each founding team. First, I defined the variable *abs_div_exp* (absolute diversity of experience). For each of the following experience types, which is present in the founding team, 1 point is added to the variable:

- Tech experience (e.g. Software developer)
- Business-related experience (e.g. Finance, Marketing, Sales)

⁴¹ Rip Empson: “Silicon Valley, London, NYC: Startup Genome Data Reveals How The World’s Top Tech Hubs Stack Up”, <http://techcrunch.com/2012/04/10/startup-genome-compares-top-startup-hubs/>, access date 09/08/2015

- Managerial experience in business-related positions (e.g. Head of Sales, CFO)
- Managerial experience in tech related positions (e.g. VP of Engineering, CTO)
- Other

As a result, the variable can take the values from 0 to 5.

Similarly, I have created a variable measuring the diversity of education, because in some of the cases the field of education might differ from the actual work experience.

For the calculation of the variable *abs_div_edu* (absolute diversity of education) one point is added for the presence of each of the following:

- Technical education
- Business related education
- Other

Thus, the variable can take the values from 0 to 3.

In a next step, I have adjusted these two variables for team size, because a team of 2 founders having an absolute experience diversity of 2 is not completely comparable with a team of 4 founders having the same diversity. Such result would suggest that in the larger team, more of the members have similar experience, which should speak for a lower diversity. In order to account for this, I have generated the two variables *rel_div_exp* (relative diversion of experience) and *rel_div_edu* (relative diversion of education). Relative diversity is calculated as the absolute diversity divided by the number of founders.

Table 3 provides a short description of the dependent and explanatory variables.

Description of Variables

Variable		Description
<i>outcome</i>	binary	1 if outcome is success; 0 if outcome is failure
<i>status</i>	ordinal	IPO acquired operating closed
<i>female</i>	binary	1 if there is at least one female founder in the founding team; 0 otherwise
<i>edu_tech</i>	binary	1 if at least one founder has technical university education (such as Engineering and Computer Science); 0 otherwise
<i>edu_ba</i>	binary	1 if at least one of the founders has business related university education (business, finance, sales, marketing); 0 otherwise
<i>edu_other</i>	binary	1 if at least one founder has university degree in a field different than technology and business administration; 0 otherwise
<i>entr_exp</i>	binary	1 if at least one founder in the founding team has founded another venture before 2004; 0 otherwise
<i>prev_outcome</i>	categorical - transformed into binary variables	<i>success</i> if the previously founded venture has gone public, has been acquired or is still operating <i>failure</i> if the previous venture has been closed or if there is no indication that it is still operating <i>success/failure</i> if members of the founding team have founded ventures with different outcomes <i>nooutcome</i> if the founders do not have previous entrepreneurial experience
<i>uni_title</i>	ordinal	notitle - if no founding member has university degree BSc - if BSc is the highest university degree in the founding team MSc - if MSc/Dipl.Ing. is the highest university degree in the founding team PhD - if PhD/MD is the highest university degree in the founding team Prof - if Prof. is the highest university degree in the founding team
<i>age</i>	continuous	average age of the founding team
<i>age_cat</i>	binary	1 if age is <40; 0 if age is >40
<i>exp_tech</i>	binary	1 if at least one founder has had tech working experience (e.g. Engineering, Software Development); 0 otherwise
<i>exp_ba</i>	binary	1 if at least one founder has had business administration working experience (e.g. Finance, Marketing, Sales); 0 otherwise
<i>exp_other</i>	binary	1 if at least one founder has had other working experience than business and tech; 0 otherwise
<i>mng_tech</i>	binary	1 if at least one founder has managerial experience in tech positions (e.g. CTO; VP of Engineering); 0 otherwise
<i>mng_ba</i>	binary	1 if at least one founder has managerial experience in business positions (e.g. Manager of Finance; Founder); 0 otherwise
<i>funding_rounds</i>	discrete	total number of funding rounds
<i>funding_total</i>	continuous	total funding amount
<i>raised_first</i>	continuous	the amount raised in the first funding round;
<i>raised_first_above</i>	binary	1 if the amount raised in the first founding round is above average; 0 otherwise
<i>funding_type</i>	categorical - transformed into binary variables	angel debt funding crowdfunding venture private equity seed post-ipo equity undisclosed
<i>VC_rep</i>	binary	1 if the VC company is one of the top 50 VC companies on Crunchbase with the highest number of investment rounds in the period 2000-2004; 0 otherwise
<i>team_size</i>	discrete	number of members in the founding team
<i>abs_div_edu</i>	discrete	absolute diversion of education: takes values between 0 and 3 (1 point for each of the following: tech education, business education, other)
<i>rel_div_edu</i>	continuous	relative diversion of education: takes values between 0 and 3 (absolute diversion of education divided by the number of founders)
<i>abs_div_exp</i>	discrete	absolute diversion of experience: takes values between 0 and 5 (1 point for each of the following: business experience; tech experience; other experience; managerial experience (tech positions); managerial business experience (business administration positions))
<i>rel_div_exp</i>	continuous	relative diversion of experience: takes values between 0 and 5 (absolute diversion of experience divided by the number of founders)
<i>cluster</i>	binary	1 if the company has been founded in one of the top 25 tech clusters, 0 otherwise

Table 3: Description of Variables

4.4. Statistical Analysis

Of all 222 startup companies in the sample, only 5 companies (2%) have managed to facilitate an IPO. 61 companies have been acquired, 126 companies are still operating and 30 companies have closed.

In this master thesis, growth has been recognized as an important indicator of startup performance. Because of the lack of data on the growth rates of the startup companies, I have assumed that a lack of funding in the last four years should indicate an inability to finance and manage growth and should indicate an insufficient growth rate. As a result, I have treated these companies as “walking dead”. I have removed them from the “operating” category and added them to the “closed” category. After this adjustment has been made, 60 companies (27%) of the sample have a status “operating” and, 96 companies (43%) are considered as “closed”.

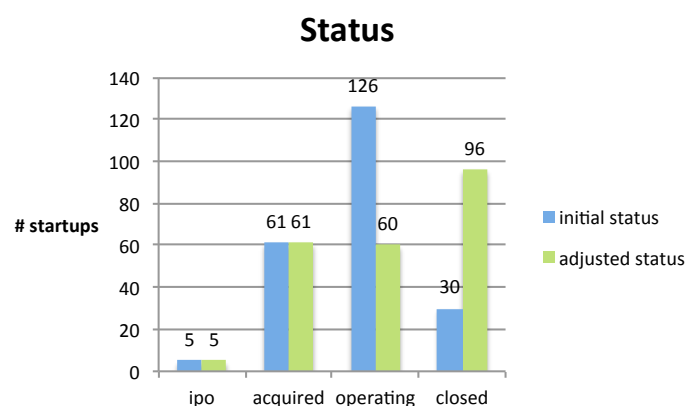


Figure 5: Company status - initial and adjusted

Following the definition of success and failure provided earlier in this master thesis, startups are categorized as *successful or failed*. Companies that have made an IPO, have been acquired or are still private and operating and have managed to achieve a sufficient growth rate are defined as successful. Thus, all companies that have facilitated an IPO, have been acquired or are operating (after adjustment) are considered successful, and

all companies that have been closed (after adjustment) are considered failed. Based on this definition, the failure rate in the sample is estimated at 43%.

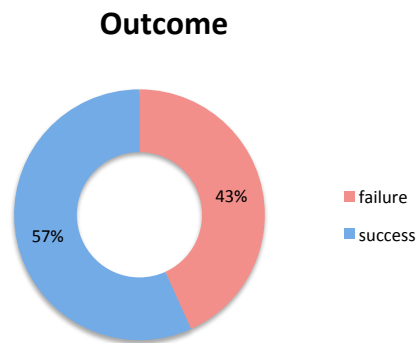


Figure 6: Startup outcome – An overview

4.4.1. Univariate analysis

In the following, the effect of each variable on startup performance will be tested. This analysis will help identify factors, which have a significant impact on startup outcome. In a next step, these variables will be analyzed jointly.

Human Capital

Gender

In the sample, the total number of founders is 456. Of them only 17 founders are women. Of all 222 companies, 17 (8%) have been co-founded by female entrepreneurs. This implies that there is no company in the dataset with more than one female cofounders. The low share of female entrepreneurs in the sample underlines the severity of the gender gap problem. Although the female subsample is not very representative, I looked at the outcomes of the companies founded only by male entrepreneurs and those founded by at least one female entrepreneur. The failure rate of the startups with at least one female founder is 41%, compared to 43% for startups with solely male

founders. These rates are very similar, indicating that female founders in this sample achieve similar performance as male founders.

Companies with female founders

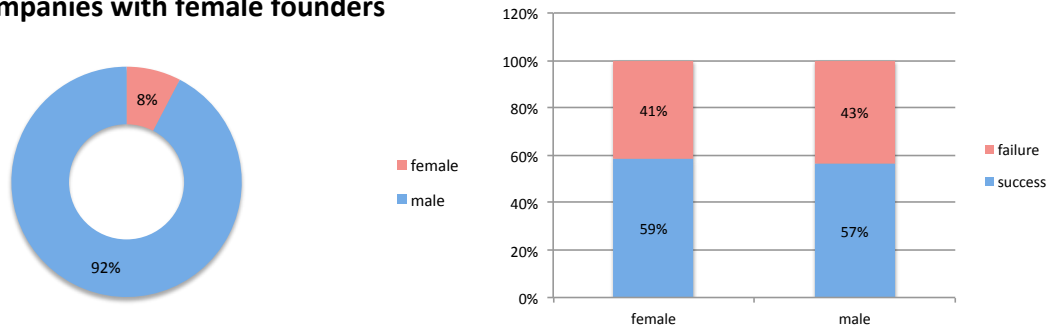


Figure 7: Companies with female founders

I ran a logistic regression with *outcome* being the dependent variable. The explanatory variables *female* is a binary variables, which takes the value 1 if there is at least one female founder in the founding team. Although a positive odds ratio is reported, the results are statistically insignificant. As a result, the first hypothesis, stating that female entrepreneurs perform worse than male entrepreneurs, could not be confirmed. The lack of significance is not surprising due to the very small subsample of female founders.

Logistic regression	Number of obs	=	222
	LR chi2(1)	=	0.03
	Prob > chi2	=	0.8577
Log likelihood = -151.82935	Pseudo R2	=	0.0001

outcome	Odds Ratio	Std. Err.	z	P> z	[95% Conf. Interval]	
female	1.096059	.5617918	0.18	0.858	.4013705	2.993109
_cons	1.303371	.1836627	1.88	0.060	.9888311	1.717963

Table 4: STATA output: Performance of female entrepreneurs

Experience and education

In 11 of the 222 sample companies, no one of the founders had university education at the time of founding. In 41 of the startups, Bachelor of Science (BSc) was the highest achieved degree in the founding team. In 107 companies, Master of Science (MSc) or equivalent degrees (such as MBA and Dipl.Ing.) represent the highest academic title achieved by at least one of the founders in the founding team. PhD is the highest degree in 48 of the founding teams, and Professor – in 14. In 165 ventures, at least one of the founders has technical university degree. In 96 ventures at least one member of the founding team has business related education. In 66 of the founding teams, there are members with technical and business education.

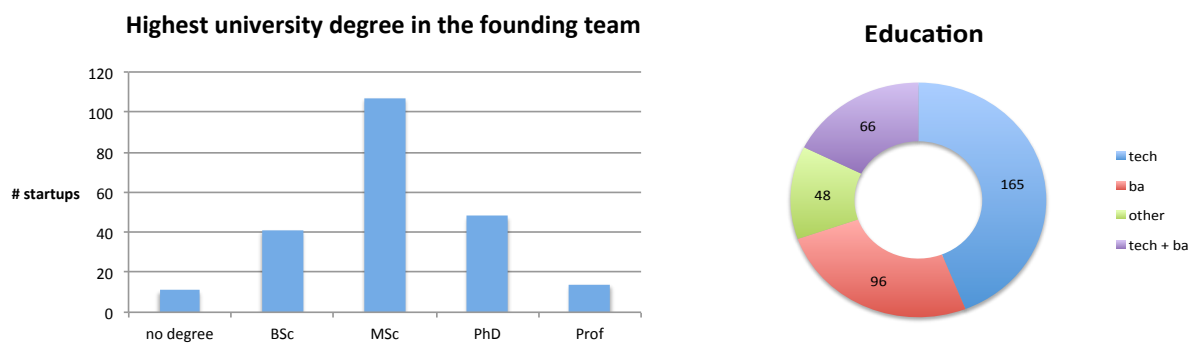


Figure 8: Education and university degrees of the founders

In 89 of the founding teams no one of the members has founded another venture before 2004. In 103 of the ventures, one or more of the founders have had successful previous entrepreneurial experience. In 22 of the companies, founding team members have founded an unsuccessful venture before 2004. In 8 of the startups, the founders have had mixed entrepreneurial experience – one has founded a successful venture, but another has been a founder of a failed business.

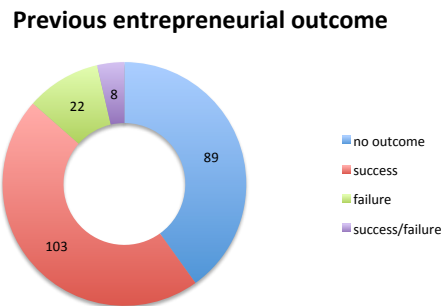


Figure 9: Previous entrepreneurial experience – outcome

I ran a logistic regression with *Outcome* being the dependent variable, and the following independent variables: university degree, technical education, business-related education, previous entrepreneurial experience and previous failure. The results are reported in the table below.

```
Iteration 0:    log likelihood = -151.84543
Iteration 1:    log likelihood = -147.24067
Iteration 2:    log likelihood = -147.23411
Iteration 3:    log likelihood = -147.23411
```

Logistic regression	Number of obs	=	222
	LR chi2(5)	=	9.22
	Prob > chi2	=	0.1005
Log likelihood = -147.23411	Pseudo R2	=	0.0304

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
uni_title	-.4295391	.1643953	-2.61	0.009	-.751748	-.1073301
edu_tech	.6519908	.3477003	1.88	0.061	-.0294892	1.333471
edu_ba	.2339789	.2841156	0.82	0.410	-.3228775	.7908353
exp_entr	-.1287539	.2941494	-0.44	0.662	-.7052762	.4477684
prev_failure	.3446705	.4916669	0.70	0.483	-.618979	1.30832
_cons	1.050085	.5376265	1.95	0.051	-.0036438	2.103813

Table 5: STATA output: Effect of education, university degree and previous entrepreneurial experience

Prior to conducting the analysis in Table 5, I ran univariate regressions for each of the independent variables. The results of the univariate analysis have shown that only the variable *uni_title*, indicating the highest university degree present in the founding team, is significantly related to outcome. The effects of the other variables were reported to be insignificant. However, when both *uni_title* and *edu_tech* are included in the same model, the effect of technical education becomes significant as well. *Uni_title* is found to have a significant effect on startup outcome at $\alpha = 0.05$. Surprisingly to me, this effect is negative. At the 10% significance level, previous technical education of the founders positively affects the probability of success. The other results are statistically insignificant. The average marginal effects of the university degree and technical education of founders are reported in Table 6. The results indicate that increasing the highest university degree in the founding team to the next possible decreases the chances of success by 10%. This effect is statistically significant at the 5% level. This result is exactly the opposite of the hypothesized effect. Previous technical education has a positive effect on success. The average marginal effects indicate that having technical education increases the success probability by 15%. This effect is not statistically significant at $\alpha = 5\%$ ($p = 0.053$), however it is significant at the 10% significance level.

```

Average marginal effects          Number of obs   =          222
Model VCE      : OIM

Expression      : Pr(outcome), predict()
dy/dx w.r.t.    : uni_title edu_tech

```

	Delta-method					
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]	
uni_title	-.1010995	.0363465	-2.78	0.005	-.1723373	-.0298617
edu_tech	.1534573	.0793318	1.93	0.053	-.0020301	.3089448

Table 6: STATA output: Average marginal effects of academic degree and technical education

Business-related education is reported to have an insignificant effect on outcome. Technical education has a significant positive impact at the 10% significance level. That is why, based on these results, hypothesis **H2a** can only partially be confirmed. **H2b** has to be rejected, because of the opposite effect observed in the results. **H2c** and **H2d** could not be confirmed.

Age

The mean age of all founding teams at the time of founding (2004) is 38.56 years. In 134 of the companies, the founding teams have an average age lower than or equal to 40. The majority of the founding teams have an age between 31 and 40. 21 companies have been founded by teams aged 50 and older.

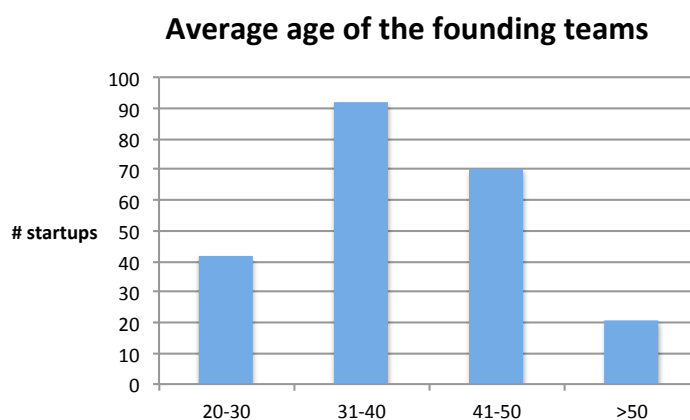


Figure 10: Average age of founding teams

I have generated four new factor variables for each of the 4 categories: average age from 20 to 30, from 31 to 40, from 41 to 50 and from 51 to 70. I ran a logistic regression with *Outcome* as the dependent variable, and all four categories as the explanatory variables. However, due to collinearity the fourth binary variable was omitted. That is why, I ran four regressions - one for each of the explanatory variables.

Number of obs	=	222
LR chi2(1)	=	3.09
Prob > chi2	=	0.0790
Pseudo R2	=	0.0102

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age_20_30	.6466272	.3773276	1.71	0.087	-.0929214	1.386176
_cons	.1643031	.1483434	1.11	0.268	-.1264447	.4550508

Number of obs	=	222
LR chi2(1)	=	0.42
Prob > chi2	=	0.5193
Pseudo R2	=	0.0014

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age_31_40	-.1765707	.2739798	-0.64	0.519	-.7135612	.3604198
_cons	.3471962	.1794471	1.93	0.053	-.0045136	.698906

```
Number of obs   =      222
LR chi2(1)      =      0.17
Prob > chi2     =      0.6792
Pseudo R2       =      0.0006
```

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age_41_50	.1218353	.2950391	0.41	0.680	-.4564307	.7001014
_cons	.2348396	.1622769	1.45	0.148	-.0832173	.5528965

```
Number of obs   =      222
LR chi2(1)      =      3.26
Prob > chi2     =     0.0709
Pseudo R2       =     0.0107
```

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age_51_max	-.837352	.4716417	-1.78	0.076	-1.761753	.0870487
_cons	.351844	.1432577	2.46	0.014	.0710641	.632624

Table 7: STATA output: Effect of age on startup outcome

The results are not significant at the 0.05 significance level. However, at the 10% significance level, an age lower than 30 seems to have a positive effect on the success probability, whereby an age higher than 50 decreases the success chances of a company. These results might indicate that very young entrepreneurs perform better than very old entrepreneurs. However, no conclusion can be made for the middle two age categories, in which most of the entrepreneurs belong.

This information is not sufficient to confirm the hypothesis that the survival probability of a company increases with the founder's age up to 40, and decreases afterwards.

That is why, I generated another binary variable taking the value 1 if the average age of the founding team is lower than 40 and 0 otherwise. However, the effect of this variable is reported to be statistically insignificant as well.

Logistic regression	Number of obs	=	222
	LR chi2(1)	=	0.03
	Prob > chi2	=	0.8653
Log likelihood = -151.83105	Pseudo R2	=	0.0001

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age_less40	.0462549	.2727454	0.17	0.865	-.4883163	.5808261
_cons	.2461331	.2035624	1.21	0.227	-.1528418	.645108

Table 8: STATA output: Effect of age under 40 on startup outcome

Based on these results, hypotheses **H3a** and **H3b** could not be confirmed.

Financial Capital

Type of Financing

In the Crunchbase dataset, only the type of financing of the last funding round is provided. As a result, it might be possible that startups, for which information on

venture capital financing is published, might have used debt or other kind of financing previously. Of all 222 startups in the sample, 182 have been financed with venture capital and only 9 with debt. For 7 companies no information has been disclosed. The high number of VC financed businesses and the lack of information on companies that have not received outside financing suggest that data on Crunchbase might be biased towards companies that have already received funding.

Of all VC backed companies only 19 have been funded by VC firms with high reputation. As an indicator of reputation, I have used the number of investment rounds of all VC firms in the database for the period 2000-2004. I have defined the top 50 VC firms, having the highest investment rounds count, as having high reputation. 150 startups in the sample have received funding from VC companies, which do not have a high reputation based on this definition. For the remaining 53 companies there is missing information in the dataset.

I ran a logistic regression with dependent variable *Outcome* and two binary independent variables: *venture* (taking 1 if a startup is VC-backed) and *debt* (taking 1 if a startup has received debt financing). The results indicate that VC financing does not have a significant impact on startup performance. As a result, hypothesis **H4a** can be rejected. The effect of debt on startup outcome is positive and significant at the 0.1-level.

Logistic regression	Number of obs	=	222
	LR chi2(2)	=	4.83
	Prob > chi2	=	0.0894
Log likelihood = -149.43078	Pseudo R2	=	0.0159

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
venture	.1784077	.3891922	0.46	0.647	-.5843951	.9412104
debt	2.014903	1.119896	1.80	0.072	-.1800525	4.209859
_cons	.0645385	.3593976	0.18	0.857	-.6398679	.768945

Table 9: STATA output: Effect of VC financing and debt financing on startup outcome

I further ran a multinomial logistic regression and looked at the effect of debt on *Status*, a variable indicating, whether a startup is closed, operating, acquired or had an IPO. The positive effect of debt on the performance of a startup has been confirmed. The results of the multinomial logistic regression suggest that debt increases the relative probability of a startup to be operating rather than closed. This effect is only significant at the 10% significance level. In addition, debt is associated with higher probability of IPO relative to firm closure, which is statistically significant at $\alpha = 0.05$. The second finding is in contradiction with the hypothesis, stating that debt should increase the chances of a startup to be still operating without a successful exit. These results are reported in the table below.

Multinomial logistic regression	Number of obs	=	222
	LR chi2(3)	=	5.89
	Prob > chi2	=	0.1170
Log likelihood = -253.80037	Pseudo R2	=	0.0115

status	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
closed	(base outcome)					
operating						
debt	1.91482	1.130656	1.69	0.090	-.3012259	4.130865
_cons	-.5285252	.1684739	-3.14	0.002	-.858728	-.1983224
acquired						
debt	1.592046	1.166662	1.36	0.172	-.69457	3.878662
_cons	-.4934339	.1666364	-2.96	0.003	-.8200353	-.1668325
ipo						
debt	3.167583	1.503505	2.11	0.035	.2207675	6.114398
_cons	-3.167583	.5104178	-6.21	0.000	-4.167983	-2.167182

Table 10: STATA output: Effect of debt financing on status

In addition, I ran a logistic regression to observe the direct effect of debt on the probability of a startup being still operating. The result is statistically insignificant. As a result, hypothesis **H4c** can be rejected.

```

Logistic regression                                Number of obs   =      222
                                                    LR chi2(1)      =      1.31
                                                    Prob > chi2     =      0.2522
Log likelihood = -128.8876                        Pseudo R2       =      0.0051

```

operating	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
debt	.8077506	.6886411	1.17	0.241	-.5419612	2.157462
_cons	-1.030894	.1556489	-6.62	0.000	-1.33596	-.7258279

Table 11: STATA output: Effect of debt on the probability of having a status "operating"

Although the hypothesis has been rejected, it should be kept in mind, that only 9 of the 222 companies in the sample have used debt financing. As a result this subsample might not be representative.

To test hypothesis **H4b**, I examined the effect of the reputation of VCs on the success probability of tech startups. The effect is positive and significant at alpha = 0.1. The reputation of the VC firm increases success probability by 23 percentage points. Based on this result, hypothesis **H4b** can be confirmed.

```

Average marginal effects                                Number of obs   =      169
Model VCE      : OIM

```

```

Expression      : Pr(outcome), predict()
dy/dx w.r.t.    : VC_rep

```

	Delta-method					
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]	
VC_rep	.2310686	.1284363	1.80	0.072	-.020662	.4827992

Table 12: STATA output: Average marginal effect of VC reputation on startup outcome

Financial capital

The average number of funding rounds in the sample is 2.23, whereby 105 startups have received financing in only one round, 56 – in two rounds, 27 – in three rounds. Only a small number of companies have been funded in more the three rounds. This information is illustrated in the graph below.

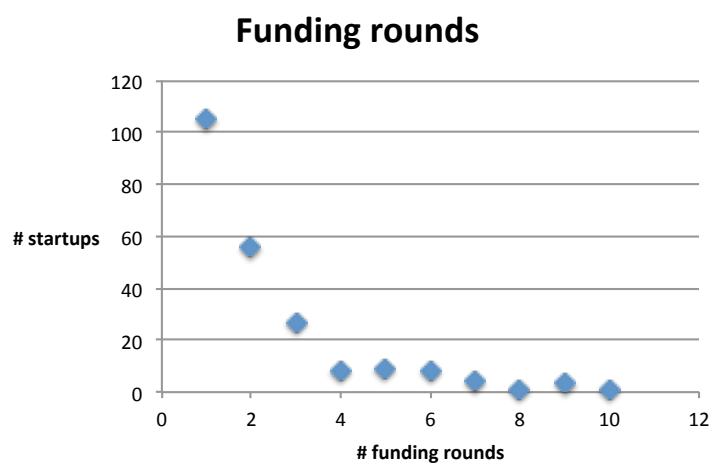


Figure 11: Number of funding rounds

For 11 companies, the total funding amount has not been disclosed, and for 17 companies no information about the amount of the first round has been provided. These instances have been treated as missing values. The minimal total funding amount in the sample is 10.000 USD, and the maximum investment reaches 250 USD million. The average total funding amount is 8.2 USD million. The first round investments vary between 10.000 USD and 250 million USD, with a mean of 18.6 million USD.

I have examined the effect of the first round amount on the outcome of startups. The result is reported in Table 13. The effect is statistically insignificant, which is why, hypothesis **H5a** has to be rejected.

Logistic regression

Number of obs = 205

LR chi2(1) = 0.37

Prob > chi2 = 0.5446

Pseudo R2 = 0.0013

Log likelihood = -140.12841

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
raised_first	4.61e-09	8.14e-09	0.57	0.571	-1.13e-08	2.06e-08
_cons	.2283533	.1541378	1.48	0.138	-.0737513	.5304578

Table 13: STATA output: Effect of first round amount on startup outcome

I ran a logistic regression with the total number of funding rounds as an independent variable. The effect on startup outcome is positive and statistically significant at the 0.05-level. Increasing the number of rounds by one, improves the success probability by 9 percentage points. Based on these results, hypothesis **H5c** can be confirmed.

Logistic regression

Number of obs = 222

LR chi2(1) = 20.04

Prob > chi2 = 0.0000

Pseudo R2 = 0.0660

Log likelihood = -141.82589

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
funding_rounds	.4233227	.1116883	3.79	0.000	.2044177	.6422276
_cons	-.599863	.2519759	-2.38	0.017	-1.093727	-.1059994

Table 14: STATA output: Effect of funding rounds on startup outcome

However, there is a possibility that this result might be influenced by the previously made adjustments to the categories *closed* and *operating* due to the assumption that operating businesses that have not received funding in the last 4 years, are considered failed. I generated the variable *status_init*, containing the initial status of each startup. Furthermore, I created the variable *outcome_init*, which takes the value 1 if a startup has

a status operating, acquired or closed and 0 otherwise. The new outcome variable does not take into account the assumption that operating startups without recent funding are considered failed. I used this variable as the dependent variable in a logistic regression. The reported results indicate an insignificant effect. This result suggests that, if the assumption that ongoing businesses without successful exit and recent funding are “walking dead” is dropped, hypothesis **H5c** has to be rejected.

Logistic regression	Number of obs	=	222
	LR chi2(1)	=	3.36
	Prob > chi2	=	0.0669
Log likelihood = -86.24105	Pseudo R2	=	0.0191

outcome_init	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
funding_rounds	.2540738	.1580313	1.61	0.108	-.0556619	.5638095
_cons	1.352708	.343063	3.94	0.000	.6803167	2.025099

Table 15: STATA output: Effect of funding rounds on the unadjusted outcome (assumption dropped)

In addition, I tested the effect of the total funding amount on the success probability of startups. Because STATA does not display longer numbers, I have generated a new variable containing the total funding amounts in thousand. The effect of the total funding amount on the probability of a successful outcome is relatively small but it is reported to be positive and statistically significant at the 0.05-level. As a result, hypothesis **H5b** can be confirmed.

Logistic regression	Number of obs	=	211
	LR chi2(1)	=	9.20
	Prob > chi2	=	0.0024
Log likelihood = -139.92048	Pseudo R2	=	0.0318

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
funding_tota~T	.0000186	7.12e-06	2.61	0.009	4.62e-06	.0000325
_cons	-.0511093	.1754939	-0.29	0.771	-.395071	.2928525

Table 16: STATA output: Effect of total funding amount on startup outcome

However, there is a possibility that this result might again be influenced by the previously made assumption that operating businesses that have not received funding in the last 4 years are considered failed. That is why, I ran a logistic regression with the newly generated variable *outcome_init*. In this way the effect on the unadjusted outcome can be estimated.

Logistic regression	Number of obs	=	211
	LR chi2(1)	=	3.70
	Prob > chi2	=	0.0544
Log likelihood = -80.753548	Pseudo R2	=	0.0224

outcome_init	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
funding_tota~T	.0000209	.0000133	1.57	0.116	-5.14e-06	.0000469
_cons	1.582921	.2514669	6.29	0.000	1.090055	2.075787

Table 17: STATA output: Effect of total funding amount on the unadjusted outcome (assumption dropped)

The reported effect is statistically insignificant. This means that if the assumption that operating businesses without recent funding are “walking dead” is dropped, hypothesis **H5b** has to be rejected.

In order to be able to test hypothesis **H6**, I generated a binary variable taking the value 1 if the amount of the first round investment lies above the average and 0 otherwise. The effect of this variable on outcome has been reported to be insignificant. As a result, **H6** can be rejected.

Logistic regression		Number of obs	=	222
		LR chi2(1)	=	0.00
		Prob > chi2	=	0.9545
Log likelihood = -151.8438		Pseudo R2	=	0.0000

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
raised_first~e	-.0172418	.3018116	-0.06	0.954	-.6087816	.574298
_cons	.276753	.1596301	1.73	0.083	-.0361162	.5896222

Table 18: STATA output: Effect of first round overinvestment on outcome

Strategic factors

Team

The average team size in the sample is 2.05. The number of startups founded by solo-entrepreneurs is 69. In the sample, 98 companies have 2 founders, 40 companies are founded by teams with 3 members and 15 startups have 4 or more founders. This information is illustrated in the graph below.

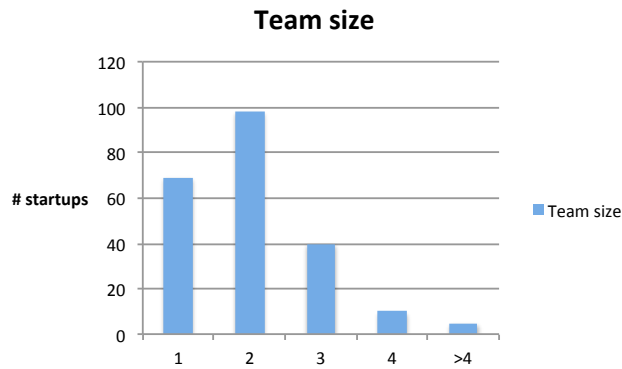


Figure 12: Team size

I ran logistic regression with dependent variable *Outcome* and *team size* as an explanatory variable. The effect of team size is reported to be insignificant.

Logistic regression	Number of obs	=	222
	LR chi2(1)	=	0.17
	Prob > chi2	=	0.6790
Log likelihood = -151.75979	Pseudo R2	=	0.0006

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
team_size	.0538992	.1307648	0.41	0.680	-.2023951	.3101934
_cons	.1614622	.29976	0.54	0.590	-.4260567	.7489811

Table 19: STATA output: Effect of team size on outcome

I generated a binary variable *team_1* taking the value 1 if a startup has been established by a single founder and tested the effect of this variable on *Outcome*. The result, reported in Table 20, indicates that there is no significant effect of solo founders on the outcome of the company. As a result, hypothesis **H7a** has to be rejected.

Logistic regression

Number of obs = 222

LR chi2(1) = 0.85

Prob > chi2 = 0.3555

Log likelihood = -151.41856

Pseudo R2 = 0.0028

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
team_1	-.2696636	.2916589	-0.92	0.355	-.8413046	.3019774
_cons	.3566749	.1642685	2.17	0.030	.0347147	.6786352

Table 20: STATA output: Effect of one-man-teams on outcome

In order to measure the effect of team diversity on performance, I created the variables *rel_div_exp* (relative diversity of experience) and *rel_div_edu* (relative diversity of education). How these variables are constructed is explained in 4.3.

Logistic regression

Number of obs = 222

LR chi2(1) = 0.14

Prob > chi2 = 0.7037

Log likelihood = -151.77313

Pseudo R2 = 0.0005

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
rel_div_edu	-.1242385	.3266731	-0.38	0.704	-.764506	.516029
_cons	.3677618	.2864788	1.28	0.199	-.1937264	.92925

Logistic regression

Number of obs = 222

LR chi2(1) = 4.56

Prob > chi2 = 0.0328

Log likelihood = -149.56646

Pseudo R2 = 0.0150

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
rel_div_exp	-.3492364	.1659866	-2.10	0.035	-.6745641	-.0239087
_cons	.859611	.3120135	2.76	0.006	.2480758	1.471146

Table 21: STATA output: Effect of team diversity on outcome

The effect of the relative diversity of education on outcome seems to be insignificant. However, relative diversity of experience has a significant negative effect on outcome. As a result, hypothesis **H7b** has to be rejected.

Location

In the sample, 117 startups have been founded in tech clusters, as defined in 4.3.

Logistic regression	Number of obs	=	222
	LR chi2(1)	=	0.50
	Prob > chi2	=	0.4814
Log likelihood = -151.59762	Pseudo R2	=	0.0016

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
cluster	.1910552	.2714835	0.70	0.482	-.3410426	.7231531
_cons	.1718502	.195901	0.88	0.380	-.2121086	.5558091

Table 22: STATA output: Effect of location on outcome

The results of the logistic regression with dependent variable *Outcome* and independent variable *Cluster*, indicating whether a startup is founded in a tech hub or not, suggest that there is no significant effect. As a result, hypothesis **H8** has to be rejected.

4.4.2. Multivariate analysis

In the univariate analysis, 9 variables were found to have a significant effect on startup outcome. In the following, these factors will be tested jointly.

I have conducted a logistic regression with a dependent variable *Outcome* and the nine selected explanatory variables.

Logistic regression

Number of obs = 160

LR chi2(9) = 27.30

Prob > chi2 = 0.0012

Pseudo R2 = 0.1238

Log likelihood = -96.638669

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
uni_title	-.5050149	.2389083	-2.11	0.035	-.9732666	-.0367633
edu_tech	.7199755	.505147	1.43	0.154	-.2700943	1.710045
age_20_30	.2496704	.5061585	0.49	0.622	-.742382	1.241723
age_51_max	.0130163	.6608378	0.02	0.984	-1.282202	1.308235
debt	.5635832	1.328213	0.42	0.671	-2.039667	3.166833
VC_rep	.5352638	.6139282	0.87	0.383	-.6680134	1.738541
funding_rounds	.3366106	.1441787	2.33	0.020	.0540255	.6191957
funding_tota~T	6.92e-06	9.33e-06	0.74	0.458	-.0000114	.0000252
rel_div_exp	-.4483349	.2247366	-1.99	0.046	-.8888106	-.0078592
_cons	.9637889	.8777298	1.10	0.272	-.7565299	2.684108

Table 23: STATA output: Multivariate analysis – Effect on outcome

The results indicate that in a multivariate setting only three of the variables have a significant impact on outcome. A higher university degree and a bigger diversity in the founding team negatively affect the success probability of startups. A higher number of funding rounds is associated with higher success chances.

Because the variable *VC_rep*, indicating the reputation of the investing VC company, has a lot of missing values due to missing data in the dataset, it has led to a decrease in the number of observations of almost 23%. Because the effect of this variable is insignificant, I have decided to remove it from the analysis and examine whether the increase of the number of observations would have an impact on the results.

This modification has resulted in a slightly improved significance of the already significant factors. In addition, the effect of debt financing has become statistically significant at the 5% level. The effect of technical education is still not statistically significant, although the p-value has decreased to 0.117.

Logistic regression

Number of obs = 211

LR chi2(8) = 39.58

Prob > chi2 = 0.0000

Pseudo R2 = 0.1369

Log likelihood = -124.73116

outcome	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
uni_title	-.4515554	.1928471	-2.34	0.019	-.8295288	-.073582
edu_tech	.6426609	.4094784	1.57	0.117	-.159902	1.445224
funding_rounds	.3910287	.1233219	3.17	0.002	.1493222	.6327351
funding_total_T	3.41e-06	6.52e-06	0.52	0.601	-9.36e-06	.0000162
debt	2.305922	1.156452	1.99	0.046	.0393181	4.572527
age_20_30	.2547362	.4238749	0.60	0.548	-.5760433	1.085516
age_51_max	-.2595148	.5542806	-0.47	0.640	-1.345885	.8268553
rel_div_exp	-.4215618	.1965985	-2.14	0.032	-.8068879	-.0362358
_cons	.885752	.7374345	1.20	0.230	-.559593	2.331097

Table 24: Multivariate analysis – Effect on outcome (modified)

In addition, I have conducted a multinomial logistic regression to test the effects of the variables on the status of startups. The results (reported in Table 25) indicate, that a higher university degree of the founder significantly decreases the relative probability of a startup being operating rather than closed. Technical education has the opposite effect – if a team member has a technical education, the startup is more likely to have a status *operating* relative to having a status *closed*. This finding partially confirms hypothesis **H2a**, which states that technical education of the founder decreases the failure probability of startups. An increase in the number of funding rounds significantly increases the chances of acquisition or being still operating relative to closure, which again confirms hypothesis **H5c**. Startups that have obtained debt financing are more likely to be operating or to have an IPO relative to closing. In addition, a higher diversity of experience in the founding team is associated with significantly lower probability of being acquired compared to closure.

The reputation of the venture capital firm and the total funding amount have a non-significant effect based on the results of the multivariate analysis. As a result, hypotheses **H4b** and **H5b** have to be rejected.

Multinomial logistic regression

Number of obs = 211

LR chi2(24) = 67.27

Prob > chi2 = 0.0000

Log likelihood = -207.88971

Pseudo R2 = 0.1393

status	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
closed	(base outcome)					
operating						
uni_title	-.815154	.2591523	-3.15	0.002	-1.323083	-.3072248
edu_tech	1.267795	.5684587	2.23	0.026	.1536369	2.381954
funding_rounds	.479466	.1378971	3.48	0.001	.2091927	.7497394
funding_tota~T	2.38e-06	7.48e-06	0.32	0.750	-.0000123	.000017
debt	2.839067	1.315424	2.16	0.031	.2608835	5.41725
age_20_30	.2630397	.5064257	0.52	0.603	-.7295364	1.255616
age_51_max	-1.574912	1.129661	-1.39	0.163	-3.789008	.6391837
rel_div_exp	-.3319687	.2457275	-1.35	0.177	-.8135857	.1496483
_cons	.2963433	.9351742	0.32	0.751	-1.536564	2.129251
acquired						
uni_title	-.2705499	.2140003	-1.26	0.206	-.6899829	.148883
edu_tech	.3178361	.4535658	0.70	0.483	-.5711365	1.206809
funding_rounds	.3492584	.1340115	2.61	0.009	.0866007	.6119162
funding_tota~T	1.65e-06	7.25e-06	0.23	0.820	-.0000126	.0000159
debt	1.890575	1.235784	1.53	0.126	-.5315179	4.312668
age_20_30	.3162245	.4777931	0.66	0.508	-.6202328	1.252682
age_51_max	.0599092	.5881976	0.10	0.919	-1.092937	1.212755
rel_div_exp	-.4593609	.2316915	-1.98	0.047	-.9134679	-.005254
_cons	.121772	.8332437	0.15	0.884	-1.511356	1.7549
ipo						
uni_title	.8064246	.9745792	0.83	0.408	-1.103716	2.716565
edu_tech	-.4635049	1.678004	-0.28	0.782	-3.752332	2.825322
funding_rounds	-.2713635	.533479	-0.51	0.611	-1.316963	.774236
funding_tota~T	.0000534	.0000244	2.19	0.029	5.58e-06	.0001012
debt	4.083241	1.932253	2.11	0.035	.2960944	7.870388
age_20_30	-20.9209	1125.522	-0.02	0.985	-2226.904	2185.062
age_51_max	.6105212	1.830324	0.33	0.739	-2.976849	4.197891
rel_div_exp	-2.059326	1.331437	-1.55	0.122	-4.668896	.5502432
_cons	-3.990314	4.115322	-0.97	0.332	-12.0562	4.075569

Table 25: Multivariate analysis - Effect on status

4.5. Discussion of Results

	Hypothesis	Result (univariate)	α	Result (multivariate)	α
Gender	H1: Startups, founded by female entrepreneurs, are more likely to fail.	rejected		rejected	
Education/Experience	H2a: Previous business management and technical university education of the founders decreases the failure probability of a startup.	confirmed*	0.1	confirmed*	0.05
	H2b: Higher academic titles of the founders have a positive effect on the success probability of a startup.	rejected		rejected	
	H2c: Lack of previous entrepreneurial experience in the tech industry decreases the success probability of a startup.	rejected		rejected	
	H2d: Previous unsuccessful entrepreneurial experience increases the failure probability of a startup.	rejected		rejected	
Age	H3a: An increase of the founder's age up to 40 increases the survival chances of a startup.	rejected		rejected	
	H3b: An increase of the founder's age after 40 decreases the survival chances of a startup.	rejected		rejected	
Type of Financing	H4a: Non-VC-backed startups are more likely to fail.	rejected		rejected	
	H4b: Startups funded by VCs with better reputation (measured as the total number of funding rounds in the period 2000-2004) have higher success chances.	confirmed	0.1	rejected	
	H4c: Debt financed ventures are more likely to be ongoing businesses without a successful exit (defined as either acquisition or an IPO).	rejected		rejected	
Financial Capital	H5a: The probability of new venture success increases with the initial funding amount.	rejected		rejected	
	H5b: The probability of new venture success increases with the total funding amount.	confirmed**	0.05	rejected	
	H5c: The probability of new venture success increases with the number of funding rounds.	confirmed**	0.05	confirmed**	0.05
	H6: An increase of first-round funding above the average for the sector increases the probability of failure.	rejected		rejected	
Team	H7a: New ventures founded by a single founder are more likely to fail.	rejected		rejected	
	H7b: New ventures founded by multiple founders with different backgrounds are more likely to succeed.	rejected		rejected	
Location	H8: Startups founded in world's top 25 tech clusters have higher success probability than startups in other regions.	rejected		rejected	

* This hypothesis is only partially confirmed. Technical university education increases the probability of success; However, the effect of business-related education is insignificant

** If the assumption that ongoing businesses are "walking dead" (and, as a result failed) is dropped, the effects become insignificant

Figure 13: Summary of results

In this section, the results of the statistical analysis will be discussed and possible explanations will be provided.

Hypotheses **H2a** and **H5c** have been confirmed (or partially confirmed). The technical university education of the founder has been found to have a significant positive impact on the probability of a startup to be operating rather than closed, while business-related education has been reported to have an insignificant impact. It is possible that tech ventures could benefit more from the technical skills of their founders than from their

managerial skills. Assuming that managerial guidance and monitoring is often provided by outside investors, it would seem such expertise is not necessarily of key importance within the founding team. Technical skills, on the other hand, are primary resource for tech ventures that cannot be that easily outsourced.

Although, the univariate analysis has shown that the success probability of startups is positively affected by the reputation of the investing VC firm, this result has not been confirmed in a multivariate setting. A possible explanation for this is that the effect identified in the univariate test has been caused by another variable. I ran some additional tests to identify which variables are related to a high reputation of VC firms. Since there is a significant relationship between VC reputation and the total funding amount, which is also positively correlated with the number of funding rounds it might be possible that these two variables have indirectly caused the significant effect of *VC_rep* found in the univariate test.

In the univariate analysis, the number of funding rounds and the total investment amount were found to increase the success probability of tech ventures. However the significance of these results depends on the assumption that operating businesses which have not received funding in the last 4 years, should be categorized as “walking dead”, and thus as failures. In the multivariate setting, however, the effect of the total funding amount was shown to be insignificant. This might have occurred because the actual effect might be caused by the number of rounds, which is reported to have a significant effect, rather than by the total funding amount itself. This finding is very interesting and unexpected. The positive effect of staging might be explained with intensified monitoring by investors, as well as with an increased incentive of the entrepreneurs to reach certain performance thresholds in order to receive a second round of funding. The insignificant effect of the total funding amount and the significant impact of the number of funding rounds might suggest that monitoring could play a more important role for success than the actual investment amount.

Most of the hypotheses have been rejected, which might be due to the relatively small sample, data incompleteness and survivorship bias in the Crunchbase dataset. However, the analysis has generated some interesting and unexpected results. Although female entrepreneurs were expected to perform worse than male entrepreneurs, no proof was found to confirm this hypothesis. However, the fact that only 8% of the sample companies were founded by female entrepreneurs is very alarming and underlines the severity of the gender gap problem. Although only 17 startups were founded by women, their performance is not significantly different from the performance of startups established by male entrepreneurs.

Another interesting finding is that having a higher academic title decreases the success probability of a startup significantly (at the 5% significance level). One possible explanation could be that entrepreneurs with higher degrees could be of higher age than others. However, results of the multivariate regression did not find a significant relationship between the age of the founder and startup performance. Another possible explanation for this finding could be that better educated entrepreneurs are capable of more easily identifying “walking dead” businesses. As a result, they might prefer a rational and financially reasonable closure instead of resource consuming continuation of low potential businesses. This could explain the finding, that startups founded by entrepreneurs with higher university degrees are less likely to be operating rather than closed.

Another interesting result of the statistical analysis is that debt improves the success chances of tech startups. Debt has a significant positive effect on the relative probability of a startup to be operating or to have an IPO rather than being inactive. However, this effect could also be inversed - it could be possible that companies with higher potential or with lower risk are able to more easily obtain debt financing.

In addition, higher diversity in the founding team has turned out to have a significant negative impact on success probability. This could possibly suggest that team members with different backgrounds have different worldviews. Consequently, they might have

difficulties reaching consensus, which could lead to a longer duration of the decision-making process and, as a result, to a suboptimal management of the company.

5. Conclusion

A lot of new innovative ventures are founded each day, however only a small fraction of them succeeds. Investors and entrepreneurs have started to realize that learning from success is not enough. By studying failure and the factors that influence the success odds of a startup, one can avoid critical mistakes and thus reduce the probability of failure.

In this master thesis, critical success factors related to founder's human capital, choice of financial capital and investors and strategic factors have been analyzed. Using a sample consisting of failed and successful ventures, the effect of these factors on the outcome of tech startups has been tested. The small sample, data incompleteness and survivorship bias in the dataset might be some of the reasons why most of the hypotheses could not be confirmed. However, some interesting findings and observations have been made. The results of the analysis suggest that a technological university education increases the relative probability of a business staying in business rather the closing. In addition, acquiring outside capital in a higher number of rounds improves the probability of a successful outcome.

These findings imply that entrepreneurs should focus on their technical skills in order to avoid the failure of their tech ventures. In addition, they should aim at obtaining capital in multiple rounds. Staging could provide the benefit of increased monitoring by investors, higher motivation of entrepreneurs to reach certain performance targets and reduction of overspending.

A very interesting and unexpected finding of this thesis is that a higher university degree of the founder is associated with a lower relative probability of a startup staying in business instead of closing. Probably better educated entrepreneurs are capable of more easily identifying low potential businesses. As a result, they might prefer an

economically reasonable closure instead of irrational business continuation. Although success is the goal of every entrepreneur, identifying failure at an early stage and knowing how to learn from it might be of great importance. Failing soon and fast might be a better alternative than running a resource consuming “walking dead” business with very low potential.

Considering the assumptions and results of this work, future research might benefit from using a larger, more representative sample. Survivorship bias is a major problem in failure studies and it should be identified and avoided. In addition, collecting information on the actual growth rates of tech ventures might lead to a more precise categorization of failed and successful startups. In this way, more accurate results can be obtained.

There is still a lot to explore in the huge startup world. Future research can manage to gain a better understanding of the reasons for the high failure rates among innovative new ventures and provide valuable advice and recommendations to entrepreneurs, making their way to success.

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Kurzfassung

Das große Wachstumspotenzial und die attraktiven Investitionsmöglichkeiten in der Technologiebranche schaffen vorteilhafte Bedingungen für die Gründung innovativer Unternehmen. Jeden Tag werden viele neuen Startups gegründet mit dem Ziel, die Welt zu verändern. Bedauerlicherweise, gelingt es der Mehrheit dieser Unternehmen nicht, eine befriedigende Wachstumsrate zu erreichen und erfolgreich zu werden. Die hohen Durchfallsquoten von Startups können als Indikator dafür dienen, dass der Weg zum Erfolg voller Hindernisse ist. Das Bewusstsein für diese Problematik ist gestiegen und sowohl Unternehmer, als auch Investoren, sind daran interessiert, die kritischen Erfolgsfaktoren zu erkennen. Diese Masterarbeit analysiert diverse Erfolgsfaktoren, die als Human Capital, Finanzielle oder Strategische Faktoren gruppiert sind, und deren Auswirkungen auf den Unternehmenserfolg. Eine empirische Analyse von 222 erfolgreichen und gescheiterten Startup-Unternehmen, die in 2004 gegründet wurden, wurde durchgeführt. Die Effekte von den studierten Faktoren auf die Erfolgswahrscheinlichkeit wurden analysiert und verglichen. Die Ergebnisse zeigen, dass eine technische Universitätsausbildung vom Gründer eine wichtige Rolle für den Unternehmenserfolg spielt. Es wurde bestätigt, dass die Anzahl der Investitionsrunden einen positiven Effekt auf die Erfolgswahrscheinlichkeit hat. Interessanterweise, besagen die Ergebnisse, dass ein höherer akademischer Grad vom Gründer und eine große Team-Diversität mit einer höheren Scheiterwahrscheinlichkeit verbunden sind.

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