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How to Measure the Success of Technology-Based Start-Ups – A Comprehensive Overview of the Perspectives of Academics & Practitioners

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Abstract

Successful technology start-ups can be a significant driver of a country's economic development and could transform entire industries with new technological innovations. For this reason, in research and practice, special attention is always paid to one particular type of start-up: a successful one. To date, however, little research has been done on how to measure a start-up's success. To advance the knowledge about start-up success measurement in academic research, this thesis investigates what academics and practitioners understand by a successful start-up and what they consider to be reliable measures of success. Several scientific studies dedicated to the examination of start-up success were analyzed and seven semi-structured expert interviews with venture capitalists from the early-stage investment sector were conducted. The results show that in both the academic and practical world, start-up success is perceived as a complex, multidimensional phenomenon whose measurement depends on a variety of different factors that may change over time. It is therefore concluded that a meaningful measurement of start-up success requires the use of a combination of different metrics to address this multidimensional nature of success.

Keywords: new venture performance; new ventures; startup success; startups; venture capital

1. Introduction

Technology start-ups can be a significant driver of a country's economic development. They create a large number of new jobs and can transform entire industries with new technological innovations (Christensen & Bower, 1996; M. Song et al., 2008). For this reason, start-ups are not only receiving growing attention in the practical but also in the academic world. Scientific interest in start-ups has increased substantially in the last two decades, with scholars from a diverse range of fields devoting their research to this topic (see Appendix A1).

Despite their considerable relevance for the economy and society, only a small fraction of all start-ups manages to survive in the long term (Schlichte et al., 2019). Technology start-ups in particular have comparatively low survival rates (M. Song et al., 2008). A considerable number of researchers is therefore concerned with finding out how to improve the survival chances of start-ups and increase their likelihood of success, resulting in a variety of different empirical studies (Jin et al., 2017; M. Song et al., 2008). An essential component of these studies is the measurement of the central dependent variable: success (Witt, 2004). To determine whether a start-up is successful, researchers have to measure success by means of selected metrics. The choice of the right success measures should be well considered, as they can have a decisive influence on the results and validity of a study (Eveleens et al., 2017).

First and foremost, I would like to extend my heartfelt thanks to my supervisor Riccarda Joas, who not only gave me the opportunity to write this thesis but also provided me with invaluable suggestions, constructive feedback, and brilliant ideas that greatly enhanced the quality of my work. I am truly grateful for her continuous support and mentorship throughout the entire writing process. Additionally, I would like to extend my appreciation to the venture capitalists who graciously shared their valuable time and knowledge with me during the qualitative research phase. Lastly, I want to extend my gratitude to Lisa Marie Hamacher for her unwavering support, encouragement, and belief in my abilities. Her continuous motivation and willingness to listen to my ideas have been instrumental in keeping me focused and motivated throughout this journey.

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The correct measurement of success is thus of major importance for researchers in the field of start-up success. Nevertheless, little research has been done on how to measure the success of start-ups. Given the ever-growing research interest in start-ups and the need for sound success measurement decisions, there is a great demand for further research on this topic (Eveleens et al., 2017; Kiviluoto, 2013). This academic work addresses this need, focusing specifically on technology-based start-ups. The aim of this thesis is to find out what academics as well as relevant practitioners define as a successful start-up and what they consider to be reliable measures of success. This is intended to contribute to a better understanding of the success phenomenon in start-up research and a more profound measurement of start-up success (Kiviluoto, 2013). Scholars, but also practitioners from the start-up environment, are to be shown with this thesis how the success of start-ups can be measured and what has to be considered when measuring success.

To achieve the objective of this academic work, a systematic literature review is conducted in the first part of this thesis, aiming to investigate the views of academics on the topic of success measurement. In order to capture the practitioners' perspective, this literature review is followed by an empirical study in which seven early-stage venture capitalists - who were considered relevant practitioners of a start-up ecosystem - are interviewed about the central research question.

2. Literature Review – Academics' Perspective

To capture the academics' perspective on the central research question, existing literature dedicated to the topics of start-ups and start-up success was analyzed. In the first half of this chapter, the review methodology used is described, and an extensive explanation of the start-up term and relevant concepts for this thesis is provided. This is followed by the main part of this chapter, which provides an overview of how start-up success is defined and measured in the scientific literature.

2.1. Review Methodology

In order to ensure an unbiased and comprehensive outcome, a systematic literature review was conducted (Tranfield et al., 2003). Following the approach of Crossan and Apaydin (2010), the review consisted of four distinct phases: planning, data collection, data analysis, and reporting. The first three phases are described below.

2.1.1. Planning

During the planning stage, the aim, as well as the scope of the literature review, was defined. The primary objective of the literature review was to provide a comprehensive overview of how start-up success is measured in entrepreneurship and management research and why certain metrics or measurement approaches are used. The literature review was limited to peer-reviewed scientific journals, as these are considered to be of high quality and influence for a scientific field (Crossan & Apaydin, 2010; Podsakoff et al., 2005). Due to their volume of peer-reviewed literature, the academic databases Scopus and ScienceDirect were used for the literature search. In addition, Google Scholar was employed to retrieve identified articles in PDF format.

2.1.2. Data collection and analysis

Prior to the collection of appropriate literature, the concept of start-up was examined in depth and finally defined due to its relevance to the topic of success measurement. To identify relevant studies, two separate searches were conducted: an initial broader search to obtain a general overview of existing success literature and a more specific search that was specifically designed to answer the central research question. To ensure a high literature quality, only studies published in influential entrepreneurship and management journals were considered in the search, i.e. the journal in which a study was published had to either be at least a C, preferably a B to A+ journal according to the VHB ranking or, alternatively have an impact factor of at least four.

In the initial search, the selected electronic databases were searched for scientific articles that were published within the last 40 years (1982-2022) and whose title, abstract, or keywords contained combinations of the terms "start-up", "startup", "venture", "success", "performance" and "measure*". Figure 1 shows the main query used in this process.

The initial search resulted in about 742 articles. After the exclusion criteria listed in Table 1 were applied to this sample by manually reviewing the individual title, abstract and/or conclusion of each article, the number of studies was reduced to 36.

To obtain a concrete overview of how academics measure the success of start-ups, the initial research was followed by a search for empirical studies that examine the success of start-ups and were published in the past 20 years (2000-2022). For this purpose, the query illustrated in Figure 2 was used.

During the search, a special focus was placed on young independent technology start-ups. Therefore, articles with a focus on corporate, public, or late-stage start-ups were intentionally excluded. Subsequently, all studies that met any of the criteria in Table 2 were also excluded.

As a result, 35 matching empirical studies were identified. Finally, a forward, as well as backward search, was again conducted based on the 71 identified studies to supplement the previously collected literature. The overall literature search resulted in a sample of 114 scientific articles, which were analyzed in the next step.

The analysis of the collected literature was based on the thematic codes listed in Table 3.

While 16 thematic codes were applied to the total of 42 empirical studies, only 7 to 8 more general codes were used for the remaining research articles.

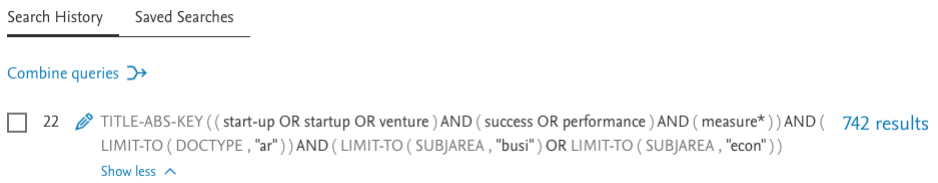

Figure 1: Scopus Query: Initial Search

Table 1: *Exclusion criteria: Initial Search*

Criteria
• Articles that were of empirical nature and provided no further relevant information
• Articles that focused only on late-stage start-ups
• Articles that did not conceptualize the concept of start-up success / performance
• Articles that were only concerned with entrepreneurial success

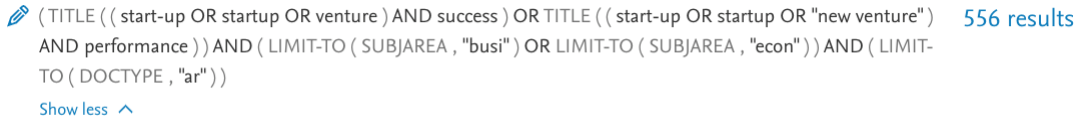

Figure 2: Scopus Query: Research Articles studying start-up success or performance

Table 2: *Exclusion criteria: Search for Success investigating Articles*

Criteria
• Articles specifying the type of success or performance in their title
• Articles that were not of empirical nature
• Articles on entrepreneurial success
• Articles that did not state properly how they measured success

Note. Furthermore, articles examining technology start-ups were preferred.

2.2. Start-up at a glance

In the further course of this thesis, it will be important to understand what a start-up is and which development phases such a company goes through. This chapter examines the concept of start-up by drawing on well-known start-up literature as well as high-impact entrepreneurship and management research.

2.2.1. Definitions of the start-up concept

The term "startup" was first mentioned in 1976 within a Forbes article published at the time to describe a newly formed business (Nguyen-Duc et al., 2020). The aspect of newness can also be found in more recent definitions, but it has become considerably less relevant, which can be seen in Table 4.

A review of existing definitions from selected entrepreneurship and start-up literature reveals that start-ups are increasingly ascribed characteristics that go beyond the purely time-related definition. It also became evident that there is no uniform characterization for a start-up, but that there are overlaps between existing definitions. Start-ups are particularly described as innovative, scalable, and growth-oriented (Tech, 2018). For example, Blank and Dorf (2012) state that a start-up is not an ordinary company but an organization looking for a suitable business model that will allow for growth and profitability. According to Graham (2012), especially the ability to grow disproportionately fast is the key criterion that differentiates a start-up from an ordinary company. In this context, he further adds that a start-up can only achieve this rapid growth if it is able to successfully serve a very large market (Graham, 2012). It thus becomes apparent that start-ups are not newly founded companies, but young organizations that aim for above-average growth in various business dimensions and therefore want to serve a large market (Tech, 2018). Research has shown that such a venture can take an average of eight to ten years to reach profitability. This time frame is therefore, often set as a threshold to characterize start-ups in terms of time (Davila et al., 2003; Li, 2020).

Table 3: *Thematic Codes for Literature Analysis*

Scope	Code
All Articles	Author name (year) Year Title Thesis Section Notes JQ3
23 Success Definition Articles	Success Definition
42 Empirical Studies	Sample Size Sample Type Company age (in years) #Employees Success Metrics Success Dimenison Number of Dimensions, [options: GROWTH, FUNDING, PROFITABILITY, LIQUIDITY EVENT, OPERATIONAL, EFFICIENCY, SURVIVAL, OTHER] Number of Measures Measure Type [options: f-financial, nf-non-financial, obj-objective, subj-subjective] Journal
Remaining Articles	Relevance Key point

2.2.2. Start-up in academic research

To obtain an overview of how start-ups are characterized in the research literature relevant to this thesis, a sample of 18 research articles from 12 different high-impact journals was reviewed (see Appendix A2). The corresponding articles were identified using the Scopus database by employing the search query illustrated in Figure 3.

Each article was dedicated to the study of start-ups and was therefore examined for both direct and indirect start-up characterizations. An analysis of the selected sample yielded 12 characteristics that were primarily used to describe start-ups. Table 5 illustrates these.

Four of these characteristics were applied particularly frequently: young, new, lack of resources, and high uncertainty. Thus, a large proportion of the sample defined a start-up mainly as a newly established firm with a relatively short operating history, which lacks resources and faces a high degree of uncertainty. Relatively little importance was attached to the characteristics of growth orientation and innovativeness. In fact, start-ups were explicitly distinguished from high-growth and innovative start-ups, with the latter two types mostly corresponding to the characterizations made in the previous chapter (Audretsch et al., 2021; Cacciolatti et al., 2020; S. Lee, 2022). This indicates that start-up definitions in research and practice slightly differ from each other. Within the reviewed academic literature start-up characterizations still seem to be predominantly influenced by the original meaning of the term. That is, a start-up is primarily considered a newly formed company and provided it has strong growth intentions and an innovative approach, it is specifically referred to as a high-growth or innovative start-up.

2.2.3. Defining a start-up

Due to the differences between various start-up definitions, it is necessary to define a start-up in concrete terms for the purposes of this thesis. Since both the academic and practical perspectives are of great relevance to this study, an attempt was made to incorporate both views in this definition. The term "start-up" is used in the further course of this work to describe a young company that (1) is not older than 10 years, (2) has strong growth intentions, (3) is developing innovative technology-based products or services and (4) strives for a scalable business model that enables profitability in the medium to long term.

2.2.4. Development stages of start-ups

In the course of their lifespan, start-ups develop on various interrelated levels and thus pass through different stages of development (Kumbhat & Sushil, 2018). A handful of researchers and practitioners have devoted themselves to identifying and explaining these developmental stages, resulting in a wide variety of models that have been created and published over the past several decades (Blank, 2007; Kazanjian, 1988; Kazanjian & Drazin, 1990; Kumbhat & Sushil, 2018; Marmer et al., 2011; Tech, 2018). Based on these models, a four-phase model was developed that explains the development of a start-up while sufficiently incorporating the financing rounds of the VC sector (see Table 6). The inclusion of the

Table 4: *Definitions of a Start-up*

Reference	Year	Title	Definition	Characteristics
Santisteban et al. (2021)	2021	Critical success factors for technology-based startups	[...] a small, dynamic, flexible, high-risk company that has a reproducible and scalable business model and provides innovative products and/or services.	small, dynamic, flexible, high-risk, scalable business model, innovative
Ripsas et al. (2018)	2018	A Startup Cockpit for the Proof-of-Concept	[...] a young company that is less than 10 years old [...] has an innovative business model and/or deploys innovative technologies. [...] shows significant growth either in the number of employees or in turnover.	young, <10 years old, innovative business model, tech-based, growth-oriented
Kumbhat and Sushil (2018)	2018	Development Stages and Scaling Issues of Startups	[...] living organisms, especially early-stage startups operate under conditions of extreme uncertainty in search of right product–market fit.	faces high uncertainty
Tech (2018)	2018	Financing High-Tech Startups	An organization that aims at scaling revenues and headcount, that is less than 10 years old, and that develops a highly innovative business model or technology.	scale-oriented, <10 years old, innovative business model/ technology
Giardino et al. (2016)	2016	Software Development in Startup Companies: The Greenfield Startup Model	Organizations focused on the creation of high-tech and innovative products, with little or no operating history, aiming to aggressively grow their business in highly scalable markets.	tech-producing, innovative, little/no operating history, growth-/scale-oriented
Thiel and Masters (2014)	2014	Zero to One	New technology tends to come from new ventures – startups [...] a startup is the largest group of people you can convince of a plan to build a different future.	new, innovative, technology developing
Blank and Dorf (2012)	2012	The Startup Owner's Manual	[...] is not a smaller version of a large company. [...] is a temporary organization in search of a scalable, repeatable, profitable business model.	temporary, scalable, seeks innovative business model

(Continued)

Graham (2012)	2012	Startup = Growth	[...] a company designed to grow fast. Being newly founded does not in itself make a company a startup. Nor is it necessary for a startup to work on technology, or take venture funding, or have some sort of "exit." The only essential thing is growth.	growth-oriented, scalable
Ries (2011)	2011	The Lean Startup	[...] a human institution designed to create new products and services under conditions of extreme uncertainty	new, faces high uncertainty
Luger and Koo (2005)	2005	Defining and tracking business start-ups	[...] a business entity: which did not exist before during a given time period (new), which starts hiring at least one paid employee during the given time period (active), and which is neither a subsidiary nor a branch of an existing firm (independent).	new, active, independent

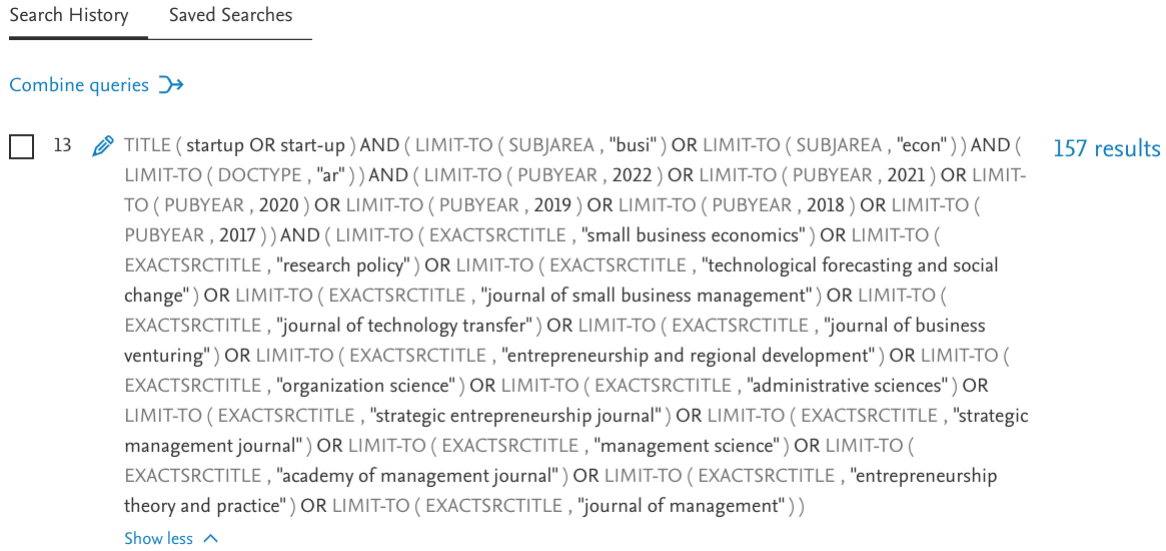

Figure 3: Scopus Query: Research Articles that study and characterize start-ups

VC investment rounds is intended to ensure the suitability of the model for the empirical part of this scientific work.

At the beginning, a start-up is in the early stage, which consists of the pre-seed and seed stage.

In the *pre-seed stage*, there is an initial assumption for a specific problem and the start-up is mainly concerned with finding out whether this problem really exists and if it is meaningful for a large number of prospective customers. The goal of this stage is therefore to identify a problem worth solving and to discover a suitable market for the intended solution (Inc42, 2022; Kumbhat & Sushil, 2018).

This is followed by the *seed stage*, in which the start-up iteratively develops a first deployable solution in collaboration with initial customers and validates whether this solution suf-

Table 5: *Start-up Characteristics in Academic Research*

Characteristic	**Frequency** (#Articles)	**Percentage** (n=18)	**References**
young ($\leq$ 7 years)	7	38.89%	Audretsch et al. (2021), Cacciolatti et al. (2020), Fackler et al. (2022), Roche et al. (2020), Sauermann (2018), Sorenson et al. (2021), and Zahra (2021)
faces high uncertainty	6	33.33%	Audretsch et al. (2021), Cacciolatti et al. (2020), Eveleens et al. (2017), Hasan and Koning (2019), Sorenson et al. (2021), and Zahra (2021)
lack of resources	6	33.33%	Audretsch et al. (2021), Chatterji et al. (2019), S. Lee (2022), Wasserman (2017), Zahra (2021), and Zhang and Gu (2021)
new	6	33.33%	Audretsch et al. (2021), Fackler et al. (2022), Grillitsch and Schubert (2021), S. Lee (2022), Roche et al. (2020), and Sauermann (2018)
small	4	22.22%	Audretsch et al. (2021), Cacciolatti et al. (2020), Fackler et al. (2022), and Sauermann (2018)
develops new products	3	16.67%	Eveleens et al. (2017), Hasan and Koning (2019), and Zhang and Gu (2021)
funded by informal / venture capital	3	16.67%	Cacciolatti et al. (2020), Croce et al. (2018), and Kolokas et al. (2020)
growth-oriented	3	16.67%	Dushnitsky and Yu (2022), Hasan and Koning (2019), and S. Lee (2022)
not directly innovative/ growth-oriented	3	16.67%	Audretsch et al. (2021), Cacciolatti et al. (2020), and S. Lee (2022)
can have any size	2	11,11%	Cacciolatti et al. (2020) and S. Lee (2022)
innovative	2	11,11%	Hasan and Koning (2019) and D. Wang et al. (2022)
vulnerable to economic downturns	2	11,11%	Fackler et al. (2022) and Sorenson et al. (2021)

ficiently satisfies the needs of the target market. This development process is usually associated with the acquisition of initial paying customers and the generation of first revenues. In the next step, the business model is also validated (Blank, 2007; Kumbhat & Sushil, 2018).

If the start-up has the necessary financial resources and the product and business model allow it, it moves into the *growth stage* (Tech, 2018). In this stage, the start-up prepares its processes, product, and business model for rapid growth and subsequently engages in very aggressive customer acquisition to establish a strong market position (Kumbhat & Sushil, 2018; Tech, 2018).

When customer and sales growth slowly level off and sales generated by existing products start to become more and more predictable, the *later stage* is reached. At this stage, VC investors in particular often insist on an exit by means of an IPO or acquisition to realize their profits. To increase sales, a later stage start-up often begins to expand into the international market and/or diversify the product portfolio until at some point the primary focus is on sustaining the company (Inc42, 2022; Tech, 2018).

2.3. Start-up Success in Academic Research

In entrepreneurship and management research, there is no clear consensus on when a start-up can be called successful. Definitions for start-up success are diverse as the meaning of success is always linked to a specific context (Nambisan & Baron, 2013; Santisteban et al., 2021).

2.3.1. Success as the sum of context-specific factors

Maidique and Zirger defined success as “the achievement of something desired, planned, or attempted" (Maidique & Zirger, 1985, p.305). According to this definition, a start-up can be considered successful when it achieves what it was supposed to achieve. The decision as to whether a start-up is successful therefore depends on the expectations placed on it and whether these have been fulfilled (Stuart & Abetti, 1987).

Table 6: *Definitions of a Start-up*

	Early stage **Pre-Seed** (Discovery)	**Seed** (Validation)	**Growth** (Efficiency/Scale)	**Later** (Expansion/Maturity)
Objective	Problem definition and customer discovery	Validation of product and market	Refinement of processes and rapid growth	Expansions on a larger scale and business sustainment
Market / Customers	No real customer, customer discovery through interviews	Market calibration; first paying customers; demand creation	Market penetration; repeatable and aggressive customer acquisition process	Diversification; internationalization; ... market saturation
Product	Value proposition defined, product concept or prototype	First level of deployable solution with core features	Product matured; complementary features added	Mature product offering
Team	Only founders	Founders on full time, few key employees	Rapidly growing	Moderately growing
Revenues	No revenues	Minimal initial revenues	Growing revenues	Stable revenue streams
Funding	Mainly informal	Seed	Series A to B	Series C+, IPO, exit
Investors	Bootstrapping, FFF, BA, crowdfunding	BA, VC, CVC, crowdfunding	VC, CVC, banks	Private / public equity, debt / loans

Note. Adapted from Kumbhat and Sushil (2018) and Tech (2018)

The expectations of a start-up and thus the definition of success depend on a variety of factors.

One of these factors is the perspective from which the start-up is viewed (Nambisan & Baron, 2013). A founder's idea of start-up success, for example, may differ from that of a venture capitalist (Black et al., 2010). For a venture capitalist, a start-up is successful if it generates a high return on investment, i.e., it enables a very profitable exit in the long term – preferably through a successful IPO or acquisition. Success is thus predominantly defined by financial indicators (Davila et al., 2003; Gompers et al., 2008). For a founder, on the other hand, personal and various non-financial criteria are usually relevant in addition to financial aspects when defining success (Fisher et al., 2014).

Another factor that influences the definition of success is a start-up's stage of development. For an early-stage start-up, for instance, success can have a different meaning than for a late-stage startup, as they face different challenges and pursue different milestones (Brush & Vanderwerf, 1992; Chandler & Hanks, 1993; Witt, 2004). While in an early phase the receipt of initial funding can already represent a success, the success in the later stage is rather determined by financial key figures and performance (Witt, 2004; Yua, 2020).

The meaning of success may also depend on the type of start-up (Nambisan & Baron, 2013).

When it comes to sustainable start-ups, success is significantly defined in terms of the contribution to society and the environment, whereas these aspects are usually given less attention in the case of an ordinary venture (Bocken, 2015). The definition of success may also differ depending on the technological complexity of the product offering. While a young software start-up is successful if it achieves a certain growth in sales, for a research-intensive biotechnology start-up, the number of registered patents may be a more appropriate indicator of success (Roche et al., 2020; Vissa & Chacar, 2009).

Lastly, when assessing the success of a start-up, the relevant time horizon is crucial (Nambisan & Baron, 2013). In the short to medium term, rapid growth or the ability to attract rounds of funding may be considered an initial success but is not a reliable indicator of a start-up's long-term success (Stuart & Abetti, 1987). Considering success only in a single time dimension can thus lead to an erroneous assessment (Maltz et al., 2003). Croce et al. (2018) therefore make a distinction between "interim" and "ultimate" success.

2.3.2. Common definitions of success

Success can have different meanings for different individuals, and interpretations can depend on a wide variety of factors (Kiviluoto, 2013; Nambisan & Baron, 2013; Witt, 2004). Nevertheless, there are dimensions in academic research that are more often considered when conceptualizing start-up success than others. Table 7 presents all definitions identified within a sample of 23 scientific articles.

Five definitions of success were particularly prevalent: (1) achieving rapid growth, (2) reaching a high level of financial performance and profitability, (3) attracting various funding rounds, (4) accomplishing a liquidity event such as

Table 7: *Definitions of Start-up Success*

Dimension	Definition	#Articles	References
Growth	Having a highly scalable business model and growing very fast, esp. in terms of sales and employment.	8	Baron and Hannan (2002), Frank et al. (2007), Guo et al. (2021), Hormiga et al. (2011a, 2011b), Peña (2002), Siegel and Wessner (2012), and Stuart and Abetti (1987)
Profitability	High level of financial performance and profitability.	7	Bocken (2015), Hormiga et al. (2011a, 2011b), S. Lee (2022), Roure and Maidique (1986), Stuart and Abetti (1987), and Stucki (2014)
Ability to attract funding	Attracting and closing various funding rounds.	6	Beckman et al. (2007), Gaule (2018), Schlichte et al. (2019), Spiegel et al. (2016), Ter Wal et al. (2016), and Woolley and MacGregor (2021)
Liquidity Event	Accomplishing an IPO or being acquired by another company.	6	Baron and Hannan (2002), Beckman et al. (2007), Croce et al. (2018), Gaule (2018), Hong et al. (2020), and Humphery-Jenner and Suchard (2013)
Survival	Surviving after a defined period of time.	6	Baron and Hannan (2002), Frank et al. (2007), Roure and Maidique (1986), Stuart and Abetti (1987), Stucki (2014), and Woolley and MacGregor (2021)
Goal Attainment	Meeting predefined goals and objectives.	4	Dvir et al. (2010), Maidique and Zirger (1985), L. Z. Song et al. (2010), and Stuart and Abetti (1987)
High Efficiency	Being very efficient in generating output compared to competitors, esp. in the form of revenue or sales.	3	Gloor et al. (2020), L. Z. Song et al. (2010), and Stuart and Abetti (1987)
Positive Founder Perception	Being perceived as successful by the founders across several different aspects.	2	Hormiga et al. (2011a) and Stuart and Abetti (1987)
Contribution	Making a positive contribution to society and the environment.	2	Bocken (2015) and Stuart and Abetti (1987)
Customer / Employee Satisfaction	Satisfying the needs of customers and employees.	1	Stuart and Abetti (1987)

an IPO or acquisition, and (5) surviving after a certain period of time. The diversity of success definitions identified, as well as the fact that 15 of the 23 articles studied (65%) included at least two different dimensions in their definition of startup success, supports the finding of Kiviluoto (2013) and Maltz et al. (2003) that success is a multidimensional construct. This assumption is also the basis of measurement frameworks, such as the "Balanced Scorecard" by Kaplan and Norton (1992) or Dvir et al.'s (1993) "Success Dimensions" (Maltz et al., 2003).

2.3.3. Success vs performance

There is also no uniform definition for the concept of performance in academic literature. Interpretations provided are rarely questioned and an understanding of this construct is usually taken for granted (Richard et al., 2009). Performance was originally defined as the sum of efficiency and effectiveness (Neely et al., 1995). However, performance is increasingly perceived as a multidimensional construct whose concrete meaning also depends on a specific context and thus on a multitude of factors that can change over time (Gerschewski & Xiao, 2015; Kiviluoto, 2013; Laitinen, 2002; Maltz et al., 2003; Richard et al., 2009).

Success and performance are often considered the same in entrepreneurship research because of their seemingly positive relationship to each other (Kiviluoto, 2013; Witt, 2004). This was also evident in the analysis of the studies located in Table 7. In more than half of the 23 reviewed articles, performance was considered an operationalization of success, resulting in the term "performance" often being used as a synonym for "success". Since these concepts can therefore not be considered separately, findings from performance research have been incorporated into this thesis.

2.4. Success Measurement in Academic Research

Success measurement of start-ups is a controversial topic in entrepreneurship and management research (Eveleens et al., 2017; Kiviluoto, 2013; Zahra et al., 2000). This chapter attempts to provide a comprehensive overview of how start-up success has been measured in scientific literature to date and why certain variables, metrics, or measurement methods are utilized. For this purpose, 42 research articles dedicated to the study of start-up success and/or new venture performance were analyzed (see Appendix A3 for a detailed overview of the articles).

2.4.1. Challenges in measuring start-up success

Measuring the success of start-ups is usually associated with special challenges (Eveleens et al., 2017). Obtaining data is mostly difficult, as start-ups do not have to publish financial performance figures and rarely want to share sensitive information with the public (Hope et al., 2013; Schlichte et al., 2019; Woolley & MacGregor, 2021). While it is possible to collect data using self-reporting within surveys, this approach is difficult to implement if very large samples of start-ups are to be studied (Schlichte et al., 2019; Su et al., 2015).

Even if a sufficient amount of data can be collected, there are other aspects to consider when measuring start-up success. Start-ups develop and change very quickly in relatively short periods of time, making the significance of a success measurement highly dependent on the exact point in time at which it was conducted (Eveleens et al., 2017; Garnsey et al., 2006). Moreover, the comparison of measures is often complicated because start-ups can differ significantly depending on their industry and the founders' objectives (Chandler & Hanks, 1993; Eveleens et al., 2017; Witt, 2004). Lastly, studies have shown that performance and success measures of start-ups rarely show significant correlations and can even be negatively correlated (Cooper, 1993; Trailer et al., 1996; Witt, 2004).

2.4.2. Dimensions of success

In analyzing the 42 selected articles, one of the objectives was to identify the specific dimensions that are considered in relevant business research when measuring start-up success.

Frequently observed success dimensions

In examining the selected sample, eight different dimensions of start-up success emerged (see Figure 4).

Most of the measures that were used within the reviewed studies to operationalize success could be assigned to one of these dimensions. The assignment was based on the specification of each study as well as common classifications from entrepreneurship and management literature (Carton & Hofer, 2006; Richard et al., 2009; Trailer et al., 1996). In addition, the determination procedure of a measure or the study-specific data collection method was not considered during assignment. That is, it was not relevant for the classification whether the objective value of a metric or variable was used within a study or whether it was assessed subjectively using a scale. The dimensions most frequently considered in the sample were growth, profitability, and funding. In about 45% of the reviewed studies growth was considered to be a reliable indicator of start-up success. This is in line with the findings of various researchers in the field of entrepreneurship. Growth has been found to be the most used measure of success (Achtenhagen, L. and Naldi, L. and Melin, L., 2010; Davidsson et al., 2009; Kiviluoto, 2013).

Growth as indication of success

The discernible preference for growth as an indication of start-up success may be attributed to the fact that strong business growth is usually associated with above-average results and can have various positive effects on a start-up's development as well as its stakeholders and economy. Growth can not only contribute to the survival of a start-up, but also increase its attractiveness to potential employees and investors (Ben-Hafaïedh & Hamelin, 2022; Coad et al., 2020; Nason & Wiklund, 2018; Phillips & Kirchhoff, 1989). Furthermore, fast-growing companies create a large number of new jobs and are considered a significant driver of a country's economic growth (Coad et al., 2017; Henrekson & Johansson, 2010; Pereira et al., 2020). In addition, business growth is often associated with profitability, as a variety of theories, such as economies of scale, suggest a positive relationship between sales growth and profits (Ben-Hafaïedh & Hamelin, 2022; Nicholls-Nixon, 2005).

However, there is also a growing body of literature that questions this supposedly positive relationship between growth and profitability and warns against viewing growth alone as an indicator of success (Ben-Hafaïedh & Hamelin, 2022; Davidsson et al., 2009; Kiviluoto, 2013). Empirical

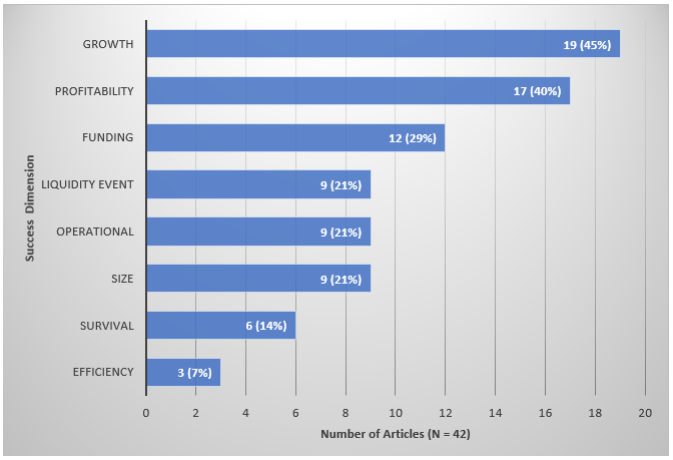

Figure 4: Usage Frequencies of Success Dimensions in Academic Research

Note. Based on Table 8 and Appendix A3, total N = 42 (research articles).

research indicates that growth has at most a weak positive correlation with profitability and may in some cases even be negatively correlated with financial gains (Delmar et al., 2013; Markman & Gartner, 2002; Nason & Wiklund, 2018). Furthermore, studies have shown that at least small and mid-sized companies may increase their likelihood of long-term success by focusing more on profitability than growth in the early years of their operations (Ben-Hafaïedh & Hamelin, 2022; Davidsson et al., 2009). In this regard, Ben-Hafaïedh and Hamelin (2022) state that a strong growth orientation may be appropriate depending on the goals of the entrepreneur and company. They emphasize, however, along with Kiviluoto (2013), that growth alone is rarely a reliable measure of success, and that sustainable growth should be given much greater importance. Growth can thus be of great relevance for the success of start-ups due to their growth-oriented nature, but its causes, reasons as well as its necessity must be questioned (Kiviluoto, 2013).

2.4.3. Types of success measures

In line with the identified dimensions of success, eight distinct types of success measures were detected within the sample studied. These could again be classified into six different categories: growth measures, accounting measures, funding measures, operational measures, liquidity event measures and survival measures. Table 8 provides a complete overview of all observed measures and how they were determined within the 42 empirical studies.

Growth measures

Growth measures comprise all metrics that provide information on the internal and external growth of a start-up (Brinckmann et al., 2011; Carton & Hofer, 2006). Since the long-term economic success of a start-up often depends on how fast it is able to grow, they can be important indicators of success (Grillitsch & Schubert, 2021; Pe'er et al., 2016). Growth measures are considered as a separate category, as they are in some cases clearly distinguished from traditional accounting-based measures in academic literature and growth is usually attributed special importance in the context of measuring the success of start-ups (Grillitsch & Schubert, 2021; Guo et al., 2021). Moreover, in entrepreneurship research, growth is often represented by non-financial indicators (Chatterji et al., 2019; Schlichte et al., 2019).

Among the sampled studies growth was preferably measured by the change in sales or employee numbers. This observation is also consistent with existing literature. According to several researchers, growth in entrepreneurship research is most frequently measured in terms of sales and employment (Achtenhagen, L. and Naldi, L. and Melin, L., 2010; Brinckmann et al., 2011; Grillitsch & Schubert, 2021; Leitch et al., 2010; Witt, 2004). Growth in these two areas is assumed to be a relatively good reflection of the internal and external progress of a start-up (Brinckmann et al., 2011; Delmar & Shane, 2003). Sales growth is a good indicator of how successfully a startup's products or services are accepted and adopted by its target market (Brinckmann et al., 2011; Zahra et al., 2000). Employment growth, on the other hand, is a clear indicator of a startup's overall internal growth and an increase in employee numbers suggests that more capacity is available to realize objectives and generate higher returns for stakeholders (Brinckmann et al., 2011; Gilbert et al., 2006). Despite their ability to capture important developmental aspects of a start-up, both sales and employment growth were rarely used alone in the sample, but rather in combination with other measures of growth to represent this dimension. This reflects the heterogeneity as well as multidimensionality of the growth construct and underlines the difficulty to capture this dimension on the basis of only one best measure (Kiviluoto, 2013; Leitch et al., 2010). Moreover, by using different measures, a more precise understanding of the type of growth achieved can be obtained (Brinckmann et al., 2011).

Table 8: *Measures of Success and Performance in Academic Research*

Dimension	Metrics	Frequency (#Articles)	Type	Determined	References
Growth	Sales growth	12	financial	obj/subj	Brinckmann et al. (2011), Deligianni et al. (2017), Fultz and Hmieleski (2021), Hormiga et al. (2011a, 2011b), C. Lee et al. (2001), Li and Atuahene-Gima (2001), Peña (2002), Ruiz-Jiménez, J. M. and Ruiz-Arroyo, M. and del Mar Fuentes-Fuentes, M. (2021), Stam and Elfring (2008), Vissa and Chacar (2009), and Zahra et al. (2000)
	Employment growth	10	non-financial	obj/subj	Beckman (2006), Brinckmann et al. (2011), Chatterji et al. (2019), Fultz and Hmieleski (2021), Hmieleski et al. (2012), Peña (2002), Ruiz-Jiménez, J. M. and Ruiz-Arroyo, M. and del Mar Fuentes-Fuentes, M. (2021), Schlichte et al. (2019), Siegel and Wessner (2012), and Stam and Elfring (2008)
	Profit growth	4	financial	obj/subj	Deligianni et al. (2017), Hormiga et al. (2011a), Li and Atuahene-Gima (2001), and Peña (2002)
	Market share growth	3	non-financial	obj/subj	Deligianni et al. (2017), Li and Atuahene-Gima (2001), and Zahra et al. (2000)
	Revenue growth	3	financial	objective	Baron and Hannan (2002), Ensley and Hmieleski (2005), and Hmieleski et al. (2012)
	Customer growth	1	non-financial	subjective	Ruiz-Jiménez, J. M. and Ruiz-Arroyo, M. and del Mar Fuentes-Fuentes, M. (2021)
Profitability	Return on investment	5	financial	obj/subj	Hormiga et al. (2011b), Li and Atuahene-Gima (2001), Podoynitsyna et al. (2013), Ruiz-Jiménez, J. M. and Ruiz-Arroyo, M. and del Mar Fuentes-Fuentes, M. (2021), and L. Z. Song et al. (2010)
	Net profit	4	financial	subjective	Chen (2009), Deligianni et al. (2017), Fultz and Hmieleski (2021), and Stam and Elfring (2008)
	Return on assets	4	financial	subjective	Chen (2009), Hormiga et al. (2011a, 2011b), and Li and Atuahene-Gima (2001)
	Return on equity	3	financial	obj/subj	Deligianni et al. (2017), Ruiz-Jiménez, J. M. and Ruiz-Arroyo, M. and del Mar Fuentes-Fuentes, M. (2021), and Zahra et al. (2000)
	Gross profit	2	financial	subjective	Fultz and Hmieleski (2021) and Stam and Elfring (2008)
	EBITDA	1	financial	objective	Cacciolatti et al. (2020)
	Profit break-even (bi)	1	financial	objective	Stucki (2014)
	Return on sales	1	financial	subjective	Li and Atuahene-Gima (2001)

(Continued)

Funding	Total funding amount received	7	financial	objective	Croce et al. (2018), de Mol, E. and Cardon, M. S. and de Jong, B. and Khapova, S. N. and Elfring, T. (2020), Gaule (2018), Gloor et al. (2020), Roche et al. (2020), Schlichte et al. (2019), and Yua (2020)
	Funding received (bi)	5	non-financial	objective	Beckman et al. (2007), Croce et al. (2018), Roche et al. (2020), Santos and Cardon (2019), and Woolley and MacGregor (2021)
	Follow-on funding (bi)	1	non-financial	objective	Croce et al. (2018)
	2nd funding round (bi)	1	non-financial	objective	Ter Wal et al. (2016)
	Time to first VC funding	1	non-financial	objective	Beckman and Burton (2008)
	Number of funding rounds	1	non-financial	objective	Schlichte et al. (2019)
	Liquidity Event Acquisition (bi)	5	non-financial	objective	Gaule (2018), Hong et al. (2020), Humphery-Jenner and Suchard (2013), Roche et al. (2020), and Yua (2020)
	IPO (bi)	5	non-financial	objective	Beckman et al. (2007), Gaule (2018), Hong et al. (2020), Humphery-Jenner and Suchard (2013), and Roche et al. (2020)
	Probability of IPO	2	non-financial	objective	Baron and Hannan (2002) and Croce et al. (2018)
	Time to IPO	2	non-financial	objective	Baron and Hannan (2002) and Beckman and Burton (2008)
Size	Annual sales	11	financial	obj/subj	Chen (2009), Deligianni et al. (2017), Gao et al. (2010), Gloor et al. (2020), Hormiga et al. (2011a, 2011b), S. Lee (2022), Li and Atuahene-Gima (2001), Siegel and Wessner (2012), Söderblom et al. (2015), and M.-C. Wang and Chen (2016)
	Number of employees	1	non-financial	objective	Santos and Cardon (2019)
Survival	Survival (bi)	5	non-financial	objective	Chatterji et al. (2019), Santos and Cardon (2019), Stucki (2014), Woolley and MacGregor (2021), and Yua (2020)
	Probability of survival	1	non-financial	objective	Baron and Hannan (2002)
Efficiency	Asset turnover ratio	1	financial	objective	Gloor et al. (2020)
	Operational efficiency	1	financial	subjective	Li and Atuahene-Gima (2001)
	Sales per employee	1	financial	objective	Hmieleski and Cole (2022)

(Continued)

Operational non-financial & objective	Number of patents	1	non-financial	objective	Roche et al. (2020) and Siegel and Wessner (2012)
	Customer retention rate	1	-	-	Podoynitsyna et al. (2013)
	Number of copyrights	1	-	-	Siegel and Wessner (2012)
	Number of licensing agreements	1	-	-	Siegel and Wessner (2012)
	Number of trademarks	1	-	-	Siegel and Wessner (2012)
	Time to product shipment	1	-	-	Beckman (2006)
	Web traffic	1	-	-	Yua (2020)
non-financial subjective	Market share	3	non-financial	subjective	Chen (2009), Fultz and Hmieleski (2021), and Stam and Elfring (2008)
	Attainment of goals	2	-	-	Hormiga et al. (2011a, 2011b)
	Development speed	2	-	-	Fultz and Hmieleski (2021) and Stam and Elfring (2008)
	Product innovation	2	-	-	Fultz and Hmieleski (2021) and Stam and Elfring (2008)
	Customer satisfaction	1	-	-	Stam and Elfring (2008)
	Product quality	1	-	-	Stam and Elfring (2008)
Other	Business Plan Quality	1	non-financial	subjective	de Mol, E. and Cardon, M. S. and de Jong, B. and Khapova, S. N. and Elfring, T. (2020)
	Cost control	1	financial	subjective	Stam and Elfring (2008)
	Credit rating	1	financial	objective	Cacciolatti et al. (2020)
	Founder satisfaction	1	non-financial	subjective	Hormiga et al. (2011a)
	Meeting economic goals	1	financial	objective	L. Z. Song et al. (2010)
	Net cash flow	1	financial	objective	Ensley and Hmieleski (2005)
	Operating cash flow	1	financial	subjective	Li and Atuahene-Gima (2001)
	Overall reputation	1	non-financial	subjective	Li and Atuahene-Gima (2001)
	Program graduation	1	non-financial	objective	Gao et al. (2010)
	Receipt of government grants (bi)	1	non-financial	objective	Woolley and MacGregor (2021)
	Team performance	1	non-financial	subjective	Santos and Cardon (2019)
	Years of operation	1	non-financial	objective	Santos and Cardon (2019)

Note. References in the rearmost column were underlined if the corresponding metric was subjectively captured in them.

Accounting measures

Accounting measures are one of the most widely used tools for measuring organizational performance and are based primarily on financial information, as found in the financial statements of a company (Carton & Hofer, 2006). Despite their supposedly low informative value for the success of start-ups they were found to be of recognizable relevance within the sample reviewed (Guo et al., 2021). Accounting measures can be further divided into profitability, size as well as efficiency measures (Carton & Hofer, 2006).

Profitability measures include all metrics that provide insights into whether and to what extent a start-up is able to generate financial gains (Carton & Hofer, 2006). Especially in entrepreneurship research, their relevance for measuring the success of a start-up is often debated and questioned, as start-ups are rarely profitable in the first years of operation. Technology-based start-ups in particular usually have to reach a specific size before they can generate their first profits (Guo et al., 2021; C. Lee et al., 2001). Profitability measures that were observed particularly frequently within the reviewed sample were ROI, net profit and ROA. However, these were rarely used as objective values, but were mainly obtained subjectively.

Size measures provide information about the scale of a start-up. Compared to growth measures, these are usually absolute instead of relative or percentage values. Typical size indicators are total sales, the number of employees or the available assets of a start-up.

In empirical research, it is recommended to use size measures mainly as control variables (Carton & Hofer, 2006). However, in the sample studied, total annual sales in particular was comparatively often considered as the dependent variable.

Efficiency measures cover all variables and metrics that demonstrate how well a start-up uses its resources. They often contrast the generated outcome of a start-up such as sales, turnover, or profit with the resources available or deployed. Resources can be both financial and non-financial. They can range from specific assets, such as a start-up's funding or cash to the number of existing employees. Therefore, efficiency measures can also contain non-accounting information that cannot be retrieved from the financial statements of a start-up (Carton & Hofer, 2006; Gloor et al., 2020).

One drawback of efficiency measures is that they are difficult to compare between different start-ups and industries, as efficiency is often defined differently depending on industry and company-specific factors (Carton & Hofer, 2006).

Funding measures

Funding measures include all variables and metrics that provide insight into how capable a start-up is at attracting financial resources from external investors. They mostly refer to funding from venture capital firms as these represent one of the most important outside sources of financing for start-ups (Gloor et al., 2020; Kolokas et al., 2020; Söderblom et al., 2015). Two funding measures that were used extensively across the 42 studies reviewed were total funding amount received and a binary variable indicating whether funding was received at all.

Funding measures are increasingly used to measure start-up success because of the positive implications of external financing for a startup's development and performance. Empirical research shows that start-ups backed by venture capital firms demonstrate significant superiority in areas such as growth, innovation, efficiency, productivity, and product development speed (Chemmanur et al., 2011; Dutta & Folta, 2016; Gloor et al., 2020; Spender et al., 2017). The ability to attract funding from venture capital firms can thus be critical to the survival of a start-up and its long-term success (Alexy et al., 2012; Audretsch et al., 2012; Beckman et al., 2007; Shane & Stuart, 2002). Especially high-tech start-ups usually need multiple rounds of funding within a relatively short period of time for the development as well as commercialization of their products and services (Schlichte et al., 2019; Ter Wal et al., 2016). Funding measures are also commonly applied, as the receipt of funding is considered an important milestone for a start-up, signaling the confidence of external investors and the start-up's progress (Beckman & Burton, 2008; Shane & Stuart, 2002; Woolley & MacGregor, 2021). Moreover, most funding variables can be compared across industries and are accessible online through public websites and company databases such as Crunchbase (de Mol, E. and Cardon, M. S. and de Jong, B. and Khapova, S. N. and Elfring, T., 2020; Ter Wal et al., 2016; Woolley & MacGregor, 2021; Yua, 2020).

Operational measures

Operational measures mainly comprise variables depicting the non-financial outcomes of a start-up and can vary depending on the industry (Carton & Hofer, 2006; Gerschewski & Xiao, 2015). They can range from the satisfaction of specific stakeholders such as customers and employees to concrete market share or productivity measures (Fultz & Hmieleski, 2021; Gerschewski & Xiao, 2015; Hult et al., 2008; Stam & Elfring, 2008). While many of these measures can be objectively captured a large proportion of operational measures are often based on the assessments of selected respondents, such as internal decision-makers of a start-up or certain experts (Carton & Hofer, 2006).

Operational measures are mostly used as a complementation for accounting-based measures because they can capture future opportunities and success potential that has been generated but is not yet evident in financial measures (Gerschewski & Xiao, 2015; Kaplan & Norton, 1992). However, one downside of these measures is that they are rarely comparable across industries and their significance must be viewed critically due to their often difficult-to-quantify nature (Carton & Hofer, 2006).

Liquidity event measures

Liquidity event measures indicate whether or how quickly a start-up was able to liquidate its assets and distribute them to stakeholders as part of a liquidity event such as an IPO or acquisition by another company (Beckman & Burton, 2008; Hong et al., 2020; Roche et al., 2020; Yua, 2020). Alternatively, they can also show how likely a liquidity event is to occur in the future (Croce et al., 2018). Liquidity event measures, which were used particularly often in the sample studied, were two binary variables used to capture whether a start-up experienced an IPO or an acquisition.

Those measures are often chosen as an indicator for final success, as they allow to compare the success of start-ups from different industries and a liquidity event can be an important milestone, especially for start-ups funded with venture capital (Beckman & Burton, 2008; Beckman et al., 2007; Roche et al., 2020).

Survival measures

Survival measures provide information about the survival and survivability of a start-up. Thus, they usually indicate whether a start-up still exists and continues its business activities within a predefined period of time. In this context, the failure of a start-up is usually equated with its closure (Richard et al., 2009; Witt, 2004). Within the sample studied, the most frequent survival measure was a binary variable, denoting whether a start-up survived after a certain time.

Since start-ups usually have to overcome numerous challenges such as liability of newness or smallness, the probability of survival is often very small (Shane, 2009; Soto-Simeone et al., 2020). Technology-based start-ups in particular have comparatively low survival rates, which is why survival can be a meaningful sign that a company is developing positively and can adapt appropriately to the needs of its market (Carton & Hofer, 2006; M. Song et al., 2008). Therefore, survival measures are mostly used as indicators of success, since the survival of a start-up can signal success in other measurement dimensions and, moreover, collecting data for these measures is comparatively easy (Chatterji et al., 2019; Richard et al., 2009; Witt, 2004; Woolley & MacGregor, 2021). These measures, however, are often associated with methodological hurdles in terms of determining an appropriate observation period and distinguishing between different types of company closures (Richard et al., 2009; Witt, 2004; Woolley & MacGregor, 2021). The closure of a start-up does not necessarily mean its failure, as a closure is not always insolvency-related, but can also be the result of a positive event such as a successful acquisition by another company (DeTienne et al., 2015; Fortune & Mitchell, 2012; Richard et al., 2009; Wennberg et al., 2010). Therefore, a distinction must be made between positive and negative closure (Woolley & MacGregor, 2021). Complementing this, Trailer et al. (1996) note that survival does not always mean success, as a venture can continue to exist despite poor performance.

2.4.4. Measurement preferences

To obtain a more holistic overview of success measurement in the scientific literature, the exact measurement behavior across the selected 42 articles was investigated. The corresponding results are presented in this chapter.

Variety of measures and dimensions of success

According to Gerschewski and Xiao (2015), a combination of different types of metrics from different measurement dimensions should be used to measure performance. This multi-dimensional measurement approach has also been recommended by a variety of other researchers in the field of performance and success measurement (Hult et al., 2008; Richard et al., 2009; Stam & Elfring, 2008; Wiklund & Shepherd, 2005). Within the sample studied, an average of three measures were used to evaluate success (see Figure 5). About 60% of the articles used three or fewer of the measures listed in Table 8.

Figure 6 presents how often a certain number of dimensions was examined in the sample.

About 69% of the sample considered a maximum of two different dimensions when measuring success. One third (33%) focused on only a single dimension. The highest number of measures and dimensions were observed in studies that used subjective measures of success (Fultz & Hmieleski, 2021; Hormiga et al., 2011a).

Subjective and objective measures

In performance research, a distinction is made between objective and subjective measures (Richard et al., 2009; Ruiz-Jiménez, J. M. and Ruiz-Arroyo, M. and del Mar Fuentes-Fuentes, M., 2021; Stam & Elfring, 2008). Subjective measures are determined with the help of subjective assessments by selected respondents. Objective measures, in contrast, originate from objective sources, such as, for example, accounting systems, financial statements or alternatively self-reports within surveys (Richard et al., 2009). Subjective measures are particularly useful for examining non-financial dimensions of start-up success and offer more flexibility than objective measures (Richard et al., 2009; Ruiz-Jiménez, J. M. and Ruiz-Arroyo, M. and del Mar Fuentes-Fuentes, M., 2021; Stam & Elfring, 2008). Empirical studies have shown that subjective measures correlate significantly with objective ones and thus can be considered sound measures when used appropriately (Fultz & Hmieleski, 2021; Wall et al., 2004). However, they can be more susceptible to bias and error and therefore subjective measures are often supplemented by objective measures (Deligianni et al., 2017; Li & Atuahene-Gima, 2001; Richard et al., 2009). Within the sample studied, a preference for objective measures was evident (see Figure 7).

About 74% of the 42 reviewed articles exclusively deployed objective measures for measuring success. Only eight

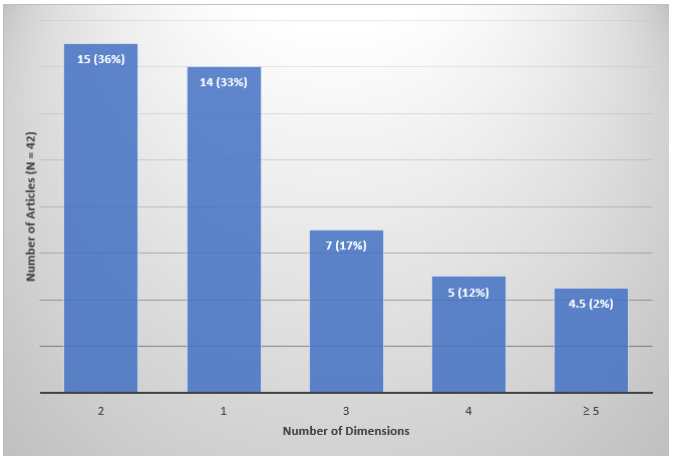

Figure 5: Number of success dimensions considered in empirical Studies

Note. Based on Table 8 and Appendix A3, total N = 42 (research articles).

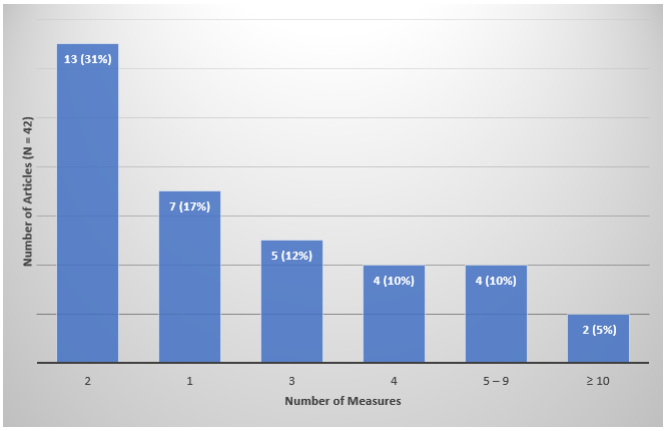

Figure 6: Number of used Success Metrics in empirical Studies

Note. Based on Table 8 and Appendix A3, total N = 42 (research articles).

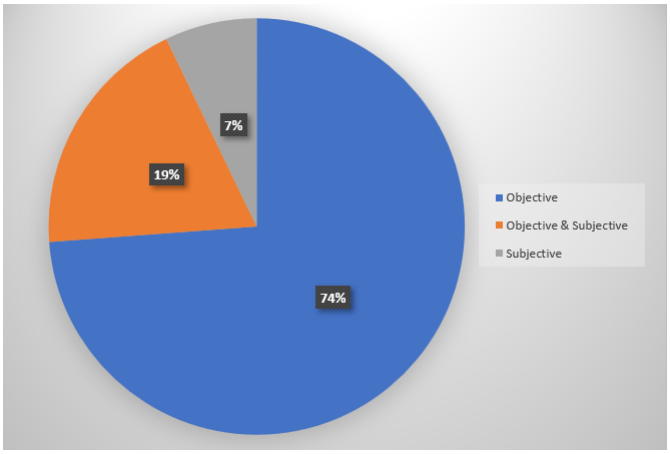

Figure 7: Usage of Subjective and Objective Measures in empirical Studies

Note. Based on Table 8 and Appendix A3, total N = 42 (research articles).

studies (19%) used a combination of objective and subjective measures.

Financial and non-financial measures

Financial measures such as accounting metrics are often used as a measurement tool to assess whether a company has been able to achieve its economic goals (Gerschewski & Xiao, 2015). However, it is increasingly recommended that these are complemented by non-financial measures such as operational metrics, since financial measures alone often fail to capture important components of success (Gerschewski & Xiao, 2015; Kaplan & Norton, 1992; Laitinen, 2002). Figure 8 illustrates the frequency of use of financial and non-financial measures in the sample studied.

The majority of the sample (62%) used a combination of financial and non-financial measures to depict success. However, still more than one fifth of the sample (21%) examined success only at the financial level.

2.4.5. Success measurement across different start-up stages

The definition of success may differ depending on the stage of a start-up's development. That is there can also be differences in how success is measured across different development stages (Brush & Vanderwerf, 1992; Chandler & Hanks, 1993; Witt, 2004). Start-ups in a very early stage, for example, rarely have a product that can be commercialized and therefore usually do not generate any revenue or sales. Financial metrics are therefore not suitable for measuring the success of such ventures. In general, it is usually hard to capture the success of a very young early-stage start-up using quantitative metrics (de Mol, E. and Cardon, M. S. and de Jong, B. and Khapova, S. N. and Elfring, T., 2020; Witt, 2004). According to the explanations of Witt (2004) and the measurement decisions observed in the 42 selected articles, all identified measures as well as measure types were assigned to the four development phases of a start-up (see Figure 9).

3. Empirical Research – Practitioners' Perspective

This study examines how start-up success is defined and measured among venture capitalists. By doing so, it aims to capture the practitioners' perspective on the central research question to complement the academics' view and gain a more comprehensive understanding of how start-up success is measured. The primary focus of the study is specifically on very young early-stage start-ups as these were only marginally represented in the literature review. However, success measurement in this phase represents an important object of investigation for this thesis since success in the early days of a start-up is comparatively difficult to measure (de Mol, E. and Cardon, M. S. and de Jong, B. and Khapova, S. N. and Elfring, T., 2020; Witt, 2004).

3.1. Research Methodology

A qualitative research design was used to gain an in-depth understanding of the views and opinions of the selected practitioners (Patton, 2002). Specifically, semi-structured expert interviews were employed to obtain information-rich insights, and to complement the literature review previously conducted (Flick, 2009).

3.1.1. Participant Sampling

Within a start-up ecosystem, there is a wide range of different participants in diverse roles, who moreover tend to have varying areas of responsibility and objectives (Cukier & Kon, 2018; Kiviluoto, 2013; Tripathi et al., 2019). It is hardly feasible to sufficiently capture the views of all relevant groups of practitioners in such an ecosystem. For this reason, this study focuses exclusively on one group of practitioners that was deemed to be particularly important within a start-up ecosystem: venture capitalists. This group of practitioners was chosen because the venture capital field can have a significant impact on the success of start-ups and venture capitalists may have valuable expert knowledge about the topic of success measurement gained from working with diverse types of start-ups (Alexy et al., 2012; Beckman et al., 2007; Gloor et al., 2020; Hall & Hofer, 1993; Maula et al., 2005). It has therefore been assumed that venture capitalists, because of their extensive experience with and knowledge of start-ups, can be considered experts whose knowledge, despite their mostly financial intentions, can potentially compensate for the lack of other practitioners' perspectives (Davila et al., 2003).

To determine an appropriate sample of respondents with a high degree of knowledge about the topic of interest, a multi-stage sampling process was conducted. First, based on the explanations of Patton (2002), purposeful sampling, specifically criterion sampling was used to identify a sample of 22 early-stage venture capital funds. For this, the LinkedIn database was used. The selection of VC companies was based on three different criteria. To be included in the sample, a VC firm had to (1) be headquartered in Europe or the UK, (2) have a special focus on for-profit early-stage technology start-ups respectively pre-seed and seed investments and (3) have a minimum number of 15 start-ups in its portfolio. Subsequently, based on three criteria, more than 57 experts were identified within the selected VC companies and contacted via LinkedIn. According to (Singh, 2015), an expert should have proven domain knowledge and experience in the relevant research domain. To be considered an expert, a potential interview participant therefore had to (1) work at a VC fund in an investment-driven position, (2) work primarily with early-stage start-ups, and (3) be active in venture capital for at least 1.5 years and/or demonstrate comparable experience with start-ups. The sampling and contacting process resulted in a final sample of seven experts from seven different early-stage VC funds with an average VC experience of more than three years.

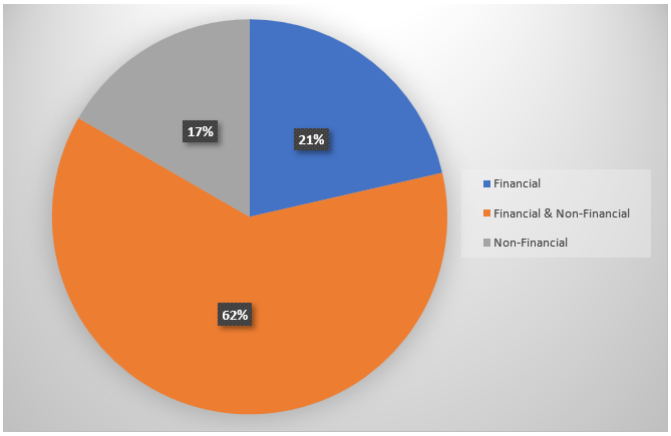

Figure 8: Usage of Financial and Non-financial Measures in empirical Studies

Note. Based on Table 8 and Appendix A3, total N = 42 (research articles).

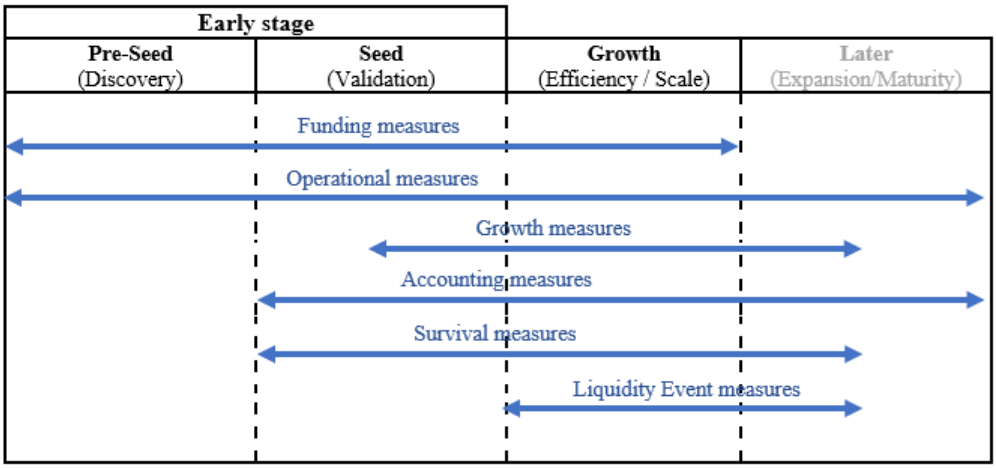

Figure 9: Success Measures across Development Stages

Note. Based on Table 8 and Appendix A3, later stage start-ups were hardly represented within the reviewed studies.

3.1.2. Data Collection

To gain a better understanding of the phenomenon of start-up success and how it is measured, seven semi-structured expert interviews were conducted with seven selected early-stage venture capitalists. An overview of these is provided in Table 9. The interviews were carried during the period of June 21-29, 2022, using the video-chatting service Google Meet, and lasted between 19 and 28 minutes, with an average duration of approximately 24 minutes. Additionally, a two- to three-minute introduction to the research was given prior to each interview.

It was decided to use semi-structured interviews to be able to elaborate on the respondents' statements and to give them the opportunity to shape the conversation themselves. This was intended to contribute positively to the substantive scope of the interviews (Singh, 2015). To allow for more consistency between interviews and completeness of content, an interview guide with key questions was created (see Appendix A4). This guide was based on the academic literature previously reviewed and was validated beforehand through a test interview with a venture capitalist from the author's network. Furthermore, the interview guide was divided into three consecutive phases, whereby in each phase it was ensured that open-ended questions were used to minimize biases (Singh, 2015). In the first phase, an attempt was made to obtain an overview of the respondent and its areas of responsibility. In the second phase, the expert was asked to conceptualize the concepts of "start-up" and "start-up success". The definitions of these key constructs were then used as a transition for the third phase, which specifically focused on success measurement. If requested, participants were provided with the prepared interview guide prior to the interview. The interviews conducted were audio recorded using software integrated into the author's laptop. Each respondent approved this recording with a prior signature of a con-

Table 9: *Overview of Interviewed Experts*

Expert	Expert's role	Investment focus	Interview duration	Interview date
E1	Investment Analyst	pre-seed	23:52	21.06.2022
E2	Investment Associate	pre-seed	24:57	23.06.2022
E3	Managing Director	early-stage	19:03	23.06.2022
E4	Investment Manager	pre-seed to seed	24:04	24.06.2022
E5	Senior Associate	early-stage	28:35	24.06.2022
E6	Investment Analyst	early-stage	23:05	24.06.2022
E7	Partner	early to growth stage	24:33	29.06.2022

firmation of consent as well as a second verbal confirmation before the start of the interview.

3.1.3. Data Analysis

After the data collection was completed, a thematic analysis was conducted following the phases and specifications of Braun and Clarke (2006). Table 10 (Braun & Clarke, 2006, p.87) illustrates the specific phases that were followed.

First, the audio recordings of each interview were reviewed and transcribed verbatim (see Appendix B for entire interview transcripts). Specifically, an intelligent verbatim transcription was performed to make the spoken text more readable. Thereby, all types of identifiers such as names, specific job titles, and the like were omitted to ensure the anonymity of interview participants. Finally, all interviews conducted in German were translated into English by using the neural machine translation software DeepL. To distinguish the individual interviews from each other in the further process, each expert was assigned a unique identifier (E1-E7). After the transcription, the interview data were coded using the data analysis software ATLAS.ti. Codes were defined inductively and then assigned to predefined as well as inductively determined themes. The final coding scheme is presented in Table 11.

3.2. Venture Capitalists' View of Success

3.2.1. Definitions of start-up success

At the beginning of the interview, the study participants were asked what they considered to be a start-up and when they considered a start-up to be successful. Start-ups were primarily described as young, innovative growth companies that often have a specific technology focus and are usually VC funded (see Appendix A5). To define a successful start-up, some of the respondents incorporated different perspectives and emphasized the different meanings of success to different viewers. Thus, three definitions of success emerged as seen in Table 12.

Contributing to the fund's performance: Four venture capitalists defined success in terms of their fund's financial goals. They described a successful start-up as one that contributes significantly to the fund's return. For example, one respondent stated: "*With the VC fund, it is relatively clear to achieve high valuations quickly.* (E3)". This statement was confirmed by another interviewee, again highlighting the importance of high valuations for the fund's viability and continued existence:

> *Speaking as a VC, the start-up has to be a unicorn. I mean we have 99 percent write-offs until we pay back our fund. [...] If we get our money back a hundred or two hundred times with a company, then that's enough to pay back the entire fund.* (E2)

Creating added value and generating profits: By taking a less investment-oriented perspective, some of the respondents came to the conclusion that a start-up is successful if it creates real value for customers while achieving a good financial performance and eventually profitability. One respondent pointed out that this should be the ultimate goal of a start-up:

> *[...] that the start-up manages to translate this growth potential into a sustainably functioning business model and bring innovative solutions to the market that customers can then benefit from. That would be the goal for me. That's how I would define success*. (E1)

Proving the viability of the company: Two venture capitalists further considered it a success if a start-up can overcome certain stage dependent hurdles and reach its milestones, proving that it is viable:

> *The way I think about things is maybe: "What is meaningful signal for a company to prove risks of that company that it's viable?" [...] But I think it comes back to just really thinking about what are the big milestones to prove as a company and where they are that in that journey [...].* (E5)

Table 10: *Overview of Interviewed Experts*

Phase	Description of the process
1. Familiarizing yourself with your data	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
2. Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
4. Reviewing themes	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
5. Defining and naming themes	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
6. Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

Note. From Braun and Clarke (2006)

Table 11: *Interview Coding Scheme*

First-order codes	Second-order themes	Aggregated Thematic Domains
• Contributing to the fund's performance • Creating added value and generating profits • Proving the viability of the company	Definition of start-up success	VCs' view of start-up success
• Being able to attract good investors • Getting closer to product-market fit • Making rapid progress in the right direction	Definition of start-up success in the early stage	
• Success as multi-dimensional construct • Success as context-specific construct	Success as a complex construct	
• Development stage • Business model • Product • Business type	Measurement influencing factors	Measuring start-up success in early stages
• Direct statements • Indirect statements	Lack of data	
• Traction • Product & engagement • Team & organization • External Validation • Other measures	Preference for operational metrics	
• Traction metrics	Traction metrics	
• Product metrics • Engagement metrics	Product & engagement metrics	
• Arguments in favor of growth measures • Arguments against growth measures	Rapid growth	Assessing the significance of growth & funding
• Arguments in favor of funding measures • Arguments against funding measures	Receipt of equity funding	

Table 12: *Respondents' Definitions of Start-up Success*

Success is identified as	**Respondents' Statements**
Contributing to the fund's performance	• *For us, from a pre-seed fund standpoint, I would say success is classified as, "You manage to raise a strong next round." [...] Then later on, again, the question will come whether you go for an IPO or whether you try to sell that or sell individual shares.* (E1) • *Speaking as a VC, the start-up has to be a unicorn. I mean we have 99 percent write-offs until we pay back our fund. You can do that if a start-up really increases its value at least a hundredfold from our point of view or increases our value in the company a hundredfold. If we get our money back a hundred or two hundred times with a company, then that's enough to pay back the entire fund.* (E2) • *It is different from the accelerator to the VC fund. With the VC fund, it is relatively clear to achieve high valuations quickly.* (E3) • *From an investor's perspective, it is often said that a start-up is successful as soon as it raises a lot of venture capital.* (E6)
Creating added value and generating profits	• *[...] that the start-up manages to translate this growth potential into a sustainably functioning business model and bring innovative solutions to the market that customers can then benefit from. That would be the goal for me. That's how I would define success.* (E1) • *We are a financial investor, which means we naturally look at the figures and then you can define success on the basis of traction, sales, revenue, growth. [...]Only if the product is good and successful, creates added value and has a market demand, then that naturally results in positive financial KPIs, which are then again defined with success. [. . .] or a financial investor, success is really defined by revenue and growth [. . .].* (E4) • *[. . .] but for me to really call a company successful, it either has to have a very clear path to profitability that I find credible or actually have already achieved profitability.* (E6)
Proving the viability of the business	• *The way I think about things is maybe: "What is meaningful signal for a company to prove risks of that company that it's viable?" [...] But I think it comes back to just really thinking about what are the big milestones to prove as a company and where they are that in that journey [...]* (E5) • *I think a successful start-up is a company that is young, as I said, and relatively new to the market with a new business model, with a new product, with a new service, whatever, and has proven that there is a product market fit. And, that the company is growing.* (E7)

3.2.2. Success in the early stage

After explaining what they understood by a successful start-up, the interview participants were asked for their definition of success in the case of an early-stage start-up. Although respondents had a relatively similar understanding of what an early-stage start-up is (see Appendix A6), a definition was previously provided to ensure a consistent understanding of this term. Again, three major definitions of success became apparent as seen in Table 13.

Being able to attract good investors: One theme that came up frequently in the context of early-stage success was raising additional funding. Three of the respondents considered it a clear success if a start-up was able to raise further rounds of financing from attractive investors following their initial investment. Respondent E1 made this particularly clear:

> *For us, from a pre-seed fund standpoint, I would say success is classified as, "You manage to raise a strong next round." [...] for us, really, the most important thing is that they manage to raise a strong follow-on round. [...] For really early stage, pre-seed start-ups, I would say very clearly: a strong follow-on round with prominent investors.* (E1)

Getting closer to product-market fit: Some respondents considered it a particular early-stage success when a start-up shows early signs of a so-called product-market fit. This was seen as a clear indication that the company is developing positively:

> *In principle, whenever you have at least five customers who are really convinced of your solution. [. . .] then you can perhaps also, although you still have few customers and are still at an early stage,*

Table 13: *Respondents' Definitions of early-stage Start-up Success*

Success is defined as	Respondents' Statements
Being able to attract good investors	• *For us, from a pre-seed fund standpoint, I would say success is classified as, "You manage to raise a strong next round." [...] for us, really, the most important thing is that they manage to raise a strong follow-on round. [...] For really early stage, pre-seed start-ups, I would say very clearly: a strong follow-on round with prominent investors.* (E1) • *It's all very individual. What's also a success criterion is, are you getting relevant investors? Do you have the ability to sell that well? Do people believe in you? That's also super important to measure success. For our start-ups, the external validation. Does anyone else believe in that? If so, how good are they, how much value do they bring?* (E2) • *It's great if they manage to achieve a high valuation or a higher valuation, and if they still manage to attract attractive investors.* (E3)
Getting closer to product-market fit	• *I think in the early stage, it's successful if you can see that they're moving in the right direction. [...] Are you getting closer to this product market fit? That is interconnected with the metrics that you map at the end. Do they grow and do you get a benchmark somewhere where you can say, "this is getting closer and closer to a product market fit".* (E2) • *[...] it gets back to that question of like, what's the signal of the company? What are the actual key risks? And so, you know, as I said, if you look at a company, and you might look at a company. The risk here is that even if you build it, it won't be valuable. And so, if they're in that part of the journey, where they've got to a stage where they have built it, and they've got it out in the market, and people are using it, and you know that it's not exciting people and retention numbers aren't going well, then they probably haven't proven the market risk attribute level. Like we're not even getting to business risks, yet. They haven't been able to prove the market risk. Maybe they've proven the product risk, they could build product. But the market risk is now kind of gone.* (E5) • *In principle, whenever you have at least five customers who are really convinced of your solution. There is the classic product-driven question "How bad would you feel or how unsatisfied would you be if our product were no longer available to you overnight?" and if a certain percentage then really says "on a scale of 1-10, it's an 8" then you can perhaps also, although you still have few customers and are still at an early stage, very strongly assume that it is a very good product and they must be close to product market fit. And accordingly, that would be one of the main success metrics.* (E6)
Making rapid progress in the right direction	• *I think in the early stage, it's successful if you can see that they're moving in the right direction. Now that's a super big question because it's a case-by-case decision. I think if you see the team manages to develop the product very quickly in one direction and add more and more features and be more and more responsive to customer needs, I think that's relatively important on the product side. If they can iterate quickly, execute quickly. Then, on the traction side, we want to see that it's going in the right direction, that they're gaining more and more customers, that they're staying longer, that they're slowly paying for it.* (E2) • *[...] they are successful...if they are naturally in our portfolio, we assume for the time being that they will continue to grow and can act positively in the market environment. [...] Success is when the team is well established, when a good organization is built up after our investment, [...] a team that is resistant to such downs when things don't go so well. They have a strong team, they can successfully deal with those problems, find solutions and move on. [...] and if they have a sales structure, that they have a strong funnel, that they can successfully convert customers from first approach into paying customers. [...] The product has to be successful. That has to offer the features and the services and solutions that are promised, that we've invested in. [...] Revenue growth over month above 10 percent is always successful for me. On the other hand, it can also be successful if it responds to market events and has to pivoted if necessary, product has to be adapted. That's what I meant at the beginning with "resistant to adversities that occur" [...].* (E4)

(Continued)

	• *I think you look very much in phases [...] in which you set milestones [...] Where you look at okay, where are we today? What is our plan? Where do we want to go? And then you look, are we achieving these goals, yes or no? [...] And I think that's when you realize you're on a good path. And honestly, in an early phase, goals often change, because you go to the market with hypotheses. It's a very iterative process. Sometimes you realize okay, the hypothesis that we have set up is maybe not quite right, maybe we need to tweak the product a little bit, adjust it so that we get in the direction of product market fit. [...] That is, you may no longer be running exactly in the direction that you set as your goal six months ago, but you are still on the right path [...] that's how I would define success. [...] Are you getting closer to your goals in the planned horizon [...]* (E7)

> *very strongly assume that it is a very good product, and they must be close to product market fit.* (E6)

Consistent with E6's statement, E7 considered an increasing use of the product as a meaningful sign of product-market fit. Furthermore, E7 defined product-market-fit as a state in which there is a pull effect from the market, i.e., customers actively demand a startup's products without the company having to draw their attention to them.

Making rapid progress in the right direction: Furthermore, a very young start-up was considered successful if it makes rapid progress and develops positively in various business dimensions. Particular relevance was attributed to the product and customer side and the team:

> *I think if you see the team manages to develop the product very quickly in one direction [...] I think that's relatively important on the product side. [...] we want to see that it's going in the right direction, that they're gaining more and more customers, that they're staying longer, that they're slowly paying for it.* (E2)

In this regard, E7 stated that the progress of a start-up can be primarily assessed by whether the planned milestones have been reached within a specified time horizon. However, E7 also emphasized that these milestones can change very quickly in the early stage.

3.2.3. Success as a complex construct

As respondents engaged in conceptualizing success, it became apparent that they perceived success as a complex, multiform construct that must be considered on multiple dimensions and whose meaning depends on contextual factors (see Appendix A7). For example, one venture capitalist stated: *"Anyone that tries to encapsulate success in one metric is wrong [...] if you're taking one in isolation from these attributes, I think you, you can't get a full picture. (E5)"*.

3.3. Measuring Start-up Success in early stages

3.3.1. Measurement influencing factors

In answering questions about success measurement, four of the interview participants pointed out that the specific metrics choice can vary depending on certain factors. The primary factors mentioned were business type, business model, development stage and the product of the start-up (see Appendix A8). This was again summarized by respondent E7:

> *So, to identify the golden KPI or North Star metric for an early-stage start-up is, I think, difficult, because it depends very much on the business model, is it a B2B or B2C company, the product and the phase.* (E7)

3.3.2. Preference for operational metrics

The respondents' statements highlighted that in the early stages of a start-up's development, there is little to no historical or financial data available to measure success (see Appendix A9). The majority of the venture capitalists therefore emphasized the need for operational metrics:

> *Basically, I think we can probably say that the goals by which one would ultimately define success in the early phase are not so much aimed at financial KPIs, but rather at operational KPIs or other milestones. The older the company, the greater the importance of the financial KPIs.* (E7)

E7 also highlighted that product milestones are particularly important for young start-ups, as the pre-seed and seed phases are primarily about product development and product improvement: *"I'm thinking here of pre-seed, seed companies. It's very much about developing a product, finding product market fit, which then at some point also means having the first customers who use the product. (E7)"*. However, some respondents noted that the early phases are very fluid (see Appendix A10) and there can be a rather quick transition from these operational metrics and product milestones to common metrics such as revenue growth:

> *I think these are the first points that you have to validate so that you are somehow successful and as soon as you have found something there, it's about these revenue metrics. [...] But as soon as [...] that slowly moves in a direction of a growing company, the metrics MRR and revenues are super important. That's a fluid stage [...].* (E2)

Table 14 shows all metrics mentioned in the interviews.

Table 14: *Success Metrics in early Stages*

Metrics	**Respondents' Statements**
Traction	
Number of customers	• *So how much interest is there on the user side? How many customers do they have in the pipeline?* (E1) • *How is your pipeline evolving? [. . .] Then, on the traction side, we want to see that it's going in the right direction, that they're gaining more and more customers [. . .]* (E2) • *[...] That's where I think it's more relevant to say, "have you been able to find paying customers? Yes or no?", [. . .] And then maybe the number and how well you can convert them.* (E6)
Paying customers (bi)	• *Then, on the traction side, we want to see [. . .] that they're slowly paying for it. [. . .]and that you test the willingness to pay. That they are willing to pay a certain price for it.* (E2) • *[...] That's where I think it's more relevant to say, "have you been able to find paying customers? Yes or no?" [. . .]* (E6) • *Usage, so do I have customers who use the product? And ideally, they are also willing to put money on the table.* (E7)
Number of pilot / PoC / development customers	• *I think it's important that you have one, two, three customers that you develop your product with. So the number of POCs is definitely important.* (E2) • *Pilot projects are very helpful. That is, of course, a very good indicator. [...] if they win customers, and paid pilot projects, I always think that's very important. That simply says a lot..* (E3) • *I think of very, very early-stage [...] it is simply more important to find a development customer who wants to use the product and is willing to pay something. [. . .] the first question is "do you find development customers and are they willing to pay for it?"* (E6)
WTP	• *Then, on the traction side, we want to see [. . .] that they're slowly paying for it. [. . .]and that you test the willingness to pay. That they are willing to pay a certain price for it.* (E2) • *[. . .] We also look at willingness to pay, which is also very important, but the first question is "do you find development customers and are they willing to pay for it?"* (E6)
PoC size	• *So the number of POCs is definitely important. How big are the POCs? How big are the departments that are testing the product?* (E2)
Traction vs age	• *There's a dimension that we call "traction versus age." That's always an absolute gut decision, but we try to score how much traction they have now compared to other companies that we see in the portfolio compared to how long they've been in the game.* (E2)
Number of people interested in product	• *Non-financial measures, for example, if you do a closed beta, how many people want to get on your platform? How many people want to use that?* (E1)
Length of sales cycle	• *I think sales cycle is also ultra important in a B2B SaaS. If they get shorter that's always good as well.* (E2)
First CAC	• *Maybe it's not sales and revenue, but it's [. . .] how the first customer acquisition costs are going.* (E4)
Product & Engagement	
Customer Churn	• *And then already the validation. The customers don't churn right away, I think that's important.[. . .] and look at "When are these customers churning? Why are they churning?".* (E2) • *[. . .] churn among customers is of course incredibly important.* (E3) • *And if there is not this churn, it means of course first of all that the product can establish itself or is used.* (E4)

(Continued)

Product development speed	• *And how can the team iterate with the feedback? How quickly can they develop the product? I think that's important. [. . .] even if you can't quantify it, how fast paced are they? [. . .] all that matters to us is growth, speed, and in the beginning you don't have metrics that grow, but can you manage to test your product quickly, iterate. Are you fast there?* (E2) • *product growth. The speed at which iteration takes place, so to speak.* (E6) • *How many sprints can we manage to achieve the goal?* (E7)
Retention rate	• *[. . .] but more non-financial metrics that show engagement. Also, retention rate and things like that. [. . .] How often do they come back?* (E1) • *Then, on the traction side, we want to see that it's going in the right direction, that they're gaining more and more customers, that they're staying longer, that they're slowly paying for it. [. . .] Also super important.[. . .] What is your seven day retention? What is your 30 day retention?* (E2)
Stickiness	• *Otherwise, it's interesting to measure stickiness from a product perspective, for example, using the retention rate.* (E1)
Session length	• *When people are on the platform, how long do they stay? How much time do they spend there?* (E1)
Active users	• *Also super important. How many one active users? How many daily active users? How many weekly active users?* (E2)
Net promoter Score	• *[. . .] and if a certain percentage then really says "on a scale of 1-10, it's an 8" then you can perhaps [. . .] very strongly assume that it is a very good product and they must be close to product market fit. And accordingly, that would be one of the main success metrics.* (E6)
Achievement of product milestones	• *We have defined milestones at product level where we want to get to.* (E7)
Product quality	• *And how well do we deliver on the tech side, on the specifications from the product?* (E7)
Team & Organization	
Team churn	• *It's also important for the team. If you notice that people are always leaving, that's also a huge issue.* (E3) • *What is their employee turnover? How many people leave the company?* (E6)
Achievement of team building or organizational goals	• *[. . .] there are also goals that we usually have that are very strong in terms of team building and organizational development.* (E7)
Team quality	• *Maybe it's not sales and revenue, but it's [. . .] how you build the team and how the first customer acquisition costs are going.* (E4) • *And to qualitatively still people and hiring. Who do they hire? How good are the people they herd, but also the people they have?* (E6)
External Validation	
Ability to attract good follow-on investors (bi)	• *For us, from a pre-seed fund standpoint, I would say success is classified as, "You manage to raise a strong next round." [...] And I would say that very clearly, for pre-seed early stage, a strong follow-on round is actually the most relevant performance indicator.* (E1) • *What's also a success criterion is, are you getting relevant investors?[. . .]* (E2)
Attractiveness for network	• *Then, of course, also attractiveness for the network.* (E3)
Others	
Business plan quality	• *Of course, that's always less numbers driven with pre-seed. [. . .] where we just go really deep is if they can just get a good business plan.* (E3)
Burn rate / runway	• *I think a good indicator of success is also how long or how well they can plan ahead. Start-ups that have to raise three rounds because they didn't manage to pay attention to their runway in the first round is always difficult.* (E3)

3.3.3. Traction metrics

In most of the interviews, one indicator of success was mentioned particularly often: Traction.

Consistent with the statements of the other respondents, E1 defined traction as evidence that users are interested in a start-up's product:

> *In the early stage, it's also always very important for us to see, [...] but simply traction. So how much interest is there on the user side? How many customers do they have in the pipeline? Things like that. traction.* (E1)

Moreover, E2 attributed great relevance to the first signs of traction for early success, as they provide insight into how close a start-up is to potential product-market fit:

> *I think to make this a bit more tangible, the combination of traction compared to age is relatively important, i.e. how quickly do you manage to build up traction, even if these are only the early signs of traction. [...] Are you getting closer to this product market fit?* (E2)

A variety of different metrics were used to measure traction (see Table 14). The most frequently stated indicator was the number of (paying) customers a start-up is able to attract to co-develop the product or conduct a pilot project or proof of concept.

3.3.4. Product and engagement metrics

Besides traction, respondents placed particular emphasis on metrics that provide insight into product progress and user engagement with the product (see Table 14). One product-related measure respondents perceived as very critical was the speed at which a start-up develops its solution. In this regard, E2 argued that even in the early stages, measuring the speed and growth of a startup is essential, but common metrics are rarely available:

> *How quickly can they develop the product? I think that's important. [...] even if you can't quantify it, how fast paced are they? [...] all that matters to us is growth, speed, and in the beginning you don't have metrics that grow, but can you manage to test your product quickly, iterate. Are you fast there?* (E2)

Furthermore, two engagement metrics that came up most often during the interviews were customer churn and user retention. E4 considered the churn rate to be a good indicator that a product is being used sufficiently and is able to succeed in its market.

3.4. Assessing the Significance of Growth & Funding

In academic literature, success has often been measured using growth or funding measures (see Chapter 2.4.2 and 2.4.3). Interview participants were therefore asked for their opinions on the use of these metrics as indicators of success, especially in the early stages of a start-up.

3.4.1. Rapid growth

Although the majority of respondents attributed great importance to growth, only the minority perceived rapid growth as a significant indicator of success as seen in Table 15.

Especially in the early stages, typical growth measures were considered a less meaningful indicator because most very young start-ups are not ready to scale. Furthermore, E1 and E3 attributed significantly more importance to sustainable growth and pointed out that, regardless of the phase, growth alone is not a sufficient measure of success:

> *Just bottomless growth without looking at the costs on the same side is, of course, dangerous. A classic is: The revenue shoots up, but in the same proportion, the costs shoot up, and so you can't build a sustainable, successful business model.* (E1)

3.4.2. Receipt of equity funding

While two respondents considered the receipt of a strong funding round as a clear success, this

potential success indicator was also viewed rather critically as seen in Table 16.

On the one hand, some significance was attached to funding measures, as external financing can be necessary to achieve fast growth , may be an indication of good start-up performance and has the potential to attract further attractive investors. On the other hand, four respondents highlighted the fact that funding is only a means to an end, and it is better to be able to grow quickly even with less equity funding:

> *But I don't think the funding itself is a success at this point. It's actually much better if you can grow quickly with less money. [...] That brings less dilution, more efficient growth, faster profitability, and that's also something that is generally very highly valued by the market.* (E7)

4. Discussion and Implications

Both in research and in practice, special attention is always paid to one particular type of start-ups: successful ones. To date, however, little research has been done on how to measure a start-up's success (Eveleens et al., 2017; Kiviluoto, 2013). This thesis therefore examined what academics as well as practitioners understand by a successful start-up and what they consider to be reliable measures of success. In addition, it outlined the rationale for certain measurement decisions.

The literature analysis shows that researchers from the entrepreneurship and management fields measure the success of a start-up primarily by its growth, profitability, and/or ability to raise rounds of financing. Especially growth and funding measures are considered significant indicators of success, as a large number of empirical studies confirm their relevance for the performance of a start-up (Gloor et al., 2020). However, a handful of authors question the use

Table 15: *Opinions on Growth as an Indication of Success*

Rapid growth ...	**Respondents' Statements**
is success indicator / success	• *[...] even if you can't quantify it, how fast paced are they? At the end of the day, all that matters to us is growth, speed, and in the beginning you don't have metrics that grow, but can you manage to test your product quickly, iterate. Are you fast there? Do you have the right nose? [...] I think that is the main indicator. You just have to look in which dimension growth. Growth in the team. Growth in founder development. Growth in product maturity. Growth in terms of the traction KPIs, but at the end of the day it's all about growth in some dimension.* (E2) • *I think for a start-up and for a financial investor, success is really defined by revenue and growth, especially if the two are related. [. . .] Sales growth is crucial for me. Sales or revenue. That is of course what is important. In the beginning, it's more sales and traction to customers.* (E4) • *Yes, absolutely. In the end, it's always about growth. [. . .] So, financing as fuel, fuel as we say, to accelerate growth, to drive it forward. [...] I would say, it's mre of a means to an end to achieve your actual goals, your actual success* (E7)
to be questioned	• *Of course, it always depends a bit on the business model. What are they trying to sell? Just bottomless growth without looking at the costs on the same side is, of course, dangerous. A classic is: The revenue shoots up, but in the same proportion, the costs shoot up, and so you can't build a sustainable, successful business model. In general, in addition to these growth metrics, I always find it interesting to see whether a product market fit has been achieved in a certain way because you can read off quite well from that or that signals relatively strongly whether sustainable, profitable growth is possible or whether you are simply forced to pump more and more money into marketing in order to keep sales high.* (E1) • *I would rather say sustainable growth. Growth alone is out of the question. Because we have seen that often enough, that companies are taken over very quickly and that then only the figures are polished for the investors. That's why early stage is so difficult, because sustainable growth is usually not yet in there. [...] I don't necessarily believe in rapid growth, but rather in sustainable growth.* (E3) • *There are start-ups where it can be a good indicator. [...]But it's not necessarily like that. When we invest in pre-seed, it's often the case that there are a lot of pilot customers, but that's not converting yet, so they don't have the big sales yet. [...] Then there are other KPIs that are paid attention to. Maybe it's not sales and revenue, but it's the customers you talk to, how you build the team and how the first customer acquisition costs are going. And that's important again on the other side. Sales is an important indicator, but it can also take a back seat in the very early stages.* (E4) • *And you could say it's successful, depending on maybe looking at growth metrics, and a bunch of things. But then you look at a space company, or a biology company or a semiconductor company. The signal for those companies might take a lot more money and a lot more time.* (E5) • *Generally speaking, no. It depends very much on whether it's a business where you know that a lot of human capital will be needed, because it's still a very operations-heavy business. There growth is extremely important [...] That would be growth of people level. If it's a pure B2B SaaS business, it's quite important how many customers can you onboard and sell, so to speak, and then also revenue growth, of course. [...] It is important, but I can't tell you, if it's just about growth in general, which level I would always look at first.* (E6) • *But even in the early stage, there are milestones that make up success before you just get into the growth scaling phase. Probably more product level milestones, organizational milestones, so team building, recruiting relevant positions, roles, product milestones.* (E7)

of growth as a measure of success and state that sustainable growth is a much better indicator of long-term success (Ben-Hafaïedh & Hamelin, 2022). In line with Eveleens et al.'s (2017) suggestion, the reviewed literature also indi-

Table 16: *Arguments for and against Funding as an Indicator of Success*

	Respondents' Statements
Pro	
Enables growth	• *I think that's one of the most valuable indicators.[...] I think funding is definitely a success indicator. If you don't have money, you can't grow.* (E2) • *There are different business models, quick commerce and everything similar just burns an insane amount of money. Of course, you need a different funding level.* (E3) • *[...] Growth stories always mean burning a lot of money.* (E4) • *When it comes to profitability, raising funding allows you to grow much faster [...]* (E6) • *[...] at the end of the day, growth usually costs money somewhere, of course, and especially in the venture area, where it's about rapid growth, about scaling, you need cash [...] So, financing as fuel, fuel as we say, to accelerate growth, to drive it forward. [...] I would say, it's more of a means to an end to achieve your actual goals, your actual success. In that sense, it's also a building block somewhere, a piece of the puzzle of the overall success.* (E7)
Suggests very good performance	• *I would say that it is particularly important for early stage start-ups. Especially because many other KPIs that you would otherwise use are simply not available. [...] And then for us, the first validation that we see is, okay, they manage to raise a strong next round, then that's definitely the most important success characteristic in the stage.* (E1) • *That's a very valuable indicator because you can assess so quickly, what are cases that hit anything. Nerve of the time, good timing, a good market, good product, good team. If they get good investors and raise a stable round, so to speak, then that's the indicator "this can be something".* (E2) • *The investment rounds are a clear indicator of where the company stands. Seed investments usually go up to a maximum of 3 million. [...] From this you can deduce how roughly the company is valued [...] you're in a rage mostly so up to 10 million pre month. That's early and you can actually deduce from that where such a company stands. These are sales of up to one million recurring per year, because in the software sector you can be significantly higher. And if this much revenue is generated, you can deduce approximately, not exactly of course, how many customers there are, how far along the product is and whether the product still needs to be developed further. That's why round size is the decisive factor for me.* (E4) • *So used to series A or Series B very, very hard to raise, and there wasn't that many people in that market, you know, there was 10 firms on Sand Hill Road in SF, and you know, if you got through, that was a real test, and you actually must have proven something.* (E5)
Potentially attracts good follow-on investors (positive signaling)	• *So this signalling is a very important thing. Which investor makes the deal? There's this notion that this is a magnetic industry. Good people track good people. Good investors, good founders, good team, etc. If you have good investors, then again they track the best follow-on investors.* (E2) • *[...] it is a reality that funding can help you a lot in terms of publicity, and then a self-reinforcing circle can form. You have been raised by good investors, you get more publicity. You will also probably find better follow-up investors with a higher likelihood, because it is simply a fact that when investors invest, it is always checked very carefully who invested before What portfolio companies do they have in that area?". Accordingly, yes, relevant.* (E6)
Brings in valuable advisors & partners	• *[...] I think in the early stage it's more important where the money comes from, how much support you get there [...]* (E2) • *But the ideal way is that every 12-24 months a financing round comes along that fits into the equity story, that is significantly better, that more great investors and partners come in that bring added value, in example internationalization or other topics that help [...]* (E4)

(Continued)

Contra	
Lower funding needs may also be due to higher efficiency or more thoughtful funding decisions	• *[...] the important thing is whether you have the right funding for the business model. So rather that the funding matched with what you need. I don't think the amount of funding alone is relevant. [...] But that has to fit your business model, that you don't go back to fundraising every six months, but that there is also a bit of a runway.* (E3) • *Of course, there might be times when you need to raise money really quickly and then you need to do the next round, but in the early stage, funding rounds are a pain for the founding team. [...] and when we have invested, we first want to see that they work with the money and then ideally only raise the next round in 12-15 months. After all, they should be able to handle the money 18-24 months.* (E4)
Being profitable and growing fast with less funding is better	• *When it comes to profitability, raising funding allows you to grow much faster, but I have a thousand times more respect for companies that manage to grow and give away very little equity.* (E6) • *But I don't think the funding itself is a success at this point. It's actually much better if you can grow quickly with less money. [...] That brings less dilution, more efficient growth, faster profitability, and that's also something that is generally very highly valued by the market. You can see that right now in the last six months where the markets have cooled down a bit. Profitability is very much appreciated by investors in particular on markets. [...] if I'm profitable [...] or the more profitable I am, the less external financing needs I usually have.* (E7)
Cannot be considered in isolation	• *You can't look at it in isolation. Either you're a killer fundraiser to get good follow-on funding because you have a super network and you're a good salesperson. Or you have a good growth in I don't know what dimensions so that somebody new goes in there.* (E2) • *I would say, it's more of a means to an end to achieve your actual goals, your actual success. In that sense, it's also a building block somewhere, a piece of the puzzle of the overall success. [...] But I wouldn't consider a financing round in itself, taken in isolation, to be a success. [...]* (E7)
Informative value of financing decisions must be questioned	• *But it's not now I mean [...] in Europe, we went from five, six years ago, we had about 600 fundraising rounds in a year, and now we're up to about 4000. So, a lot more, a lot more investors a lot more rounds. So, I think there's less signal in the fundraising to the success of the company. I think sometimes actually it can be the wrong thing. People get funded too early because it's a hype play. And often they then don't focus on the fundamentals of the company. [...] So, if you are getting rewarded for not having great metrics, so in terms of this revenue multiple in the growth model you don't need to focus on people giving you money.* (E5)

cates that a combination of different types of measures is preferable for measuring the success of start-ups due to the multidimensional nature of the success phenomenon (Gerschewski & Xiao, 2015; Richard et al., 2009). It also became apparent, however, that academics face specific challenges in measuring start-up success that may limit their choice of success measures (Eveleens et al., 2017).

The qualitative study reveals that venture capitalists, despite their financial intentions, perceive start-up success as a multidimensional construct whose concrete definition depends on a wide variety of factors. How they specifically measure success therefore depends for example on the business model, development phase, or product of a start-up. According to the venture capitalists interviewed, reliable financial metrics are usually not available in the very early stages of a start-up. Operational metrics and milestones at the product or organizational level were therefore considered the preferred options for measuring initial success. Along with this, the interviews once again confirmed that growth and the ability to raise rounds of equity financing can be important indicators of start-up success, but that their necessity and cause should always be questioned.

4.1. Theoretical Implications

This scientific work contributes to a more holistic and better understanding of the success phenomenon in start-up research. The results show substantial overlaps with the findings of Kiviluoto (2013): Start-up success has multiple dimensions that need to be considered and measuring it using only one metric or dimension is rarely recommended. According to the experts interviewed, even growth measures should be viewed critically (Ben-Hafaïedh & Hamelin, 2022; Davidsson et al., 2009). This questions the validity of studies that have used only one indicator to measure success (S.

Lee, 2022; Söderblom et al., 2015). The limited informative value for start-up success attributed to funding measures also contradicts the measurement approach of studies that have exclusively used measures of this type (Ter Wal et al., 2016). Furthermore, the findings of the empirical study support Nambisan and Baron's (2013) as well as Witt's (2004) statement that success and its measurement depend on various factors, such as perspective or development stage.

4.2. Practical Implications

At a practical level, the results of the study are valuable for both researchers and practitioners as they present how the success of start-ups can be measured and what needs to be considered. The findings from the literature review as well as the empirical research suggest that start-up success is a multi-dimensional phenomenon that can hardly be measured by only one metric or captured within one single dimension. Scholars and practitioners could therefore benefit from a more differentiated view and measurement of start-up success that specifically takes into account its multi-dimensionality. In particular, the literature reviewed indicates that financial, non-financial, subjective as well as objective measures of different success dimensions should ideally be combined in future research to provide a more meaningful measurement of start-up success. Furthermore, venture capitalists are provided with opinions and experiences from peers in their field, allowing them to gain deeper insights into what to look for when measuring start-up success, especially in the early stages of development. Other relevant practitioners can especially use the results of the empirical research to better understand how venture capitalists think about and measure start-up success. Founders, for example, can thus better understand the expectations of their investors both before and after raising VC funding.

4.3. Limitations and Future Research

Although the goals of this academic work could be achieved, this was still only possible to a limited extent. Start-ups and their success have been the focus of academic research for some time, but very limited research has been conducted on the topic of success measurement. Moreover, in entrepreneurship and management research, an explicit distinction between success and performance is rarely made. Therefore, in the course of the literature review, the available success literature had to be supplemented by findings from performance research. Within the empirical research, only the perspective of venture capitalists was examined, leaving other relevant practitioners of a start-up ecosystem, such as founders, unrepresented in the results. In addition, despite the strong commitment to scientific rigor, the results of the empirical study are hardly generalizable due to the qualitative approach and the relatively small sample size. To address these limitations, future research could examine the findings of the empirical study using a large-scale quantitative approach or replicate the study including significantly more types of relevant practitioners. Future research could also attempt to develop a standardized success measurement framework for technology start-ups taking into account, for example, the measurement challenges of researchers

5. Conclusion

This thesis aimed to advance the knowledge about success measurement in start-up research by providing a comprehensive overview of what academics as well as practitioners define as a successful start-up and what they consider to be reliable measures of success. To achieve this goal, several scientific studies dedicated to the investigation of start-up success were analyzed and semi-structured expert interviews with venture capitalists from the early-stage investment sector were conducted.

It was found that start-up success in the academic world is particularly measured by the growth of a start-up, its profitability and/or ability to raise external capital. The empirical research revealed that venture capitalists mostly prefer common financial metrics for measuring start-up success. However, for very early-stage start-ups they rely mainly on operational metrics as well as product and organizational milestones due to the lack of financial data. Both the academic and practical perspectives suggest that start-up success is a complex, context-specific phenomenon whose measurement depends on a variety of different factors that may change over time. A meaningful measurement of start-up success therefore requires the use of a combination of different types of metrics to address this complex nature of success. To determine a start-up's success, for example, by considering only one metric or dimension is a dangerous approach that does not account for the true character of the success construct.

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