Investment Decision-Making and Venture Performance
Indicators in the Venture Capital Industry

D I S S E R T A T I O N
of the University of St.Gallen,
School of Management,
Economics, Law, Social Sciences,
International Affairs and Computer Science,
to obtain the title of
Doctor of Philosophy in Management

submitted by

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The University of St.Gallen, School of Management, Economics, Law, Social Sciences, International Affairs and Computer Science, hereby consents to the printing of the present dissertation, without hereby expressing any opinion on the views herein expressed.

St.Gallen, October 29, 2021

The President:

Prof. Dr. Bernhard Ehrenzeller

Acknowledgments

This dissertation would not have been possible without the help of many great colleagues, collaborating partners, as well as my family and friends.

First of all, I want to express my special gratitude to my supervisor Dietmar Grichnik. The opportunity to graduate at your chair gave me a one-of-a-kind chance to dive into the European startup scene, to conduct research on the highest level, and to meet many inspirational people. By that, this dissertation will certainly offer to me many exciting opportunities for my personal future. Your feedback guided this dissertation form the very beginning and encouraged me to bring my research repeatedly to the next level. In this regard, I also want to thank Klaus Möller for his valuable feedback. Your insights on performance management helped me to understand and to position my research from a broader research perspective.

In addition to my supervisors, I want to thank the entire team at the chair of Entrepreneurship. You made the dissertation from the very first day a truly remarkable experience. You offered me, depending on the situation and mood, either fun and laugh or support and an unlimited supply of coffee. Here, I want to express a special thanks to Manuel Hess, who constantly supported me over the years by brainstorming sessions and personal advice in manifold occasions. Thank you, for cheering me up after feedback sessions that made this dissertation feel like an endless rollercoaster. Especially the late but great pizza nights, with Joakim Wincent, will always be remembered.

The research of this dissertation required deep practice insights. Therefore, I also want to express my deepest appreciation to all those anonymous interview and collaboration partners from the Berlin- and Switzerland-based startup and venture capital scene. Your warm attitude and deep, unmasked insights made this dissertation to a truly exciting experience and to a highly relevant research piece. Without your trust and contribution this research would not have been possible.

Afterall, Helena, my wife, and Pia and Thomas, my parents, deserve a truly special thanks. Your indispensable support and endurance formed the foundation on which I could constantly rely, grow, and build, what was needed for this dissertation. Thus, thank you for your love and the necessary strengths.

St.Gallen, April 2021   Yaro Wolff

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List of abbreviations

Adj.	Adjusted
AOM	Annual Meeting of the Academy of Management
AOV	Average Order Volume
AuM	Assets under Management
AVG or avg.	Average
B2B	Business-to-Business
B2C	Business-to-Customer
BA	Business Angel
BCERC	Babson College Entrepreneurship Research Conference
BM	Business Model
CAC	Customer Acquisition Cost
CEO	Chief Executive Officer
cf.	Confer
CIO	Chief Investment Officer
CLTV	Customer Lifetime Value
CM	Contribution Margin
Df	Degrees of Freedom
Dr.	Doctor
DV	Dependent Variable
e.g.	Exempli gratia
EBITDA	Earnings before Interest, Taxes, and Depreciation and Amortization
EIF	European Investment Fund
et al.	Et alii
etc.	Et cetera
ETL	Extraction Transformation and Load Sheet
Eval.	Evaluation
Expo	Exponential
FinTech	Financial Technology
FTE	Full Time Equivalent
GM	Gross Margin
GMV	Gross Merchandise Value
GP	General Partner
HighTech	High Technology

i.e.	Id est
InsureTech	Insurance Technology
IRR	Internal Rates of Return
IT	Information Technology
KPI	(Key) Performance Indicator
Ln	Natural Logarithm
LP	Limited Partner
LTM	Last Twelve Months
M	Millions
MAX	Maximum
MBA	Master of Business Administration
Mgt.	Management
MIN	Minimum
MIT	Massachusetts Institute for Technology
MOIC	Multiples of Invested Capital
MRR	Monthly recurring revenue
n.a.	Not available
NPS	Net Promoter Score
nQDF or non-QDF	Non-Quality Deal Flow
OLS	Ordinary Least Squares
p.	Page
Ph.D.	Doctor of Philosophy
Poly	Polymeric
pp.	Pages
ppt	Percentage points
PR	Practical Requirements
Pr.	Probability
Prof.	Professor
PropTech	Property Technology
Q	Question
QDF	Quality Deal Flow
r	Correlation
RQ	Research Question
rQDF	Real Quality Deal Flow

RSE	Residual Standard Error
SaaS	Software as a Service
SD	Standard Deviation
SE	Standard Error
SK	Skewness
SME	Small and Medium Enterprises
TR	Theoretical Requirements
US	United States of America
USP	Unique Selling Proposition
UX	User Experience
VC	Venture Capital Firm; Venture Capital
VIF	Variance Inflation Factor
vs.	Versus
YOY	Year-over-Year
z.B.	Zum Beispiel

List of symbols

&	And
*	Asterisk
@	At
χ^2	Chi-Square
=	Equal
€	Euro
< / >	Larger / Smaller
#	Number
N	Number of Observations
Ø	On Average
%	Percent
?	Question Mark

Executive summary (English)

This dissertation investigates the phenomenon that venture performance and even early indicators for venture performance remain hard to grasp for scholars and practitioners alike. This is driven by a lack of transparency and strong information asymmetries between investors (principals) and entrepreneurs (agents) in the venture capital (VC) industry. Although research investigates venture performance since decades, empirical research based on archival data remains the exception. Therefore, this dissertation contributes to literature through novel insights about investors' and entrepreneurs' decision-making, derived from unprecedented real-world evidence, including several thousands of actual, recorded, deal screenings and evaluations, data that is usually sealed from scholars.

The first article contributes to literature and practice by improving the understanding of how and when VC investment criteria are applied along the investment decision process. Thereby, we expose and proof some common myths of the industry while refuting others, including: the effect of so-called quality deal flow, the importance of teams, the timing of the VC-fund depending on the fund-life cycle, the leapfrogging to VC decision-makers, and the disguising behavior of being an outlier venture case.

The second article contributes to literature by using the principal-agent theory to explain the investment decision-making along the multi-staged venture selection process of VCs. Further, it provides an explanation for the inconclusiveness of results on relative criteria importance from prior studies (i.e., which is more important, the "jockey" or the "horse"). Finally, it contributes to the VC literature by separating the effect of deal sourcing and deal selection activities, i.e., is VC performance driven by having access to a "universe" of high-quality deal flow, or by picking the "winners" from the "universe".

The third article shows that the entrepreneur-investor relationship has a strong need for transparency in form of formal reporting structures and benchmarks. For this reason, this dissertation provides a useful "how-to-guide" to early-stage investor on how to design efficient and effective formal venture reporting processes, which (a) manage the tension between unique ventures and generalizable knowledge, and (b) support investor's overall decision-making. Further, this dissertation provides to certain ventures (e.g., Software as a Service and eCommerce ventures) useful benchmarks on measurable venture KPIs and their relationships to venture milestones along the life cycle, such as funding events. By that, this dissertation strengthens the not yet sufficiently established link between observable venture KPIs and eventual venture performance.

Executive summary (German)

Venture Performance sowie dessen frühe Indikatoren sind sowohl für die Wissenschaft als auch für die Praxis nach wie vor schwer greifbar. Auf Grund dieses Phänomens widmet sich die vorliegende Dissertation der ursächlichen mangelnden Transparenz und starken Informationsasymmetrie zwischen Investoren (Prinzipals) und Gründern (Agenten), innerhalb der Wagniskapitalbranche. Trotz jahrelanger Forschung in diesem Bereich fehlen weitgehend empirisch-tiefgehende Untersuchungen, welche auf tatsächlichen und dokumentierten Entscheidungsgrundlagen beruhen. Diese Dissertation trägt zur Schließung dieser Forschungslücke bei, indem auf Basis von mehreren Tausend eben solcher aufgezeichneten, Screening und Evaluationsdaten neue Erkenntnisse zu Investmententscheidungen sowie zur Performance von Ventures erlangt werden.

Der erste Artikel trägt zu Literatur und Praxis bei, indem er das Verständnis dafür stärkt, wie und wann Investmentkriterien in der Wagniskapital- oder VC-Branche angewandt werden. Dabei werden gängige Mythen beleuchtet, darunter: die Auswirkung des Quality Deal Flow, die Bedeutung von Teams, die Relevanz von Timing in Abhängigkeit vom Investitionszyklus von VC-Fonds, das Umgehen von Hürden im Investmentprozess sowie die Möglichkeit zu suggerieren das nächste, alles verändernde, Venture zu sein.

Der zweite Artikel trägt zur Literatur bei, indem mittels der Prinzipal-Agent-Theorie die Investitionsentscheidungen entlang des mehrstufigen Venture-Auswahlprozesses von VCs aufgeschlüsselt und erklärt werden. Ferner liefert der Artikel eine Erklärung für die uneinheitlichen Ergebnisse früherer Studien bezüglich der relativen Relevanz von Investmentkriterien (z.B. was ist wichtiger, "Jockey" oder "Pferd"?). Schließlich separiert der Artikel für VCs (a) die Bedeutung vom Zugang zu qualitativen Ventures von (b) der Fähigkeit die „Gewinner" aus den besagten Ventures auszuwählen.

Der dritte Artikel zeigt, dass die VC-Branche ein starkes Bedürfnis nach Transparenz in Form von Reporting-Strukturen und Performance-Benchmarks hat. Diese Dissertation bietet ein Beispiel dafür, wie ein Venture Reporting für VCs effizient und effektiv gestaltet werden kann. Darüber hinaus werden für ausgewählte Ventures (z. B. „Software as a Service" und „E-Commerce" Ventures) (a) Benchmarks für messbare und quantifizierbare KPIs bereitgestellt und (b) diese in Beziehung zu wichtigen Meilensteinen entlang des Venture-Lebenszyklus, wie Finanzierungsrunden, gesetzt. Hierdurch trägt die vorliegende Dissertation zur Stärkung der noch nicht hinreichend etablierten Beziehung zwischen beobachtbaren, messbaren, KPIs und schlussletztlicher Performance von Ventures bei.

Part I – dissertation framework

1. Introduction

Ventures are an essential source of innovation and economic growth (Kaplan & Lerner, 2010). Given the world-shaping role of innovative firms, such as Amazon, Facebook, or Google, it is important to understand *why* ventures strive and *how* indicators of venture performance (KPIs) are identifiable and measurable early in their life cycle (Fisher et al., 2016). For high-growth ventures, requiring external funding from venture capitalists (VCs), performance is commonly defined – and from investors requested – as a financial return, measured in pre-money valuations, and corresponding internal rates of return (IRR), or multiples of invested capital (MOIC) (Fisher et al., 2016; Gompers et al., 2020). In theory, more precisely in the principal-agent framework, the alignment on a venture's performance goals creates the essential fundament of the relationship between investors (principals) and entrepreneurs (agents) (Fama & Jensen, 1983; Shepherd & Zacharakis, 2001; Kaplan & Strömberg, 2003; Burchardt et al., 2014). In practice however, actual venture performance becomes evident only late, while early indicators for performance are hard to grasp for scholars and practitioners alike. This is due to an enormous lack of transparency in the VC industry (Delmar et al., 2013; Köhn, 2018; Gornall & Strebulaev, 2020). This lack of transparency leads to strong information asymmetries between principals and agents, which invite agency problems (Burchardt et al., 2014; Glücksman, 2020; Gompers et al., 2020) and hence contribute to the high failure rates among ventures (Song et al., 2008; Gage, 2012; Fisher et al., 2016; Soto-Simeone et al., 2020).

Therefore, prior literature provides an understanding of how VCs adapt to those agency problems (Burchardt et al., 2014; Gompers et al., 2020). For instance, VCs use diversification, syndication, staging strategies, contracting, and monitoring to mitigate investment risks and uncertainty (Lerner, 1994; Gompers, 1995; Amit et al., 1998; Shane & Cable, 2002; Kaplan & Strömberg, 2001, 2003). Scholars also find that VCs apply complex decision-making processes and multiple investment criteria to select the most promising venture proposal (Tyebjee & Bruno, 1984; Franke et al., 2008; Petty & Gruber, 2011). The liability of newness that ventures bring along with their innovation and non-existing track records (Stinchcombe, 1965; Delmar & Shane, 2004) implies that the investment criteria of VCs must remain elusive in their nature, such as the *team* ("jockey"), or the *business* ("horse") (Kaplan et al., 2009). Although asked for by scholars since the beginning (Tyebjee & Bruno, 1984; MacMillan et al., 1987; Miloud et al., 2012), the VC

literature made only little progress on which practically measurable investment criteria, or KPIs, explain and (early on) indicate venture performance (Gornall & Strebulaev, 2020). Therefore, it is no surprise that investors struggle to establish data-supported venture selection processes, formal venture reporting structures, or benchmarking approaches for venture performance (Kaplan & Strömberg, 2001, 2003; Burchardt et al., 2014; Fisher et al., 2016). Instead, VCs often rely on rather qualitative-driven, or *gutfeel,* decision-making (Garg, 2013; Huang & Pearce, 2015; Garg & Eisenhardt, 2017; Huang, 2018). The overall lack of transparency in the VC industry, however, has severe effects for investors, entrepreneurs, and scholars alike. Investors and entrepreneurs suffer from a two-sided information asymmetry which invites opportunistic behavior from both sides, including adverse selection and moral hazard (Amit et al., 1998; Burchardt et al., 2014; Glücksman, 2020), inefficient capital allocations, high transaction costs, and frictions in value-adding collaborations (Akerlof, 1970; Kaplan & Strömberg, 2001, 2003). At the same time, scholars face empirical challenges as data on venture performance and actual decision-making is usually undocumented or sealed, which leads to methodological limitations and ambiguous findings (Petty & Gruber, 2011; Hsu et al., 2014; Monika & Sharma, 2015; Drover et al., 2017). For instance, scholars who investigated in prior studies the relative importance of investment criteria present inconclusive results, whereas other scholars could not yet establish the missing link between venture performance and measurable KPIs (Monika & Sharma, 2015). Therefore, Gornall & Strebulaev (2020) conclude that academic literature still lacks an essential understanding of venture performance.

Given these empirical challenges, we build and then make use of an unprecedented data sample to investigate two relevant topics of venture performance, both grounding on agency theory (Jensen & Meckling, 1976; Eisenhardt, 1989). The first two articles of this dissertation (Sections 5 & 6) investigate the VCs' venture selection process. The articles focus on the main research question of how and when VCs weight the elusive investment criteria along the decision stages, depending on the only gradually emerging information – that is, varying degrees of information asymmetries. By that, we investigate the relevance of the common investment criteria based on actual decision data, while paying attention to the complex decision-making process. The third article of the dissertation (Section 7) shifts the focus from the investment process towards the persisting lack of measurable early venture performance indicators in the VC industry. Here, we address through the design of two artifacts the main research question of how transparency could be enhanced in form of formal VC-venture reporting structures and benchmark data for venture performance.

1.1 Venture selection process

Building on the principal-agent theory (Jensen & Meckling, 1976; Eisenhardt, 1989), VC decision-making is discussed in literature for decades (cf. Tyebjee & Bruno, 1984; Gompers et al., 2020). One of the most prominent discussions in this field of literature covers the relevance of the global investment criteria *team* and *business* for VC decision-makers. Some surveys find that the business is the most important criterion (Kaplan & Strömberg, 2009), while others identify the team as the most decisive factor (Bernstein et al., 2017; Gompers et al., 2020). Hence, research concludes that both the team and the business matter along other criteria for an investment decision (MacMillan et al., 1985; Gompers et al., 2020) – a very intuitive conclusion. Further, some studies also rank the importance of the criteria based on retrospective questionnaires, case studies, or experimental analyses (cf. MacMillan et al., 1985; Muzyka et al., 1996; Silva, 2004; Mishra et al., 2017; Gompers et al., 2020). However, the decision-making at the screening and evaluation stages between the principal and the agent continuous to pose two critical challenges to scholars. First, there is a theoretical challenge from the agency theory perspective since prior studies considered investment criteria to assess deal proposals independently of the multiple decision stages (Petty & Gruber, 2011). Research lacks an understanding of how and when VCs weight investment criteria along the decision stages, depending on the only gradually emerging information – that is, varying degrees of information asymmetries from different information sources. Second, there is an empirical challenge since actual decision-making is usually undocumented or sealed from scholars, leading to methodological limitations and ambiguous findings (Petty & Gruber, 2011; Hsu et al., 2014; Monika & Sharma, 2015; Drover et al., 2017). The lack of archival data prevents research from more complex, stage-specific breakdowns of the venture selection process. Recent literature calls for research that investigates the relevance of the common investment criteria based on actual decision data, while paying attention to the decision-making process designed to deal with asymmetric information and agency problems (Monika & Sharma, 2015; Drover et al., 2017). Hence, the research questions for the first two articles are:

> *RQ: How do VCs structure their investment process and which investment criteria do they apply to select ventures?*

RQ: How does agency theory explain when in the investment process investment criteria matter, given a gradual decrease of asymmetric information along funding decision stages?

By addressing those research questions, our first explorative article (Section 5) contributes to literature and practice by improving the understanding of how and when VC investment criteria are applied along the investment decision process. Thereby, we expose and proof some common myths of the industry while refuting others, including: the effect of so-called quality deal flow, the importance of teams, the timing of the VC-fund depending on the fund-life cycle, the leapfrogging to VC decision-makers, and the disguising behavior of being an outlier venture case. With our second article (Section 6), we contribute to literature by using the principal-agent theory to explain the investment decision-making along the multi-staged venture selection process of VCs. Further, we provide an explanation for the inconclusiveness of results on relative criteria importance from prior studies (i.e., which is more important, the "jockey" or the "horse"). Finally, we contribute to the VC literature by separating the two VC performance channels of deal sourcing and deal selection, i.e., is VC performance driven by having access to a "universe" of high-quality deal flow, or by picking the "winners" from the "universe". Overall, the first two articles of this dissertation contribute to VC literature by following the call for an investigation of the commonly known investment criteria while considering the processual character of the decision-making with its corresponding dynamics, including changing information availability. For this research purpose, we make use of an unprecedented data sample of several thousands of actual, recorded, deal screenings and evaluations.

1.2 Venture performance indicators

But why is the venture selection for investors so difficult at a first place? Why do VCs employ elusive investment criteria such as the "team" rather than precise, quantifiable figures on growth or profitability? In an ideal world, few KPIs would capture what matters to predict the *true* performance of a venture and hence reduce complexity and uncertainty in early-stage investments a lot, or as an investment professional said: "*I would love to simply buy monthly recurring revenues based on a solid multiple valuation, but ventures are so different and reliable benchmarks are not available*." (quote of an interviewed investment professional). In practice however, the landscape of measurable performance drivers in the VC industry is dispersed, untransparent and thus often suffers an existence in the shadow (Delmar et al., 2013; Köhn, 2018). Research has shown that entrepreneurs

have difficulties to assess their investor readiness (Proimos & Murray, 2006) and hesitate to present KPIs as they feel unsecure about which matter (Alemany & Andreoli, 2018, p.279). Investors consider KPIs as soon as they become available (Fisher et al., 2016) but have a hard time to interpret figures as the comparability is limited. And the main body of literature, even though scholars asked for measurable KPIs relatable to venture performance (Tyebjee & Bruno, 1984; MacMillan et al., 1987), focuses more on the global principal-agent relationship (cf. Kaplan & Strömberg, 2003), rather than detailing out which specific KPIs should be monitored to capture the performance of a respective venture. At least we are not aware of any successful attempt to consolidate and prioritize existing knowledge about performance indicators in a practicable manner that goes beyond a list of uninterpreted KPIs or some case-studies; leaving entrepreneurs lost in their striving to pass life cycle milestones (Fisher et al., 2016) and to drop their liability of newness (Stinchcombe, 1965; Delmar & Shane, 2004). First attempts to build theoretical frameworks around the concepts of venture growth, profitability, and survival are investigated by Delmar et al. (2013); while Miloud et al. (2012) try to establish a link between strategic theories and startup valuations. Consequently, given the limited understanding of literature in this field, as concluded by Delmar et al. (2013), Köhn (2018), and Gornall and Strebulaev (2020), we identify the following research questions which are addressed in the third article of this dissertation:

> *RQ: How to increase transparency in the venture capital industry from a quantitative performance indicator perspective?*
> *RQ: Which KPIs are relevant for ventures and how do they relate to ventures' milestones?*

By addressing those research questions, the third article of this dissertation (Section 7) shows that the entrepreneur-investor relationship has a strong need for transparency in form of formal reporting structures and benchmarks, which complement less-formal bilateral interactions between investors and entrepreneurs. For this reason, we provide a useful "how-to-guide" on how to design efficient and effective formal venture reporting processes for early-stage investor, which manage the tension between unique ventures and generalizable knowledge, and support investor's decision-making. Further, we provide to certain ventures (e.g., Software as a Service and eCommerce ventures) useful descriptive insights (i.e., benchmarks) on measurable venture KPIs and their relationships to venture milestones along the life cycle, such as funding events. By that, we strengthen with the not

yet sufficiently established link between observable venture KPIs and eventual venture performance.

2. Theoretical framework

2.1 Principal-agent theory

Agency problems have been discussed for decades in VC literature (Fama & Jensen, 1983; Fried & Hisrich, 1994; Fiet, 1995; Amit et al., 1998; Shepherd & Zacharakis, 2001; Burchardt et al., 2014; Hsu et al., 2014; Gompers et al., 2020). Agency problems, including adverse selection and moral hazard, occur when a principal, who's typical goal is profit maximization, selects an agent (Jensen & Meckling, 1976), who has a conflicting agenda, given prevailing information asymmetries (Eisenhardt, 1989; Shapiro 2005). These problems are inherent and empirically observable along all VC activities (Fama & Jensen, 1983; Burchardt et al., 2014), which are described by the seminal works of Wells (1974) and Tyebjee & Bruno (1984). Building on those studies, recent research clusters the activities of VCs along the following stages: (1) deal sourcing; (2) initial screening of proposals; (3) two sequential evaluations; (4) deal structuring; (5) post-investment activities; and (6) cashing out or exit (Kollmann & Kuckertz, 2010; Gompers et al., 2020). Initially, high-quality deal flow is created through networking activities. These are followed by the investment decision-making activities, leading to deal investments or rejections. Eventually, the VC cooperates with the deal in its post-investment activities until the exit. Table 1 presents an overview of several attempts in literature to cluster the VC activities from deal origination to divestment, more details on the stages are provided in Table 3.

In practice, the information asymmetry varies across these stages. Whereas in post-investment activities (5) to (6), the VC has an insider role, capable of steering the relationship with written contracts, incentives, and monitoring activities (e.g., Kaplan & Strömberg, 2001, 2003; Cumming, 2005; Bernstein et al., 2015), in pre-investment activities (1) to (4), the VC has an outsider role. Here at the venture selection process, the investors suffer the highest level of asymmetric information regarding qualities of the potential investment cases. Hence, they are most vulnerable to opportunistic behavior (Akerlof, 1970; Amit et al., 1990, 1998).

Table 1: Overview of VC activity stages

Activity stage	Wells (1974)	Tyebjee & Bruno (1984)	Silver (1985)	Hall (1989)	Fried & Hisrich (1994)	Boocock & Woods (1997)	Bliss (1999)
1 Pre-Invest	Search	Deal Origin	Search	Generating Deal Flow	Deal Origination	Generating Deal Flow	Origination
2 Pre-Invest		Screening	Initial Screen	Proposal Screening	Firm-Specific Screen	Initial Screening	Generic Screen
2 Pre-Invest				Proposal Assessment	Generic Screen	First Meeting	
3 Pre-Invest	Evaluation	Evaluation	Due Diligence	Project Evaluation	First Phase Evaluation	Second Meeting & Board Presentation	First-Phase Evaluation
3 Pre-Invest				Due Diligence	Second Phase Evaluation	Due Diligence	Second Phase Evaluation
4 Pre-Invest		Deal Structuring	Deal Structuring	Deal Structuring	Closing	Deal Structuring	Closing
5 Post-Invest	Venture Board Meetings and Operations	Post-Investment Activities	Monitor Progress	Venture Operations		On-Going Monitoring of Investments	
6 Post-Invest	Cashing Out		Cashing Out	Cashing Out		Cashing Out	

Source: Adapted from Hall & Hofer (1993), Table 2, p. 28 and Silva (2004), Table 2, p.129.

2.2 Venture selection process

Given this high degree of upfront investment risks and uncertainty (Sahlman, 1990), the investors perform portfolio diversification, syndication, and staging at the portfolio management level (Lerner, 1994; Gompers, 1995; Amit et al., 1998; Shane & Cable, 2002; Ferrary, 2010). At the investment level, Shepherd & Zacharakis (2001) indicate that mutual trust between principals and agents could mitigate agency problems, but Christensen et al. (2009) find that VCs expect entrepreneurs to be potentially opportunistic and open to moral hazard, an attitude which seems to be reciprocal (Glücksman, 2020).

Therefore, VCs adapted to agency problems by sophisticated screening and evaluation stages along which rigorous investment criteria are applied (MacMillan et al., 1985; Shepherd, 1999a; Burchardt et al., 2014). Given the processual structure of deal screenings and evaluations as well as their dependencies on varying levels of deal information from stage to stage, it is surprising from a principal-agent perspective how prior research has been inattentive of such structures when investigating VC investment decision-making. In the absence of data availability, the dominant research approach of early studies relied on retrospective, self-reporting of VCs in form of questionnaires, generating a basic understanding of decision criteria applied but generally disregarding any potential processual dynamics in their relevance (Zacharakis & Meyer, 1998; Shepherd, 1999b; Franke et al., 2006; Petty & Gruber, 2011; Monika & Sharma, 2015; Drover et al., 2017).

One exception of this survey-dominated first wave of research is Hall & Hofer (1993), who use verbal protocoling in their explorative study, capturing the processual character of the decision-making. By that, they identify dynamics in the criteria relevance along the process. Scholars also found that VCs may have only limited insight into their own decision-making and are prone to cognitive biases, leading to inaccurate reflections on their decision-making process (Khan, 1987; Sandberg et al., 1988; Zacharakis & Meyer, 1998; Shepherd, 1999b; Shepherd & Zacharakis, 1999; Shepherd et al., 2003; Franke et al., 2006, 2008; Petty & Gruber, 2011). This insight led to a second wave of research, which predominantly focused on experimental (conjoint) analyses. However, while these experimental studies could extenuate such concerns and helped to provide an understanding of how decision-makers weight criteria against each other in investment decisions (Riquelme & Rickards, 1992; Shepherd & Zacharakis, 1999; Franke et al., 2006, 2008; Murnieks et al., 2011), they are based on hypothetical and simplified investment cases, again missing the processual perspective (Petty & Gruber, 2011; Monika & Sharma, 2015). Therefore, scholars concluded that literature has hardly any evidence on the dynamics of investment criteria relevance along the decision stages, besides dispersed indications from small sample sizes (Petty & Gruber, 2011). Given this research gap, Petty & Gruber (2011) find through their explorative study that the importance of decision criteria seems to be subject to considerable dynamics along the decision process. A finding, which is underlined by Kollmann & Kuckertz (2010), who show that VCs perceive the evaluation uncertainty of the investment criteria as highly sensitive across both, the criteria and along the decision stages of the process – implying varying levels of information asymmetry in both dimensions.

Within this process of VCs' decision-making, which the principals design to reduce the initially high degree of asymmetric information, prior research has identified elusive but commonly acknowledged investment criteria that VCs use to assess a ventures suitability for funding: the management team, the business model, the target market, the product or service, and financial aspects around a deal represent the overarching criteria, while the deal source indicates deal quality even before actual evaluations on the common criteria are performed (Sahlman, 1990; MacMillan et al., 1985; Gompers et al., 2020). Among the common investment criteria, the most prominent discussion focuses on the relative importance of the entrepreneur ("jockey") versus the venture ("horse"). Kaplan and Strömberg (2009) see the business as marginally more important than the team. Contrarily, Bernstein et al. (2017) find the team as the most decisive factor for investments, whereas

more recently Gompers at al. (2020) confirm in their recent survey about VC decision-making, that the team seems to be the most decisive investment criterion. For references showing empirical significance of these common investment criteria see Table 4.

However, it remains puzzling how the most prominent but elusive investment criteria act in concert in their natural environment, given ever changing levels of information asymmetry along the process. More precisely, literature does not incorporate how the flow of information along the decision process impacts the relevance of the criteria. For instance, little is known about how a signaling effect associated with high-quality investment opportunities, generated through the VC's network (Sahlman, 1990; Shane & Cable, 2002; Sørensen, 2007; Gompers et al., 2020), is affected by the increasing substance behind inherent deal qualities, captured through the investment criteria. An inevitable but from VC-perspective desired process that comes along with decreasing information asymmetry and uncertainty as deals progress through the investment process stages (Kollmann & Kuckertz, 2010).

2.3 Venture performance indicators

As described, selecting the right ventures is associated with high degree of uncertainty and asymmetric information (Sahlman 1990; Sievers et al. 2013). The elusive nature of the investment criteria supposed by MacMillan et al. (1985) makes their interpretation ambiguous (Kollmann & Kuckertz, 2010). This challenge leads to the phenomena that entrepreneurs have difficulties to assess their investor readiness (Proimos & Murray, 2006) and that even investors do not trust each other on their latest unicorn valuations (Gornall & Strebulaev, 2020; Gompers et al., 2020).

Against this backdrop, academic literature made progress in understanding the elusive concept of venture performance along the venture life cycle (Miloud et al., 2012; Fisher et al., 2016). Fisher et al. (2016) cluster the venture life cycle in stages, starting with the conception, or product-market-fit stage, the commercialization stage, and eventually the growth stage. Along these stages, performance is commonly defined as a financial return, measured in venture valuations, and in corresponding IRRs, or MOICs in the context of high-growth ventures, requiring external funding from early-stage investors (Fisher et al., 2016; Gompers et al., 2020). However, despite calls from scholars (e.g., Tyebjee & Bruno, 1984; MacMillan et al., 1987; Miloud et al., 2012), less progress has been made on which practically measurable venture KPIs explain and indicate (early on) venture performance (Gornall & Strebulaev, 2020). Fisher et al. (2016) show depending on the venture's life

cycle that measurable KPIs become more relevant as the venture matures. Which KPIs may matter is often illustrated in lists of endless KPIs potentially of relevance, in anecdotical form, or by case studies (cf. Kemell et al., 2018; Alemany & Andreoli, 2018, pp.295–303). However, literature usually lacks a prioritization or relative assessment of the mentioned KPIs. Kemell et al. (2018) identify in their study a need for specific KPIs defined for software ventures but acknowledge that their list of over 100 identified KPIs is more of a glossary. Alemany & Andreoli (2018, pp.278–309) select three potential business models and provide exemplified KPIs in a structured way but they miss to link the KPIs to venture valuations or milestones along the venture life cycles. First attempts to relate measurable and observable KPIs to venture performance are conducted by Davila et al. (2003), who show how employee figures relate to venture valuations. Further, Delmar et al. (2013) build a theoretical framework around the concepts of venture growth, profitability, and survival, suggesting that profitability enhances both survival and growth, while growth helps profitability but has a negative effect on survival. Furthermore, Miloud et al. (2012) are with their explorative cross-sectional study, according to our understanding, the first who try to establish a direct link between global investment criteria such as teams or markets, and startup valuations, using strategic theories, such as (i) industry organization economics, (ii) resource-based view and (iii) network theory. Finally, Sievers et al. (2013) and Kam & Witherow (1999) have shown that the industry, the profitability stage of a venture's life cycle, and the geographical location can affect valuation-levels. Nevertheless, despite these initial steps, research on the relations between performance indicators and actual venture performance remains premature as Delmar et al. (2013) and Köhn (2018) conclude. This is also shown by (a) Gornall and Strebulaev (2020), who investigate the valuation-levels of unicorns based on annual financials, identifying unexplainable deviations, and (b) high failure rates for venture investments (Song et al., 2008; Gage, 2012; Soto-Simeone et al., 2020).

3. Overview of dissertation articles

This section provides an overview of the research articles of this dissertation (see Table 2). All articles deal with the described phenomena, which relate to the principal-agent relationship in the venture capital industry, with its high degree of asymmetric information. Yaro Wolff is the lead author of all three articles and owns the primary responsibility for the data collection, analyses, writing, and the collaborations with the partners in the European startup scene. For consistency and convenience purposes, the "we" pronoun is

used for the author or authors across all articles. In addition to the three described research articles, two practical artifacts are developed within the scope of this dissertation. The two artifacts enhance transparency for principals (Investor Reporting Tool) and agents (Startup Benchmark Tool) by reducing information asymmetry.

1st Article – Abstract: Looking behind closed Doors at Venture Capital Investments

This explorative paper gains unique insights into VC decision-making by looking behind the closed doors of VCs when they screen and evaluate ventures and make investment decisions. Our research on a total of over 14,000 deal proposals and various interviews shows, VCs established an effective and systematic multi-stage investment process to find one promising deal they invest in out of 1,000s. While prior research and best practice emphasize that several criteria are important for a VC's investment decision, we find new evidence on which criteria are applied and how the relevance of these criteria changes along the screening and evaluation process of a venture. By that, our research manages to expose and proof some common myths of the industry while refuting other myths that entrepreneurs usually rely on, e.g., the effect of so-called quality deal flow, the importance of teams, the timing of the VC-fund, the gut-feel decision-making of VCs, the leapfrogging to VC decision-makers, the disguising behavior of being an outlier venture case.

2nd Article – Abstract: An Agency Framework on Venture Selection in VC Funding Decisions

Venture capitalists' (VCs) investment decision-making is a prominent research topic since decades. However, prior research lacks an understanding of the deal selection process – i.e., the distinct deal screening and evaluation stages – where information asymmetry from various sources is at its highest. In this study we use agency theory to build a framework of how and when the common investment criteria used by VCs (team, business model, market, product, financials) reach relevance during the process and affect decision-making. Surprisingly, our analysis based on data from 16,676 venture deal proposals and 60 VC interviews also indicates the non-existence of signaling effects at final decision stages.

3rd Article – Abstract: Venture Performance Indicators: Two Artifacts towards enhanced Transparency in the Venture Capital Industry

The landscape of measurable venture key performance indicators (KPIs) in the venture capital (VC) industry is dispersed and opaque, which is why they have not yet played the supportive decision-making role they potentially could have played so far. The limited and asymmetric information between the entrepreneurs and the investors leads to inefficient

capital allocations, frictions, and agency problems. We address this transparency issue with a design science research approach by developing two artifacts: one for investors and one for entrepreneurs. For investors, transparency is increased by a portfolio reporting solution, which provides a useful "how-to-guide" on formal venture reporting processes and structures, supporting future venture selections, portfolio monitoring, and value-adding activities. For relevant groups of entrepreneurs, transparency is increased by a benchmarking solution, which provides useful descriptive insights on measurable venture KPIs and their relationships to venture milestones along the life cycle, such as funding events. The post-development evaluations of the artifacts show that practitioners have a strong need for such transparency. We conclude that beyond structural challenges of the venturing environment, such as pace, dynamics, and the inherent uniqueness of ventures, also the fragmentation of the VC industry seems to pose a key challenge to the establishment of a direct linkage between venture performance and measurable venture KPIs.

Table 2: Overview of dissertation articles

Authors	Research questions	Main contributions
1st Article: Looking behind closed Doors at VC Investments (target publication outlet: MIT Sloan Management Review)		

Yaro Wolff
Manuel Hess
Dietmar Grichnik
Joakim Wincent
	▪ How do VCs structure their investment process to select ventures?
	▪ Which investment criteria are when in the investment process applied?
		▪ We contribute to literature and practice by improving the understanding of how and when VC investment criteria are applied along the investment decision process. Thereby, we expose and proof some common myths of the industry while refuting others, including:
		  ▪ the effect of so-called quality deal flow
		  ▪ the importance of teams
		  ▪ the timing of the VC-fund depending on the fund-life cycle
		  ▪ the leapfrogging to VC decision-makers
		  ▪ the disguising behavior of being an outlier venture case.

2nd Article: An Agency Framework on Venture Selection in VC Funding Decisions (target publication outlet: Journal of Business Venturing; 2021 AOM; accepted at 2021 BCERC)		
Yaro Wolff Manuel Hess Dietmar Grichnik Joakim Wincent	▪ How does agency theory explain when in the investment process investment criteria matter, given a gradual decrease of asymmetric information along funding decision stages?	▪ We contribute to literature by using the principal-agent theory to explain the investment decision-making along the multi-staged venture selection process of VCs ▪ We contribute to the VC literature by providing an explanation for the inconclusiveness of results on relative criteria importance from prior studies (i.e., which is more important, the "jockey" or the "horse") ▪ We contribute to the VC literature by separating the two VC performance channels of deal sourcing and deal selection, i.e., is VC performance driven by having access to a "universe" of high-quality deal flow, or by picking the "winners" from the "universe"
3rd Article: Venture Performance Indicators: Two Artifacts towards enhanced Transparency in the Venture Capital Industry (target publication outlet: www.alexandria.unisg.ch)		
Yaro Wolff	▪ How to increase transparency in the venture capital industry from a quantitative performance indicator perspective? ▪ Which KPIs are relevant for ventures and how do they relate to ventures' milestones?	▪ We show that the entrepreneur-investor relationship has a strong need for transparency in form of formal reporting structures and benchmarks, which complement less-formal bilateral interactions between investors and entrepreneurs ▪ We provide a useful "how-to-guide" on how to design efficient and effective formal venture reporting processes for early-stage investor, which manage the tension between unique ventures and generalizable knowledge, and support investor activities ▪ We provide to relevant groups of ventures (e.g., Software as a Service and eCommerce ventures) useful descriptive insights (i.e., benchmarks) on measurable venture KPIs and their relationships to milestones along the venture life cycle, such as funding events ▪ By enhancing transparency in the VC industry, we strengthen the not yet sufficiently established link between observable venture KPIs and eventual venture performance

4. Conclusion

This dissertation investigates phenomena that relate to the issue that venture performance and even early indicators for venture performance remain challenging to grasp for scholars and practitioners. This is driven by a lack of transparency and strong information asymmetries between principals and agents in the VC industry. Although research investigates venture performance since decades, empirical research based on archival data remains the exception. While the predominant research approaches of self-reporting questionnaires and experimental conjoint analyses generate valuable insights for the VC literature, they are also prone to cognitive biases, have their boundaries towards complexity, and led in the past to inconclusive results.

Therefore, we dedicated three years of research into a close and intense collaboration with the Berlin-based startup scene. By that, this dissertation has two significant strengths. First, the research is at the pulse of the practitioners' needs, as regular interactions with investors and entrepreneurs sharpen our research. Second, the collaboration enables us to make use of an unprecedented data sample. In detail, the research on the venture selection process employs several thousands of actual deal screenings and evaluations, while the research on venture performance indicators employs actual venture data, such as pre-money valuations, recurring revenues, or gross merchandise values, data that is usually sealed from scholars.

By taking advantage of this valuable data access, we contribute to two relevant topics of venture performance. First, we provide a richer and better understanding of VC-investment decision-making as it is conducted under real-world conditions. Second, beyond the research on the elusive investment criteria, we contribute to literature and practice through the design of two artifacts. These artifacts enhance transparency in the VC industry and hence strengthen the link between venture performance and measurable performance indicators. When reflecting on these contributions, we conclude that more research is needed to test literature's theoretical knowledge about VCs' investment behavior and venture performance under real-world conditions. Such research needs to acknowledge the given levels of information asymmetry along the stages of the principal-agent relationship to allow for deeper insights and contributions to the VC literature.

Against this backdrop, we find that the overall need for more transparency and data-supported decision-making gains momentum in the VC industry. However, whether early-stage investors, who earn significant fees by managing the issues related to asymmetric information, really aspire transparency in the VC industry is questionable.

As of today, at least barely any investment professional believes that algorithms or artificial intelligence in general could in the near future revolutionize the VC industry. This hypothesis of the market, however, might be challenged as soon as transparency in the VC industry prevails.

Part II – articles of the dissertation

First Dissertation Article

Looking behind closed Doors at Venture Capital Investments

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5. Looking behind closed Doors at Venture Capital Investments

Entrepreneurs need to carefully consider what happens in one of the shortest touchpoints they may ever have when going for venture capital funding. Why? Because the venture capital investment process is brutal, and it is about time to dispel some myths entrepreneurs rely on.

5.1 Introduction

Many entrepreneurs tell stories about what is going on when meeting with venture capitalists (VCs). Working with and coaching entrepreneurs over the years, one has heard a lot of fragmented and simplified stories. These stories are of course subjective and experience driven, attempting to demystify what is going on during the short touchpoints entrepreneurs have with VCs when going after investments. Academic research has concluded that VCs spend less than six minutes on average to screen a deal on first sight and make the decision to take it further or not within the next 21 minutes (Hudson & Evans, 2005; Gompers et al., 2020).

In a vacuum of several thousand deal proposals to VCs per year and these quick but important touchpoints, many myths exist among entrepreneurs and VCs. For example, some claim that getting a deal is all about a strong team (Gompers et al., 2020). Others hold it is all about networks (Zhang & Guler, 2019) or the business idea (Kaplan & Strömberg, 2009). We had the chance to have a careful look behind closed doors as VCs made investment decisions and gained an inside perspective on what really matters to succeed in the investment process until the final decision is made. And, indeed, it´s hard to pass the bar. The likelihood of receiving funding is not the 1% (Gompers et al., 2020) or 2–3% (Bronzini et al., 2020) that has been reported in the scientific literature. Instead, our results suggest that the chance of obtaining funding is one out of 1,000, or just 0.1%. The insights from our data led us to a critical conclusion: the simplified messages that we often hear in the fragmented stories among entrepreneurs and the overview of factors that we teach at business schools are snapshots that do not fully capture the causal relationships that exist throughout the venture capital investment process. Thus, we highly recommend entrepreneurs consider the overarching investment process and ultimately deliver on all facets necessary to improve their odds.

5.2 Key findings

5.2.1 What is rarely discussed about the venture capital investment process?

VCs screen and evaluate proposals in several stages, use sophisticated evaluation methods and heuristics, form multiple independent opinions, and discuss the results in several meetings. Figure 1 shows the generalized investment funnel process we observed during our research, including the total numbers in our sample and the odds of getting from one investment process stage to the next. The decisions are always final: if you do not pass a stage, you are rejected, and there isn't a chance for resubmission for this funding round.

The initial contact between entrepreneurs and VCs is often established via references, active screening by investment professionals, or - the least common way - a cold inbound from an entrepreneur. Our sample includes 14,459 deals in this initial deal-flow stage, which were screened on the basis of a few-minute heuristic that rejects more than 90%. Generally, throughout the investment process, evaluations are based on a scorecard concept capturing seven investment criteria: (1) team, (2) market, (3) product, (4) business model, (5) traction, (6) defensibility of the value proposition and (7) financial aspects (see Figure 2). Those few deals that pass the *screening stage* enter the *first evaluation stage*, which includes a call or meeting between the entrepreneurs and the VCs' investment team. Again, a deal is evaluated along the seven criteria, and the results of this evaluation are discussed in a deal-flow meeting. Here, investment professionals, often juniors, present their new potential investment cases briefly to the

general partners (GPs) of the venture capital firm. Thus, an entrepreneur's first touchpoint with the final decision makers—the GPs—generally does not follow the form you might expect of an entrepreneur meeting the GPs and pitching to them. Rather, some investment professional meets the GPs and pitches the entrepreneur's case to them. This is something rarely discussed. So, better make your slide deck and case as self-explanatory as possible. Investment professionals and GPs spend about 10 minutes per deal on average and make an irreversible decision of whether your deal passes or not.

If the GPs decide to pursue the deal, a detailed *due diligence* process starts. This includes additional calls with the entrepreneurs; preparation of follow-up questions; and detailed analyses of the product, the business model, and the market. Hence, while the GPs have already assessed these latter criteria, their weight increases, and they start to become more central in the following stages. If your deal proposal also survives this due diligence, only then are you invited to give an onsite pitch in front of the GPs. Only 6.2% of deals passing to the first evaluation stage and no more than 0.6% of all deals manage to get in front of the GPs where you as an entrepreneur present (similar studies (Bronzini et al., 2020) find 50% pass the screening stage and 10% make it to the end of this evaluation stage).

After the pitch, the GPs evaluate the deal (using the same seven investment criteria) and then engage in final clarification through follow-up questions, deal structuring, negotiations, and legal due diligence. This *second evaluation stage* finishes with the investment decision: either a rejection or the eventual funding of the deal. We find that 22.6% of pitched deals are funded. This may not sound too bad, but this 22.6% translate into a terrifying 0.1% chance of receiving funding relative to all the deals screened.

We hate to break it to you, but entrepreneurs need to be on their toes. The odds of obtaining funding shown here based on actual investment funnel data are worse than we ever could have imagined after reading research reports. Only one out of 1,000 proposed deals receives funding. If you apply for venture capital funding, the odds are 99.9% that it's not you who is going to be funded.

① Key fact: In general, VCs have established an effective multi-stage investment process with several criteria that helps them identify deals that comply with their rigorous aspiration level.

Figure 1: Investment funnel of a VC

ABOUT THE INVESTMENT FUNNEL

Event	Origination of deal flow	Venture outreach	Deal-flow meeting & entry of rQDF	Pitch stage	Investment decision

		Initial evaluation	Due diligence	GP judgment	
Stage	**Screening**	**1ˢᵗ evaluation**		**2ⁿᵈ evaluation**	**Investments**
Deals	14,549	1,362		84	19 x "Yes"
Odds (stage by stage)		9.2%[1]		6.2%	22.6%
Odds (cumulated)				0.6%	0.1%
Key facts	① ② Overarching	③ ④	⑤ ⑥	⑦ ⑧	

Note: Full information of all seven investment criteria scores is available for 427 out of 1,362 deals.

1 Excluding real quality deal flow (rQDF).

Figure 2: VCs' evaluation card

ABOUT THE INVESTMENT EVALUATION

> **Venture X**
> (Source: X; Founded: 2019; Located: Berlin)
>
> **1. Team** (4/5)
> - CEO trustworthy, serial entrepreneur with relevant market knowledge
> - CIO rather unexperienced but strong academic background
>
> **2. Market** (3.5/5)
> - Huge market but crowded, maybe too late
> - ...
>
> **3. Product** (5/5)
> - Superior product, UX better than that from established competitors
> - ...
>
> **4. Business model** (5/5)
> - SaaS business, increasing MRR, CACs low, great scalability
> - ...
>
> **5. Traction** (4/5)
> - Decent MRR growth over LTM, margin +10% since January, outlook questionable
> - ...
>
> **6. Defensibility** (5/5)
> - Good platform, deep integration into customer IT systems
> - ...
>
> **7. Financial aspects** (4/5)
> - Valuation at x, 10% share for y million, co-Lead with VC z, term sheet from VC z

Note: This is a VCs' evaluation card. Each criterion is graded on a 1–5 scale for all evaluations. The GPs' assessments are conducted independently and anonymously. Finally, the GPs judge their willingness to investment on a scale with the options "Yes," "Rather yes," "Rather no," and "No, veto."

5.2.2 Does VCs' own fundraising interact with venture capital investments?

So, how can you as an entrepreneur increase your chances of belonging to the 0.1% of those being funded? Our data reveals important insights about timing. When looking at all the deals in the data, we see that entrepreneurs seem to be able to time investors. VCs screen much more actively (see Figure 3A) but also more rigorously (Figure 3B) when they raise new funds. However, for those deals that survive screening, numbers indicate looser pockets for VCs with recently raised funds compared to VCs who have to make more rigorous investment decisions as their funds mature (Figure 3C and 3D).

Figure 3: Deal success by venture capital fund age and investment funnel stage
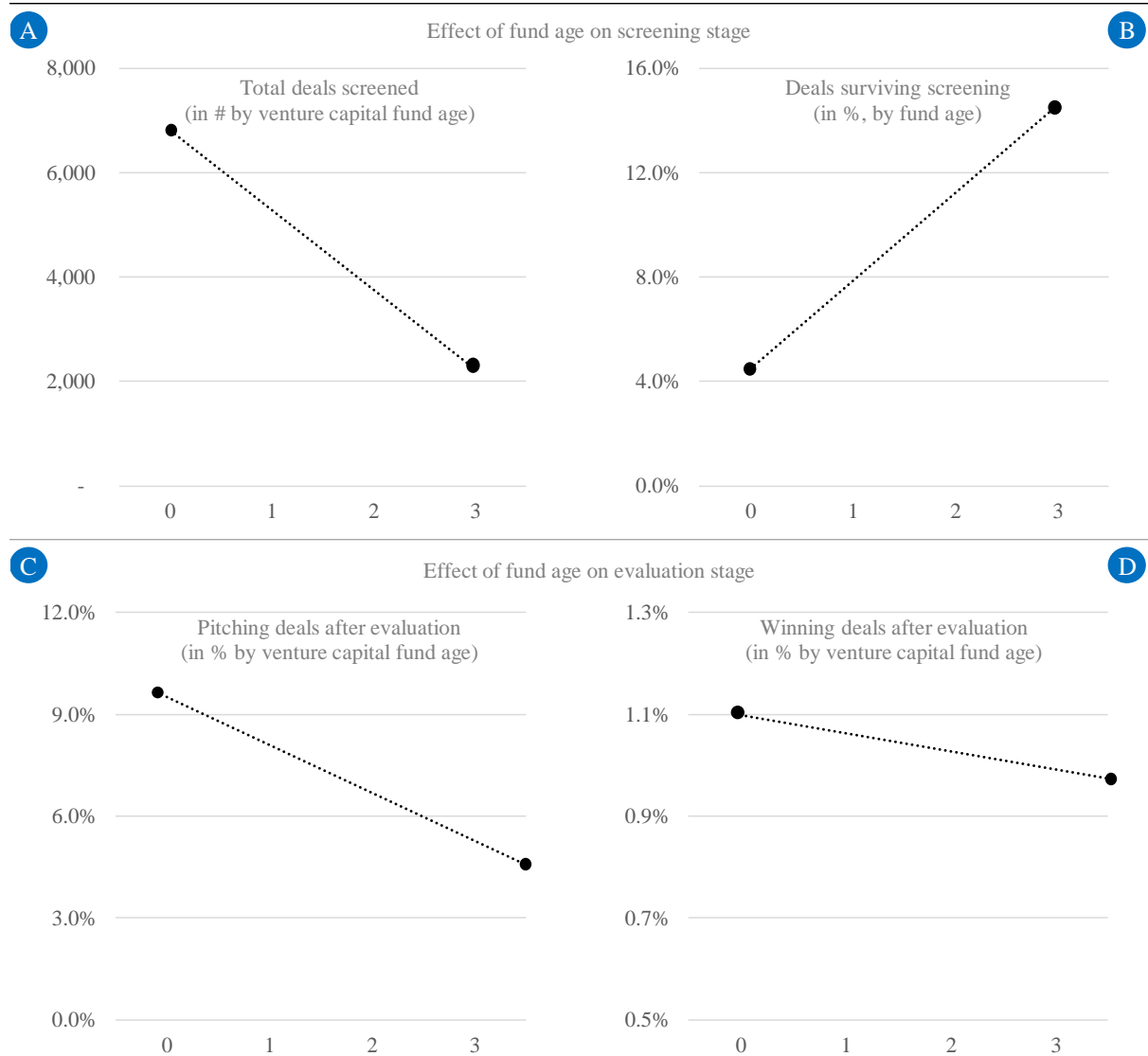
Note: Linear trendlines depict the total N or the share of deals that manage to succeed respective funnel stages (Y-axis) depending on the age of the VC-fund in years (X-axis). All deals of the screening and evaluation stage included (Total N = 14,549 and 1,362 respectively).

In other words, if you make it to the evaluation stage when funds were recently raised, your chance of pitching in front of the GPs and being funded could slightly increase. Now, this is something you as an entrepreneur can steer. Do your homework and target VCs with newly raised funds.

2 Key fact: Be at the right place at the right time. Entrepreneurs seem to be able to time investors. For deals that reach the evaluation stage, our numbers indicate looser pockets for VCs with recently raised funds.

5.2.3 How can you improve your "deal quality"?

Discussions with venture capital practitioners on the screening and evaluation process reveal that it appears to be common knowledge that the deal source is a major differentiation factor when it comes to the quality of a deal. For this reason, investment professionals differentiate between quality deal flow (QDF) and non-quality deal flow (non-QDF). Our data allows us to use such deal-source classifications. Looking at more than 10,000 deals, we find that 23% of all original deals are classified as QDF, and 60% of the deals that pass screening stem from QDF (see Figure 4). This finding is in line with prior research showing the importance of venture capital network access to eventually be recognized as QDF by investment professionals (Sørensen, 2007). As one investment professional in our data stated, "*After three years as investment professional, I know what to look for and whose deal recommendations to follow.*"

Figure 4: Share of deals in the screening and first evaluation by deal source

Screening stage

23%

77%

Evaluation stage

40%

60%

Quality deal flow (QDF)
Non-quality deal flow

Total N = 11,236 deals

Total N = 1,254 deals

Note: Excluding deals without specified information of deal source.
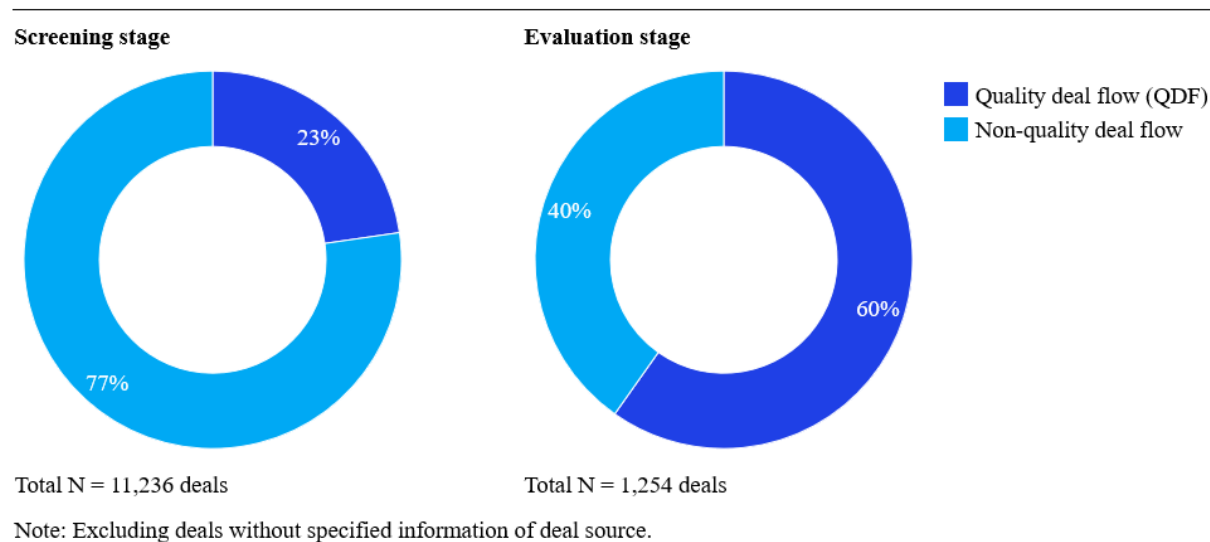
③ Key fact: Investment professionals leverage their networks to narrow down the thousands of deals they receive to the hundreds of deals they want to evaluate in detail.

5.2.4 What are simple rejection reasons you can avoid?

Our data also shows why VCs reject deals at the screening stage, enabling new insights into the venture capital decision-making process based on actual deal data. In our sample, we find that the two most common reasons VCs reject a deal at the screenings stage are "no venture capital case" and "no investment focus" (see Figure 5). Discussing these results with investment professionals, we found that the underlying aspects for a "no venture capital case" rejection are either that the target market is too small or too crowded or that the business model is unscalable, both of which typically align with

limited upside potential for the deal and the return prospects of the venture capital firm (i.e., target internal rate of return [IRR] or multiple of invested capital [MOIC]). This does not surprise. On the other hand, it is interesting for entrepreneurs to know that investment focus is the second most specified reason for rejection. This shows that VCs specialize, too, both toward industry and geography. In fact, most investors in our sample already had explicit target industries or were about to shift focus toward those industries. Further, VCs prefer deals that are easily accessible. Many deals are rejected because they are in the wrong geographical area. While these rejection reasons are not new to research (Alemany & Andreoli, 2018; Bernstein et al., 2015), we can show the difference in importance of rejection reasons and rank them and a more detailed level. These aspects should be considered by entrepreneurs seeking funding.

Grouping the rejection reasons from the screening stage alongside VCs' investment evaluation criteria, we conclude that investment professionals focus on a deal's financial aspects for VCs as well as its market potential and business model. This all occurs upon initial review during the screening stage. Hence, showcasing the *team* or the *defensibility of the value proposition* are minor motivators for rejection until the more detailed evaluation stage. Remind yourself, investment professionals screen within minutes by looking at a pitch deck and the deal source.

Figure 5: Number of deal rejections by reason and by investment criterion
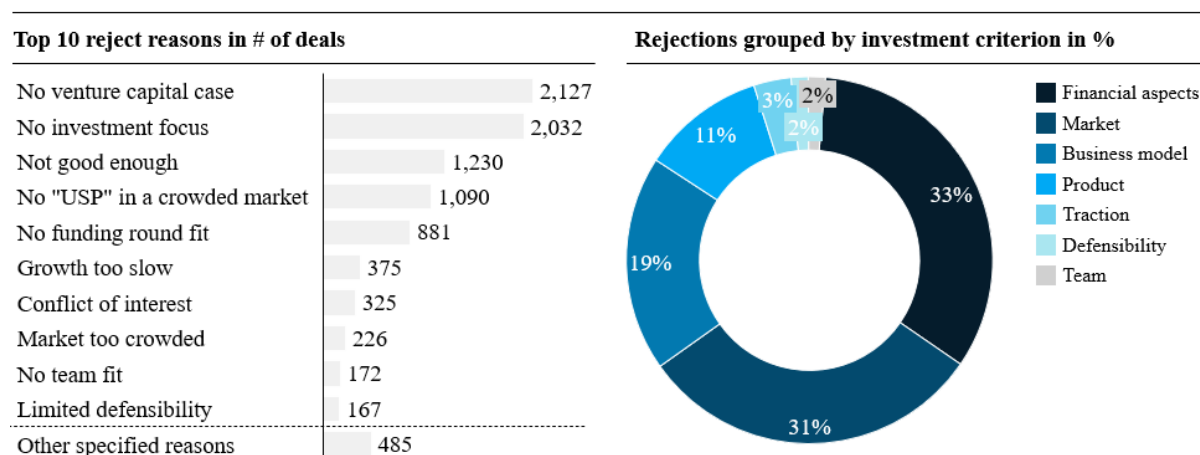
Note: In total, 13, 187 deals are rejected at the screening stage. Thereof, 9,110 rejections are specified (excluding deals without specified information).

4   Key fact: A first screening of your deal takes place before any personal interaction. Look out for VCs' industry and geography investment foci and how you present your financials to avoid no-go criteria. Proving your team will have more relevance later in the process.

5.2.5 What is QDF really worth?

After a deal has successfully passed the screening stage, VCs usually reach out to the venture and do a *first evaluation* to decide whether to invite the entrepreneurs for a pitch. Again, this is something that is rarely discussed. We investigate how QDF is considered in the first evaluation stage and illustrate our findings in Figure 6. We exploit the circumstance that deals are evaluated independently by investment professionals along the seven investment criteria. Here, our data shows that the average QDF score is 3.62, which is not differentiable from the average deal. This means that investment professionals do not attribute higher scores for deal characteristics like team, product, business model, etc., to QDF, which is unexpected. Investigating the effect of QDF for passing the first evaluation stage and reaching the pitch, we find that QDF only marginally increases the likelihood of getting an invitation to pitch (8.0%) compared to the average evaluated deal (6.7%). Thus, it seems that QDF is mainly a screening heuristic and loses its explanatory power at the evaluation stage.

However, we find that some deals indeed leapfrog the screening and initial evaluation stages and directly enter the short-term due diligence just before the pitch. We discussed these results with investment professionals to triangulate our understanding of QDF. According to interviewed practitioners, the story behind these leapfrogging deals is typically twofold: first, they are recommended by partnering investors (i.e., frequent co-investors), and second, *such deals already successfully went through similar screening and evaluation processes with the referring partners*. The combination of these characteristics provides a different signaling effect because other (befriended) VCs have put these deal proposals through their paces, which provides additional legitimacy. Including this differentiation of *real* quality deal flow (rQDF) in our analysis, we see that the average deal quality—as evaluated by investment professionals—is higher (3.86 vs. 3.62, see Figure 6). We also find that 62% of rQDF deals make it to the pitch presentation, which is significantly higher than the average deal (6.7%).

To conclude, while our data indicate that QDF deals are more likely to pass the screening stage, we observe that the role of simple referrals is now ambiguous in the first evaluation stage. *Simple referrals or introductions between insiders of the venture capital scene do not always materialize*, meaning they do not work as a wildcard to move on to the pitch presentation. In contrast, we find that referral deals that have already successfully gone through the investment process at a referring venture capital firm have dramatically increased odds of pitching. For you as an entrepreneur, the message is clear: going to networking events and meeting VCs or the like who can help you tap into the venture capital universe may help you enter the very first door of the

process. However, there is no way around; you must flow through the whole investment funnel successfully in one go. Only after that can you leapfrog the initial evaluation stages at befriended venture capital firms and directly pitch.

⑤ Key fact: Simple referrals from other VCs alone do not work. However, deals referred from one VC to another after they have successfully survived the investment process are substantially more likely to pitch in front of other VCs. This is the way to leapfrog the initial investment funnel stages.

Figure 6: First evaluation stage—The path toward the pitch

Deal source	Avg. score 1st eval.	After 1st evaluation: Share of deals reaching the pitch stage by deal source
Quality deal flow (# of deals = 750)	3.62	8.0%
All (# of deals = 1,254)	3.62	6.7%
Real quality deal flow (# of deals = 42)	3.86	61.9%
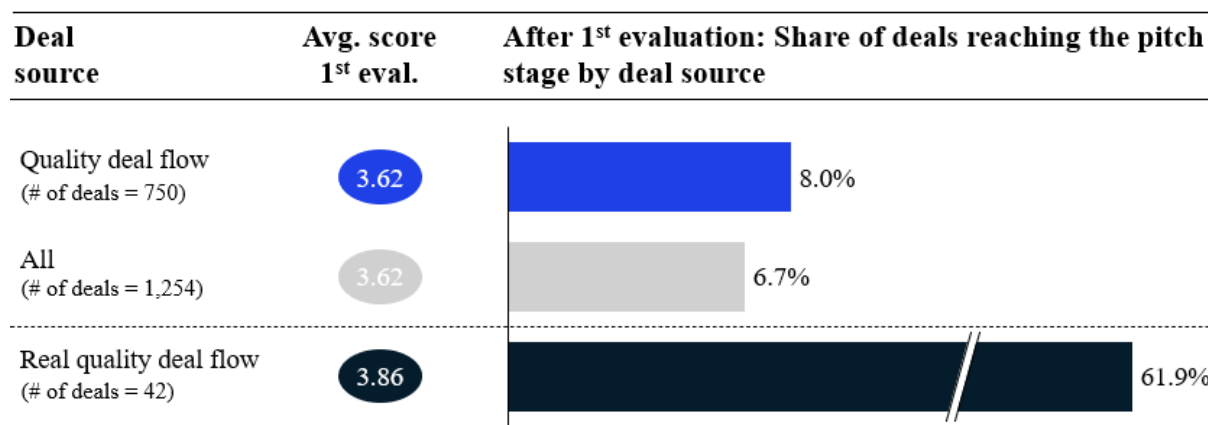
Note: First evaluation scores range from 1 to 5. Total N = 1,254 deals (excluding deals without information on deal source, so probabilities might different from all deals depicted in the investment funnel).

5.2.6 So, what about the team?

There is a longstanding discussion in research and among practitioners regarding the question of whether investors bet on the management team or the business (Gompers et al., 2020). Also, both researchers and practitioners have identified a common set of factors everyone looks at when assessing deals (Gompers et al., 2020; Alemany & Andreoli, 2018). However, we have yet only few insights into how these factors relate to each other and how they are valued across the investment funnel, while the common notion remains that *it's okay to have a mediocre idea when you have an A-team and vice versa*. We contribute to this discussion by exploiting our unique access to funnel stage–specific deal evaluation data and investigate the importance of the investment decision criteria depending on the funnel stage and relative to each other.

We have scorecard evaluations for 1,362 deals. Thereof, 427 deals offer the full picture of all evaluated investment criteria. These deal numbers translate into 7,518 and 2,989 individually assessed investment criteria, respectively. Of the seven criteria, we find that the team indeed stands out in terms of relevance for VCs, especially at the

beginning of the evaluation process. What we didn't know before this research, however, is that the team is usually the first investment criterion assessed in the *first evaluation.* Indeed, most of the investment professionals we interviewed said the team is a *go/no-go criterion* to proceed (see Figures 8 and 9). In fact, of the 427 deals with full data on all funnel stages, 36% of the teams with a 5-star score make it to the pitch presentation, while only 2% of the deals with a 3-star score are invited (see Figure 8). The significant relationship between the team and the pitch invite may not sound surprising, but out of the seven investment criteria, only the team exhibits this strong relationship. Unlike all the other investment criteria scores from the first evaluation, we find that the team's first impression remains imprinted until the investment decision.

We also investigate how the team relates to the other investment criteria. We use five deal-variation scenarios from our data to estimate the probability of reaching the pitch presentation. The exemplified models are based on a deal with a SaaS-business model focusing on B2B customers. Our results show that the base-case deal (with a rating of 4 on all criteria in the first evaluation stage) has an 8% chance of reaching the pitch presentation (Model I, Figure 7). If the same deal receives a higher team ranking (5 instead of 4), the chance almost doubles to 15%—an increase of 7 percentage points (Model II, Figure 7). On the contrary, if the business model criterion increases to 5 and the team criterion remains a 4, the likelihood to reach the pitch presentation is 12% (Model III, Figure 7). If a deal scores 5 on the team criterion but only average on all the other criteria (i.e., a score of 3), its likelihood to make it to the pitch presentation is just 5% (Model IV, Figure 7). This model illustrates that an outstanding team alone is most likely not enough to make a deal survive the investment funnel, therefore unmasking the "A-team but average case" myth because your chances *are* weak if you have a super-star team but present an average case. Finally, if a deal has full scores across all the other criteria (i.e., all scores of 5) but only an average team score of 3, the chance of reaching the pitch presentation is 13% (Model V, Figure 7). This result shows that the difference between Model II (great team) with 15% and Model V (great deal) with 13% is not as strong as we expected. These valuable insights about the interactions between and the relevance of the investment criteria are novel to research and practice alike.

> 6 Key fact: The team is a gatekeeper to the pitch, but the team alone won't make it.

Figure 7: Estimated probability of pitching based on deal characteristics on a 1–5 scale

Deal characteristics		Model I Good deal Good team	Model II Good deal Great team	Model III Good deal Great BM	Model IV Average deal Great team	Model V Great deal Average team
1ˢᵗ evaluation stage: Criteria						
Team	(***)	4.0	5.0	4.0	5.0	3.0
Business model (BM)	(*)	4.0	4.0	5.0	3.0	5.0
Defensibility		4.0	4.0	4.0	3.0	5.0
Financial aspects		4.0	4.0	4.0	3.0	5.0
Market		4.0	4.0	4.0	3.0	5.0
Product		4.0	4.0	4.0	3.0	5.0
Traction		4.0	4.0	4.0	3.0	5.0
Other characteristics						
Venture fixed effects		Yes	Yes	Yes	Yes	Yes
VC fixed effects		Yes	Yes	Yes	Yes	Yes
Year fixed effects		Yes	Yes	Yes	Yes	Yes
Pitch probability		8%	15%	12%	5%	13%

Note: Pitch probabilities are normalized by the ratio of deals with full first evaluation information divided by total deals at the first evaluation (ratio = 427/1,362 = 0.3135). Logistic regression model: N = 427, AIC score = 341, and residual deviance score = 315. Coefficients that are statistically different from 0 are market with the appropriate asterisk: *** at $p < 0.001$, ** at $p < 0.01$, and * at $p < 0.05$ level.

Figure 8: First evaluation stage selection based on investment criteria scores

Criteria 1st eval.	Avg. score 1st eval.	Share of deals reaching the pitch stage by criteria score of 1st eval.	Score composition of deals at the pitch stage by criteria of 1st eval.

In %

1 Star · 2 Stars · 3 Stars · 4 Stars · 5 Stars

Team	3.8	36 / 19 / 2	3 / 53 / 44
Product	3.7	32 / 21 / 6 / 6	1 / 9 / 60 / 29
Traction	3.4	32 / 21 / 14 / 8 / 4	1 / 5 / 24 / 44 / 25
Business model	3.6	32 / 24 / 6 / 3	1 / 11 / 69 / 19
Defensibility	3.0	31 / 27 / 16 / 10	11 / 32 / 52 / 5
Market	3.7	29 / 22 / 6 / 3	1 / 8 / 61 / 29
Financial aspects	3.5	25 / 21 / 12 / 7 / 4	3 / 1 / 16 / 59 / 21

Note: Scores are rounded (e.g., a score of 3.5 is rounded to 4.0). Total N = 427 (excluding deals without full first evaluation score information). 100%

Figure 9: Total number of completed first evaluations along the investment criteria
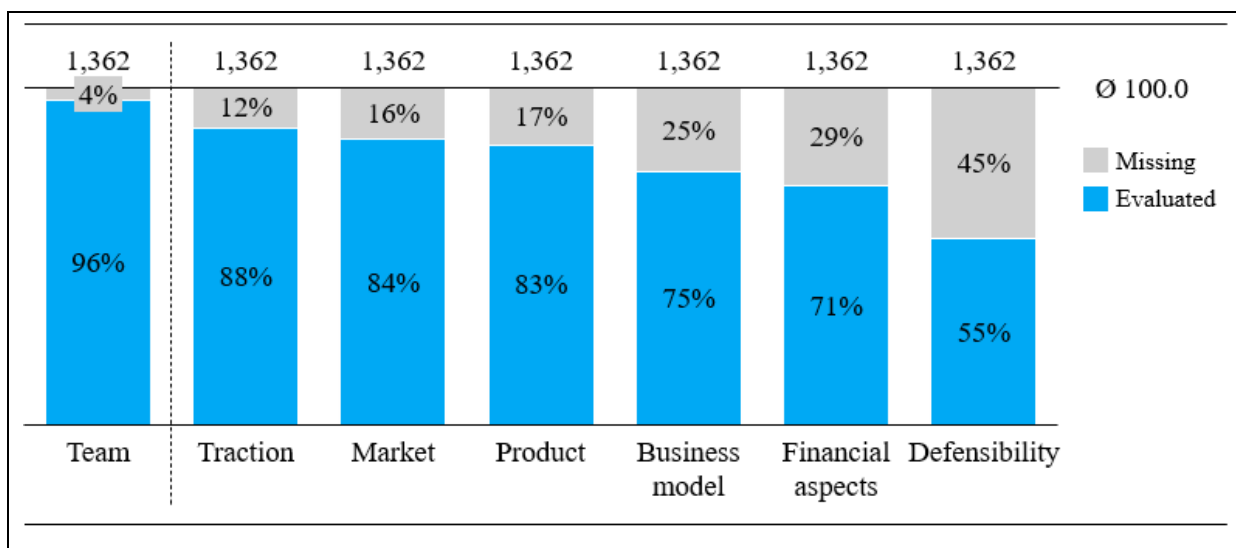
5.2.7 The pitch presentation

So far, we have captured what is most relevant to navigate through the investment funnel to meet the decision makers—the GPs—at the pitch presentation. It should be clear by now that the importance of criteria changes along the way. Here, at the second evaluation stage, the deal is again evaluated along all seven investment criteria based on the pitch presentation—a key milestone toward funding. This time the GPs conduct

the evaluation—anonymously and independently—along with indicating their investment willingness.

So, what makes you truly win in the end? Since rQDF allows some entrepreneurs to skip the funnel up to here, we explore if those deals are also more likely to win the pitch compared to QDF deals or other deals that make it to the pitch presentation (see Figure 10). Thus, we first compare QDF to other deal sources but do not find a significant difference in the likelihood of finally being considered for funding. Second, we investigate how rQDF deals compare to other deals and, again, do not find a significantly different likelihood in being considered for funding, which is an unexpected result (see Figure 10). In this stage, VCs seem to conduct their evaluations of rQDF deals as rigorously as they do for other deals. The pitch situation sorts out advantageous characteristics that QDF might have had until this point. Consequently, the final investment decision between the pitching deals is not affected by the source of the deal, although better deal quality results in slightly better odds of receiving funding. This basically implies that the GPs of venture capital firms are not biased when considering rQDF that comes from other VCs but may use it as an opportunity to spare resources in the assessment stage.

Our findings provide important insights into how VCs' deal sourcing and deal selection interact within the actual investment process, a puzzle that was yet unsolved in research (Gompers et al., 2020; Sørensen, 2007).

> 7 Key fact: At the pitch, deal quality equalizes irrespective of source. Thus, entrepreneurs cannot just rest and rely on their backing networks.

Figure 10: Second evaluation stage—The pitch evaluation and successive funding

Deal source	Avg. score 2nd eval.	After 2nd evaluation: Share of winning deals by deal source
Quality deal flow (# of deals = 60)	2.03	25.0%
All (# of deals = 84)	2.02	22.6%
Real quality deal flow (# of deals = 26)	2.19	26.9%
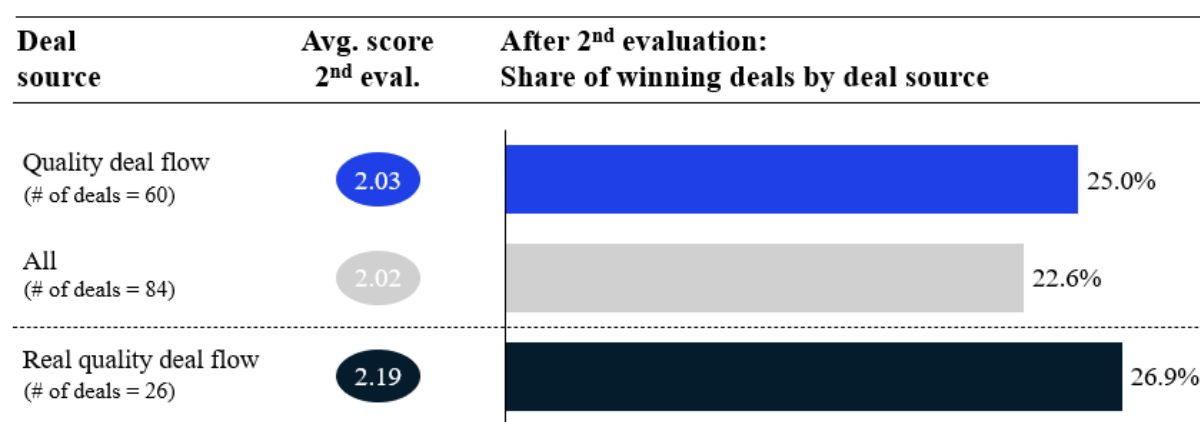
Note: Second evaluation scores are translated to a 0–3 scale. Total N = 84 (excluding deals without information for deal source, so the probabilities might different from all deals depicted in the investment funnel).

For you as an entrepreneur, the message is clear: being treated as QDF still helps you survive the hard investment process from screening to funding. In particular, if an entrepreneur has the backing of a credible VC, pitching at another VC becomes very likely. However, according to our sample, the QDF signal is not cheap, and entrepreneurs cannot rest on it as competition at the pitch presentation is tough.

"*I know that most other VCs feel the same about this, so if you want to raise money, spending time on producing a great pitch deck is time well spent.*" (Quote from a general partner of a venture capital firm)

The overall results of the pitch evaluation show that investors draw a comprehensive picture of the investment cases. While the screening and the first evaluation seem to make use of specific heuristics, such as filtering by deal source or by inferring deal quality based on team impression, the second evaluation seems to leave nothing to chance.

By now, the investors have done their homework. They have conducted their due diligence, made reference-calls, had internal discussions, understood the business model, and have prepared some final questions to "grill" the entrepreneur. Based on this preparation, for the second evaluation, we observe that VCs apply multiple investment criteria, of which the majority are also statistically relevant for this evaluation and the respective funding. Figure 11 shows positive relationships between the second evaluation scores—namely, the GPs' willingness to invest—and all applied investment criteria.

Figure 11: Lion's den—Second evaluation scores related to investment criteria

Criteria 2nd eval.	Univariate coefficients of investment criteria vs. 2nd evaluation scores	Multivariate coefficients of investment criteria vs. 2nd evaluation scores
Business model	0.59	0.28
Team	0.55	0.25
Market	0.45	0.18
Financial aspects	0.42	0.26
Product	0.36	0.15
Defensibility	0.26	0.07
Traction	0.16	0.12
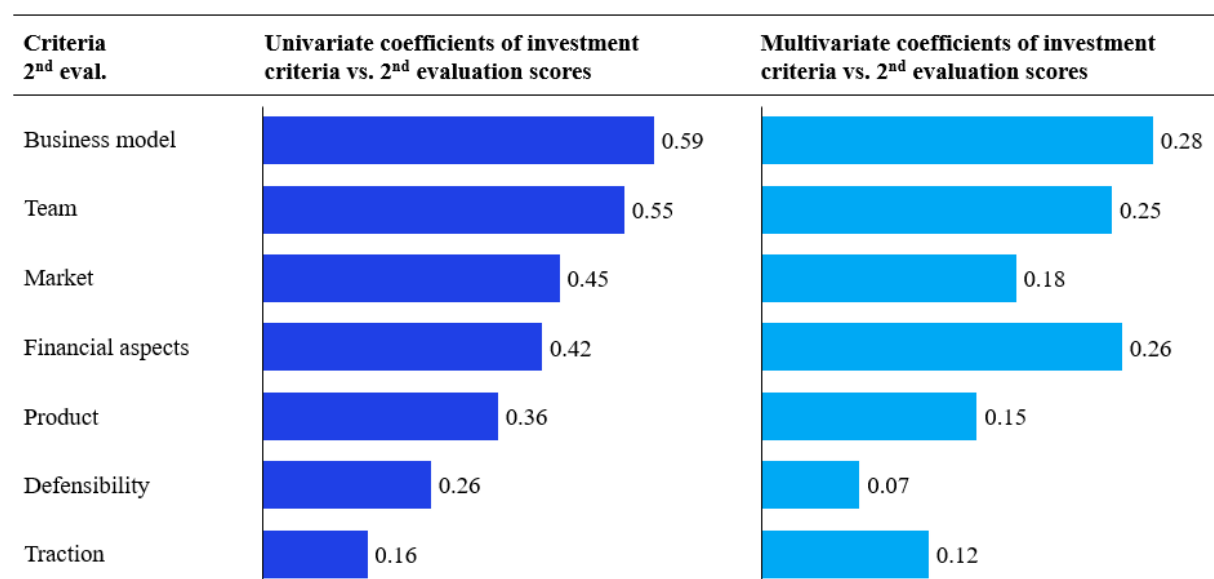
Note: Investment criteria scores are on a 1–5 scale, whereas the second evaluation scores are on a 0–3 scale. The linear regression model behind multivariate coefficients is controlled for venture, VC, and year fixed effects. Total N = 84.

8 Key fact: A strong team carries you to the pitch presentation. However, in front of the GPs, a comprehensive picture of your deal matters.

5.3 Conclusion

We conclude that the comprehensive perspective of VCs that we observed firsthand is not fully acknowledged in publications focusing on snapshots and fragmented aspects of the whole investment process. On this basis, we advise entrepreneurs. You need to consider this process for what it is: a process in which several criteria are important, related to each other, and emphasized differently along the way. From an investor's perspective, we conclude that venture capital investors have found an effective (in terms of rigor and consistency) multi-stage investment process. However, time will show whether their selection of 0.1% of screened deals was right. Using such a structured process to identify deals may contradict the search for the much-desired outliers. For entrepreneurs seeking funding, we show that VCs will gain a holistic perspective of your proposal—you will not fool them. Thus, do your homework on all the relevant aspects of your business. You cannot shortcut your first funding; there is no way around VCs' rigorous investment process, and you need to run through it at least once. However, you can steer the tough investment process by knowing what criteria to focus on at what point. That said, because trustworthiness matters so much in such a dynamic environment, entrepreneurs should present themselves and their businesses as what they are. Eventually, this is always the upside.

Second Dissertation Article

An Agency Framework on Venture Selection in VC Funding Decisions

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6. An Agency Framework on Venture Selection in VC Funding Decisions

Abstract

Venture capitalists' (VCs) investment decision-making is a prominent research topic since decades. However, prior research lacks an understanding of the deal selection process – i.e., the distinct deal screening and evaluation stages – where information asymmetry from various sources is at its highest. In this study we use agency theory to build a framework of how and when the common investment criteria used by VCs (team, business model, market, product, financials) reach relevance during the process and affect decision-making. Surprisingly, our analysis based on data from 16,676 venture deal proposals and 60 VC interviews also indicates the non-existence of signaling effects at final decision stages.

Key words: venture capital; decision-making; information asymmetry; investment criteria; deal source; deal evaluation

6.1 Introduction

Agency problems in the entrepreneur-venture capitalist (VC) relationship have been discussed for decades (Fama & Jensen, 1983; Fried & Hisrich, 1994; Fiet, 1995; Shepherd & Zacharakis, 2001; Burchardt et al., 2014; Hsu et al., 2014; Gompers et al., 2020). Generally, prior research advanced our understanding of the investment contract structuring and post-investment stages when principals (VCs) and agents (entrepreneurs) steer their relationship with monitoring activities based on contractual rights (e.g., Kaplan & Strömberg, 2001, 2003; Cumming, 2005; Bernstein et al., 2015). Scholars have shown how VCs adapted to the risks inherent in agency problems (Burchardt et al., 2014; Gompers et al., 2020), for instance, by using diversification, syndication, and staging strategies to build portfolios and therefore to mitigate investment risks and uncertainty (Lerner, 1994; Gompers, 1995; Amit et al., 1998; Shane & Cable, 2002; Ferrary, 2010). However, when information asymmetry between both parties is at its highest, i.e., at the screening and evaluation stages of deal proposals, research lacks insights into how VCs alleviate agency concerns and decide on the basis of limited and only gradually emerging information.

Prior literature has evidenced how VCs involve multiple decision-makers validating venture deal propositions (e.g., Petty & Gruber, 2011) and the relevance of deal sourcing activities in deal selection (e.g., Shane & Cable, 2002; Franke et al., 2006; Zhang & Guler, 2019), which indicate the increasing complexity of the VC investment decision process. While such prior research created significant contributions to the field, it lacks the ability to study investment criteria used by VCs to assess deal proposals over multiple decision stages and decision makers as they take place in practice (Petty & Gruber, 2011; Gompers et al., 2020). This is an empirical challenge since actual decision-making is usually undocumented or sealed, leading to methodological limitations and ambiguous findings (Petty & Gruber, 2011; Hsu et al., 2014; Monika & Sharma, 2015; Drover et al., 2017). Although it is well known that obtaining VC funding means going through a long decision process, it is not much acknowledged in existing studies. The lack of archival data prevents research from more complex, stage-specific breakdowns of the venture selection process. Such data is necessary to research how VCs address the only gradually emerging information – that is, varying degrees of information asymmetries from different information sources – that continues to pose a challenge for VCs who aim at alleviating principal-agent concerns early on in the process (Monika & Sharma, 2015; Drover et al., 2017).

In this paper, we use agency theory (Jensen & Meckling, 1976; Eisenhardt, 1989) to develop a framework that explains how and when principals apply the common

investment criteria most suitable along the decision stages, driving a gradual decrease of information asymmetry. As actual flow of information is an essential foundation of our research, we address this research gap by using large-scale unique data on screenings and evaluations of 16,676 deals. We employ decision stage-specific analyses. Regression models tailored to the subsequent evaluations enable us to investigate the effect of the common investment criteria and the deal source on decision-making beyond ordinal rankings, while avoiding cognitive biases of surveys or experiments (cf. Silva, 2004; Hudson & Evans, 2005; Franke et al., 2006; Kollmann & Kuckertz, 2010; Petty & Gruber, 2011; Monika & Sharma, 2015). Our analyses are complemented by 60 interviews and practice participations, both verifying our results and supporting our theorizing.

This paper makes three main contributions to literature. First, we use the principal-agent theory (Jensen & Meckling, 1976; Eisenhardt, 1989) to develop an agency framework that provides a processual break-down of the venture selection process of VCs. This breakdown shows how agency theory explains VC decision-making along the subsequent screening and evaluation stages, based on the decrease of information asymmetry, while considering the involvement of multiple decision-makers. In other words, we show based on agency theory that the gradual closure of information asymmetry materializes in staged criteria relevance in the decision process.

Second, we contribute to VC literature by providing an explanation for the inconclusiveness of results on relative criteria importance from prior studies. Some scholars find that the team ("jockey") is the most important investment criterion (MacMillan et al., 1985; Bernstein et al., 2017; Gompers et al., 2020), while others find evidence for the business, the market, financial aspects, or the product ("horse") as being most decisive for the investment decision (Hall & Hofer, 1993, Shepherd, 1999a; Zacharakis & Meyer, 2000; Kaplan et al., 2009; Petty & Gruber, 2011). Our analyses of the whole selection process reveal new insights. We provide empirical evidence that management teams seem to play a relatively minor role at initial screening activities, whereas their role becomes decisive at the subsequent evaluations. That criteria relevance is sensitive to the decision stage has implications for developing a more complex understanding of VC decision making (Monika & Sharma, 2015; Drover et al., 2017). Our paper suggests that future scholars should consider which decision stage they target and to admit that factors may be more or less relevant in different VC stages.

Third, we contribute to the VC literature by separating the two VC performance channels of deal sourcing and deal selection (Sørensen, 2007; Gompers et al., 2020). Our findings improve scholars' understanding of which VC activities predominantly

influence VC performance, the deal sourcing or the deal selection activity. Former research struggled to identify whether generating high-quality investment opportunities or skills in the venture selection from these opportunities are the key-drivers making VCs successful (e.g., Sørensen, 2007; Bernstein et al., 2017). Our results provide unprecedented evidence for an existing but over the decision process diminishing signaling effect for deals from trusted sources. We show that the deal source is highly important at the screening and the early steps of the evaluation when information on inherent deal qualities is highly incomplete and uncertain. On the contrary, the associated signal becomes obsolete for the eventual investment decision. According to our knowledge, the distinction between actual deal quality, captured in form of the measurable and gradually substantializing investment criteria, and the signaling effect of the deal source along the decision stages is novel to literature.

6.2 Theoretical framework

6.2.1 Principal-agent theory in VC-investment literature

Agency problems have been discussed for decades in VC literature (Fama & Jensen, 1983; Fried & Hisrich, 1994; Fiet, 1995; Amit et al., 1998; Shepherd & Zacharakis, 2001; Burchardt et al., 2014; Hsu et al., 2014; Gompers et al., 2020). Agency problems, including adverse selection and moral hazard, occur when a principal, who's typical goal is profit maximization, selects an agent (Jensen & Meckling, 1976), who has a conflicting agenda, given prevailing information asymmetries (Eisenhardt, 1989; Shapiro 2005). These agency problems are inherent and empirically observable along all VC investment activities (Fama & Jensen, 1983; Burchardt et al., 2014), which are described by the seminal works of Wells (1974) and Tyebjee & Bruno (1984). Building on those studies, recent research clusters the investment activities of VCs dealing with agency problems along the following stages: (1) deal sourcing; (2) initial screening of proposals; (3) two sequential evaluations; (4) deal structuring; (5) post-investment activities; and (6) cashing out or exit (Kollmann & Kuckertz, 2010; Gompers et al., 2020). Table 3 describes these phases, including the activities and lead decision makers. Initially, high-quality deal flow is created through networking activities. These are followed by the investment decision-making activities, leading to deal investments or rejections. Eventually, the VC cooperates with the deal in its post-investment activities until the exit.

Table 3: VC investment activity stages

	VC activity stages						
Stage	(1) Sourcing	(2) Screening	(3a) First evaluation	(3b) Second evaluation	(4) Structuring	(5) Post-investment activities	(6) Cashing out or exit
Lead decision-makers	Junior/senior decision-makers	Junior decision-makers	Junior decision-makers	Senior decision-makers	Senior decision-makers	Junior/senior decision-makers	Senior decision-makers
Stage definition	Networking activities, creating a high-quality deal flow	Initial stage, starting with the review of sourced deals, ending with the decision to invite the entrepreneurs to a video call or an in-person meeting	Intermediate stage, starting with the first face-to-face interaction, followed by due diligence activities, ending with the decision to invite the deal to the pitch presentation in front of the senior decision-makers	Final stage before structuring, starting with the pitch presentation, followed by the clarification of final questions and the finalization of the due diligence, ending with the expressed willingness to invest	Final pre-investment stage, including negotiations, ending with either deal closing or rejection	Post-investment stage, starting with an onboarding, followed by monitoring and advisory activities, ending with exit	Sale or write-off

In practice, the information asymmetry and the involvement of senior and junior decision-makers varies across these stages. Whereas in post-investment activities (5) to (6), the VC has an insider role, capable of steering the relationship with written contracts, incentives, and monitoring activities (e.g., Kaplan & Strömberg, 2001, 2003; Cumming, 2005; Bernstein et al., 2015), in pre-investment activities (1) to (4), the VC has an outsider role. Here, the investors suffer the highest level of asymmetric information regarding qualities of the potential investment cases. Hence, they are most vulnerable to opportunistic behavior (Akerlof, 1970; Amit et al., 1990, 1998).

Given this high degree of upfront investment risks and uncertainty (Sahlman, 1990), the investors perform portfolio diversification, syndication, and staging at the portfolio management level (Lerner, 1994; Gompers, 1995; Amit et al., 1998; Shane & Cable, 2002; Ferrary, 2010). At the investment level, Shepherd & Zacharakis (2001) indicate that mutual trust between principals and agents could mitigate agency problems, but Christensen et al. (2009) find that VCs expect entrepreneurs to be potentially opportunistic and open to moral hazard, an attitude which seems to be reciprocal (Glücksman, 2020).

Therefore, VCs adapted to agency problems by sophisticated screening and evaluation stages along which rigorous investment criteria are applied by the lead decision-makers (Burchardt et al., 2014). Especially the work-intensive screening and first evaluation activities are managed by rather junior colleagues, whereas eventual investment decisions are performed by the seniors (Franke et al., 2008). While this separation of subsequent decisions seems to be efficient, the irreversibility also implies that a stage-by-stage consideration of decisions is critical (Franke et al., 2008), as research found that the experience of decision-makers influences the venture selection (Shepherd et al., 2003; Franke et al., 2006).

Given the processual structure of deal screenings and evaluations as well as their dependencies on varying levels of deal information from stage to stage, it is surprising from a principal-agent perspective how prior research has been inattentive of such structures when investigating VC investment decision-making. In the absence of data availability, the dominant research approach of early studies relied on retrospective, self-reporting of VCs in form of questionnaires, generating a basic understanding of decision criteria applied but generally disregarding any potential processual dynamics in their relevance (Zacharakis & Meyer, 1998; Shepherd, 1999b; Franke et al., 2006; Petty & Gruber, 2011; Monika & Sharma, 2015; Drover et al., 2017). One exception of this survey-dominated first wave of research is Hall & Hofer (1993), who use verbal protocoling in their explorative study, capturing the processual character of the

decision-making. By that, they identify dynamics in the criteria relevance along the process. Scholars also found that VCs may have only limited insight into their own decision-making and are prone to cognitive biases, leading to inaccurate reflections on their decision-making process (Khan, 1987; Sandberg et al., 1988; Zacharakis & Meyer, 1998; Shepherd, 1999b; Shepherd & Zacharakis, 1999; Shepherd et al., 2003; Franke et al., 2006, 2008; Petty & Gruber, 2011). This insight led to a second wave of research, which predominantly focused on experimental (conjoint) analyses. However, while these experimental studies could extenuate such concerns and helped to provide an understanding of how lead decision-makers weight criteria against each other in investment decisions (Riquelme & Rickards, 1992; Shepherd & Zacharakis, 1999; Franke et al., 2006, 2008; Murnieks et al., 2011), they are based on hypothetical and simplified investment cases, again missing the processual perspective (Petty & Gruber, 2011; Monika & Sharma, 2015). Therefore, scholars concluded that we have hardly any evidence on the dynamics of investment criteria relevance along the decision stages, besides dispersed indications from small sample sizes (Petty & Gruber, 2011). Given this research gap, Petty & Gruber (2011) find through their explorative study that the importance of decision criteria seems to be subject to considerable dynamics along the decision process. A finding, which is underlined by Kollmann & Kuckertz (2010), who show that VCs perceive the evaluation uncertainty of the investment criteria as highly sensitive across both, the criteria and along the decision stages of the process – implying varying levels of information asymmetry in both dimensions.

Within this process of VCs' decision-making, which the principals design to reduce the initially high degree of asymmetric information, prior research has identified specific criteria VCs use to assess a ventures suitability for funding: the management team, the business model, the target market, the product or service, and financial aspects around a deal represent the overarching criteria, while the deal source indicates deal quality even before actual evaluations on the common criteria are performed (Sahlman, 1990; MacMillan et al., 1985; Gompers et al., 2020). Table 4 represents the five commonly acknowledged investment criteria and the deal source with references to empirical studies investigating criteria relevance.

Table 4: Venture capitalists' investment criteria

Investment criteria	Evidence of criterion's relevance
Management team	MacMillan et al. (1985); Robinson (1987); Muzyka et al. (1996); Shepherd (1999a); Franke et al. (2006); Kaplan & Strömberg (2009); Bernstein et al. (2017); Gompers et al. (2020)
Product | service	Tyebjee & Bruno (1984); MacMillan et al. (1985); Petty & Gruber (2011); Mishra et al. (2017); Gompers et al. (2020)
Market	Tyebjee & Bruno (1984); MacMillan et al. (1985); Shepherd (1999b)
Business model	MacMillan et al. (1985); Kaplan & Strömberg (2009); Gompers et al. (2020)
Financial aspects	Tyebjee & Bruno (1984); MacMillan et al. (1985); MacMillan et al. (1987); Robinson (1987); Muzyka et al. (1996); Zacharakis & Meyer (1998); Petty & Gruber (2011); Gompers et al. (2020)
Deal source	Sahlman (1990); Hall & Hofer (1993); Kelly & Hay (2003); Zhang & Guler (2019); Gompers et al. (2020)

However, it remains puzzling how the most prominent but elusive investment criteria act in concert in their natural environment, given ever changing levels of information asymmetry along the process. More precisely, literature does not incorporate how the flow of information along the decision process impacts the relevance of the criteria. For instance, little is known about how a signaling effect associated with high-quality investment opportunities, generated through the VC's network (Sahlman, 1990; Shane & Cable, 2002; Sørensen, 2007; Gompers et al., 2020), is affected by the increasing substance behind inherent deal qualities, captured through the investment criteria. An inevitable but from VC-perspective desired process that comes along with decreasing information asymmetry and uncertainty as deals progress through the investment process stages (Kollmann & Kuckertz, 2010). In this paper, we use agency theory to explain these dynamics in investment criteria relevance based on the decreasing information asymmetry between principals and agents along the decision stages.

6.2.2 Investment criteria and deal source relevance along the decision process

6.2.2.1 Screening stage
At the screening stage, the beginning of the principal-agent relationship the information asymmetry is the highest between the VCs and the entrepreneurs. Here, deals are screened within minutes usually solely based on written investment teasers (Hudson & Evans, 2005). By that, the management team criterion is especially unsuitable for irrevocable decision-making, as relevant components, such as leadership capabilities (MacMillan et al., 1985), entrepreneur's experiences (Muzyka et al., 1996; Shepherd, 1999b; Franke et al., 2006, 2008), or passion (Warnick et al., 2018) remain unobservable at this point. This implies that principals still lack decisive information regarding the team qualities at the initial screening stage, leading to relatively few deal

rejections related to the management team (Franke et al., 2008). In contrast, investment teasers typically include already some go/no-go information which are immediately observable for the junior decision-makers, such as general financial aspects relating to the VC's investment strategy, including the industry, the geographical location, and the round size and timing (Hall & Hofer, 1993), or too small target markets (Kollmann & Kuckertz, 2010). Therefore, these observable information are decisive and determine relatively frequent deal rejections, or alternatively the continuation of a deal proposal to the next decision stage.

As mentioned before, early-stage investments occur in an environment of highly asymmetric information. Especially at the screening stage, the principals know barley anything about the deal except for what is stated in the investment teaser or maybe in a referral email. Given this high degree of information asymmetry and the time pressure that principals are exposed to, junior decision-makers employ third-party signals, such as the reputation of the deal source (Sahlman, 1990; Riley, 2001; Gompers et al., 2020), indicating deal quality even before the deal inherent criteria substantialize. As signaling theory suggests, those observable signals enable the junior decision-maker to distinguish between deals under the condition of asymmetric information (Akerlof, 1970; Riley, 2001). Combining signaling theory with the decreasing information asymmetry, third-party signals should be particularly important when asymmetric information is the highest. In other words, deals originating from quality deal sources are more likely to pass the screening and continue to the evaluation stage than deals from non-quality sources. In practice, VCs use so-called trusted ties in deal sourcing activities between befriended investors, helping each other to find qualitative deals (Shane & Cable, 2002; Zhang & Guler, 2019; Gompers et al., 2020). Quoting a junior decision-maker on this topic: "*Our sourcing network is one of our strongest assets [...]. If deals do not manage to be at least somehow introduced to us, this implies a lot about the quality of the deal*".

6.2.2.2 First evaluation stage

However, this picture changes dramatically at the first evaluation stage. Here, after first face-to-face interactions between the principals and agents took place, the richness of novel, now observable, information about the management team, leads to a particularly strong decrease of information asymmetry for the relevant criterion (Franke et al., 2008). This low degree of information asymmetry makes the team decisive at the first evaluation stage. In contrast, as the due diligence is still ongoing, product-market fits, or detailed financial aspects remain relatively uncertain and require further clarification (Kollmann & Kuckertz, 2010). This reasoning is backed by a quote of an interviewed

junior decision-maker: "*Teams are often much easier to assess than product-market fits or future margins at this stage […], after the first calls, you immediately have an impression of how the founders tick and whether you'd like to proceed*", a reasonable remark, considering the time pressure that junior decision-makers face (Hudson & Evans, 2005).

While there is the discussed variation in the degree of asymmetric information across the common investment criteria, the overall information asymmetry remains high at the first evaluation stage, as the due diligence is still incomplete. Consequently, the environment of incomplete and uncertain information on deal inherent qualities leads in accordance with signaling theory to a signaling effect related to quality deal sources. In other words, the high information asymmetry on actual deal characteristics makes the trusted ties between investors a valuable source of information, as the actual, deal inherent qualities are still about to substantialize through the due diligence.

6.2.2.3 Second evaluation stage
Nevertheless, if a deal impresses, the management team finally meets the senior decision-makers in person at the second evaluation stage. The seniors are briefed in detail by their junior colleagues to clarify every relevant and solvable remaining question before the seniors express their investment willingness. Hence, "*the second evaluation is kind of a restart, all criteria are assessed as far as possible and also the lead decision-makers change*", as a junior decision-maker put it. Here, although early-stage investments are always associated with a relatively high degree of uncertainty and incomplete information, the information asymmetry decreases across all relevant, common, investment criteria to a minimum within the pre-investment decision-process, which is why the management team, besides all other investment criteria should convey decisive information at this final evaluation stage, explaining the eventually expressed investment willingness by the investors (MacMillan et al., 1985; Gompers et al., 2020).

Contrarily, that the decision-makers could by now address and clarify all relevant and solvable questions before expressing their investment willingness, makes the deal source an increasingly obsolete information. Therefore, at the second evaluation stage the deal inherent qualities, the characteristics of the actual investment opportunity, captured through the common investment criteria, explain the investment decision-making of the investors, whereas formerly employed quality signals associated with the deal source become insignificant.

Therefore, building on the concept of a gradually decreasing information asymmetry on the common investment criteria along the decision stages, we state our two main hypotheses about the criteria and the deal source relevance as follows:

Hypothesis 1: *The degree of information access affects investment criteria relevance on investment decision-making, with:*
a. *high information asymmetry on team decreasing its effect at the screening stage.*
b. *low information asymmetry on team increasing its effect at the first evaluation stage.*
c. *low information asymmetry on team increasing its effect at the second evaluation stage.*

Hypothesis 2: *The degree of information access affects deal source relevance on investment decision-making, with:*
a. *high information asymmetry on inherent deal qualities, increasing its effect at the screening stage.*
b. *high information asymmetry on inherent deal qualities, increasing its effect at the first evaluation stage.*
c. *low information asymmetry on inherent deal qualities, decreasing its effect at the second evaluation stage.*

6.3 Methodology

6.3.1 Data

Our sample comes from a European-based venture capital firm, focusing on seed and early-stage investments. Through the collaboration, we have access to 16,676 actual deals screened by VC decision-makers during the period from 2017 to 2020. Of those, 1,446 deals are evaluated on the five common investment criteria "management team", "product or service", "market", "business model", and "financial aspects". The evaluations are conducted in form of scorecard concepts and detailed evaluation reports. Of those deals, 104 deals succeeded to a second evaluation stage, eventually leading to 21 actual investments. In addition to the investigation of the archival deal data, we participated in VC-round-table events and several decision-making activities, such as evaluation calls, deal flow meetings, and pitch presentations. Finally, we conducted 60 formal open and semi-structured interviews with junior and senior decision-makers to validate our methods and results.

Our data is collected and build from five sources. First, we use a proprietary deal flow management tool which stores the information of all considered deals, including the entire deal-related email traffic. Second, we screened all due diligence files which

contain the evaluation reports for recorded first evaluation information. Third, we applied text-mining on all sent and received emails of the VC decision-makers to identify additional first evaluations. The applied trigger words include (a) "debrief", which is typically part of the title of relevant emails containing first evaluations, and (b) key words related to the investment criteria: "team", "product", "market", "business model", "funding round", and "returnability". Fourth, we manually screened the email traffic for existing but still missing evaluation data. Finally, the scores for the second evaluation and the recorded investment willingness of the senor decision-makers are collected from a survey tool, which is used by the VC after the second evaluation is finalized.

6.3.2 Measures

Table 5: Overview of measures and research methods by decision stage

Research approach	Screening stage		First evaluation stage	Second evaluation stage
Deal success definition	Deal continuation to next stage		Deal continuation to next stage	Investment willingness
Method(s) (*Hypotheses*)	i.	Chi-square goodness of fit test (*H1a*)	Logistic regressions (*H1b*, *H2b*)	OLS regressions (*H1c*, *H2c*)
	ii.	Two-proportions z-test (*H2a*)		
Dependent variable(s)	i.	Rejection proportions by criterion	Deal continuation (*binary*)	Ln Investment willingness
	ii.	Deal continuation proportions by deal source		
Independent variable(s)	i.	Rejection reasons	Ln Management team	Ln Management team
	ii.	Deal sources	Ln Product | Service	Ln Product | Service
			Ln Market	Ln Market
			Ln Business model	Ln Business model
			Ln Financial aspects	Ln Financial aspects
			Quality deal flow (*dummy*)	Quality deal flow (*dummy*)
			Real quality deal flow (*dummy*)	Real quality deal flow (*dummy*)
Control(s)	n.a.		Yes	Yes

Our research on investment decision-making spans over the screening stage, the first evaluation stage, and the second evaluation stage (cf. Tyebjee & Bruno, 1984; Fried & Hisrich, 1994; Kollmann & Kuckertz, 2010; Gompers et al., 2020). These stages differ substantially in their level of information completeness and uncertainty, deal ownership, decision-activities, and other surrounding circumstances. Hence, we tailor our employed measures and methods to each respective stage. Table 5 provides an overview of the employed measures and research methods at the different stages.

6.3.2.1 Dependent variables

In this study, we operationalize the VC's preferences in investment decision-making along the decision stages through four dependent variables, which are in accordance

with former studies (see also Riquelme & Rickards, 1992; Murnieks et al., 2011; Petty & Gruber, 2011; Warnick et al., 2018). Thereof, we employ two dependent variables at the screening stage, and one respectively at the first and second evaluation stage of the VC investment process.

At the screening stage, firstly we rely on deal rejections – the exact opposite of deal continuations. We investigate the proportions of recorded rejection reasons grouped by the investment criteria; a procedure motivated by the methodology of Petty & Gruber (2011). While this measure gives us limited explanatory insights compared to separate evaluations of all criteria, we find through our interviews that it suits the decision design of the screening stage and provides, on its large scale of more than 16,000 deals, insights on which criteria relatively often explain rejections. The top-ten recorded reasons of our sample, representing more than 90% of the rejections, are then mapped to the common investment criteria and considered as categorical factors, as shown in Table 6.

Table 6: Screening stage deal rejection reasons related to investment criteria

Top-ten deal rejection reasons	Investment criteria related to the rejection
1 No VC case	Market; Business model; Financial aspects
2 Out of Investment Focus	Financial aspects
3 No USP in a crowded market	Product | Service; Market
4 Not Good Enough	Unspecific
5 No Funding Round Fit	Financial aspects
6 Growth to Slow	Financial aspects
7 Conflict of Interest	Financial aspects
8 No Team Fit	Management team
9 Limited Defensibility	Business model
10 No USP	Product | Service
The top-ten rejection reasons represent more than 90% of all recorded reasons in our sample.	

We performed the retrospective mapping mutually with the junior decision-makers. Here, we learnt that some reasons relate to multiple criteria, whereas other rejections are too unspecific to infer the corresponding criteria. Secondly, we directly rely on stage continuation, indicating the provisional interest of the VC to invest in the deal. Here, the proportions of deal sources are compared between deals that enter the stage versus deals that continue to the next stage.

At the first evaluation stage, the dependent variable is again simply the stage continuation. Therefore, it is binary, equal to one if a deal succeeds and equal to zero if it is rejected.

At the second evaluation stage, the investment willingness is directly expressed by the senior decision-makers (see also Riquelme & Rickards, 1992; Murnieks et al., 2011;

Warnick et al., 2018). On average, five senior decision-makers vote independently on a 0 to 3 scale, resulting in an arithmetic mean for investment willingness for each deal. Here, 0 translates into "veto, no interest", 1 into "rather no", 2 into "rather yes" and 3 into "total conviction, yes". We consider the investment willingness as an appropriate measure given our research goal for two reasons. First, it is an overall judgement that considers all aspects of the deal. Second, differently to the eventual investment decision, the willingness to invest measures the effects of the investment criteria without being distorted by deal structuring components, such as negotiations and deal competition.

6.3.2.2 Independent variables

The actual deal-inherent qualities are explicitly evaluated across the five common investment criteria, which are our main independent variables. The common investment criteria comprise "management team", "product or service", "market", "business model", and "financial aspects". A strength of our study is that the actual investment proposals are evaluated on a prescribed scorecard from the decision-makers without interference of the researchers. The evaluation scores of the investment criteria range theoretically on a 5-point Likert-scale, whereas it is common that also half-points are given. The first evaluation is conducted by one junior decision-maker per deal, whereas the subsequent second evaluation is performed by on average five senior decision-makers, here the arithmetic means are used.

The deal source in our sample is categorized into "quality deal flow" (QDF), "real quality deal flow" (rQDF), and "non-quality deal flow" (nQDF). Quality deal flow contains deals that are introduced from trusted sources of the VC's network, and by that, conveying a quality signal. Real quality flow is characterized by deals that are not only introduced by partnering investors but create a certain level of pressure to the considering VC, as those deals are usually close to finalize their funding round, and hence, have already successfully gone through similar screening and evaluation processes. This combination provides additional legitimacy and hence a more credible signal (Riley, 2001). The legitimacy and often associated timing pressure lead to the effect that on those deals screening activities are not performed. Hence, deals labeled as real quality deal flow effectively start the decision-making process at the first evaluation. Finally, non-quality deal flow contains the remainder, comprising "active screenings" of the VC, "could inbounds" from ventures, or employed third-party web-crawlers. These deals are not part of the VC's network. We operationalize the categorical deal source variable of "quality deal flow", "real quality deal flow", and "non-quality deal flow" as factor-dummy variables, equal to one if a deal source characteristic is true and zero if not.

6.3.2.3 Control variables

We control in our models of the first and the second evaluation stage for other relevant factors for the decision-making. On the venture-level we control for the deal industry. Industry clusters in our sample comprise "IT", "FinTech", "Health", and "Other". Other industries comprise "Retail", "Travel, Food, Hospitality", "HighTech", "Mobility", "Energy, Agriculture, Chemicals", and "Education". This classification is comparable to and in line with prior literature (see also Gompers et al., 2020). On the VC-level we control for the VC-experience of the responsible junior decision-makers. In our models, we incorporate 6 juniors with their experience-level as categorial variables. The VC-experience of the juniors is measured in years, at the time the deal occurred. These 6 juniors included in our models are in lead of 85% to 95% of all deals, depending on the decision stage. The remaining deals are owned by 27 other short-stayed juniors, consolidated as "Other junior decision-maker". Lastly, we control for the deal year.

6.3.3 Empirical strategy

6.3.3.1 Screening stage

To test H1a, we draw our findings on the relevance of investment criteria from the one-sample proportions of the recorded rejection reasons grouped by criterion, using χ^2 goodness of fit statistics. In addition, we compare descriptive statistics on rejection reasons to support our hypothesis that management team-related rejections range behind rejections related to other investment criteria. This method is similar to the research of Petty & Gruber (2011) but differs so far as the rejection reasons are explicitly recorded by the junior decision-makers rather than deduced by us. To test H2a, we compare the continuation rates of deals, depending on their deal source, using two-proportion z-test statistics.

6.3.3.2 First evaluation stage

To test H1b and H2b at the first evaluation stage, we use logistic regression models. At this stage, the evaluation is based on a scorecard concept, capturing the deal quality along the five investment criteria on a 5-point Likert-scale. However, whereas the evaluations are measured in scores, the dependent variable of this first evaluation stage is simply the stage continuation, which is either true, or false. Therefore, we test the effect of the investment criteria (H1b) and the deal source (H2b) on this stage decision by logistic regression models, estimating regression coefficients based on maximum-likelihood (Long, 1997). However, while logistic regression models have the advantage that the effect of explanatory factors can be translated into probabilities, the coefficient interpretation might become less intuitive. Therefore, we complement, as suggested in literature (Thrane, 2005), the logistic regression models with intuitive and interpretable

case-simulations with implied continuation probabilities for deals, based on selected characteristics, evaluations, and deal sources (see Figure 12). For this purpose, we impute for one regression model (Table 10, Model 3) the missing evaluation scores by the respective criterion means. This should be satisfying for the purpose of our investigation as the comparison between the distributions of the total sample and the complete subsample indicates that the missing evaluations are unsystematic (i.e., completely at random) and that the variation of values is relatively low.

6.3.3.3 Second evaluation stage and investment willingness
To test H1c and H2c, we employ OLS regression models. At this stage, the senior decision-makers evaluate the deal again across the five investment criteria, capturing the deal quality on a 5-point Likert-scale. In addition, the on average decision-makers are asked to express their willingness to invest in the deal proposal on a 0 to 3 scale. Hence, based on the arithmetic means, we can use OLS regression models to test the effect of the collectively applied criteria (H1c) and the deal source (H2c) on the overall investment willingness.

6.4 Results

6.4.1 Descriptive Insights about the overall investment process

From the 16,676 deals at the screening stage, 1,446 deals entered the first evaluation stage (8.7%). Of those, 104 deals moved on to the second evaluation stage. The number translates into 7.2% of the evaluated deals and 0.6% of the screened deals. Eventually, 21 deals were funded. This equals 20.2% of the deals, which met the senior decision-makers at the second evaluation. While this ratio may sound promising to entrepreneurs, it translates into a terrifying 0.1% chance of receiving funding relative to all considered deals. These odds differ from former surveys, which find that about one deal receives funding for each 100 considered deals (Bronzini et al., 2020; Gompers et al., 2020). We summarize the descriptive numbers by stage, including breakdowns by deal characteristics, in Table 7.

We observe an obvious pattern in the deal source and industry distributions, depending on the decision stage. Quality deal flow represent only 18% of the deals at the screening stage. Its share increases at the first evaluation stage and then stabilizes. Non-quality deal flow dominates at the screening stage (59%). However, its share decreases over time, representing only 10% of all investments. This decrease seems to be largely offset by the real quality deal flow, entering at the first evaluation stage. While only 3% of all evaluated deals are categorized as real quality deal flow, these deals represent 38% of all investments. Further, the top-three industries "IT", "FinTech", and "Health"

represent 49% of all sourced deals, hence the industry focus of our sample corresponds to global startup trends (Statista Research Department, 2020). In our sample, the combined share of these industries increases at the evaluation stage to 63% and remains on that level along the subsequent decision stages.

Table 7: Investment process statistics by investment decision stage

A. Investment decision stage statistics	Investment decision stages			
	Screening	First evaluation	Second evaluation	Investments
Total deals	16,676 [1]	1,446 [2]	104	21
Continuation rates (*stage to stage*)		8.7%	7.2%	20.2%
Continuation rates (*cumulative*)			0.6%	0.1%
B. Deals by deal source				
Quality deal flow	18%	54%	50%	52%
Real quality deal flow	0%	3%	31%	38%
Non-quality deal flow	59%	42%	19%	10%
n.a.	22%	0%	0%	0%
C. Deals by industry				
IT	27%	36%	43%	29%
FinTech	13%	16%	13%	29%
Health	10%	11%	5%	5%
Other	30%	37%	38%	38%
n.a.	21%	0%	0%	0%
D. Lead decision-maker	Junior	Junior	Senior	Senior

[1] Deals include 50 deals categorized as real quality deal flow, for which screening activities are not performed.

[2] Thereof 676 deals form our subsample with completed valuation scores.

Finally, we observe that junior decision-makers are employed to screen deals and to conduct first evaluations on arm's length guidance to manage the mass of deal proposals. Only if a deal is promising, the senior decision-makers take over and finally make the investment decision.

6.4.2 Screening stage

Our H1a states that the high information asymmetry on management teams decreases its effect on investment decision-making, leading to under-proportionally frequent team-related rejections compared to rejections related to financial aspects relevant for the VC's investment strategy and unattractive markets. Further, our H2a states that the overall high information asymmetry on inherent deal qualities at the screening stage leads to higher continuation probabilities for deals originating from VCs' networks, as investors rely on signaling effects associated with trusted sources in environments of high uncertainty and limited information.

Of the 16,676 deals in our sample, 15,230 are rejected at the screening stage. Thereof, 11,064 rejections (73%) are specified. These numbers, including the breakdowns by deal source are presented in Table 8.A.1. The breakdown reveals that 18% of all deals sourced belong to quality deal flow, 59% to non-quality deal flow, and for 22% the source information is missing.

Table 8: Screening stage descriptive results

A.1 Deal rejections	Total deals	in %			QDF	nQDF	n.a.
All deals	16,676	[1]			18%	59%	22%
Total Rejections	15,230				15%	61%	24%
Missing rejection reason	4,166	27%			20%	47%	32%
Recorded rejection reason	11,064	73%			13%	66%	21%
A.2 Recorded rejections by investment criteria (allocated original recorded reasons, multiple allocation possible)	Total deals	in %		Delta to AVG	QDF	nQDF	n.a.
Financial aspects (1,2,5,6,7)	7,819	42%	24%	***	13%	66%	21%
Market (1,3)	4,129	22%	4%	***	13%	67%	20%
Business model (1,9)	2,752	15%	-3%	***	15%	65%	19%
Product | Service (3,10)	1,713	9%	-9%	***	12%	67%	21%
Management team (8)	255	1%	-16%	***	30%	53%	18%
Unspecific (4, 99)	2,087	11%			13%	60%	26%
A.3 Top-ten rejection reasons	Total deals	in %			QDF	nQDF	n.a.
1 No VC case	2,557	23%			15%	66%	19%
2 Out of Investment Focus	2,320	21%			7%	71%	22%
3 No USP in a crowded market	1,572	14%			11%	68%	21%
4 Not Good Enough	1,389	13%			14%	59%	27%
5 No Funding Round Fit	1,083	10%			12%	72%	16%
6 Growth to Slow	470	4%			21%	57%	23%
7 Conflict of Interest	384	3%			18%	61%	20%
8 No Team Fit	255	2%			30%	53%	18%
9 Limited Defensibility	195	2%			24%	59%	17%
10 No USP	141	1%			21%	56%	23%
99 Other recorded rejection reasons	698	6%			12%	63%	25%
B. Deal continuations	Total deals	in %			QDF	nQDF	n.a.
		[1]					
All deals	16,676	100%			3,058	9,865	3,703
Deal continuations and continuation rates	1,446	9%			25% ***	6% ***	0%

Proportions of investment criterion-related rejection reasons are tested for equality, using χ2 goodness of fit statistics. Hypothesis = rejection proportions across the related investment criteria are not equal. Quality deal source specific continuation rates are pairwise-tested against non-quality deal flow, using two-proportions z-tests. Hypothesis = quality deal sources have higher continuation probabilities. Statistical differences are marked with an appropriate asterisk: *** at $p \leq .001$, ** at $p \leq .01$, and * at $p \leq .05$ level.

[1] All deals include 50 deals categorized as real quality deal flow, for which screening activities are not performed.

Testing our H1a with focus on rejection reasons by investment criterion, we find that financial aspects (42%), market (22%), and business model (15%) related rejections are the most frequent recorded reasons, followed by product (9%). At the same time, the management team (1%) is rarely stated as a rejection reason at the screening stage, as shown in Table 8.A.2. Our χ^2-test finds that these rejections are statistically disproportional distributed across the investment criteria. Moreover, the originally

recorded rejection reasons, shown in Table 8.A.3, help to better understand the underlying rejection causes. Beyond the top-ten reasons, a long-tail of other explanations is documented (698 rejections, 6%). This long-tail and the fourth most frequent rejection reason "Not good enough" are not allocated to the investment criteria, as they are either neglectable or too unspecific. Further, although based on descriptive analyses, it seems that the deal source affects the rejection reasons at this stage. Empirical evidence suggests that non-quality deal flow relatively often fail VCs' expectations on the criteria financial aspects (5ppt above average), market (6ppt above average), business model (4ppt above average), and product (6ppt above average). Whereas deals from quality sources are relatively often rejected for a missing team fit (15ppt above average). These observations would comply with an assumed signaling effect associated with quality sources, as junior decision-makers expect from their trusted sources recommendations in line with the investment strategy.

Testing our H2a, we find that quality deal flow is more likely to pass the screening than non-quality deal flow, as shown in Table 8.B. While 25% the of quality deal flow reach the evaluation stage, only 6% of the non-quality deal flow continue to the next stage, the difference is statistically significant based on a two-proportions z-test.

Consequently, we find evidence that criteria-related rejections are highly disproportional at this stage. Hence, we find supporting evidence for our H1a that the limited information access on management teams, decreases its effect on VC's decision-making at the screening. In contrast, given the frequently recorded reasons "No VC Case", "Out of Investment Focus", "No Funding Round Fit", and "Conflict of Interest" (overall 6,344 rejections, representing 57%), we conclude that the VC's investment strategy is, combined with related easy-to-assess Go/No-go deal characteristics, a main driver of rejections at the screening stage. Finally, we find that deals originating from VCs' networks are more likely to continue to the next decision stage. Hence, we confirm our H2a that junior decision-makers, overwhelmed by high information asymmetry and the number of proposals, use the deal source as a signal to identify those deals, they want to evaluate in greater detail.

6.4.3 First evaluation stage

Our H1b states that the quality of the management team has a significant effect on investment decision-making, as face-to-face interactions between the VC and the venture entail a low level of information asymmetry. Further, the still ongoing due diligence implies H2b, which states that the signaling effect related to quality deal

sources remains relevant, as first evaluations on deal inherent qualities often occur in an environment of incomplete and uncertain information.

6.4.3.1 Descriptive analyses

At the first evaluation stage, 1,446 deals are evaluated. However, thereof only 676 deals have a complete set of evaluated criteria. The comparison of the two samples is important, as the subsample is the basis for the first two logistic regression models, focusing on the criteria coefficients. Table 9.A.1 and 9.B.1 show the descriptive statistics for the total sample, while Table 9.A.2 and 9.B.2 show the same statistics for the subsample.

Overall, we find that the distributions of the evaluation scores are relatively similar between the two samples. The average criteria score per deal in the total sample is 3.78, whereas it equals for the subsample 3.79. The similarity also holds for the single criteria. Both samples are left-skewed across all criteria scores. Differentiating between rejected and continued deals, our data shows that for both samples and all criteria, the average scores for deals that pass the first evaluation are significantly higher compared to those deals, being rejected. We used Wilcoxon-Mann-Whitney-U statistics for the tests as the evaluation scores are not normally distributed. For both samples, the difference is highest for the management team criterion (0.54 and 0.58 score points respectively for the total and the subsample). Also, correlation coefficients are relatively similar across the samples. We find that all pairwise correlations are positive and range from $r = .30$ to $r = .43$ for the total and from $r = .32$ to $r = .46$ for the subsample.

However, there are two material differences between the total sample and the subsample, as shown in Table 9.B. First, we find that the real quality deal flow is overrepresented in our subsample (7%) compared to the total sample (3%). This effect is largely offset by an underrepresentation of the quality deal flow (51% vs. 54%). Second, we find that all deals that pass the screening stage are evaluated along all criteria, with no exception. As it seems that junior decision-makers require a comprehensive perspective on deals, before sending them to the senior decision-makers, continuation rates for our subsample are upward-biased compared to the total sample. For the total sample, we find that quality deal flow is continued significantly more frequently (6.6%) than non-quality deal flow (3.3%) to the next decision stage. This significant effect is even stronger for the real quality deal flow. Of those deals, astonishing 64.0% pass on to the first evaluation. The significant differences also hold for the completed subsample.

Table 9: First evaluation stage descriptive results

First evaluation statistics	Descriptive evaluation score statistics by investment criterion						Average criteria scores by evaluation result		Correlation table				
A.1 Total sample first evaluation scores by criterion	Total deals	AVG	MAX	MIN	SK	SD	Continuation	Rejection	Management team	Product | Service	Market	Business model	Financial aspects
Average criteria score	1,446	3.78	5.00	1.00	-1.11	0.58	4.18 ***	3.75 ***					
Management team	1,391	3.93	5.00	1.00	-0.73	0.75	4.42 ***	3.89 ***	1.00				
Product | Service	1,211	3.79	5.00	1.00	-0.82	0.78	4.21 ***	3.75 ***	0.43	1.00			
Market	1,234	3.84	5.00	1.00	-0.92	0.87	4.21 ***	3.81 ***	0.34	0.38	1.00		
Business model	1,102	3.72	5.00	1.00	-0.71	0.74	4.09 ***	3.68 ***	0.37	0.41	0.36	1.00	
Financial aspects	1,047	3.58	5.00	1.00	-0.83	0.92	3.95 ***	3.53 ***	0.30	0.30	0.36	0.36	1.00
A.2 Subsample first evaluation scores by criterion	Total deals	AVG	MAX	MIN	SK	SD	Continuation	Rejection	Mgt. team	Product | Service	Market	Business model	Financial aspects
Average criteria score	676	3.79	5.00	1.00	-1.25	0.60	4.18 ***	3.72 ***					
Management team	676	3.93	5.00	1.00	-0.77	0.79	4.42 ***	3.84 ***	1.00				
Product | Service	676	3.83	5.00	1.00	-0.79	0.79	4.21 ***	3.77 ***	0.46	1.00			
Market	676	3.83	5.00	1.00	-0.86	0.85	4.21 ***	3.76 ***	0.46	0.46	1.00		
Business model	676	3.71	5.00	1.00	-0.73	0.80	4.09 ***	3.64 ***	0.40	0.44	0.40	1.00	
Financial aspects	676	3.64	5.00	1.00	-0.94	0.92	3.95 ***	3.58 ***	0.32	0.34	0.39	0.38	1.00

B.1 Total sample deal continuation statistics by deal source

Deal sources	Total deals	Share	Rejections	Continuations	Continuation rate
QDF	783	54%	731	52	6.6% **
rQDF	50	3%	18	32	64.0% ***
nQDF	613	42%	593	20	3.3%
All deals	1,446	100%	1,342	104	7.2%

B.2 Sub-sample deal continuation statistics by deal source

Deal sources	Total deals	Share	Rejections	Continuations	Continuation rate
QDF	347	51%	295	52	15.0% **
rQDF	48	7%	16	32	66.7% ***
nQDF	281	42%	261	20	7.1%
All deals	676	100%	572	104	15.4%

Total sample: N = 1,446; sub-sample with complete first evaluations: N = 676. Average evaluation scores of continued deals are tested against those of rejected deals, using the Wilcoxon-Mann-Whitney-U test. Quality deal source specific continuation rates are pairwise-tested against non-quality deal flow, using two-proportions z-tests. Statistical differences are marked with an appropriate asterisk: *** at $p \leq .001$, ** at $p \leq .01$, and * at $p \leq .05$ level.

6.4.3.2 Regression analyses

Next, we test the effects of the investment criteria (H1b) and the deal source (H2b) on the investment decision-making, measured by deal continuation, shown in Table 10. In the first logistic regression model, we examine the criteria without the deal source information, which we add as a variable in the second model. These two models investigate the relative effect sizes of the explanatory variables, relying on the subsample of 676 deals with complete evaluation data. These models, however, are not suitable to draw conclusions on actual deal continuation probabilities. The investigation of continuation probabilities for deals with certain characteristics is conducted by a third model, including all 1,446 deals entering the stage. For this model, we need to impute missing evaluation data. All models control for venture, VC, year fixed effects. We use the natural logarithms of the criteria scores, as they are not normally distributed. We also conduct variance inflation factors (VIF) tests but detect no variance inflation across our independent variables, with all VIF values below 2.

In our first model, we find that all coefficients are economically positive, which shows that they act in concert, jointly lifting deals to the next evaluation stage. The management team and the business model are statistically significant. The management team has the strongest effect on the deal continuation of the stage and is highly statistically significant. The business model has a significant impact on a 95% significance level. The weakest positive impact in the first model comes from the criterion financial aspects.

In our second model, we introduce the deal source. We find that the introduction of the deal source has an effect on the investment criteria. Whereas the management team undisputedly persists as the most important of the criteria, the business model is not statistically significant anymore. Further, the criterion product gained importance. The effect indicates that VCs use the deal source to complement their elsewise incomplete or uncertain picture of these criteria. Further, besides the effects on the criteria, we find that the deal sources with the associated signals are highly relevant at the first evaluation stage. Both, quality deal flow and real quality deal flow are statistically significant, with real quality deal flow having the stronger effect on the deal continuation. This effect is even understated through our analysis, when we have in mind that the second model includes only the subsample with fully completed criteria evaluations, which also includes all continuing deals.

Table 10: First evaluation stage logistic regression models

DV: Deal continuation (dummy)	Model I			Model II			Model III		
First evaluation criteria	Coefficient		SE	Pr (>|z|)	Coefficient		SE	Pr (>|z|)	Coefficient		SE	Pr (>|z|)
ln Management team	4.6732 ***	0.9365	(<.001)	4.3278 ***	1.0034	(<.001)	4.3700 ***	0.9641	(<.001)
ln Product | Service	1.3477	0.7773	(.083)	1.8968 *	0.8230	(.021)	2.8853 **	0.8818	(.001)
ln Market	1.3431	0.7382	(.069)	1.5086	0.8241	(.067)	1.4277	0.7827	(.068)
ln Business model	1.7371 *	0.7368	(.018)	0.7299	0.7616	(.338)	1.0622	0.8564	(.215)
ln Financial aspects	0.5109	0.5267	(.332)	0.7740	0.5886	(.188)	1.5663 *	0.6615	(.018)
Deal Source									
Quality deal flow (dummy)	-		-	0.9289 **	0.2974	(.002)	0.9258 **	0.2857	(.001)
Real quality deal flow (dummy)	-		-	3.1303 ***	0.4372	(<.001)	3.9734 ***	0.4308	(<.001)
Controls									
Venture fixed effects	Yes			Yes			Yes		
VC fixed effects	Yes			Yes			Yes		
Year fixed effects	Yes			Yes			Yes		
Residual deviance (degrees freedom)	482 (659)			422 (657)			524 (1,427)		
AIC	516			460			563		

This Table shows generalized least square regressions. The binary DV "deal continuation" is regressed on the logarithms of the investment criteria scores of the first evaluation stage, deal source dummies, and controls (total sample N = 1,446 deals, subsample N = 676 deals, deal continuations N = 104). The DV is equal to one if the deal is invited to a pitch in front of the decision-makers, and zero, if the deal is rejected. The investment criteria scores are incorporated as logarithms, original scores range from 1 to 5 on an ordinal scale. Quality deal flow and real quality deal flow are included as dummy variables. They are one if they are true characteristics of a deal and zero if not. Control variables are included in the models. Controls comprise venture, VC, and year fixed effects. Venture fixed effects include the venture industry, while VC fixed effects include fund age, respective deal owners and deal owners experience. Coefficients statistically different from zero are marked with an appropriate asterisk, while corresponding *p* values are presented in parentheses next to the coefficients. Significant: *** at $p \leq .001$, ** at $p \leq .01$, and * at $p \leq .05$ level.

In our third model, we shift focus from measurable relative coefficient effects towards more intuitive and interpretable continuation probabilities for deals based on their characteristics, evaluation, and deal source. The investigation of deal continuation probabilities requires the treatment of our evaluation data, as the analyses must be conducted on the total sample of 1,446 deals. Figure 12 illustrates, based on our third model, that the management team criterion has the strongest impact of all criteria on the deal continuation at that decision stage. Therefore, the depict s-shape function of the modelled deal continuation probabilities are most distinct for the management team score variation across all charts.

Figure 12: First evaluation stage deal continuation probability
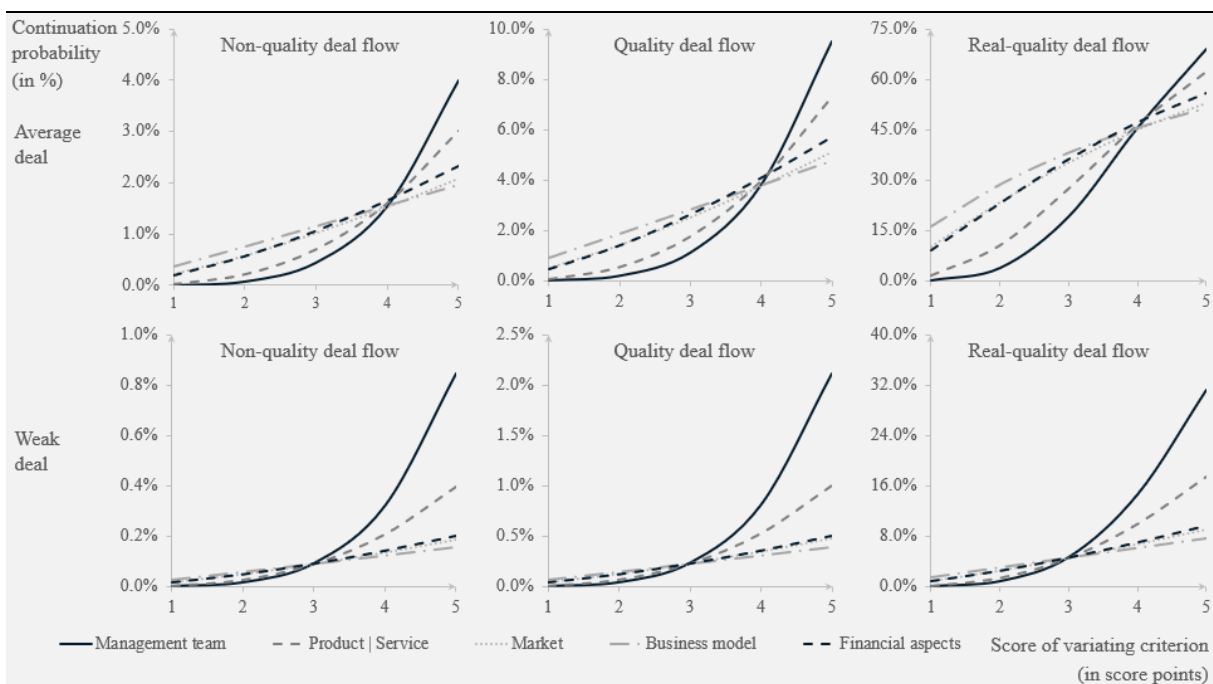
This Figure shows deal continuation probabilities, depending on criteria scores and deal sources based on logistic regression estimates. The estimates are calculated based on regression model III, including the total sample (total sample N = 1,446 deals, deal continuations N = 104). In the upper half of the chart, deal continuation probabilities (y-axis) are modelled based on a deal with average criteria scores, except of one criterion being variated from 1 to 5 (x-axis). In the bottom half of the chart, continuation probabilities are modelled based on a weaker deal, in which all criteria scores are equal to 3 except for the one criterion being variated. Each chart presents the continuation probabilities for the deals given a deal source. Controls are the same for all illustrations, precisely, the deal belongs to the "IT" industry, it is owned by a semi-experienced junior decision-maker and takes place in 2018.

In detail, the upper half of the Figure illustrates that, irrespective of the deal source, a weak team with average scores on all other investment criteria most definitely leads to a deal rejection. Further, while the bottom half of the chart shows again the importance of the team, it also indicates that the team alone does not steal the show. Taking for instance a look at the bottom-center of Figure 12, we find that a deal which is marked as quality deal flow, scoring a score of 5 on the management team criterion, while having only scores of 3 for all other common criteria, has only a probability of below

2.5% to reach the second evaluation stage. This 2.5% compares to a 6.6% average deal continuation rate for an average deal, recorded as quality deal flow. Comparing the charts from left to right, we find that the deal source plays a major role to reach the second evaluation stage. The upper-left chart illustrates that even a top-team with an average deal would have a below average likelihood to be continued after the first evaluation stage if it does not belong to the VC's network. The upper-right chart, however, makes clear that an average deal, being recorded as real quality deal flow has about a 50% chance to reach the second evaluation stage.

Thus, we find supporting evidence for our H1b. While all commonly discussed investment criteria have economically positive effects on the deal continuation probability at this evaluation stage, the management team has the strongest, also statistically significant, impact. Overall, our results indicate that weaknesses can be compensated by strength only within certain boundaries, meaning that performing outstanding in one criterion, while neglecting others most likely does not lead to success. Finally, we find supporting evidence for our H2b. We show that quality deal sources are statistically relevant at the first evaluation stage. The particularly strong effect of the real quality deal flow complies perfectly with our agency framework, considering information asymmetry. It shows that junior decision-makers rely on signals when suddenly real quality deal flow appears, for which a conclusive investigation of all actual deal-inherent qualities is impossible on short notice, given that these deals are usually near closing.

6.4.4 Second evaluation stage and investment willingness

At the second evaluation stage, the senior decision-makers take the lead and eventually express their investment willingness based on the finalized due diligence. The outlined decision-making process ensures a low information asymmetry on deal inherent qualities at the end of this second evaluation. Therefore, the management team is relevant and positively affects the investors willingness to invest (H1c). In contrast, the clarification of all relevant questions on deal inherent qualities entails that the signal of the deal source becomes obsolete in the eventual investment decisions (H2c).

6.4.4.1 Descriptive analyses
Starting with the dependent variable, we find that the investor willingness to invest is higher for deals which eventually get funded, as shown in Table 11.A. The difference of 0.45 score points is statistically significant, showing that the willingness to invest is directly related to the actual investment behavior. The investment willingness seems to be relatively mean-centric, with an average score of 2.05, resulting from 104 conducted

second evaluations. The criteria scores are left-skewed, similar to the first evaluation. This is interesting, as this indicates that the investment criteria might not fully explain the distribution pattern of the investment willingness.

Focusing on the investment criteria scores, we find that these are economically higher for all criteria, if the deals are funded. The largest and statistically significant differences are related to the criteria financial aspects (0.34 score points), followed by market (0.33 score points), and management team (0.26 score points).

The correlation table provides new insights on how criteria are pairwise correlated to the investment willingness and to each other. All criteria are positively correlated to the investment willingness. The strongest correlation between investment willingness and investment criteria exists for the criterion management team with a correlation coefficient of $r = .60$, followed by financial aspects with $r = .49$. We find the weakest correlation between the investment willingness and a criterion for the product or service, having a coefficient of $r = .37$. The correlations among the investment criteria are all positive and range from $r = .03$ to $r = .39$.

Shifting focus to the deal sources and the related deal continuation rates (or funding rates), we find that quality deal flow (21.2%) and real quality deal flow (25.0%) have economically higher deal continuation rates compared to non-quality deal flow (10.0%), as shown in Table 11.B. However, these are no longer statistically pairwise differentiable from non-quality deal flow, using simple two-proportions z-tests. Table 11.C shows the cumulative deal continuation rates for both subsequent evaluation stages, being a blended result of the first and the second evaluation.

Table 11: Second evaluation stage descriptive results

Second evaluation statistics	Total	Descriptive evaluation score statistics by investment criterion					Average criteria scores by evaluation result					Correlation table			
A. Second evaluation scores by criterion	Total deals	AVG	MAX	MIN	SK	SD	Continuation	Rejection	Mgt. team	Product | Service	Market	Business model	Financial aspects	Investment willingness
Average criteria score	104	4.00	4.50	3.40	-0.20	0.25	4.20 ***	3.95 ***						
Management team	104	4.30	5.00	3.20	-0.27	0.40	4.50 **	4.24 **	1.00					
Product | Service	104	3.97	5.00	2.00	-1.05	0.40	4.10	3.94	0.34	1.00				
Market	104	4.06	5.00	2.00	-1.00	0.44	4.32 **	3.99 **	0.20	0.14	1.00			
Business model	104	3.88	4.50	2.80	-0.73	0.34	3.96	3.86	0.35	0.03	0.26	1.00		
Financial aspects	104	3.81	4.60	2.60	-0.34	0.40	4.08 ***	3.74 ***	0.39	0.16	0.34	0.18	1.00	
Investment willingness	104	2.05	3.00	1.00	0.04	0.42	2.40 ***	1.95 ***	0.60	0.37	0.46	0.45	0.49	1.00

B. Second evaluation deal continuation statistics by deal source

Deal sources	Total deals	Share	Rejections	Cont-inuations	Cont-inuation rate
QDF	52	50%	41	11	21.2%
rQDF	32	31%	24	8	25.0%
nQDF	20	19%	18	2	10.0%
All deals	104	100%	83	21	20.2%

C. Cumulative first and second evaluation deal continuation statistics by deal source

Deal sources	Total deals	Share	Rejections	Cont-inuations	Cont-inuation rate
QDF	783	54%	772	11	1.4% *
rQDF	50	3%	42	8	16.0% ***
nQDF	613	42%	611	2	0.3%
All deals	1,446	100%	1,425	21	1.5%

Second evaluation: N = 104. First evaluation: N = 1,446. Average evaluation scores of continued deals are tested against those of rejected deals, using the Wilcoxon-Mann-Whitney-U test. Quality deal source specific continuation rates are pairwise-tested against non-quality deal flow, using two-proportions z-tests. Statistical differences are marked with an appropriate asterisk: *** at $p \leq$ .001, ** at $p \leq$ .01, and * at $p \leq$ .05 level.

6.4.4.2 Regression analyses

The second evaluation is the final formal stage before the deal is structured. Hence, this stage enables us to test the effects of the investment criteria (H1c) and the deal source (H2c) on the VC's unobstructed willingness to invest, as shown in Table 12. In our OLS regression models, we use log values for the investment willingness and the investment criteria. Further, we tested our models for variance inflation, with all VIF values for investment criteria below 2, and for deal source dummies below 3.

Table 12: Second evaluation stage OLS regression models

DV: *ln* Investment willingness	Model I			Model II		
Second evaluation criteria	Coefficients		Pr (>|z|)	Coefficients		Pr (>|z|)
ln Management team	0.8324	***	(<.001)	0.8792	***	(<.001)
ln Product | Service	0.2946	*	(.032)	0.2890	*	(.039)
ln Market	0.4190	**	(.002)	0.4328	**	(.002)
ln Business model	0.5485	**	(.002)	0.5600	**	(.002)
ln Financial aspects	0.4896	***	(<.001)	0.4957	***	(<.001)
Deal Source						
Quality deal flow (dummy)	-		-	-0.0274		(.478)
Real quality deal flow (dummy)	-		-	-0.0446		(.313)
Controls						
Venture fixed effects	Yes			Yes		
VC fixed effects	Yes			Yes		
Year fixed effects	Yes			Yes		
df	87			85		
Pr (>|z|)	(<.001)			(<.001)		
F-statistic	11.62			10.27		
Adj. R^2	0.62			0.62		
RSE	0.13			0.13		

This Table shows ordinary least square regressions. The log of the DV "investment willingness" is regressed on the logarithms of the investment criteria scores of the second evaluation stage, the deal source dummies, and fixed effects (sample N = 104 deals). The DV is the log of the mean investment willingness of on average five decision-makers per deal. The original investment willingness values range from 0 to 3 on an ordinal scale. The original investment criteria scores range from 1 to 5 on an ordinal scale. Quality deal flow and real quality deal flow are included as dummy variables. They are one if they are true characteristics of a deal and zero if not. Control variables are included in the models. Controls comprise venture, VC, and year fixed effects. Venture fixed effects include the venture industry, while VC fixed effects include fund age, respective deal owners and deal owners experience. Coefficients statistically different from zero are marked with an appropriate asterisk, while corresponding p values are presented in parentheses next to the coefficients. Significant: *** at $p \leq .001$, ** at $p \leq .01$, and * at $p \leq .05$ level.

In our first model, we find that all criteria coefficients are positive and statistically significant, hence, our model suggests that senior decision-makers take a comprehensive perspective on deals, with all criteria being statistically explanatory. The effect of the management team on the investment willingness is highly significant and economically the strongest. Financial aspects are also highly significant, showing that financial considerations gain importance, when senior decision-makers state their investment

willingness. The coefficient of the product criterion is the smallest, indicating that decision-makers consider the products or services as rather pivotable, compared to other deal characteristics.

In our second model, we find no considerable effect when we introduce the deal source. Thus, we conclude that the deal source does neither affect the impact of the common investment criteria nor does it affect the stated investment willingness at the second evaluation stage. Small negative coefficients for both types of quality deal flow indicate that quality deal flow is equally challenged from the senior decision-makers at the second evaluation stage as non-quality deal flow.

Taking one step back, adjusted R square of both models (adj. R2 = 0.62) indicate that the investment criteria explain in fact a relevant part of the variation of the investment willingness. However, critics might say that the commonly acknowledged investment criteria discussed in literature do not fully explain VC-investment decisions.

Thus, our data supports H1c that, with full information access, the management team is relevant and positively affects the senior decision-makers' willingness to invest. The same finding holds for all other deal inherent qualities measured through the common investment criteria. This indicates that seniors conduct complex multi-criteria decision-making, carefully weighting all investment criteria against each other. We show that the management team plays again a key role. Also, financial aspects gain in importance as the deal steps towards the structuring phase. With respect to the deal source, we confirm our H2c, stating that the deal source becomes obsolete as the information asymmetry on the deal inherent qualities decreases. This finding implies that senior decision-makers seem not to attribute a standalone value to coinvest in deals brought by trusted sources, and that entrepreneurs cannot rest and rely on the associated signaling effect.

6.5 Discussion

Although literature made considerable progress in understanding VCs' investment decision-making, it remains puzzling with regards to the processual structure of the venture selection process how and when VCs assess the commonly acknowledged investment criteria and how VCs use and apply different signals. The combination of such elements across the multiple decision stages lead to the actual investment decision, which has been largely overlooked by prior research (for an exception describing such complexity see Petty & Gruber, 2011). Surveys and experiments helped literature to gain an essential

understanding of which criteria are relevant, but those studies considered these criteria independently from the processual structure which VCs implemented to deal with only gradually emerging information and agency problems. Prior research has focused on contract structuring and post-investment stages when addressing agency problems but has not addressed such issues in the screening and evaluation stages. Therefore, in this study we addressed this research gap by showing how the relevant investment criteria and the deal source signal act in concert along the defined decision stages in the real-world. We provide an initial theoretical framework based on principal agent theory, describing the criteria relevance conditional on the respective investment decision stages and test this framework on an extensive sample of 16,676 actual deals. According to this agency framework, which aims to consider real-world decision-making circumstance including varying levels of uncertainty and information completeness, the common investment criteria all have a positive impact on decision-making, whereas relative importance changes along the defined decision stages of the investment process. Given the high degree of incomplete information at the beginning of the investment process, the deal source plays a key role at the screening and early evaluation stage. However, its importance decreases together with information incompleteness and uncertainty.

6.5.1 Implications for research on venture capital

We provide three main contributions to literature on venture capital. Our first main contribution is the development of a framework that provides a processual break-down of the venture selection process of VCs build on principal-agent theory (Jensen & Meckling, 1976; Eisenhardt, 1989). This breakdown shows how agency theory explains VC decision-making along the subsequent screening and evaluation stages. Prior research has neglected these stages and its process structure that deals with gradually uncovering incomplete or missing information while considering the involvement of multiple decision-makers and deal quality signals. In other words, we show based on agency theory that the gradual closure of information asymmetry, the desired gain in certainty, materializes in staged criteria relevance in the decision process. Our agency framework enables future researchers of investment criteria relevance to design their research properly. For instance, the results of our study suggest that scholars who investigate management team characteristics should consider face-to-face impressions and interactions between the agents and the principals rather than relying on written information from investment teasers or pitch documents. Further, the framework guides scholars in asking the right questions. It is not always a

question of which criteria matter, but also when do criteria matter, and for whom. Taking the deal source for instance, most practitioners would agree that the deal source plays a relevant role in VCs' investment activities. However, our results indicate that junior decision-makers, who screen 1,000s of deals, put another weight to the deal source than the seniors.

Our second main contribution comprises real-world evidence from 16,676 actual deals on how the commonly acknowledged investment criteria impact decision-making. We find that relative importance of the criteria changes along the defined decision stages of the investment process. We show that junior decision-makers screen proposals for easy-to-assess Go/No-go venture characteristics, which often relate to the VC's investment strategy. This insight contributes to literature as former studies with similar insights were so far limited by small sample sizes. For instance, Hall & Hofer (1993), who performed verbal protocols on 16 deals, find that VCs apply at the screening non-compensatory investment criteria. Further, we find that management teams play a neglectable role at the screening stage. This insight contributes to literature as former studies with smaller sample sizes led to contradicting results about the relevance of teams at the screening stage (Franke et al., 2008). Our finding is in line with Hall & Hofer (1993), who suggest that human capital characteristics play a minor role during the screening of venture proposals, and Kollmann & Kuckertz (2010), who find in their survey about criteria evaluation uncertainty that team evaluations are particularly difficult at this stage, when solely relying on curriculum vitae presented in investment teasers. However, our study contradicts the observations of Riquelme & Rickards's (1992) experimental analyses and Silva's (2004) participant observation, who experience that team information are already relevant at this early stage. This picture changes dramatically at the first evaluation stage. Here, we find that the management team seems to be the most decisive factor. At the second evaluation, conducted by senior decision-makers, we find that VCs take a comprehensive view on the deals, with all common investment criteria significantly explaining their investment willingness. Statistical significance is strongest for the management team and financial aspects. That financial aspects gain importance at the end of the evaluation stage makes sense as first deal structuring components potentially fade in. This finding extends Petty & Gruber (2011), who observe that financial-related rejection reasons occur more frequently after long-lasting deal reviews. Further, our results indicate that throughout the two subsequent evaluation stages tradeoffs between criteria are possible within certain

boundaries. That is, the management team seems to play a special role in real-world investment decisions but just after controlling for other investment criteria.

As our results show, investment criteria relevance is sensitive to the decision stage as information on these criteria gradually but differently emerges over the process. This finding, tested on 16,676 real-world deals, is relevant for the decades-lasting discussion on relative criteria importance. We support early suggestions from Hall & Hofer (1993), who criticize that scholars do not sufficiently differentiate in their research between decision stages, and hence mix research objectives and results. Against this backdrop, our study might explain why survey-based research, which over-proportionally targets senior decision-makers from selected MBA programs (Gompers et al., 2020), tends to find management teams as the most distinctive investment criterion (Monika & Sharma, 2015). The reason could be that those respondents are more heavily involved in later evaluation stages, in our study the second evaluation, and cognitively underestimate the relevance of applied criteria during screening activities. This implies that investment decision research that targets later stages of the decision process neglects any causalities that result from the high degree of incomplete and uncertain information at the earlier decision stages. Correspondingly, our research might also explain why research, using actual data respectively archival methods tends to see market, product, and financial-related criteria as the most important factors (cf. Hall & Hofer, 1993, Shepherd, 1999a; Petty & Gruber, 2011). Those criteria are not only relevant for deals at the second evaluation stage, but also the most frequent rejection reasons for the more than 90% of all considered deals, which are abandoned at the early screening stage.

Our final main contribution is that we provide novel evidence on how the deal source impacts investment decisions along the decision stages. We find that the signaling effect associated with the deal source affects decision-making at the screening stage and the early steps of the evaluation, when information is rare and highly uncertain, whereas the deal source does not affect the senior decision-makers' eventual willingness to invest after deals are rigorously evaluated across the substantialized investment criteria over the screening process. Our findings imply three takeaways: First, the deal source owns an important signaling effect to identify the few deals worth spending more time on from 1,000s of originating deal proposals. Of all deals being a type of quality deal flow (N = 3,108), 19 deals were funded, whereas of non-quality deal flow (N = 13,568), only 2 deals convinced the investor. Second, VCs' senior decision-makers seem not to attribute a standalone value to the deal source and the associated collaboration with their befriended investors. Third,

although entrepreneurs should aim to become part of the VCs network, they cannot rest and rely on the associated signal.

Our findings explain the relevance of signaling effects associated with quality deal flow that over the decision process diminish. We extend prior research by showing that VC decision-makers complement the actual deal qualities – captured in form of measurable and gradually substantializing investment criteria – with signals when information is particular incomplete. Our identification of the stage-specific signaling effects conveyed by the deal source and separated from actual deal quality contributes to the unsolved puzzle of whether the deal sourcing or the deal selection activity affects VC performance (cf. Sørensen, 2007; Gompers et al., 2020).

6.5.2 Implications for practice

We consider our research as particularly interesting to entrepreneurs, seeking VC-funding, because our research manages to expose and proof some common myths of the industry while refuting others' entrepreneurs usually rely on. For instance, we reveal that being introduced through trusted ties (i.e., befriended VCs) of a potential investor might catapult an investment case to the first evaluation, where a strong management team increases again the entrepreneurs' chance to eventually meet the senior decision-maker at the second evaluation. However, in front of the seniors, a comprehensive picture of the deal is drawn, irrespective of solitary criteria strengths or the deal source. Hence, entrepreneurs cannot rest and rely on either their team qualities or their backing network.

We show that entrepreneurs should be aware of investors' investment strategies to avoid immediate desk-rejections. We provide insights on the relative importance of team versus venture characteristics and give indications on when these are most critical for a successful funding round. Our findings also suggest that entrepreneurs should aim to acquire a signaling effect by being part of the VC's network. However, such signals merely open the door to get into a later evaluation stage and do not compensate any deficiencies.

For investors, the accumulated evidence presented in this study based on an extensive quantitative data set and qualitative insights form over 60 interviews, confirms former suggestions that even professional VCs remain elusive and biased about the impact of investigated criteria and their process-specific relevance. While many practitioners would argue that ultimately they trust their gut feeling, the investment process is surprisingly structured and engineered to find outlier-cases.

6.5.3 Limitations and future research directions

Despite its contributions, our research comes not without limitations. Given the research goal of investigating investment criteria in their natural environment along the defined decision stages, we chose a research design that is built on an extensive collaboration with one European-based VC. Since former research shows that VCs have varying investment preferences (Shepherd & Zacharakis, 1999; Franke et al., 2006; Murnieks et al., 2011), our results and in particular our agency framework for venture selection needs further validation. While we are confident in our conceptualization and provided evidence to it, future research may further investigate the relative importance of investment criteria in relation to varying investor preferences.

Further, our research investigated the common investment criteria on a main criterion level. This approach enabled us to capture the holistic picture of the investment cases, while contributing to the puzzling question of whether the jockey or the horse is the most important aspect for investors' decisions. However, a similar investigation on the sub-investment criterion level (e.g., management team experience, management team passion) would further extent scholars' understanding of investment decisions.

Furthermore, former research has shown that US- and European-based VCs resemble another in terms of investment decision-making (Muzyka et al., 1996). Nevertheless, while our sample includes investments from multiple geographies abroad from Europe (especially from the US), we acknowledge that our research might be impacted by its geographical focus on Europe. Therefore, promising research would extend our deal data-driven research by shifting geographical focus towards the US.

Finally, another avenue for future research based on our limitation in access to a larger number of outlier cases, could be to study how our agency framework may successfully predict outliers. Finding outlier cases via a structured and systematic process that assesses pre-defined investment criteria may itself represent a puzzle since the outlying element may exist beyond such criteria. Examples such as the trade sale of WhatsApp or Facebook itself could illustrate such puzzles. Either case did not have promising business models nor outstanding co-founder teams at initial investment stages.

6.6 Conclusion

Empirical research based on archival data in the field of VC-investment decision-making remains a challenge for scholars. This study contributes to literature by the development

and testing of an agency framework for investment criteria relevance along the VC decision-making process as it takes place in practice. Our research helps towards a richer and better understanding of VC-investment decision-making. However, more research is needed to test literature's theoretical knowledge on VCs' investment behavior under real-world conditions. Such research needs to acknowledge the processual structures identified in this study in their research designs to allow for deeper insights and contributions to theory on VC decision-making.

Third Dissertation Article

Venture Performance Indicators: Two Artifacts towards enhanced Transparency in the Venture Capital Industry

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7. Venture Performance Indicators: Two Artifacts towards enhanced Transparency in the Venture Capital Industry

Abstract

The landscape of measurable venture key performance indicators (KPIs) in the venture capital (VC) industry is dispersed and opaque, which is why they have not yet played the supportive decision-making role they potentially could have played so far. The limited and asymmetric information between the entrepreneurs and the investors leads to inefficient capital allocations, frictions, and agency problems. We address this transparency issue with a design science research approach by developing two artifacts: one for investors and one for entrepreneurs. For investors, transparency is increased by a portfolio reporting solution, which provides a useful "how-to-guide" on formal venture reporting processes and structures, supporting future venture selections, portfolio monitoring, and value-adding activities. For relevant groups of entrepreneurs, transparency is increased by a benchmarking solution, which provides useful descriptive insights on measurable venture KPIs and their relationships to venture milestones along the life cycle, such as funding events. The post-development evaluations of the artifacts show that practitioners have a strong need for such transparency. We conclude that beyond structural challenges of the venturing environment, such as pace, dynamics, and the inherent uniqueness of ventures, also the fragmentation of the VC industry seems to pose a key challenge to the establishment of a direct linkage between venture performance and measurable venture KPIs.

Key words: venture capital; principal-agent theory, monitoring, information asymmetry, venture performance indicators, venture performance, startups.

7.1 Introduction

In an ideal world, a few key performance indicators (KPIs) would capture what matters to predict the *true* performance of a venture and hence reduce the high degree of complexity and uncertainty in early-stage investments. "*I would love to simply buy monthly recurring revenues based on a solid multiple valuation, but ventures are so different and reliable benchmarks are not available.*" This quote of an interviewed investment professional however shows that in practice, the landscape of measurable KPIs in the venture capital (VC) industry is dispersed and untransparent, thus often suffers from an existence in the shadow (Miloud et al., 2012; Delmar et al., 2013; Köhn, 2018). Given this high degree of uncertainty and asymmetric information, institutional investors (hereafter limited partners, or LPs) rely for investments on specialized VC firms (VCs managed by general partners, or GPs). However, even those specialized VCs do not trust each other on their latest unicorn valuations (Gornall & Strebulaev, 2020; Gompers et al., 2020). Against this backdrop, Gornall & Strebulaev (2020) conclude that academic literature still lacks an essential understanding of venture performance. This lack of knowledge about observable relations between venture performance and measurable KPIs has negative effects for VCs (principals) and entrepreneurs (agents) alike. The associated two-sided information asymmetry results in potential opportunistic behavior (Amit et al., 1998; Burchardt et al., 2014; Glücksman, 2020), inefficient capital allocations, and frictions in value-adding collaborations (Akerlof, 1970; Kaplan & Strömberg, 2001, 2003, Kollmann & Kuckertz, 2006).

Over the decades, academic literature made progress in studying the elusive concept of venture performance along the venture life cycle (Miloud et al., 2012; Fisher et al., 2016). In an agency context of high-growth ventures, aiming for external funding from early-stage investors, performance is commonly defined as a financial return, measured in pre-money venture valuations, and in corresponding internal rates of return (IRR), or multiples of invested capital (MOIC) (Fisher et al., 2016; Gompers et al., 2020). However, less progress has been made on the question of which practically measurable venture KPIs explain and indicate early venture performance (Gornall & Strebulaev, 2020), although many scholars have been asking for these KPIs for decades (Tyebjee & Bruno, 1984; MacMillan et al., 1987; Miloud et al., 2012). Instead, research developed a profound understanding of the principal-agent relationship, which manages the complexity of venture performance (Fama & Jensen, 1983; Tyebjee & Bruno, 1984; Kaplan & Strömberg, 2001, 2003; Shepherd &

Zacharakis, 2001; Burchardt et al., 2014; Hsu et al., 2014; Korteweg & Sorensen, 2017; Gompers et al., 2020). Scholars find that principals and agents have informal and formal means to track and discuss performance (Shepherd & Zacharakis, 2001; Garg, 2013; Garg & Eisenhardt, 2017). Informal means include on-demand, sometimes bilateral, and spontaneous interactions (Kollmann & Kuckertz, 2006). Here, Garg & Eisenhardt (2017) find that distinct monitoring techniques work for individual entrepreneur-investor relationships. Regarding the formal part, which comprises recurring venture board meetings and formal milestone discussions, research finds that investors have a strong demand for venture KPIs as soon as they become available (Fisher et al., 2016) but a hard time to interpret figures given a limited comparability and consensus on KPI relevance (Kollmann & Kuckertz, 2006; Köhn, 2018). At the same time, scholars find that entrepreneurs have difficulties to assess their investor readiness in fundraising situations (Proimos & Murray, 2006). A key question remains to be "*what do I need to get a series A funding?*" (quote of an interviewed investment professional). This leaves entrepreneurs lost in the striving to pass their life cycle milestones (Fisher et al., 2016), to drop their liability of newness (Stinchcombe, 1965; Delmar & Shane, 2004), and to present their KPIs as they feel unsecure about which matter and about what is needed to impress investors (Alemany & Andreoli, 2018, p.279). In other words, research does not sufficiently provide answers on how to capture and monitor venture performance through observable, measurable venture KPIs. At least, the authors of this paper are not aware of any successful attempt to consolidate and prioritize existing knowledge about venture KPIs in a practicable manner that goes beyond a list of uninterpreted KPIs or venture cases studies.

Given the premature research field, the purpose of this paper is to develop two artifacts. The first artifact aims at early-stage investors and provides a useful blueprint for an effective and efficient venture reporting solution, which complements the entrepreneur-investor relationship from a formal, quantifiable perspective (see Section 7.4). The second artifact targets entrepreneurs with high-growth ambitions and provides useful orientation to certain ventures on which KPIs are relevant and how these KPIs relate to ventures' milestones along their life cycle (see Section 7.5). Hence, our paper is different to other research by providing practical solutions capable of mitigating agency issues and enhancing transparency. The development of the two artifacts is inspired by the design science frameworks of Hevner (2007) and Peffers et al. (2007). Practical relevance and usefulness of the study are ensured by an intensive three-year long collaboration with the European startup-scene. Here, we continuously iterated and triangulated the research

results throughout the development, implementation, test, and evaluation phases. Theoretical relevance is ensured by reviewing academic and practical literature.

This study has three main contributions. First, the strongest contributions of this paper are the two designed artifacts, which are constructed to reduce the two-sided asymmetric information between entrepreneurs and investors (Glücksman, 2020; Gompers et al., 2020). The *Investor Reporting Tool* provides a useful "how-to-guide" on formal venture reporting processes and structures, supporting pre- and post-investment activities of investors, such as future venture selections, portfolio monitoring, and value-adding activities (Tyebjee & Bruno, 1984). The evaluation of the Investor Reporting Tool shows external validity for the developed design requirements, the conception, and hence for the eventual usefulness of the artifact for early-stage investors. The *Startup Benchmark Tool* provides useful descriptive insights on measurable venture KPIs and their relationships to venture milestones, such as funding events (Fisher et al., 2016), to certain ventures (e.g., Software as a Service and eCommerce ventures). These insights improve the entrepreneur's self-perception of investor readiness and support potential fundraising activities (Proimos & Murray, 2006). Further, the Startup Benchmark Tool increases the entrepreneur's confidence about venture KPIs, venture steering, and competitor analyses (Alemany & Andreoli, 2018, p.279). The evaluation of the Startup Benchmark Tool shows external validity for the developed design requirements, principles, conception, and hence for the eventual usefulness of the artifact. Interestingly, we find that besides entrepreneurs, also other market participants are interested in the benchmarking artifact, especially early-stage investors. Therefore, we conclude that the artifact is an important step towards enhanced transparency in the VC industry.

Second, through the two instantiated venture performance artifacts, this paper contributes to the venture capital literature by strengthening the not yet sufficiently established link between observable venture KPIs and eventual venture performance, asked for by research (Tyebjee & Bruno, 1984; MacMillan et al., 1987; Miloud et al., 2012). Our intensive collaboration with an early-stage investor reveals relevant KPIs and benchmarks, which are triangulated in countless interviews with investors and entrepreneurs. Our real-world insights into concrete KPIs and design choices for formal reporting structures, enable us to abstract and to identify common denominators for early-stage investors' performance tracking on portfolio, sub-portfolio, and venture level. These insights are valuable to literature's understanding of how early-stage investors handle the puzzle of balancing the "uniqueness of ventures" and the "abstraction of generalizable knowledge from

investments" (Huang & Pearce, 2015). For instance, we find that often dismissed financial accounting KPIs such as EBITDA, or FTE play in fact an important role in venture reporting, besides KPIs which are more venture specific, such as monthly recurring revenues (MRRs), or gross merchandise values (GMVs).

Third, the in-depth evaluation of the artifacts contributes to the venture capital literature by showing that the entrepreneur-investor relationship has a strong general need for formal reporting structures and benchmarks, which complement less-formal bilateral interactions between investors and entrepreneurs (Garg, 2013; Huang & Pearce, 2015; Garg & Eisenhardt, 2017). We confirm earlier findings in literature that investors both rely on trust (Shepherd & Zacharakis, 2001) and on caution, regarding potentially opportunistic behavior in the entrepreneur-investor relationship (Christensen et al., 2009; Glücksman, 2020). Our evaluation and discussion of the current status quo on formal reporting solutions and benchmark standards indicate that the early-stage investment market will suffer from a lack of transparency and asymmetric information until a "market standard" for venture data prevails, or at least a market consolidation for such data occurs. We conclude that fragmented reporting and benchmark solutions with constrained data availability across ventures and investors have a limited effectiveness and efficiency, bounding their usefulness. As of today, we find that some investors prefer provisional transparency solutions, while others advocate for an intermediate third-party solution to implement formal reporting structures. The different stances seem to be sensitive to the bargaining power and reputation of the respective investors, relative to their venture investments.

7.2 Theoretical framework

7.2.1 Venture performance indicators

Academic literature made progress in understanding the elusive concept of venture performance along the venture life cycle (Miloud et al., 2012; Fisher et al., 2016). Fisher et al. (2016) cluster the venture life cycle in stages, starting with the conception, or product-market-fit stage, the commercialization stage, and eventually the growth stage. Along these stages, and in the context of high-growth ventures, requiring external funding from early-stage investors, performance is commonly defined as a financial return, measured in venture valuations, and in IRRs, or MOICs (Steier, 2003; Fisher et al., 2016; Gompers et al., 2020). However, despite calls from scholars (e.g., Tyebjee & Bruno, 1984; MacMillan et al., 1987; Miloud et al., 2012), less progress has been made on the question of which practically measurable venture KPIs explain and indicate (early on) venture performance

(Gornall & Strebulaev, 2020). Fisher et al. (2016) show, depending on the venture's life cycle, that measurable KPIs become more relevant as the venture matures. Which KPIs may matter is often illustrated in lists of endless KPIs, in anecdotical form, or in form of case studies (cf. Kemell et al., 2018; Alemany & Andreoli, 2018, pp.295–303). However, literature usually lacks a prioritization or relative assessment of the mentioned KPIs. For instance, Kemell et al. (2018) identify in their study a need for specific KPIs defined for software ventures but acknowledge that their list of over 100 identified KPIs is more of a glossary. Alemany & Andreoli (2018, pp.278–309) select three potential business models and provide exemplified KPIs in a structured way. Nevertheless, they miss to link the KPIs to venture valuations or milestones. First attempts to relate measurable and observable KPIs to venture performance are conducted by Davila et al. (2003), who show how employee figures relate to venture valuations. Further, Delmar et al. (2013) build a theoretical framework around the concepts of venture growth, profitability, and survival, suggesting that profitability enhances both survival and growth, while growth helps profitability but has a negative effect on survival. Moreover, Miloud et al. (2012) are with their explorative cross-sectional study, according to our understanding, the first who try to establish a direct link between global investment criteria such as teams or markets, and startup valuations. They try this by using strategic theories, such as (i) industry organization economics, (ii) resource-based view and (iii) network theory. Finally, Sievers et al. (2013) and Kam & Witherow (1999) have shown that the industry, the profitability stage of a venture's life cycle, and the geographical location can affect valuation-levels. Despite these initial steps, research on the relation between performance indicators and actual venture performance remains premature as Delmar et al. (2013) and Köhn (2018) conclude. This is also shown by (a) Gornall and Strebulaev (2020), who investigate the valuation-levels of unicorns based on annual financials, identifying unexplainable deviations, and (b) high failure rates for venture investments (Song et al., 2008; Gage, 2012; Soto-Simeone et al., 2020).

7.2.2 Entrepreneur-investor relationship

Literature developed a profound understanding of the principal-agent relationship, which manages the complexity of venture performance in an environment of asymmetric information along the venture life cycle (Fama & Jensen, 1983; Tyebjee & Bruno, 1984; Kaplan & Strömberg, 2001, 2003; Shepherd & Zacharakis, 2001; Burchardt et al., 2014; Gompers et al., 2020). Investors suffer from asymmetric information (Fama & Jensen,

1983; Tyebjee & Bruno 1984), which invites opportunistic behavior of the entrepreneur (Amit et al., 1998; Burchardt et al., 2014), inefficient capital allocations, and prevents value creation through advisory and monitoring activities (Akerlof, 1970; Sapienza, 1992; Jain, 2001; Kaplan & Strömberg, 2001, 2003; Chen, 2009). Korteweg & Sorensen (2017) find that those issues are disproportionally high present for investors that lack reputation. Also, entrepreneurs suffer from potentially opportunistic behavior of the investors and forgone alternative resources, which they could have obtained in exchange for ownership in their ventures (Salancik & Pfeffer, 1978; Shepherd & Zacharakis, 2001; Hellmann & Puri, 2002; Proimos & Murray, 2006; Garg, 2013; Huang & Knight, 2017; Glücksman, 2020). The relationship of principals and agents can be characterized through informal and formal interactions, designed to close information asymmetries (Cable & Shane, 1997; Shepherd & Zacharakis, 2001; Garg, 2013; Garg & Eisenhardt, 2017). Regarding the informal part, including on-demand, sometimes bilateral, and spontaneous interactions (Kollmann & Kuckertz, 2006), Garg & Eisenhardt (2017) find distinct monitoring techniques to work for individual entrepreneur-investor relationships. Regarding the formal part, research finds that investors steer the relationship with contracts (e.g., investment agreements) and monitoring activities (e.g., board discussions, including the achievements of milestones) (Kaplan & Strömberg, 2001, 2003; Bernstein et al., 2015; Gompers et al., 2020). However, beyond these overarching steering instruments, investors have a strong demand for measurable venture KPIs as soon as they become available (Fisher et al., 2016; Köhn, 2018).

7.3 Research methodology

7.3.1 Design science research

As KPIs for ventures are dispersed, we tailor our research approach accordingly. We use the design science research approach to develop two artifacts, which increase transparency in the VC industry and hence enable data-supported decision-making for both, the ventures, and the investors. By its nature, we follow the design science frameworks of Hevner (2007) and Peffers et al. (2007). Figure 13 illustrates the three cycles of design science research, which ensure that practice-oriented research is rigor, relevant, and useful (Hevner, 2007).

Figure 13: The three-cycle view of design science research
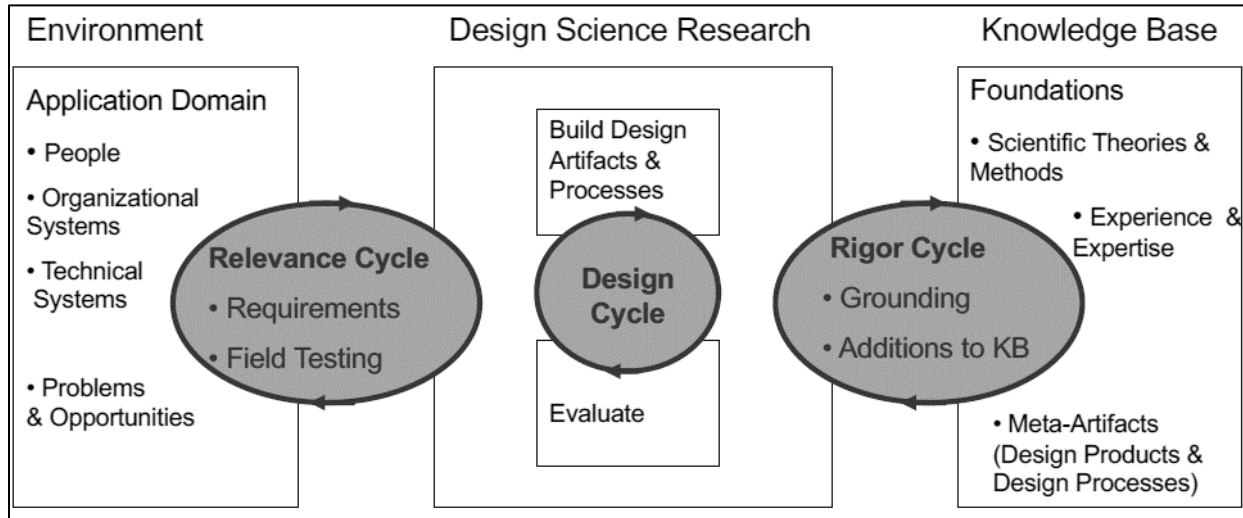
Source: Hevner (2007)

The two artifacts presented in Section 7.4 (Investor Reporting Tool) and Section 7.5 (Startup Benchmark Tool) are built for practitioners. Therefore, we acknowledge the relevance cycle by closely collaborating with the industry, while ensuring that the literature cannot sufficiently solve the needs. The close collaboration with investors and founders includes assessments of the phenomenon, the requirements, and the evaluation of the artifacts. We decided to closely collaborate with a Berlin-based early-stage venture capital investor. This investor grants us unlimited access to its data. The data includes overall 72 investments of which 45 are active portfolio ventures. Besides the collaboration with the investor, we also triangulate our results with the corresponding startups. These startups have been, by their funding status, successful in their transition towards the commercialization and growth stage (Fisher et al., 2016). Hence, they are a viable source to infer from for other ventures with similar aspirations. Based on the developed requirements, we build the artifacts and implement, if required, the associated processes throughout the design cycle. Here, the two artifacts are constantly and iteratively evaluated, piloted, and tested by investors and founders. The iterations ensure that the derived requirements are met. This is further secured by extensive post-development evaluations of the design artifacts through external industry experts. Finally, in the rigor cycle, the artifacts are embedded in theoretical knowledge, making them compliant with theoretical requirements. By that, we also ensure to contribute to future research by synthesizing practitioners needs in a premature field of research.

7.3.2 Requirements and design principles

The research activities started with an investigation of the demand for solutions that create transparency and support to investors and founders in data-driven decision-making in the European VC industry. Open and semi-structured interviews indicate that tools are already available for investor reporting purposes (e.g., investory.io, visible.vc, Ledgy) but that those are either (a) internally developed and too provisional, (b) too expensive, or (c) too static and over-standardized, limiting the usability. At the same time, a need for quantitative venture benchmarks is expressed – especially in non-US markets, benchmarking data is barely available. According to the identified need for data-supporting solutions in the European VC industry, practical requirements (PR) are developed. We apply a development process similar to Meth et al. (2015). The requirements are developed in both physical and virtual meetings as well as telephone interviews on the one hand and deducted from countless venture reports and board presentations on the other hand. The practical requirements are shown in Table 14 for the Investor Reporting Tool and in Table 20 for Startup Benchmark Tool. The theoretical requirements (TR) are derived from a literature review, which aimed at identifying steering mechanisms of the formal entrepreneur-investor relationship and at tracking mechanisms for venture performance. The theoretical requirements for the Investor Reporting Tool are presented in Table 15, while the requirements for the Startup Benchmark Tool are shown in Table 21. Both practical and theoretical requirements were consolidated towards overarching design principles for each of the two artifacts.

7.3.3 Evaluation

The developed artifacts are instantiations according to March & Smith (1995). Therefore, the following key evaluation parameters are selected: (a) efficiency and (b) effectiveness of the artifacts and their (c) impact on the users, i.e., the usefulness of the artifact. These parameters are operationalized through detailed questions on product-market fits, conceptions of the artifacts, comprehensiveness of the artifacts, and design specifications. We further followed the evaluation approach proposed by Sonnenberg & vom Brocke (2012), who recommend a constant gathering of feedback during the design cycles along the development and the post-development phases.

Development phase: The development of the Investor Reporting Tool is based on more than 150 conducted meetings and workshops with representatives of a collaborating Berlin-based VC and their startup portfolio, the latter comprises 45 active ventures. External VC

round table events, and interviews are conducted to evaluate the design of the artifact. The instantiation grounds on the screening of about 200 capitalization tables and more than 100 investment agreements, as well as on the review of countless venture reports, board presentations, and other files related to venture reporting. After the development, the reporting tool went live in order to test it. The testing-period lasts 18 months (September 2019 rollout, until February 2021). This long period ensures that the Investor Reporting Tool effectively deals with day-to-day as well as infrequent circumstances both manifested in the artifact's requirement.

The development of the Startup Benchmark Tool is mutually conceptualized with five junior investment decision-makers from the collaborating VC, and with teaching scholars from business schools (e.g., University of St.Gallen). These experts are involved in conceptual decisions and provide valuable feedback towards the specifications of the artifact. Further, at the final stage of the development, the Startup Benchmark Tool is demonstrated to the collaborators for additional feedback on the usefulness.

Post-development phase: After development and testing, both artifacts are evaluated in form of semi-structured expert interviews. The convenience sampling strategy reflects knowledgeable senior experts from the VC industry and potential users for the artifacts. By that, all interviews are equally important. Initially eleven industry experts had been asked for an interview, thereof eight experts responded, and seven were available for an interview. The interviewed experts have an average experience in the VC industry of 17 years. Industry experience comprises founding and managing of a venture, investing in ventures, or having board seats in ventures. Five experts are active venture capital investors (VC), whereas two experts are active business angels (BA). Demographic information about the experts is shown in Table 13.

The interview partners of the post-development evaluation have not been involved in the previous steps of the development, i.e., they had an outsider perspective on our research. This improved external validity of the designed artifacts. The interviews lasted 60 minutes each, were conducted via video calls, and were transcribed at the day of occurrence. The original evaluation results are depicted in Table 18 as well as Table 19 for the Investor Reporting Tool, and in Table 23 as well as Table 24 for the Startup Benchmark Tool. To increase transparency on the post-development evaluation, *edited* transcripts of the expert interviews are attached in Appendix 1 for the Investor Reporting Tool and in Appendix 2

for the Startup Benchmark Tool. The structured questions of our interviews use a 5-point-Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Table 13: Demographic information about post-development expert interviewees

Expert	Expert A	Expert B	Expert C	Expert D	Expert E	Expert F	Expert G
Investor type	BA	VC	VC	VC	BA	VC	VC
Background	Technical background, software development, entrepreneur, business angel; ~25 investments	Serial tech-entrepreneur and CTO background, currently VC partner and board member; ~120 investments	Corporate finance background, today LP-board member at VCs, and managing partner at an early-stage fund-of-fund	Former CEO of an insurance company, today multiple board and director roles, and an active VC investor	Academical background in digital marketing, today board member, business consultant, and business angel	Investment professional at a VC, focusing on series A in the field of Tech and Life-Science	MBA degree holder from top university, since then severed through equity partner and director roles at several VCs
Overall experience	10 years	25 years	15 years	25 years	22 years	5 years	20 years

7.4 Artifact #1: The Investor Reporting Tool

Summary

The Investor Reporting Tool supports early-stage investors (venture capitalists, and potentially business angels) in keeping track of the performance of their ventures. This supports investors in investment as well as divestment decision-making, portfolio monitoring, and value-adding activities, such as board discussions. The tool consists of three levels. The venture level, where startups independently enter predefined KPIs on a regular basis. The portfolio consolidation level, on which the venture data is consolidated and made comparable in a single source of truth. And the visual dashboard level, on which portfolio and venture KPIs are made visually available to the investor's organization (general partners of the investment firm, investment team members, finance team members).

7.4.1 Conceptualization of the artifact

Using the frameworks of Hevner (2007) and Peffers et al. (2007), we develop theoretical and practical design requirements which lead to the design principles for the Investor Reporting Tool. As mentioned, several reporting solutions already exist on the market. However, as the existing solutions are not broadly adapted by the industry, a detailed initial investigation of the practitioner needs is required to identify how our artifact should be conceptualized.

The eight practical requirements (PR), listed in Table 14, were discussed, pivoted, and evaluated with the practitioners during meetings and workshops until they comply with the practitioner's demands.

Table 14: Practical requirements of the Investor Reporting Tool

PR, #	Requirement description
PR1	The artifact should be a transparency tool, which provides a "single source of truth" on decision-relevant venture performance data
PR2	The artifact should be useful for: limited partner (LP) reporting, regulatory purposes, portfolio reviews, investment decision-making, and benchmarking purposes, by consolidating venture performance data
PR3	The artifact should be standardized enough to allow portfolio analyses across ventures
PR4	The artifact should be flexible enough to allow specifications across the ventures and to cope with dynamic changes in reporting needs over time for a given venture
PR5	The artifact should include and enable performance comparisons between actual and budgeted figures for a given venture
PR6	The artifact should require only limited effort from the ventures, it should be perceived as a "non-bureaucratic" solution
PR7	The artifact should require only limited effort and costs from the investors
PR8	The artifact should be embedded into the entire organization to ensure durability, while considering a role management (e.g., on both, the investor, and the venture level)

At the rigor design cycle, three aggregated theoretical requirements (TR) have been identified from the literature. The theoretical requirements are displayed in Table 15.

**Table 15: Theoretical requirements of the Investor Reporting Tool**

TR, #	Requirement description	Relevant source(s)
TR1	The artifact should mitigate potential agency problems (e.g., opportunistic behavior, hidden actions) by enabling the monitoring capabilities of the investor	Kaplan & Strömberg, 2003; Bernstein et al., 2015
TR2	The artifact should enable board activities and other forms of support from the investor to the venture, in accordance with the resource dependency theory	Hellmann & Puri, 2002; Kaplan & Strömberg, 2003; Garg, 2013; Bernstein et al., 2015; Huang & Knight, 2017
TR3	The artifact should support in the long-run data-supported decision-making, as research misses yet the direct link between venture performance indicators, controls, and valuations	Gornall & Strebulaev, 2020; Gompers et al., 2020

Based on those specific practical and theoretical requirements, we define in accordance with March & Smith (1995) usefulness and efficiency as the overarching design principles for the reporting tool. The tool is considered as useful if it fulfills the users' needs, i.e., captures portfolio performance, enables monitoring and venture-board advisory services, or complies with other investors goals, such as the upward reporting to the LPs. The usefulness is also measured in the endurability of the solution. The artifact must be efficient, i.e., the efforts and costs must stand in reasonable relation to the associated benefits. In detail, costs and efforts should be kept low, while bureaucratic impressions and reporting redundancies should be avoided.

7.4.2 Presentation of the artifact

According to these design requirements and principles, the designed artifact is a low-tech offering with a three-layer base architecture. It is manageable and maintainable with limited effort by the investor. The IT architecture, built on a standard software, is accompanied by new reporting processes and organizational changes, which are implemented by individual onboardings and coaching sessions with the required stakeholders on the investor and venture level. When implemented, the new reporting processes create an important framework for the technical solution, jointly building a compatible and holistic venture-investor reporting that suits the organizational goals.

Figure 14: Simplified IT architecture of the artifact
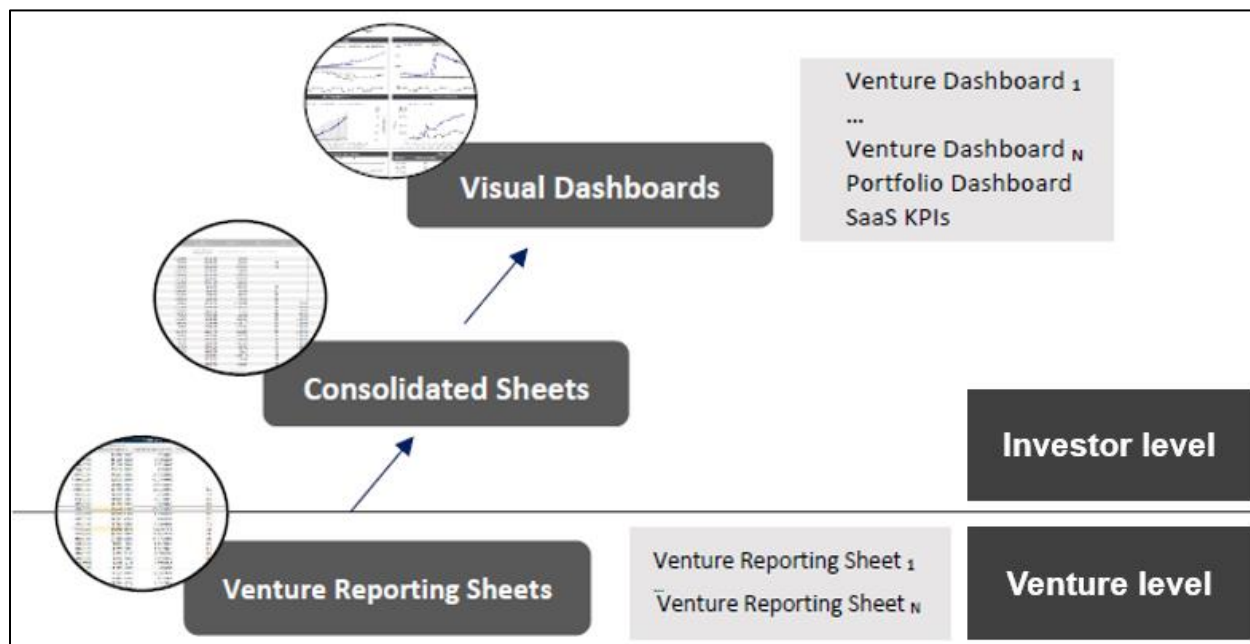
The applied standard software is "Google Workspace". Several elements from Google are used: Google sheets, Google studio, and Google mail. Google sheets represent the backbone of the artifact. They are used to build the base layer of the three-layer architecture: The Venture Reporting Sheets that are distributed to each venture. Also, the consolidator on the intermediate layer is built based on Google sheets. However, the visual dashboards on the top layer are designed in Google studios. The cloud-based standard software of Google was chosen due to several reasons. In particular the real-time data management, which provides a single source of truth (PR1), while being securely hosted in the cloud, manageable by various roles across the organization, as well as the transferability towards future applications, make Google Workspace the suitable software for the Investor Reporting Tool. The base architecture is illustrated in Figure 14.

Venture Reporting Sheets: The venture reporting sheets at the venture level are the basis for the reporting. Here the relevant KPIs are collected from the ventures. Each portfolio venture is responsible for its own reporting sheet. Hence, the ventures have ownership of the reported data. Time investment for initial coaching of the respective venture representative in charge is necessary, since only the ventures can efficiently and effectively report their data over a long period of time. This in turn ensures correctness and timely adjustments of the data, if needed. The reporting sheet contains three tabs.

First, a tab with reporting instructions, including reporting dates, formats, and explanatory comments (see Table 17).

Second, the main tab, which contains the template for the monthly KPI reporting. Here, the venture reports the operational and financial KPIs on a monthly basis. The KPIs are split into two categories. The so called *standard KPIs* and the so called *specific KPIs*. The standard KPIs were jointly defined by the authors and the investors, whereas the specific KPIs are additionally iterated with the respective venture representative. The six defined standard KPIs are consistently collected by the investor across the entire portfolio. These include typical financial KPIs easily extractable for all venture, namely: Revenue, EBITDA, cash balance, cash burn, FTE, and account receivables. The standard KPIs meet the practical requirement of sufficient standardization to conduct portfolio reviews, benchmarking analyses, or LP-reporting (PR2, PR3). Further the standard KPIs are easily extractable for all ventures, as most accounting reporting standards require them. The venture specific KPIs on the other hand allow venture performance measurement that is tailored to the uniqueness of each venture. Hence, these specific KPIs create the required reporting flexibility across the portfolio (PR4). Among the most common specific KPIs within the portfolio are venture-specific gross or contribution margins (GM, CM), number of customers, or customer acquisition costs (CACs). Overall, we define 326 specific KPIs, relating to 45 corresponding ventures (on average about seven specific KPIs per venture). Thereof, 220 KPIs have unique labels, illustrating the dispersion of operational and financial KPIs in this field. We further assess with the investor representatives the comparability of specific KPIs across the investor portfolio, classifying the KPIs into a "low" comparability and a "high" comparability. Among the most common specific KPIs with a relatively high comparability across the portfolio ventures are existing customers, monthly recurring revenues (MRR), gross merchandise values (GMV), and the take rate. Table 16 shows a list of the most frequently defined specific KPIs, including the KPIs' assessment of comparability across the portfolio.

Third, a final tab of the venture reporting sheets contains a reporting template for balance sheet figures, i.e., financial KPIs, to be reported on an annual basis. These include the venture debt, net debt (debt minus cash), and equity. These KPIs are increasingly frequent requested from regulators and LPs, in particular from the US. Overall, due to the principle of efficiency, we only collect KPIs, which cannot be derived by the combination of other KPIs. If a KPI can be calculated based on these, so called, *original* KPIs, the calculation is

performed on the investor level (e.g., EBITDA vs. EBITDA growth, or average order volume vs. total order volume and total number of orders). The combination of standard and specific KPIs with no redundancies leads to a minimized effort required by the ventures (PR6). On average, ventures enter in the Google sheet 13 numerical KPIs per month and three numerical KPIs per year. Further, the financial budgeted figures for the upcoming year must be sent by the venture to the investor (PR5) once a year (usually in the fourth quarter of the previous year). This occurs after the venture-board approves the budgeted figures. Finally, we exclude qualitative reporting from the reporting sheets. Although qualitative aspects are important for the context, an initial trial to collect them revealed that they significantly increase the effort on the venture level, while they failed to replace other established informal reporting structures for the qualitative content (see Garg & Eisenhardt, 2017). Thus, the collection would oppose the efficiency requirement (PR6).

Table 16: Most frequent venture specific KPIs

Venture-specific performance indicators	Comparability	Count
Profitability figure (e.g., gross margin, contribution margin)	Low	22
Existing customers	High	21
Customer acquisition costs (CACs)	Low	16
Revenue share (e.g., for a target region, or target product)	Low	16
Monthly recurring revenue (MRR)	High	15
Total transactions	Low	13
Gross merchandise value (GMV)	High	9
Customer lifetime value (CLTV)	Low	8
Average order volume (AOV)	Low	8
Take rate	High	7
Pipeline	Low	5
Repeat customers	High	3
Net Promoter Score (NPS)	High	3
Leads	High	2
Conversion Rate	High	2
Visits	High	2
Assets under Management (AuM)	High	2

Note: Total sample size of active ventures = 45.

Consolidator: On investor level, all Venture Reporting Sheets from the portfolio ventures are consolidated in a Google sheet. This consolidator meets the requirements of being the single source of truth (PR1). The requirement is met by having the entire architecture in a cloud solution, in which changes are displayed in real-time. This makes distribution of files with potentially conflicting versions via emails obsolete. In addition, the Google "Workspace" environment enables sufficient role management. Only investor representatives have viewing or editing rights, depending on the role within the firm (PR8). As all changes in the tool are instantly deployed, it is important that changes are traceable and revocable. The consolidator has the following four main functionalities. First, within the consolidator, every venture reporting sheet has a matching tab, which imports the venture data as it is. Second, the investor can also enter budgeted figures, which are received in raw format from the venture. The budgeted figures enable comparisons between actuals and budgeted figures. The budgeted figures are not updated when new forecasts become available over time. This improves consistency, interpretability and reduces the effort (PR5, PR7). Third, the consolidator also contains demographic venture data, such as the industry, the business model, the customer focus, or the revenue model. This makes clustering and filtering across ventures possible (PR2, PR3). Fourth, many relevant performance indicators, such as growth figures (e.g., revenue growth), or certain ratios (e.g., actual/forecast), can be calculated based on original KPIs. For instance, Software as a Service (SaaS) ventures within the portfolio share a broad set of common specific KPIs. These KPIs comprise the components of the monthly recurring revenues (i.e., New MRR, Upsell MRR, Churn) and cost figures (i.e., marketing spend). As those KPIs are consistently calculated across the portfolio ventures, synthetic "SaaS Efficiency Scores" can be derived from the original KPIs. For this synthetization, we reuse the work of Alemany & Andreoli (2018, pp.278–309) and enhance the list of KPIs by aggregating, prioritizing, and combining the listed KPIs. The differentiation between original KPIs and calculatable KPIs reduces the required effort (PR6, PR7). Overall, the consolidator brings all venture data together. Therefore, it provides the single source of truth for the investor (PR1), representing an essential element of the investor's front-end. It is the data base for portfolio reviews, benchmark analyses, venture performance reviews, data-supported investment decision-making, board meeting preparations, and LP-reports (TR1, TR2, TR3).

Visual dashboards: Interestingly, we experienced that investors are already largely satisfied with the consolidated portfolio data within a single source, including

accompanying processes that ensure that the data quality is maintained in the future. This is also indicated by the fact that to this point all eight practical requirements and all three theoretical requirements are addressed. Nevertheless, to ease accessibility and to improve user experience, we identified in close alignment with the practitioners three main use cases, which the relatively static visualization dashboards could be leveraged for. As these visualizations can be easily implemented in Google studios without violating the efficiency design principle, we decided to build the following three types of dashboards:

The first dashboard supports portfolio reviews which are conducted by the general partners on a quarterly base. The dashboard contains all ventures of the portfolio as line items. The portfolio overview includes the standard KPIs and their deviations between actual and budgeted figures for each venture. The dashboard has simple filter options, such as "by fund", or "by general partner". Also, the considered period of time can be chosen, making reviews over last month, last quarter, or very specific periods of time possible. Thus, the portfolio dashboard enables data-driven decision-making in the context of subsequential investment rounds (see Figure 15).

Figure 15: Portfolio review example

Fund	Partner	Jahr/Monat: Sept. 20... (1)		Data Source

#	Venture	1st Reporting Month	Revenue Description	Actual Revenue (T€)	Plan Revenue (T€)	Δ Revenue Actual/Plan (%)	Avg. Δ MoM Revenue (%)	Efficiency Score	Cash Balance (T€)	Cash Burn (T€)	Accounts Receivables (T€)	FTE
1.	Venture	Jan. 2017	Total	184 €	165 €	12 %	1 %	53 %	955 €	46 €	Keine Daten	14,2
2.	Venture	Jan. 2020	Total	Keine Daten	Keine Daten	Keine Daten	Keine Daten	Keine Daten	Keine Dat..	Keine Daten	Keine Daten	Keine Daten
3.	Venture	Jan. 2020	Gross profit	252 €	223 €	13 %	8 %	120 %	3.099 €	-261 €	982 €	75
4.	Venture	März 2018	Total	1.516 €	6.346 €	-76 %	102 %	120 %	6.119 €	-685 €	300 €	33
5.	Venture	Juli 2018	Total	116 €	53 €	119 %	316 %	120 %	272 €	-54 €	160 €	7
6.	Venture	Mai 2019	Total	58 €	372 €	-84 %	-17 %	-40 %	1.586 €	152 €	103 €	27
7.	Venture	Feb. 2019	Gross	2.765 €	3.182 €	-13 %	360 %	120 %	7.215 €	-2.394 €	47.515 €	144
8.	Venture	Jan. 2017	Net	5.884 €	4.979 €	18 %	10 %	50 %	27.246 €	116 €	791 €	539
9.	Venture	Jan. 2017	Internal	153 €	1.036 €	-85 %	14 %	-40 %	12.516 €	-854 €	1.029 €	167
10.	Venture	Jan. 2017	Total	149 €	247 €	-40 %	5 %	-40 %	261 €	-204 €	239 €	35,7
11.	Venture	Jan. 2019	Invoiced	442 €	653 €	-32 %	12 %	34 %	15.469 €	-741 €	391 €	98
12.	Venture	Jan. 2020	Total	26 €	Keine Daten	Keine Daten	Keine Daten	Keine Daten	6.099 €	-341 €	0 €	21
13.	Venture	Nov. 2019	Total	36 €	0 €	Keine Daten	122 %	Keine Daten	859 €	-187 €	0 €	15
14.	Venture	Jan. 2017	Total	2.497 €	2.895 €	-14 %	21 %	23 %	3.714 €	-196 €	3.477 €	56
15.	Venture	Jan. 2017	Total	683 €	Keine Daten	Keine Daten	-7 %	63 %	12.471 €	1.457 €	0 €	204
16.	Venture	Okt. 2020	Total	3.834 €	Keine Daten	Keine Daten	Keine Daten	Keine Daten	0 €	0 €	Keine Daten	Keine Daten
17.	Venture	Jan. 2017	Invoiced	2.863 €	4.589 €	-38 %	20 %	120 %	2.711 €	-1.891 €	3.626 €	189
18.	Venture	Jan. 2017	Net after Returns	Keine Daten	1.512 €	Keine Daten	Keine Daten	Keine Daten	Keine Dat..	Keine Daten	Keine Daten	Keine Daten
19.	Venture	Jan. 2017	Net	Keine Daten	Keine Daten	Keine Daten	Keine Daten	Keine Daten	Keine Dat..	Keine Daten	Keine Daten	Keine Daten
20.	Venture	Jan. 2017	Income	258 €	216 €	19 %	3 %	-40 %	14.041 €	-577 €	145 €	60
21.	Venture	Jan. 2017	Total	8.244 €	Keine Daten	Keine Daten	69 %	97 %	90.149 €	-6.697 €	3.732 €	539
22.	Venture	Jan. 2017	Total	Keine Daten	Keine Daten	Keine Daten	Keine Daten	Keine Daten	Keine Dat..	Keine Daten	Keine Daten	Keine Daten
23.	Venture	Nov. 2017	Total	20.725 €	Keine Daten	Keine Daten	14 %	97 %	14.142 €	-116 €	4.956 €	383

The second dashboard is a one-pager with four main charts for each venture of the portfolio. The one-pagers are consistently designed, they depict for all venture on the top of the page the time series of standard KPIs (revenue, EBITDA, cash balance, and cash burn; with

actuals and budgeted figures) and on the bottom of the page time series of selected specific KPIs for the respective ventures. The selected specific KPIs have been triangulated together with the responsible general partner to ensure the ("north-star") relevance of the selected KPIs. An illustration of a one-pager is shown in Figure 16.

Figure 16: Venture dashboard example
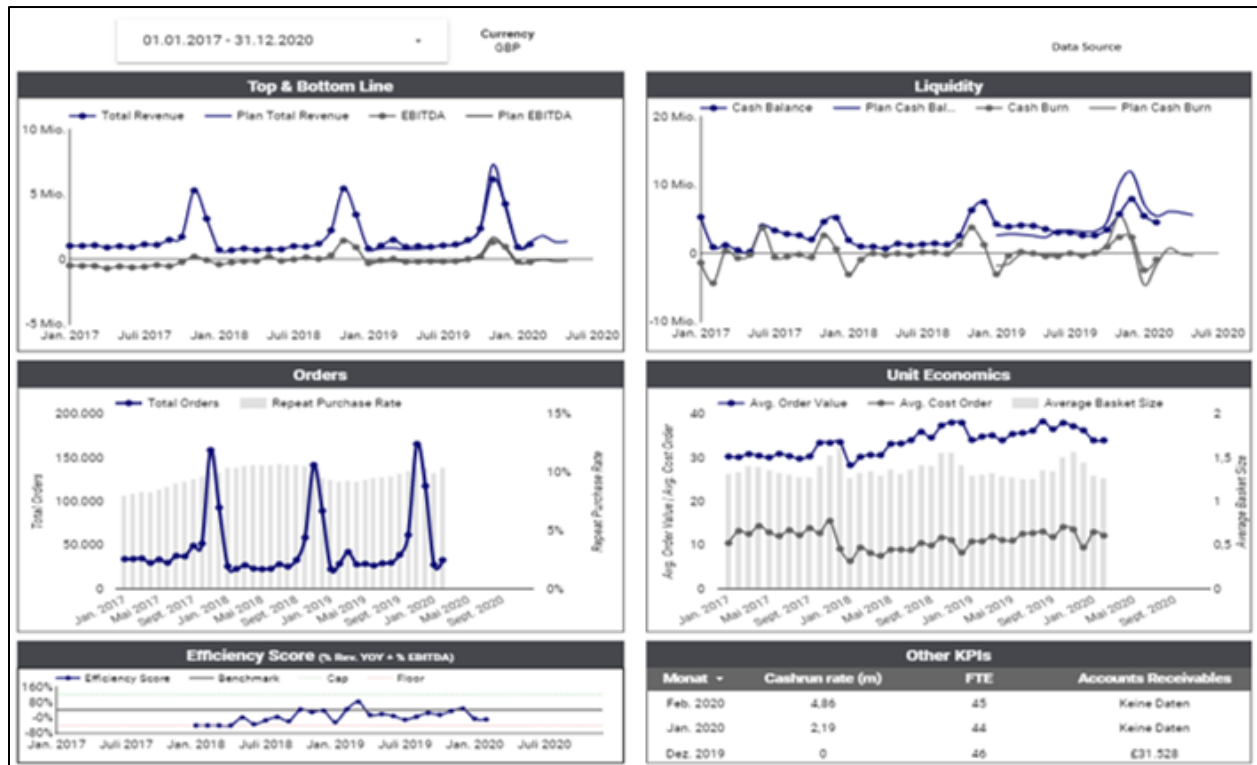
The third dashboard enables benchmarking between certain ventures since we identified a need for relative performance measures within the portfolio. The Software as a Service (SaaS) ventures within the portfolio combine two distinct advantages for such a benchmark approach. Their scalability suits the return profiles of typical financial investors of early-stage companies (e.g., business angels and venture capitalists). By that, it is no surprise that SaaS ventures represent a relatively large share of the collaborator's portfolio. Also, the recurring revenue model of SaaS ventures leads to a relatively low degree of heterogeneity across the ventures. Thus, the relatively large sample size and the low variability make SaaS ventures the ideal candidate for benchmarks. Consequently, we developed for the SaaS venture sub-portfolio a visual dashboard. Here, the relevant KPIs for the business model are depict across ventures and over time. The KPIs, consistently collected across the ventures, comprise the detailed composition of the monthly recurring revenues (i.e., New MRR, Upsell MRR, Downsell MRR, Churn), related costs figures (e.g.,

total marketing spend), and synthesized efficiency scores. The SaaS dashboard is illustrated in Figure 17. The dashboard enables the investor to compare the ventures and to perform data-supported decisions (PR3, TR3).

Figure 17: SaaS dashboard example
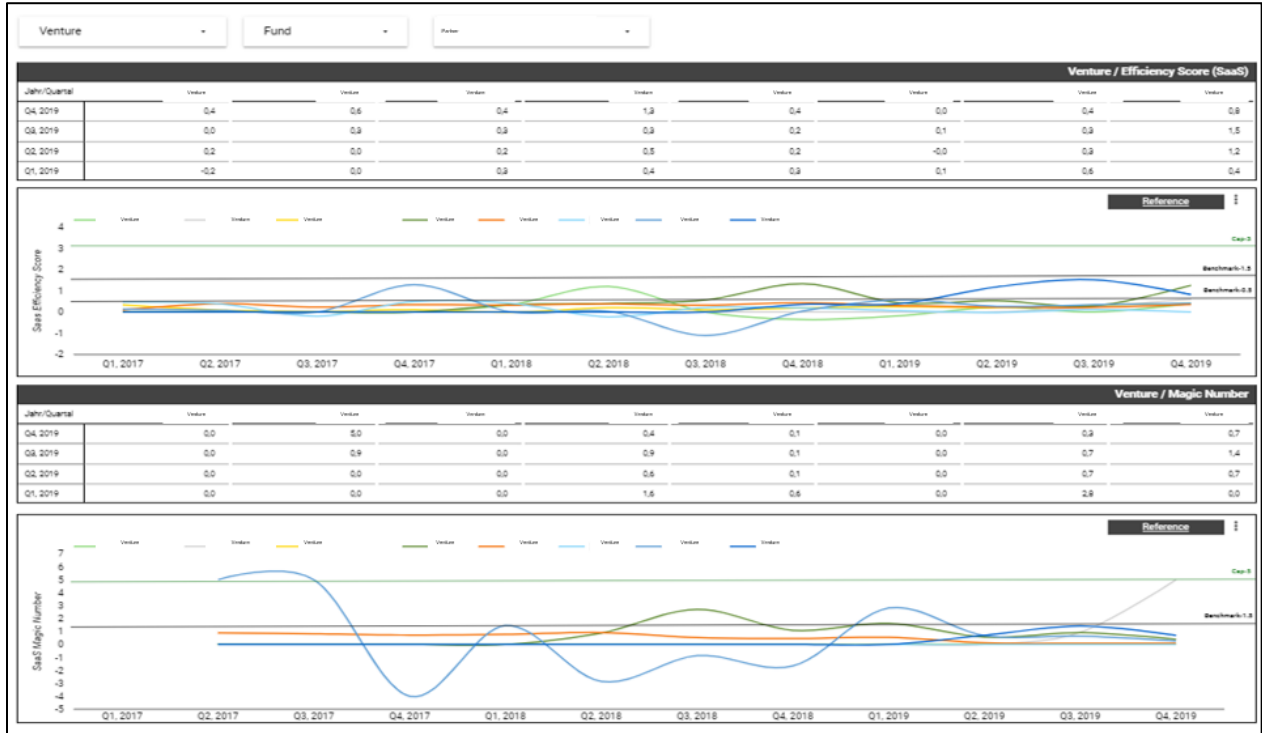
Process, supplementary functions, and organizational changes at implementation: According to the inquired needs, the goals of the artifact require more than a lean IT solution which could be send-over as a software as a service. We experienced that other online-tools, available at the market, suffer from poor acceptance and eventually short-lived usage, as neither investors nor ventures adapt their habits sufficiently towards these solutions. Therefore, the following supplementary design elements are mutually developed with investor representatives to create a carrying environment for the IT artifact.

A key component of the conception, development, and implementation was a close alignment with the stakeholders. This ensured two essential aspects. First, the designed artifact suits the requirements, by iteratively evaluating the progress of the artifact. Second, the acceptance of the users of for the new reporting is secured.

At the implementation, role specific onboardings and coaching sessions are performed. The ventures, the investment managers, the general partners, as well as the finance department

received separated coaching and onboarding sessions suited to their involvement in the new reporting process.

With the rollout of the Venture Reporting Sheets, the ventures receive written explanations of the reporting process and an invite for an (optional) virtual online session. In a nutshell, the ventures learn that new reporting templates are now mandatory, while the existing, unstructured, reporting (e.g., sending of board of director documents, individual reporting files) should be proceeded, to keep the information richness. As it is essential to limit the effort for the entrepreneurs (PR6), efficiency is the key design principle at the venture level. However, this does not imply that ventures are freed from all obligations, as also investors require low maintenance costs and efforts (PR7), while the entire reporting is required to endure (PR8). By triangulating those opposing requirements, the development phase reveals that ventures are the natural owners for the data. Table 17 shows the reporting guideline for ventures. Onboarding sessions are used to iterate the specific KPIs, to minimize the effort for the ventures (e.g., discussing potential intercepts with existing venture reports), and in few cases to exclude some ventures from their new reporting obligation. In the latter case, the finance department of the investor internalizes the reporting based on the venture-individual reporting formats. Cases in which the reporting is internalized include ventures of a considerable size with matured reporting standards, or ventures with small shareholdings and an appropriate side-role of the collaborating investor (i.e., being following investor only).

Table 17: Reporting guidelines for ventures

Example document type	To be sent
Budgeted figures (for next year on monthly basis)	15th November of previous year
Board of director documents	Before board meeting
Significant Ad hoc updates	As soon as available
BWA (betriebswirtschaftliche Auswertung)	Monthly when available and on request
SuSa (Summen- und Saldenliste)	Monthly when available and on request
Other excel spreadsheets and extensive reporting	Monthly when available and on request
Template reporting	**To be filled until**
Monthly Reporting	20th of next month
Annual figures (testified)	30th June of next year

At the investor level, the general partners and the members of the investment team are the most important target users of the artifact from a performance management perspective.

Therefore, the coaching focuses on the capabilities and the usefulness of the artifact. The integration of the artifact into decision-making is essential. For this purpose, we introduce the "directory" to the users. The directory is a Google studio page, from where all dashboards and the data consolidator are accessible within one "click". After the directory, the dashboards and the consolidator are presented in detail, including potential use cases, export and drilldown functions, filter options, and importantly, the role management status for the respective users. The reporting processes are of lesser concern for this user group; hence only a basic understanding of the reporting processes and the technology is given.

The finance department hosts the Investor Reporting Tool. Therefore, a finance department representative has to understand the entire reporting architecture and the associated processes. To ensure a proper knowledge management, the collaborative development of the artifact is located within the finance department since the beginning. The department is closely involved in the conception, development, and implementation of the Investor Reporting Tool. In addition, an extensive, technical, "Reporting Guide" is developed to manifest the knowledge management within the investor's organization. The close collaboration and the intense coaching sessions enable the artifact to cope with dynamic changes over time, a requirement to ensure durability (PR8). The recurring tasks of the finance representative comprise the following: (a) Technical maintenance of the Investor Reporting Tool, (b) the user role management, (c) the governance of the venture data, including reminder emails in case of delayed reporting, (d) changes in specific KPIs, (e) follow up coaching for existing portfolio ventures, and (f) onboardings for new ventures. The latter comprises the definition of and the alignment on the specific KPIs besides the introduction of the reporting process and templates. Apart from the before mentioned administrative role, the finance representative also uses the venture data for regulatory requests, LP-reporting, and potentially for fund raising activities. Thus, given the broad spectrum of tasks related to the reporting tool, we see both usefulness and efficiency as key criteria for the finance department representative. Therefore, to limit the effort to a minimum, the base architecture is complemented by some supplementary Google sheets, only accessible for the reporting representative in the finance department. These include the "extraction transformation and load" (ETL) sheet, the "action tracker" sheet, and the "KPI-master" sheet. To connect the consolidator and the visuals, the consolidator is extended by the ETL sheet. The ETL sheet transforms the data from the consolidator into the right format and currency for the analyses and visualizations of the top layer. The action tracker sheet provides an overview about the monthly reporting status and reporting

activities of the ventures for each month (i.e., whether the ventures reported or not). This overview supports the venture follow up communication. Finally, a central KPI-master sheet admins all defined venture KPIs across the portfolio, including the aligned definitions. KPIs can be changed only from this sheet.

7.4.3 Test & evaluation of the artifact

The goal of the Investor Reporting Tool is to be an effective and efficient solution, which is useful for portfolio reviews, venture analyses, portfolio analyses, regulatory topics, and LP-reporting. We performed two procedures in order to achieve a maximum of confidence about the usefulness of the tool. First, the artifact is tested for an extensive period of time. Second, the artifact is evaluated by semi-structured expert interviews, to prove its external validity beyond the instantiation.

7.4.3.1 Test of the artifact
We tested the artifact in its natural environment for 18 months. The long period enables us to test the usefulness, for both day-to-day activities and for occasional activities, such as onboarding of new ventures onto the reporting tool, changes of KPIs, and quarterly portfolio reviews. In addition, the durability of the artifact becomes testable through the long period.

Elaborating on the usefulness, we first focus on the general partners, second on the investment team, third on the finance department, and finally on the ventures. First, three of six general partners (50%) confirmed that the reporting tool became an integral part of their day-to-day activities, whereas all six partners (100%) said that it is of value in occasional situations, such as formal (quarterly) portfolio reviews, fund raising activities, or other occasions. Second, the investment team mentioned that preparations of board meetings and communications with other investors improved, making the tool useful. For instance, when later-stage investors inquire for investment cases, the reporting tool supports the investment team to identify potential ventures of interest. The investment team also mentioned that sub-portfolio benchmarks, implemented for SaaS ventures, are valuable and should be extended for further venture groups. Third, the finance department considers the artifact as useful, as the artifact improves the handling of LP-requests and fundraising activities. Also, venture reporting becomes more effectively and efficiently compared to the former reporting process, which was basically an email address, containing all emails with venture data. Further, efficiency is relevant for the finance department, as it administers the tool. The testing period reveals that the implementation

of the instantiation required an initial ramp up within the organization. According to the collaborating investor, it took the organization, including the ventures, about six months to comprehensively adapt the new reporting processes. After month six, the steady state, about 0.2 FTE (on an accountant level) are required to maintain the tool. Eventually, 80% of all portfolio ventures comply with the new reporting process. The reporting of the remaining 20% is internalized by the finance department. Comparing this adaption rate with known industry benchmarks, the artifact is more effective than competitors. This is inferred from expert interviews in the development and evaluation phase, which exposed that other investors with comparable solutions achieve adaption rates of only 50% to 75%. Finally, these high adaption rates indicate that portfolio ventures accept the artifact, as "non-bureaucratic". Hence, the test of the tool indicates effectiveness and efficiency across all user groups, making the artifact a useful Investor Reporting Tool.

7.4.3.2 Post-development evaluation of the artifact

After the development, implementation, and test of the artifact, a post-development evaluation increases external validity for the instantiation. The evaluation bases on seven semi-structured expert interviews of an hour's length. Table 18 presents the overarching evaluation results, whereas Table 19 provides evaluation details by each evaluator, including representative quotes. In addition to these summarizing tables, *edited* transcripts are attached in the Appendix 1 to ensure transparency on the research.

Table 18: Overarching evaluation results of the Investor Reporting Tool

Overarching evaluation on 5-point Likert scale	Average	Median	MAX	MIN	SD
[Q1] There is relevance and a market-wide need for an early-stage investor reporting tool that creates transparency and enables data-supported decision-making.	4.2	4.5	5.0	3.0	0.8
[Q2] The service-oriented approach with upfront development and implementation effort is suitable to solve the need for a broad investor base.	3.0	3.0	4.0	2.5	0.5
[Q3] The organizational structures and the required change are the core challenge for a useful investor reporting solution.	4.6	5.0	5.0	3.0	0.7
[Q4] The design choices and the conception of the artifact suit industry-wide investor requirements.	4.8	5.0	5.0	4.5	0.2
[Q5] The comprehensiveness of the artifact suits industry-wide investor requirements.	4.1	5.0	5.0	3.0	1.0

Note: The overarching questions are evaluated on a 5-point Likert scale, whereas the 1 indicates a "strong disagreement" and the 5 a "strong agreement" to the statement. Total number of conducted expert interviews: 7.

Table 19: Detailed evaluation of the Investor Reporting Tool by evaluator

Expert	Investor type	Q1	Q2	Q3	Q4	Q5	Willingness to pay	Excerpt of representative quotes
Expert A	BA	4.0	2.5	5.0	5.0	5.0	Y	▪ "[The] need is definitely there [and] the approach makes sense. But [...] [an] upfront implementation effort which is associated with costs [will meet] limited excitement at potential investors". ▪ "The venture owns the data. So, [...] they are the natural owners of the [reporting templates]." ▪ "I like the mix and quantity of the [...] KPIs. It is very useful that the standard KPIs are accounting figures".
Expert B	VC	5.0	3.0	3.0	5.0	3.0	Y	▪ "It will be extremely important in the future to make venture data accessible to investors [though] I do not expect that investment decisions will be taken any time soon by algorithms". ▪ "We funded [...] a startup that addresses the same market with a similar product. [...] We always though 'how to avoid providing just the next tool?'. Therefore, we [...] integrate as many accounting systems and functions as possible on the platform. [...] you will need standardization, otherwise you get into trouble."
Expert C	VC	5.0	3.0	5.0	4.5	3.0	Y	▪ "Way too few VCs have [a] functioning [venture] reporting either because it is too expensive or too bad." ▪ "I have heard from cases in which ventures overstated their performance, therefore I would add sanity checks. [...] LPs request from GPs some qualitative explanations for their performance [which] GPs struggle to provide [therefore, I would integrate qualitative venture] information [into the reporting]". ▪ "Sequoia Capital is known for being one of the most standardized and bureaucratic investors of them all. [...] I think that especially VCs with limited reputation [are afraid of being perceived as bureaucratic and hence being rejected]."
Expert D	VC	4.5	2.5	5.0	5.0	3.0	Y	▪ "[...] the European VC scene professionalized, and the players grow. This increase in portfolio sizes and fund complexity needs to be matched by mature processes. [...] It is a bit like 'the winner takes it all game'. If one template, one standard, is used by all players [...] adaption and implementation become easy". ▪ "[For a functioning reporting] the mindset [is] super important, [...]. The output can only be as good as the input". ▪ "I really like a lot [...] the integration of the budgeted figures. This review "closes the circle" and enables constructive [board] discussions".
Expert E	BA	3.0	3.0	5.0	4.5	5.0	Y	▪ "The ventures as well as the investors need to understand that with growth and professionalization reporting obligations come along. However, for many investors large implementation costs are not bearable. They want tools that are immediately usable [while] the tool needs to be lean and create a minimum of administrational effort." ▪ "I dictated to my ventures a quarterly reporting. For my purposes this is enough as I steer my ventures from milestone to milestone."
Expert F	VC	3.0	3.0	4.0	5.0	5.0	Y	▪ "[...] the early-stage [investment] scene largely relies on trust." ▪ "We plan to introduce a self-built [reporting] solution [...] but frankly, if GPs would not have other stakeholders, such as LPs, [they] would rather forgo the topic [as] monitoring remains a challenge, with or without a reporting tool."
Expert G	VC	5.0	4.0	5.0	4.5	5.0	Y	▪ "The core problem is within the VC-venture relationship, [...] if the VC dictates a reporting tool to the ventures it is often perceived as a burden." ▪ "The solution [...] is very nice but remains a self-built solution. Hence [...] potential customers will have concerns over the robustness and stability of the tool. [...] Durability of [...] a reporting solution is key as many investors [...] have an unprofessional knowledge management." ▪ "A 'standard' needs to prevail but everyone hesitates until it becomes clear which solution it is. [...] position your tool as an [almost government alike neutral] third party [solution offering a reporting as a service]." ▪ "The chosen KPIs are valuable as they [...] allow prevention [if] ventures run into liquidity issues".

Note: The overarching questions (Q1 to Q5) are evaluated on a 5-point Likert scale, whereas the 1 indicates a "strong disagreement" and the 5 a "strong agreement" to the statement. Total number of conducted expert interviews: 7. Y = Yes, N = No.

7.4.3.3 Synthesis of the post-development evaluation

Overall relevance and market need, Q1: Overall, experts perceive an investor reporting solution as relevant and needed. The average score of 4.2 is, according to the experts, driven by the need for a single source of truth for portfolio benchmarking, fundraising, LP-reporting, and regulatory tasks. Further, the average investor size grows and hence investor organizations become more complex. According to the experts, this complexity needs to be matched by a professionalization of the decision-making processes and organization. The conducted interviews show that investors both rely on trust (e.g., expert F) and caution (e.g., expert C), regarding potentially opportunistic behavior in the entrepreneur-investor relationship. Strikingly, while all seven experts see a need for an investor reporting tool, which enables data-supported decision-making, none of our interviewees expressed the believe that performance indicators, synthetized to artificial intelligent decision-making, could replace the current status quo of decision-making by anytime soon.

Assessment of the benchmark approach, Q2 and Q3: Further, the service-oriented approach with a standard IT software is only conditionally perceived as generalizable for other investors (average score of 3.0). The main concerns of the evaluators center around (1) a discouraging initial effort with the risk of having in the long run an outlived tool without access to external resources for maintenance, and (2) the general concern of investors being perceived as a bureaucratic burden from high quality ventures. Regarding those concerns, four experts (experts: B, D, F, G) suggested to position the artifact as a packaged third-party IT solution (software offering) rather than as a service-oriented solution. This is striking, as experts also strongly agree with the presented statement that the core challenge for a functioning reporting solution is the required change in the organization's processes and mindsets (average score of 4.6), not particularly the strength of newly introduced IT solutions.

Design choices and conception of the artifact, Q4: The design choices and the conception of the artifact are overwhelmingly perceived as applicable for the industry-wide investor requirements set for a reporting solution (average score of 4.8). The three-layer base structure is considered as clean, functional, and on-point from all seven experts. In particular the data responsibility at the venture level is seen as essential for the durability of the tool, even though some evaluators expect pushback from the ventures. Also, enabled portfolio-internal benchmark capabilities and the mix of standardization across ventures and individualism for each venture (e.g., standard KPIs, specific KPIs) are perceived as strengths of the tool. Across the experts, the collected KPIs are seen as reasonable and as

in line with other reporting solutions at the market (e.g., Ledgy). The estimated effort to maintain the tool is also considered as reasonable.

Comprehensiveness of the artifact, Q5: Next, we evaluate the comprehensiveness of the reporting tool regarding reporting functionalities and specifications (average score of 4.1). The variance among the evaluations suggests that the experts represent two distinct points of view. One group of experts perceives the tool generally as sufficient in its scope (four of seven experts rate the comprehensiveness with a score of 5, experts: A, E, F, G), whereas another group of experts would prefer a more comprehensive solution (three of seven experts rate the comprehensiveness with a score of 3, experts: B, C, D). In detail, both groups consider the functionalities and specifications of the presented artifact as useful. For instance, the standard KPIs are perceived from all experts as the most important standard KPIs (except of the account receivables), whereas on average 6 additional specific KPIs per venture are seen as a reasonable number to balance effectiveness and efficiency of the reporting. Further, all experts consider the budgeted figures as highly valuable, as comparisons between actuals and budgeted figures make board discussions more tangible, according to the experts. Furthermore, six of seven experts (all except of expert E) agreed with the requirement of a monthly reporting, as timely data is seen as important to secure use cases, such as board of director presentations, or liquidity management. Four of seven experts (experts: B, C, D, F) prefer to also incorporate qualitative insights into the reporting requirements, which are relevant for the decision-making context and for LP-reports. According to them, the qualitative insights should include ventures milestones and explanations for considerable effects in the reported KPIs. In addition to the beforehand mentioned specifications, some experts (experts: B, C, D) would like to go a step further. These three experts advocate for additional functionalities towards: (a) other accounting systems (e.g., capitalization table and capital call management systems), having all fund and venture data in one solution, and (b) fraud detection, as entrepreneurs could potentially overstate their performance.

Overall: The external validation confirms the need, the derived design and conception elements, and therefore the usefulness of the reporting tool. This is observable by the expressed interest in the artifact and the assessed willingness to pay. Three of seven expert (experts: A, E ,F) showed an actual interest in the presented artifact, preferably in exchange for future collaborations, whereas all seven experts believe that investors, in general, would be willing to pay a small fee for the tool.

7.4.4 Discussion of the artifact's product-market fit

Against the backdrop, we conclude that there is a strong market for transparency solutions, which support decision-making and enable reporting to stakeholders. We find that going forward most early-stage investors require an investor reporting tool in order to both grow and stay competitive. An exception might be some business angels, or micro-VCs. However, the evolution of automated algorithm-based decision-making based on KPIs seems to be a topic for the distant future. For today, the test and the evaluation of the artifact indicate a fit between the VC industry requirements and the chosen design, conception, and specification of the artifact. In other words, the Investor Reporting Tool meets the essential demands of the market by effectively creating a single source of truth for the investor's portfolio data on a monthly base for relevant KPIs, while being efficient in terms of costs and required effort. Therefore, we infer distinct trajectories for a market positioning based on the evaluation.

First, the artifact could be seen as "best-in-class" of "provisional" reporting solutions. This might sound less attractive than it actually is. In fact, expert interviews revealed that the current version of the Investor Reporting Tool achieves what many investors in the industry currently aim to build by themselves: A simple solution that enables future decision-making and coping with both LP-reports as well as regulatory requests by collecting the venture data at one place. Investors try to develop such tools, because the existing solutions, available at a fragmented market, do not fit the individual needs of the respective investors, or because the external solutions are too expansive. Interestingly, cyber security was neither a serious concern during the development phase nor of the post-development evaluation of the artifact. By that, the presented artifact is well-positioned, as it could successfully satisfy a need in the market for many investors. This is proven by (a) the successful adaption of the tested artifact by the collaborating partner, and by (b) an external post-development evaluation in which all seven experts believe that investors, in general, would be interested in such a reporting tool. Of them, three experts, being professional investors, expressed their own actual interest in the artifact. If proceeding with this first trajectory, qualitative venture reporting aspects could be an additional feature, which could be offered to investors.

Alternatively, the artifact could be positioned as a professional third-party software that could be enhanced with several features. The positioning as an external third-party software eases the tensions in the relationship between the investor and the venture. Further, the

software could aim to create a "pull effect" from the investors and the ventures by embedding the venture reporting into a broader software solution with additional functionalities that the users need anyways. In case of the investors, fund management functionalities (e.g., capitalization table and capital call management) could be included. In case of the ventures, accounting functionalities (e.g., employee stock ownership plan management) could be beneficial for entrepreneurs and hence decrease potential adaption pushbacks. In this model, the investors would pay a monthly fee, whereas ventures could use the tool free of charge. The latter aims at creating a critical mass of ventures using the tool. The goal of the market penetration would be to eventually become a "market standard" for venture performance reporting. This status would make double reporting for ventures obsolete and would pull ventures which are not yet using the reporting solution on the platform. The external, closed software solution would also ease concerns of investors regarding the knowledge management if key positions in the finance department rotate. Also, evaluators stated that the development of an own software compared to the usage of the standard software "Google Workspace" potentially increases the payment willingness. The reason mentioned are (a) an improved customer experiences, and (b) a higher robustness in case of inappropriate usage of the tool (i.e., the current version of the artifact is sensitive to interventions of admins). The outlined approach of a third-party software solution is currently pursued by VC-backed startups in the fragmented venture reporting market (e.g., Ledgy). Against this competition, our differentiation could rely on the identified need for a change management in the organizational mindsets and processes. In other words, the software solution could be complemented by an implementation phase, as well as intense onboarding and coaching sessions.

Irrespective of the trajectory, the Investor Reporting Tool is not considered by the experts as a standalone "business case" per se, but as an essential step towards business relations with investors and ventures alike. These business relations enable subsequential monetarization options through premium offerings, such as integrated industry-wide benchmarking data on venture performance indicators and valuations.

7.5 Artifact #2: The Startup Benchmark Tool

Summary

The Startup Benchmark Tool supports entrepreneurs to orientate themselves in the venture capital (VC) industry by means of selected benchmarks. These benchmarks enable the users to evaluate their "investor readiness" and to derive possible next steps for an appropriate growth. We target entrepreneurs who aim for external funding from early-stage investors, i.e., that follow a high-growth path and offer scaling opportunities. The benchmarks are derived from historical valuation rounds, as well as operational and financial KPIs of ventures with similar characteristics. In essence, the benchmark logic addresses the tension between the fundamental "uniqueness of each venture" and the "abstraction of generalizable knowledge from other investments". The artifact is accessible for current and future entrepreneurs through the St.Galler Startup Navigator (Grichnik et al., 2017; St.Galler Startup Navigator, 2021).

Startup Benchmark App — Back to the survey

You are benched against the median and average values of your peers. Usually, average values are more ambitious as they are prone to upward-outliers, especially in the long-run, due to the survival bias.

This statistics page will expire at 3/24/2021, 11:29:00 AM.

Current stage	Series A	Average time to Series B		Cash run rate		Cash situation **	
		In Months	32	In Months	5	funding needed	

Pre-Money Valuation in EUR	5,000,000	You at your current life-cycle stage		You in 12 months from your current stage		At the Series B funding round	
		Median	Average	Median	Average	Median	Average
Benchmark	in EUR	3,000,000	4,800,000	6,300,000	10,600,000	12,500,000	26,700,000
Delta	in %	-40.9%	-4.3%	25.2%	111.8%	150.0%	434.6%
Implied relative performance*		ahead	on track				

Total Revenue in EUR	45,000	You at your current life-cycle stage		You in 12 months from your current stage		At the Series B funding round	
		Median	Average	Median	Average	Median	Average
Benchmark	in EUR	4,000	4,000	15,000	12,000	60,000	49,000
Delta	in %	-91.1%	-90.6%	-66.3%	-74.0%	32.7%	9.3%
Implied relative performance*		ahead	ahead				

Revenue Growth (3 Months trailing) in %	10.0%	You at your current life-cycle stage		You in 12 months from your current stage		At the Series B funding round	
		Median	Average	Median	Average	Median	Average
Benchmark	in %	18.6%	6.9%	8.5%	6.7%	5.0%	6.6%
Delta	in ppts	8.6%	-3.1%	-1.5%	-3.3%	-5.0%	-3.4%
Implied relative performance*		behind	ahead				

7.5.1 Conceptualization of the artifact

Continuing the work on transparency, we use the Investor Reporting Tool (of Section 7.4) as a starting point, to create a second artifact, the Startup Benchmark Tool. The Startup Benchmark Tool makes the benchmarking approach, considered as useful from an investor perspective, also accessible for entrepreneurs through the St.Galler Startup Navigator (Grichnik et al., 2017; St.Galler Startup Navigator, 2021). The second artifact connects venture performance indicators (KPIs) and venture differentiation factors with the venture life cycle, i.e., funding events. Employing the frameworks of Hevner (2007) and Peffers et al. (2007), we depict the pivoted practical requirements, developed with practitioners, for the Startup Benchmark Tool in Table 20.

Table 20: Practical requirements of the Startup Benchmark Tool

PR, #	Requirement description
PR1	The artifact should create transparency regarding performance indicators (KPIs) and valuations for entrepreneurs on high-growth trajectories, given their stage in the venture life cycle and their venture characteristics
PR2	The artifact should provide data-driven support to entrepreneurs in assessing their investor readiness, competitor, and market analyses, steering their business, and extending their knowledge
PR3	The artifact should contain KPI-benchmarks broadly adapted from ventures, ensuring the comparability and the reach of the artifact
PR4	The artifact should consider the benchmark resiliency of the data base, when calculating and selecting the benchmarks, whereas resiliency of benchmarks is determined by the sample size and the sample variability
PR5	The artifact should be applicable for European ventures
PR6	The artifact should provide benchmarks in a simple, inexpensive, and user-friendly way, applicable for the artifact's target user group

For the rigor design cycle, the theoretical requirements displayed in Table 21 are identified and aggregated from the literature.

Table 21: Theoretical requirements of the Startup Benchmark Tool

TR, #	Requirement description	Relevant source(s)
TR1	The artifact should consider the life cycle and the variations in important cross-sectional venture differentiation factors of ventures	Fisher et al., 2016
TR2	The artifact should decrease asymmetric information by increasing comparability, and by that, improve capital allocations in the "market-of-lemons"	Akerlof, 1970; Fama & Jensen, 1983; Amit et al., 1998
TR3	The artifact should improve the venture's ability to assess its investor readiness	Proimos & Murray, 2006
TR4	The artifact should support in the long-run data-supported decision-making, as research misses yet the direct link between venture performance indicators, controls, and valuations	Delmar et al., 2013; Gornall & Strebulaev, 2020; Gompers et al., 2020

Taking stock from those practical and theoretical requirements, we define in accordance with March & Smith (1995) the usefulness for the target users as the overarching design principle for the benchmark tool. The artifact is considered as useful when it supports decision-making based on quantitative data. However, this implies that the artifact leaves sufficient space for interpretation, in case that the data does not suit the context of the user.

7.5.2 Presentation of the artifact

Derived by the design requirements and principles, the tool is considered as useful when it creates transparency to entrepreneurs for their investor readiness, market, and competitor analyses, as well as in educational purposes (PR1, PR2, TR2, TR3, TR4). For these purposes, the artifact provides benchmark information to entrepreneurs for frequently applied venture KPIs and valuations (PR3). The benchmarks are derived based on matching venture demographics, including the venture's stage at its life cycle, and other performance relevant factors, that differentiate the one venture from the other (PR1, TR1).

This section proceeds as follows: First, the target group and the benchmark data of the artifact are discussed. Second, the operationalization of the venture's life cycle is in focus. Third, we elaborate on relevant categorial differentiation factors across ventures. Fourth,

the selected KPIs are described. Fifth, the calculation logics for the benchmarks are depicted. Finally, we present the frontend of the artifact, via a case example.

Target group and benchmark data: In general, it is important to emphasize that the general benchmark idea can be applied to various business models of ventures. However, in practice there must be fit between the user, the entrepreneur applying the benchmark, and the underlying data creating the benchmark. We identified the need for benchmarks in particular for entrepreneurs and startups from Europe who aspire a high-growth trajectory, requiring external funding (PR1, PR3, PR5). Ventures in between the seed and series A funding round are the natural candidates for the Startup Benchmark Tool as pre-seed funding decisions usually occur before performance indicators are quantitatively measurable and hence trackable, and as heterogeneity across ventures increases with the venture life cycle. Therefore, venture data from early-stage investors are an appropriate choice to build the artifact upon. Their portfolio ventures successfully managed to receive funding at least once. Hence, in the worst case, the artifact suffers from a survivorship bias, making the benchmarks too ambitious. The data base for funding events is built on 72 ventures with 186 associated funding events. These consist of 44 seed (average venture age at funding = 20 months), 67 series A (average venture age at funding = 35 months), 31 series B (average venture age at funding = 53 months), and 44 later funding rounds (series C, D, E, and exists). The corresponding operational and financial performance indicators are collected from 45 ventures. The venture data comes from a Berlin-based investor, predominantly investing in Western European startups with focus on the German-speaking area (86% and 68% respectively), followed by American startups (13%).

Venture life cycle: Ventures are evolving entities, which maneuver through highly dynamic life cycles (Fisher et al., 2016). In addition, professional investors, especially venture capitalists, have determined investment horizons to achieve their performance goals, usually measured through IRRs or MOICs. Therefore, the age of the ventures is an essential determinant for the appropriate benchmark (PR1, TR1). Hence, all benchmarks retrieved from the venture data are normalized by the respective date of the venture's incorporation. In other words, the venture age measured in months, is the operationalization for the venture's stage in the venture life cycle.

Venture differentiation factors: In addition, ventures tend to perform differently depending on venture characteristics. Therefore, the artifact differentiates for those characteristics, called differentiation factors (PR1, TR1). The identified differentiation

factors include: the industry, the revenue model, and the customer focus. The non-exhaustive list of differentiation factors follows a prioritization, jointly determined with the collaborating investor in the development phase. The industry factor comprises the following categories (representation in data base, in percent): Universal (Others) (40%), Information Technology (IT) (40%), Fin, Insure, Prop Tech (13%), and Digital Health (7%). The industries correspond to the most common industry trends in the VC industry (Statista Research Department, 2020). The factor revenue model categorizes the ventures into recurring revenue models (11%), transactional revenue models (64%), and mixed revenue models (25%). eCommerce and marketplace ventures (31%) are considered as a subcategory of transactional revenue models. Finally, venture performance differs depending on the customer focus, which can be either B2B (business-to-business) (53%), B2C (business-to-customer) (42%), or a mixed customer focus (5%).

KPIs: The included KPIs of the artifact are selected based on their relevance and their comparability across ventures (PR3, PR4). The relevance, or prioritization, of KPIs is approximated by their frequency of occurrence within the investor portfolio, this addressee-oriented focus ensures the relevance criterion. The comparability dictates that we exclude KPIs which are frequently requested from investors but lack a tolerable level of homogeneity (see KPI classification in Table 16). For instance, "average order volume" or "profitability" are unsuitable KPIs for benchmarking as the variance across ventures is simply too high, implying a low comparability.

Consequently, the artifact includes the following three types of KPIs. First, the KPIs that are potentially relevant for all ventures, including: Total revenue, total revenue growth (3-months trailing), full time equivalents (FTE), FTE growth (3-months trailing), existing customers, customer growth (3-months trailing), as well as cash balance and cash burn. Second, KPIs that are relevant for important venture types, such as recurring revenue models, or eCommerce and marketplaces. In the case of recurring revenue models, these KPIs are "monthly recurring revenue" (MRR) and MRR growth (3-months trailing). Furthermore, the following KPIs are of relevance in the context of eCommerce and (online) marketplace ventures: "Gross merchandise value" (GMV), GMV growth (3-months trailing), and the venture's "take rate". The trailing growth figures associated to KPIs are included to depict the momentum of a venture. The three months trailing period for growth figures are a compromise between actuality and persistence. Third, valuation figures are included in the artifact. Valuations are operationalized by pre-money valuation figures, as common in literature and practice (Miloud et al., 2012). The valuations enable the

entrepreneur to relate the operational and financial KPIs with an industry-wide accepted proxy for venture performance.

Benchmarks. *KPI-benchmarks* for a venture are derived by the combination *of benchmark values* for each of a venture's differentiation factor categories along the venture life cycle. Benchmarks are estimated based on the median values and the average values. Median values represent the KPI value of the median venture, whereas average values represent the average KPI value across all ventures. Median benchmarks are more representative for the most entrepreneurs, making them a valuable source of information. However, average benchmarks are sensitive to outlier values, which usually gain momentum after several funding rounds. As outliers are the state of aspiration for entrepreneurs on high-growth trajectories, the average benchmarks are useful for users with appropriate ambitions. The usage of both median and average benchmark estimators increases the resiliency (PR3, PR4), as users are given a range between the two benchmarks.

The longitudinal (venture age) and cross-sectional (differentiation factor categories) determinants are the key information to calculate the benchmark values from the underlying data base. In other words, a benchmark value is determined by (a) the inquired KPI, (b) the venture age, and (c) the category for a respective differentiation factor (e.g., total revenue of an 18-month-old venture from the category Digital Health). Venture data availability is limited given the underlying portfolio size. Therefore, we use analytical techniques for the benchmark value curves along the venture life cycle, which are described in the following and illustrated in Figure 18. These analytics increase the resiliency and robustness of the benchmarks given the data availability (PR4).

Figure 18: Illustration of the benchmark logic, derived from underlying data

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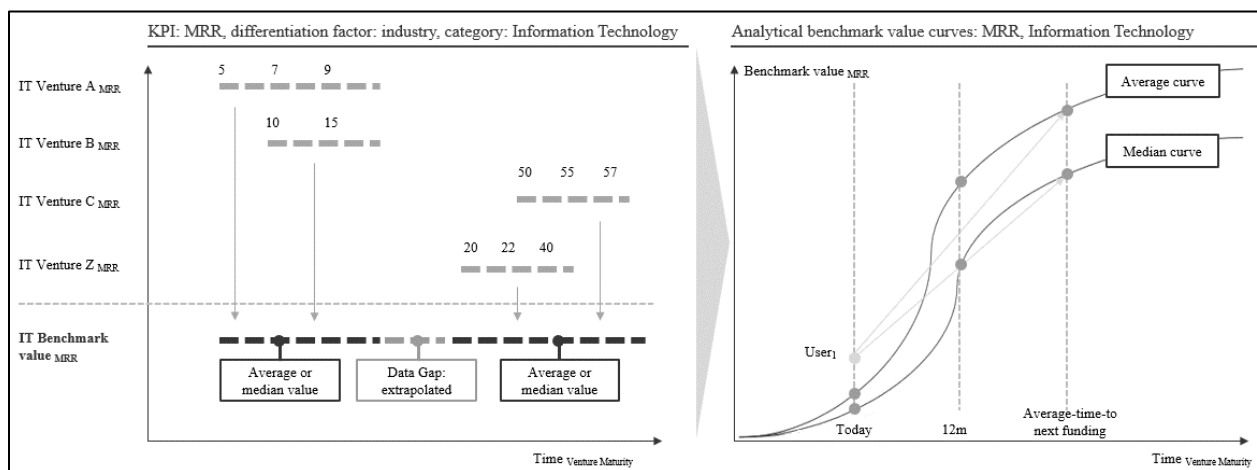
In detail, the development of clean benchmark curves for absolute KPIs (i.e., measured in a currency or an integer number) and valuations follows three steps. First, for each differentiation factor category a raw benchmark curve is derived along the venture life cycle. Second, trendlines are used to estimate the benchmark developments for each KPI and a given differentiation factor category over time, as these raw benchmark curves are noisy and potentially have data gaps. The estimation trendline type for the benchmarks differs from KPI to KPI, and from differentiation factor category to differentiation factor category. A summary of the estimation trendlines for the benchmarks is shown in Table 22. KPIs that depend on other KPIs, such as growth figures, are calculated based on the precedented KPIs for consistency purposes. Finally, the trendlines for a respective benchmark curves, are manually adjusted on a case-by-case basis. There are two typical reasons for adjustments, insufficient data, or unplausible data. For a few KPIs the data basis for a certain differentiation factor category was not available (e.g., GMV values for ventures with recurring revenues are not available in the data base) or too limited. In these non-available or non-resilient cases, benchmark value curves are not calculated. Instead, all ventures are used as the default option to calculate the KPI-benchmark value. Moreover, the trend curves are adjusted for venture-specific outliers that distort the respective curve. De facto, this translates into a manual under-weighting of few outstanding KPI developments in the data base, which the authors can identify as the portfolio ventures are well-known to them. Consequently, the result of this process are clean benchmark curves for each KPI along the venture life cycle, which are specified for each category of differentiation factors.

After the estimation of all the differentiation factor category-specific benchmark curves is conducted, they are used to build benchmarks that fit to the user's venture. As ventures are a combination of differentiation factor categories (e.g., Digital Health, transactional revenue model, and B2C), the final benchmarks are calculated as a combination of the benchmark values from these differentiation factor categories. We use an equally weighted combination of the separate curves to estimate the final KPI-benchmarks. For instance, the final median benchmark for the KPI "total revenues" for a venture with the characteristics of "Digital Health" as the industry, "B2C" as a customer focus, and a "transactional revenue model" is calculated as the average of the three median benchmarks, for a given month.

Table 22: Base estimation function, by KPI and differentiation factor category

Differentiation factor (1/2)	Revenue model				Customer focus				All ventures	
Category	Recurring		Transactional		B2B		B2C			
Performance indicators	Median	Average	Median	Average	Median	Average	Median	Average	Median	Average
Pre-money Valuation	Expo	Linear	Expo	Poly	Linear	Linear	Poly	Poly	Expo	Expo
Total revenue	Power	Power	Poly	Poly	Power	Poly	Poly	Poly	Power	Power
Revenue growth	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Full time employee	Linear	Poly	Linear	Poly	Linear	Poly	Poly	Poly	Linear	Poly
Full time employee growth	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Cash balance	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cash burn	Poly	Poly	Poly	Poly	Poly	Poly	Poly	Poly	Poly	Poly
Existing customers	Poly	Poly	Power	Poly	Power	Power	Power	Power	Power	Power
Customer growth	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Total MRR	Power	Poly	Power	Power	Power	Poly	Power	Poly	Power	Poly
MRR growth	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Total GMV	n.a.	n.a.	Power	Expo	Power	Power	Expo	Expo	Power	Expo
GMV growth	n.a.	n.a.	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Take rate	n.a.	n.a.	Poly	Poly	Log	Log	Log	Log	Poly	Poly
Take rate growth	n.a.	n.a.	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated

Differentiation factor (2/2)	Industry								All ventures	
Category	Universal (Others)		Information Technology		Fin, Insure, Prop Tech		Digital Health			
Performance indicators	Median	Average	Median	Average	Median	Average	Median	Average	Median	Average
Pre-money Valuation	Poly	Expo	Linear	Linear	Poly	Poly	Power	Power	Expo	Expo
Total revenue	Expo	Expo	Power	Poly	Poly	Poly	Power	Power	Power	Power
Revenue growth	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Full time employee	Linear	Linear	Poly	Linear	Linear	Linear	Poly	Poly	Linear	Poly
Full time employee growth	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Cash balance	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cash burn	Linear	Linear	Poly	Poly	Poly	Poly	Poly	Poly	Poly	Poly
Existing customers	Power	Expo	Power	Power	Power	Power	Power	Power	Power	Power
Customer growth	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Total MRR	n.a.	n.a.	Power	Poly	Power	Poly	Power	Poly	Power	Poly
MRR growth	n.a.	n.a.	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated	Calculated
Total GMV)	Power	Expo	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Power	Expo
GMV growth	Calculated	Calculated	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Calculated	Calculated
Take rate	Poly	Poly	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Poly	Poly
Take rate growth	Calculated	Calculated	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Calculated	Calculated

Note: "poly" = polymeric, "expo" = exponential, "n.a." = no data availability, and "calculated" = a function of other estimated benchmark curves.

The beforehand logic is overridden in only two special application cases. In these cases, determined KPI relationships rule the calculation logic. The first case comprises pure-play MRR ventures, which explicitly specify that they have only monthly recurring revenues. In this case total revenue benchmarks are overridden by and set equal to the total MRR. The second case are eCommerce or marketplace ventures, which explicitly specify that their business model is based on an online platform. In this case, the total revenue benchmark is calculated as the GMV multiplied by the take rate. The KPI-benchmark calculation is depicted in Figure 19, in the illustrated example, the total revenue

benchmarks are calculated. However, as the example venture is a pure-play MRR venture, the total revenue benchmarks are not directly calculated by the equally weighted benchmark values of IT, recurring revenues, and B2B. In this special case, the benchmarks are, as explained, overridden by the total MRR benchmark.

Figure 19: KPI-Benchmark calculation example

Inputs	Units	Data	Data_2	Data_3	
Age	in Months	29	29	29	
Age + 12 Months	in Months	41	41	41	
Industry		IT	IT_Median_Clean	IT_Average_Clean	
Recurring/Transactional		Recurring	Recurring_Median_Clean	Recurring_Average_Clean	Inputs for calculation, including reference dates and differentiation factors
Customer Focus		B2B	B2B_Median_Clean	B2B_Average_Clean	
Fallback Option		*all ventures*	*all ventures Median Clean*	*all ventures Average Clean*	
eCommerce/Market Place					
Current Funding Round		Seed	Seed	Seed	
Next Funding Round		Series A	Series A	Series A	
Average time to Series A	in Months	39	39	39	
Average remaining time to Series A	in Months	10	10	10	
Total Revenue	**in EUR**	*Total Revenue_29*	*Total Revenue_41*	*Total Revenue_39*	
User		Median: Benchmark	Median: 12M Benchmark	Median: Series A	Median Benchmark
5,000		25,627	60,104	53,141	
Industry	IT	32,099	74,616	66,058	
Revenue Model	Recurring	20,040	45,944	40,756	Benchmark values for categories, incl. fallback and override option
Customer Focus	B2B	28,742	71,160	62,427	
Fallback Option	*all ventures*	*90,149*	*216,806*	*190,998*	
override	override	*25,627*	*60,104*	*53,141*	
		Average: Benchmark	Average: 12M Benchmark	Average: Series A	Average Benchmark
		23,521	56,945	50,408	
Industry	IT	86,345	399,042	361,344	
Revenue Model	Recurring	27,467	66,164	58,275	Benchmark values for categories, incl. fallback and override option
Customer Focus	B2B	194,437	304,219	284,729	
Fallback Option	*all ventures*	*140,714*	*538,717*	*298,359*	
override	override	*23,521*	*56,945*	*50,408*	

Differentiation factors — Categories — Benchmarks along venture life cycle

As explained, the benchmarks are calculated based on the venture life cycle. The operationalization based on the venture age enables our artifact to provide benchmarks at various times. Based on practitioner interviews, we identified three relevant points in time. Obviously, the entrepreneur is interested in today's status quo. Further, some of the most important milestones are funding events (PR2, TR2, TR3). Hence, we provide the benchmark values for the next funding event, enabling entrepreneurs to assess their own investor readiness. Furthermore, we also provide a static projection in form of twelve-month target benchmarks. Depending on the average time to the next funding event, the static projection is either before or after the next funding milestone.

Frontend: After the technical description, the following case example illustrates the Startup Benchmark Tool. The entrepreneur enters the application through the St.Galler Startup Navigator website, or later, through an embedded section in the St.Galler Startup

Navigator App (St.Galler Startup Navigator, 2021). The St.Galler Startup Navigator App is an online tool collection, which is based on the entrepreneurship insights of the associated St.Galler Startup Navigator Handbook (Grichnik et al., 2017; St.Galler Startup Navigator, 2021).

Figure 20: Startup Benchmark Tool: Questions and answers

At the beginning of the customer journey, the user answers several questions regarding the venture and its ecosystem: Venture age, industry, revenue model, customer focus, and funding status (see Figure 20). The questions are all precisely defined to avoid misunderstandings and to educate the user in case of any unclarity (PR6). The user's answers enable the artifact to classify the venture and to calculate the appropriate benchmark values (e.g., the benchmark for a 2-years old venture in the IT industry, focusing on B2B customers with a recurring revenue model), which fit to the user-case (PR1, TR1). After all questions of this first step are answered, the user clicks next.

On the next page, the user selects and enters the relevant KPIs for the own venture and for the chosen reference month (see Figure 21). Again, the KPIs are explained with the help of information boxes in order to avoid mistakes (PR3, PR6). The entrepreneur's

information enables the artifact at a later step to calculate deviations between the peer-benchmark and the benched venture.

Figure 21: Startup Benchmark Tool: KPI selection and entry

Finally, after the user entered the venture information, the artifact produces the *Benchmark Report,* which comprises the KPI-benchmarks and relevant information on the underlying benchmark data (PR4). An excerpt of an exemplified Benchmark Report is shown in Figure 22.

The cash situation and the average-time-to-next funding round are separately presented in the Benchmark Report. Based on the figures, the entrepreneur can conclude whether the current funding is still sufficient for a given cash burn. As a sufficient timeframe can be considered at least the upcoming six months. Apart from this first information, all the other KPIs follow the same structure. In detail, the report shows the benchmarks, based on medians and averages, for ventures at the same stage of the life cycle (as of reference

month) and for relevant future states. The future states include a static perspective, as of in one year from the reference month and a dynamic perspective, as of the average-time-to the next funding round.

As derived by the design principles, the artifact is not supposed to interpret the results, given the limited context and the uniqueness of ventures. Nevertheless, the venture data is descriptively compared to the benchmarks. For absolute KPIs, measured in a currency (e.g., total revenue) or in an integer number (e.g., number of customers), the relative implied performances are notated in percent. In contrast to that, the relative implied performances are notated in percentage points for growth figures (e.g., total revenue growth, 3-months trailing) or KPIs measured in percentage (e.g., take rate). These implied performances are presented in three categories, each with an own color-coding: "On track" marks an absolute deviation of less than five percent, "behind" marks a negative deviation between the user data and the benchmark data of more than five percent, whereas "ahead" marks a positive deviation of more than five percent.
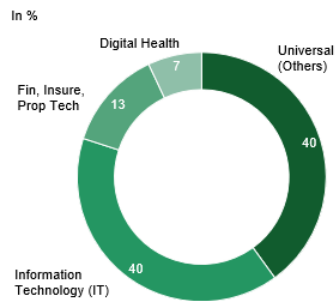
Overall, the Startup Benchmark Tool creates transparency for entrepreneurs about their current status quo by comparing them to benchmark ventures along the life cycle (PR1, TR1, TR2). Entrepreneurs can use the descriptive insights on typical pre-money valuations, or total revenues for their steering of the business, for preparations of the next pitch presentation, competitor analyses, or simply for educational purposes (PR2, PR3, TR3, TR4). The closure of the asymmetric information between the investors and the entrepreneurs potentially facilitates the matching between players, and hence capital allocations in the European VC industry become more efficient (TR2, PR5).

Nevertheless, the tension between the fundamental "uniqueness of each venture" and the "abstraction of generalizable knowledge from other investments" (PR4) makes the Startup Benchmark Tool a solution that provides orientation (PR6). The user needs to interpret the results of the benchmark report carefully to draw the appropriate conclusions for the very own user-case. For this reason, transparency on the underlying benchmark data is inevitable. Therefore, the benchmark report depicts the descriptive statistics of the benchmark data, increasing transparency and hence usefulness of the Startup Benchmark Tool.
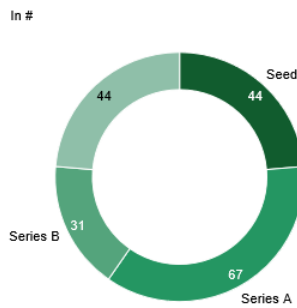
Figure 22: Startup Benchmark Tool: Benchmark Report

Note: The descriptive statistics of the benchmark ventures relies on 72 ventures with 186 corresponding funding events.

7.5.3 Evaluation of the artifact

7.5.3.1 Post-development evaluation of the artifact
After the development, the presented artifact is evaluated based on seven semi-structured expert interviews of an hour's length. Table 23 presents the overarching evaluation results. Table 24 contains detailed evaluation results by each evaluator, including representative quotes. In addition to these summarizing tables, *edited* transcripts of the interviews are attached in the Appendix 2 to ensure transparency on the research.

Table 23: Overarching evaluation results of the Startup Benchmark Tool

Overarching evaluation on 5-point Likert scale	Average	Median	MAX	MIN	SD
[Q1] There is relevance and a market-wide need for a Startup Benchmark Tool that creates orientation on performance indicators and enables data-supported decision-making for entrepreneurs	3.9	4.0	5.0	2.0	1.1
[Q2] The venture life cycle approach with few essential differentiation factors, built on investor portfolio data, is suitable to calculate the benchmarks.	4.2	4.0	5.0	3.0	0.7
[Q3] The design choices and the conception of the artifact suit general requirements of entrepreneurs.	4.5	4.5	5.0	4.0	0.5
[Q4] The comprehensiveness of the artifact suits general requirements of entrepreneurs.	3.4	3.0	5.0	2.0	0.9

Note: The overarching questions are evaluated on a 5-point Likert scale, whereas the 1 indicates a "strong disagreement" and the 5 a "strong agreement" to the statement. Total number of conducted expert interviews: 7.

Table 24: Detailed evaluation of the Startup Benchmark Tool by evaluator

Expert	Investor type	Q1	Q2	Q3	Q4	Willingness to pay Venture	Investor	Excerpt of representative quotes
Expert A	BA	4.0	5.0	5.0	3.0	N	Y	▪ "[...] there is definitely a need [for the tool]. [...] of course, more data is needed to be accurate." ▪ "[...] relative performance is often not the biggest issue for founders. Founders are focused more on product-market fits at the beginning and after that they see whether they fail or not."
Expert B	VC	5.0	4.0	4.0	4.0	Y	Y	▪ "I see the need the most for startups being between the seed stage and [...] the series B round. Whereas the key question remains: What do I need to get a series A funding?" ▪ "It would be great [...] if some VCs pool their anonymous data. However, in the German-speaking area this would pose the challenge that the industry knows itself too well". ▪ "I like that you include [...] growth figures, the momentum [...] puts the data into the right perspective."
Expert C	VC	5.0	5.0	4.5	4.0	Y	Y	▪ "Especially for the non-US VC industry there is barely [...] [benchmark] data available [...] I could imagine that later stage investors and SMEs looking for innovation are interested [in the tool]." ▪ "[...] from series A on it is all about numbers, before it is more about execution, prototypes, etc. [...] after series B you will have trouble to find sufficient comparable ventures to perform benchmarking." ▪ "The few factors you use belong definitely to the most relevant ones that investors evaluate first."
Expert D	VC	3.5	3.0	4.0	3.0	Y	Y	▪ "Exciting question, many founders would benefit from benchmarks about their valuation and [...] KPIs." ▪ "[...] the current version of the tool is a good heuristic into the direction of a valuation tool [but] resiliency is missing [...] to offer valuation multiples (e.g., x Euro valuation for 1 Euro in MRR)".
Expert E	BA	2.0	5.0	5.0	5.0	N	Y	▪ "[...] the explanatory power is too limited at this point in time. A benchmark calculated in a 'black box' is not a strong argument in actual price negotiations. The idea is great, but you need to reach a certain critical reputation. [...] if such a tool becomes a [reputable] market champion [...] then this is huge." ▪ "[...] increase the robustness of the benchmarks by showing on how many ventures the user is benched. Even better, which ventures, e.g., you are compared to five ventures among those are Uber, Lift, and …"
Expert F	VC	3.0	4.0	4.0	3.0	Y	Y	▪ "I would love to simply buy monthly recurring revenues based on a solid multiple valuation, but ventures are so different and reliable benchmarks are not available." ▪ "[...] weaker ventures or at least unsecure entrepreneurs might need the [benchmarks], as they do not get it from investors – the crème-de-la-crème [of the entrepreneurs] does not need the [benchmark] tool". ▪ "I would not build a tool for many business models [...] instead you could build two separated tools. One for SaaS. One for eCommerce. FinTech [...] could be too heterogeneous for my taste."
Expert G	VC	5.0	3.5	5.0	2.0	N	Y	▪ "I think both startups and investors are looking for such a tool. Startups could use the information [...] for funding events. [However,] ventures are an unattractive customer group [...], as they never have much money left. Therefore, [...] the benchmarks are very interesting for investors and potential investors." ▪ "The way how you think about the data and the idea is really good. [However,] the quick tool that you presented will not survive in the long run [if it does not evolve]. It has to growth with new data, and from learnings of other investors and startups."

Note: The overarching questions (Q1 to Q4) are evaluated on a 5-point Likert scale, whereas the 1 indicates a "strong disagreement" and the 5 a "strong agreement" to the statement. Total number of conducted expert interviews: 7. Y = Yes, N = No.

7.5.3.2 Synthesis of the post-development evaluation

Overall relevance and market need, Q1: First of all, the idea of a benchmark tool is absolutely valued by the evaluators. One stated: "*I would love to simply buy monthly recurring revenues based on a solid multiple valuation, but ventures are so different and reliable benchmarks are not available.*" (quote of expert F). Nevertheless, the inquiry on the overall relevance of benchmarks and the need for such for entrepreneurs draws a manifold picture (average score of 3.9). According to the experts, this differentiated perspective is driven by the newness and uniqueness of ventures.

The newness of ventures implies that ventures at pre-seed and seed stages focus more on internal product or prototype developments than on external relative comparisons. This point is stressed by the two business angel experts in our sample, who interact with ventures earlier than VCs do from a life cycle perspective (experts: A, E). Interestingly though, experts A and F suspect that "strong" entrepreneurs (e.g., serial entrepreneurs) have less problems to obtain information about their peers, irrespective of the stage. The reason is that they simply ask their existing network.

The uniqueness of ventures implies a limited comparability. According to the experts, this applies to some ventures more than to others. First, the benchmarking idea is challenged for ventures beyond the series B funding stage when ventures become less comparable to their non-successful peers. Second, evaluators repeatedly mentioned that certain ventures have very individual go-to-market strategies or growth paths. This makes the operationalization of the venture life cycle by the age of the venture and therefore the calculation of benchmarks difficult. For instance, ventures belonging to deep-tech, biotech, or pharma should be advised that the benchmark logic might not suit to their individual user-case, whereas a fit between the user and the benchmark data is crucial. Hence, the experts emphasize that the tool must be very precise about which ventures are addressed by the Startup Benchmark Tool.

Despite those remarks on the scope of potential users, five of seven experts (experts: A, B, C, D, G) see for a significant group of entrepreneurs a need for an orientation tool (i.e., Q1 score > 3), such as the Startup Benchmark Tool.

Assessment of the benchmark approach, Q2: The benchmark approach based on venture data from a European investor portfolio is perceived by the evaluators as especially valuable as benchmarks on the European market are barely available. Also, the usage of the venture life cycle (Fisher et al., 2016) and the selected differentiation factors are

considered as appropriate for a large group of ventures – leading to an overall assessment of the artifact's approach of 4.2. Interestingly, the evaluation reveals that especially SaaS and eCommerce ventures, between the seed and the series B funding round, could benefit from such a solution. By that, the evaluation confirms the target venture groups and the target stage within the venture life cycle, which we identified during development of the artifact. Interestingly though, online marketplace ventures – which are incorporated in the eCommerce category of the artifact – are already considered as more heterogeneous, according to one expert (expert: F). Further, the evaluation shows that the underlying data base is critical for the eventual usefulness. Therefore, the experts are asked to estimate the required number of datapoints to perform resilient benchmarks. The answers range from on average 15 to 30 ventures, which are seen as required for a given differentiation factor category. The experts emphasize that the number depends on the heterogeneity of the differentiation factor category (e.g., a typical " SaaS" or "eCommerce" venture requires rather 15 comparable ventures for resilient benchmarks, whereas "FinTechs" require rather 30 data points). Eventually, the evaluation of the approach shows that as long as the artifact lacks a critical mass of benchmark data, transparency on the underlying benchmark data is inevitable to mitigate this limitation. Or as one expert stated it: *"A benchmark calculated in a 'black box' is not a strong argument in actual price negotiations."* (quote of expert E).

The evaluation of the conception and the comprehensiveness of the artifact revealed an interesting field of tension in the artifact's design choices and requirements.

Design choices and conception of the artifact, Q3: The conception is praised for its simplicity and clean design (average score of 4.5), which successfully includes and focuses on exactly the most important differentiation factors. All seven interviewees confirmed that the chosen differentiation factors belong to the most important venture characteristics. The next most frequently mentioned differentiation factor (mentioned by experts: B, F) is the geographical location of a venture, as ventures from Western Europe, for instance, have ceteris paribus different valuation levels or growth patterns than ventures from Eastern Europe, or the Silicon Valley. Besides the differentiation factors, the calculation of the analytical benchmark curves based on the venture life cycle is considered as a viable modelling technique. The benchmarks as of today and for the next (expected) funding events are seen from all seven evaluators as valuable, whereas the static one-year benchmarks are seen from five experts (experts: B, C, D, E, F) as insightful for the user. Further feedback points include potential concerns regarding the differentiation factor

category "Fin, Insure, and Prop Tech". The industry category is seen by two evaluators (experts: B, F) as potentially *too* heterogeneous. They recommend further differentiations for sub-categories (e.g., NeoBanks, NeoBrokers), or to omit, or to merge the category with the industry category "Universal (Others)". Another recommendation aims at the degree of smoothening for the analytical benchmark curves. Two evaluators (experts: A, B) suggest that the more venture data build the benchmarks the less smoothing should be performed to capture the actual performance of the ventures (i.e., moving from cleansed estimation trendline curves towards moving averages).

Comprehensiveness of the artifact, Q4: Whereas the before discussed conception of the artifact is praised for its simplicity, the comprehensiveness of the artifact achieves on average a score of only 3.4. The comprehensiveness captures the capability of the artifact to produce important and resilient KPI-benchmarks to the user. First, the chosen KPIs (e.g., pre-money valuation, standard KPIs, MRR, GMV) are considered by all seven interviewees as important KPIs. Further, four evaluators (experts: B, E, F, G) explicitly stated that the inclusion of the growth rates (3-months trailing) for selected KPIs is a very useful feature, as the growth-momentum of a venture puts the absolute KPIs into relevant context. Besides those KPIs, additional KPIs which are more than once mentioned for future inclusion by evaluators comprise: Customer acquisition costs, customer lifetime value, customer churn, and contribution margins. However, the open parts of the interview sessions clarified that the inclusion of additional KPIs is directly linked to the corresponding data availability and comparability. Interestingly, those KPIs coincide with identified but excluded KPIs from the artifact's development phase, as a mutual KPI classification with practitioners indicated a relatively low comparability (see KPI classification in Table 16). Second, while the evaluators praised the simplicity of the artifact as a strength of the conceptualization, the few differentiation factors also trigger prudence in the artifact's resiliency and applicability beyond pure orientational purposes, as ventures are complex entities. This is seen by the Q4 score of 3.4, which also reflects the repeated impression of the experts that the current version of the tool needs to grow in terms of data availability and complexity.

Overall: The external validation confirms the need as well as the design and conception choices, for the Startup Benchmark Tool. However, experts remark that the practical execution of such a benchmark tool requires a fit between the ventures applying the benchmarks and the ventures creating the benchmarks. Further, interviewees repeatedly stated that the extension of the sample size beyond the collaboration of this study, the

setting of a precisely defined target user group, and transparency on which ventures determine the benchmarks are important for the future's development as well as today's usefulness. While we adhered these recommendations as far as possible during the collaborative development setup of the artifact (see PR3), we acknowledge that further steps are required to increase the resiliency of the benchmark data base by a pan-investor data collection.

Inquiring the willingness to pay, four of seven experts (experts: B, C, D, F) state that entrepreneurs would be potentially willing to pay a small amount for the tool on a one-off basis. This result must be seen against the backdrop that according to evaluators: "*Ventures are an unattractive customer group anyways, as they never have much money left*" (quote of expert G). Interestingly, the experts uniformly emphasize that early-stage investors and other beneficiaries of such benchmarks (such as strategic buyers or business partners of startups) would have a considerably higher interest and willingness to pay for benchmarks.

7.5.4 Discussion of the artifact's product-market fit

Based on the evaluation, we conclude that some entrepreneurs would benefit from venture performance benchmarks for orientation purposes. In particular, this holds true for SaaS or eCommerce ventures between the seed and the series B funding round. Here, the entrepreneur's key question is "*what do I need to get a series A funding?*", as expert B phrased it. The evaluation of the Startup Benchmark Tool shows external validity for the developed design requirements, principles, conception, and hence for the eventual usefulness of the artifact. By that, we conclude that the artifact provides useful orientation on measurable venture KPIs and their relationships to venture milestones, such as funding events. These insights improve the entrepreneur's self-assessment of investor readiness and support fundraising activities. Further, we find that the Startup Benchmark Tool increases especially for novel entrepreneurs the confidence about which KPIs matter.

In addition to the positioning as a tool for entrepreneurs, the post-development evaluation reveals other potential target groups for the artifact – above all, investors. This is not surprising, as the benchmark approach is also a practical requirement for the Investor Reporting Tool (see Section 7.4). Besides financial investors, also strategic investors searching for innovation are mentioned as potential target customers. According to the evaluators, small and medium-sized enterprises could have a material interest on a benchmark tool. This is particularly relevant, as the interviewees uniformly emphasize that investors and other beneficiaries would have a considerably higher willingness to pay for

benchmarks compared to ventures. According to the evaluators, entrepreneurs are not seen as an attractive customer group from a monetarization perspective.

The post-development evaluation yield five other important aspects regarding the product-market fit. First, the focus on the European market is perceived by the evaluators as especially valuable as benchmarks for non-US markets are barely available. Second, the conception is praised for its simplicity and clean design, which successfully includes and focuses on the most important differentiation factors. Third, the underlying sample for the benchmark tool needs to be increased. Fourth, the artifact should ideally center around certain ventures, and fifth, be as transparent as possible for the users. The latter two aspects are especially relevant as long as the underlying sample lacks a critical sample size. The sample size can be increased by adding venture data from additional early-stage investors, while a focus on certain ventures (e.g., SaaS and eCommerce ventures) reduces the complexity of providing benchmarks for all ventures and increases transparency on the target groups. A detailed description of the sample data achieves even more data transparency but has its limits with respect to data confidentiality.

Consequently, the Startup Benchmark Tool is a valuable and important step towards a useful and needed solution, even though the current version requires further development to reach market-readiness. Further, the venture performance benchmarks seem to be relevant for several target groups. Especially investors could benefit from the insights besides certain entrepreneurs. At the same time, the most critical asset of the artifact is the growing venture data base. Consequently, an attractive monetarization strategy tailored to the customer groups could be as follows: Ventures could get the benchmarks on a free-for-data or pay-per-use basis. Financial investors should benefit from a competitive pricing. The latter could be achieved by bundling the Investor Reporting Tool with the Startup Benchmark Tool. By that, the reporting tool (base package) could be offered free of charge, having the advantage that investors contribute to the data base. In addition, financial investors could get the benchmarks for a monthly recurring fee (premium package). For strategic investors, the benchmarks are available on a recurring fee basis only.

7.6 Conclusion, limitations, and outlook

7.6.1 Conclusion

In this study, we build two artifacts designed to reduce the two-sided asymmetric information between entrepreneurs and investors. By that, we contribute towards the

mitigation of opportunistic behavior and frictions in value-adding collaborations in the principal-agent relationship as well as towards the reduction of inefficient capital allocations. The Investor Reporting Tool is a useful blueprint for an efficient and effective venture reporting solution, which complements the elsewise trust-based entrepreneur-investor relationship from a formal, quantifiable perspective. Meanwhile, the Startup Benchmark Tool provides useful orientation for relevant groups of ventures (e.g., Software as Service and eCommerce) on which KPIs are relevant and how these KPIs relate to venture milestones along the venture life cycle.

More generally, our design science research contributes to literature by strengthening the link between measurable venture KPIs and venture performance. Our three-years long collaboration with an early-stage investor eventually yields relevant KPIs and benchmarks for venture performance, which are triangulated in countless interviews with investors and entrepreneurs. The concrete KPI and design choices in formal reporting structures, enable us to identify common denominators for early-stage investors' performance tracking on portfolio, sub-portfolio, and venture level. For instance, we find that often anecdotally dismissed financial accounting KPIs such as EBITDA, or FTE play in fact an important role in venture reporting, besides KPIs which are more venture specific, such as MRRs, or GMVs. These insights are valuable by improving literatures understanding of how early-stage investors handle the puzzle of balancing the "uniqueness of ventures" and the "abstraction of generalizable knowledge from investments", as requested by scholars (Gornall & Strebulaev, 2020).

Overall, our post-development evaluation of the two artifacts shows that industry experts uniformly agree that there is a strong market need in the VC industry for solutions that enable data-supported decision-making. However, we conclude that besides structural challenges of the venturing environment, such as pace, dynamics, and the inherent uniqueness of ventures, the fragmentation of the VC industry obstructs the evolution of data-driven solutions from two angles. First, the fragmentation requires relatively high upfront investments for market participants before the benefits of a data base can be generated, making any attempts costly and unappealing. Second, the fragmentation leads to isolated portfolios which struggle to derive resilient benchmarks capable of coping with the heterogeneity among ventures. Therefore, we conclude that a significant consolidation, or even better, an "industry standard" for data collection in the VC industry could solve those problems, as the data-driven decision-making becomes more effective and efficient through scale (i.e., useful). A significant portion of ventures on one platform, would push

the resiliency of benchmarks despite ventures' heterogeneity, and make benchmarks to valuable reference points in negotiations. However, whether early-stage investors, who earn their fees by managing the existing market frictions, inefficiencies, and asymmetric information (Amit et al., 1998), really aspire such a strongly positioned data provider in the VC industry is questionable. As of today, at least above-average performing investors, such as Sequoia Capitals, seem to have no problems to negotiate their terms regarding transparency in the entrepreneur-investor relationship. "*Sequoia has implemented extremely standardized venture selection and reporting processes, and certainly has no worries to be viewed as bureaucratic, or, due to this, to be rejected by any venture.*" (quote of expert C). Consequently, a Sequoia could pick the good "lemons", whereas the mainstream or average investors, deals with the remaining investment opportunities. This proposed reasoning is in line with Korteweg & Sorensen (2017), who find that current early-stage investor performance relates to future investor performance.

7.6.2 Limitations

Of course, the study is not without limitations. First, the most prominent limitation of this study comes along with the inherent methodological choice to tradeoff research broadness versus research depth. The collaboration with one medium-sized VC from Berlin ensures unique insights into elsewise sealed decision-making processes and venture data. However, at the same time it limits the broadness of the study's exposure. Therefore, the development of the artifacts, including the derived practical requirements, depends to a large extent on the perspective of the collaborating VC, which is why the generalizability of this work is limited. Also, the data of this study is limited to the collaborator's portfolio ventures in terms of investment focus and sample size. For this reason, we acknowledge that for a market-ready benchmark solution further steps are required to develop resilient benchmarks, which are applicable for critical events, such as actual price negotiations in funding rounds. We mitigate these inevitable tradeoff consequences by extensive post-development evaluations on both artifacts. This increases external validity of our results. A second limitation are potential biases of early-stage investors. The evaluation, conducted with professional investors, reveals (a) that the developed artifacts appeal to investors but (b) that they express a limited excitement to actually put resources into more transparency. This could be explained by the implication that VCs also benefit from limited transparency and associated high search and transaction costs, which they manage for LPs. However, an industry-wide collusion across evaluators seems to be unlikely, whereas individual

investors would, as evaluations suggest, certainly benefit from the findings of this study. Further, we included a fund-of-fund investor (LP) in our evaluation to address and mitigate this potential bias. Third, the artifacts could ever be further refined and extended. Thus, we do not claim to provide perfect transparency solutions, solving for every early-stage investor and venture the huge puzzle of linking the most relevant performance indicators to venture performance. Instead, we consider this study as a success, if it contributes a little towards enhanced transparency in the VC industry and towards the knowledgebase of venture performance for entrepreneurs, investors, and researchers.

7.6.3 Outlook

Future research could make use of the derived artifacts. The initial development of the artifacts required a methodological focus on depth. However, future research could focus on broadness to extent and further evaluate the applicability of the designed artifacts. By that, scholars would improve literature's understanding of the formal, quantifiable, venture performance. For instance, our triangulated and prioritized KPIs could now be used in a cause-effect setup to establish the direct link between measurable performance indicators and eventual venture performance. With our benchmarking approach, we make an important step towards transparency for entrepreneurs. We are aware that further steps are required to provide a resilient and market-ready tool for critical events to entrepreneurs. As the usefulness of benchmarks is inherently sensitive to the size and comparability of the benchmark data, we encourage future researchers and practitioners to put further effort into a pan-investor consolidation of venture data. This would improve literature's essential understanding about measurable KPIs and eventual venture performance.

Appendices

Appendix 1: Investor Reporting Tool
– edited expert interview transcripts –

The transcribed interviews below represent accurate scripts focused, formalized, and edited for readability and clarity. The transcription occurred immediately after the interview. Before each transcribed session, the artifact was conceptually presented and demonstrated in detail.

Expert A interview: Investor Reporting Tool   Date: 22nd of January 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for an early-stage investor reporting tool that creates transparency and enables data-supported decision-making.	4.0

Expert A: Very much, the need is definitely there. […] I think that investors require reporting solutions keep an eye on their ventures. […] I also think that this is basically a common understanding among investors, however, the problem is [that] there is no standard. When I request a reporting, somewhen a bigger investor shows up and requests again an own reporting, so there are always dynamics, and change depending on bargaining power. So, it is not an easy undertaking.

Interviewer: How much would you agree with the following statement?

The service-oriented approach with upfront development and implementation effort is suitable to solve the need for a broad investor base.	2.5

Expert A: Well, the approach makes sense. But I think that an upfront implementation effort which is associated with costs meets limited excitement at potential investors, which are your customers. It will not be the business case for itself, because it requires a lot of effort and many people to implement [the service-oriented reporting solution at various investors]. The business case would be what you do after you have one foot in the door of the various investors.

Interviewer: How much would you agree with the following statement?

The organizational structures and the required change are the core challenge for a useful investor reporting solution.	5.0

Expert A: Absolutely, the problem is purely organizational. But […], the issue will be that ventures do not deliver as discussed and inconsistently in the long run. As mentioned, often investors cannot choose the reporting format (i.e., only lead investors, and even they might be pushed away from even bigger investors in the follow-up round). Two additional benefits of the [service-oriented] approach [and the associated changes] are the educational

aspect for startups and the alignment between investors and ventures, which you achieve through onboardings and coaching.

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit industry-wide investor requirements.	5.0

Expert A: I like the conceptualization a lot. [The three-layer structure built in standard software] is super clean – very good. […] It is great that the software is a standard software, so it easy to integrate for many potential users.

Interviewer: What do you think about the fact that the venture has the data responsibility?

Expert A: I mean, the venture owns the data. So, it makes sense that they also choose what they report. I think they are the natural owners of the data and therefore the task [of entering the data in a template]. I also like the mix and quantity of the collected KPIs. It is very useful that the standard KPIs are [classical] financial accounting figures. This makes it easier to retrieve the data for ventures and also makes comparisons easier.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits industry-wide investor requirements.	5.0

Expert A: At early stage, you should not ask for more than 12 KPIs in total, I think the quantity is fine but should not be increased.

Interviewer: Would you also include qualitative aspects or other additional functions, such as regulatory, forensic, accounting, or compliance into the reporting?

Expert A: No, as tools often do not survive for too long, I would not increase the effort related to the reporting or include more functionalities [i.e., compliance, forensic or other accounting functionalities] – it would be a "waste".

Interviewer: What about the inclusion of the budgeted figures, and the monthly reporting frequency?

Expert A: I like that a lot – it is on spot for the practical needs.

Interviewer: What do you think, would investors be willing to pay for such a reporting solution?

Expert A: Yes I think so, but most likely not "much" – the tool will not be the business case, it is the entry point instead. […] But I really like would you developed here if you want to publish and share this knowledge [about how to conduct venture reporting and to benchmark ventures]. You could publish your insights on my website.

Expert B interview: Investor Reporting Tool   **Date: 25th of January 2021**

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for an early-stage investor reporting tool that creates transparency and enables data-supported decision-making.	5.0

Expert B: It will be extremely important in the future to make venture data accessible to investors. Few exceptions might be some micro-VC or some small business angels. Do not get me wrong, I do not expect that investment decisions will be taken any time soon by algorithms but the importance of transparency on performance drivers will evolve. […] At our investment firm we are split in two camps about this. Approximately 50% see proper venture performance data usage as key in the future, whereas about 50% do not share this opinion.

Interviewer: How much would you agree with the following statement?

The service-oriented approach with upfront development and implementation effort is suitable to solve the need for a broad investor base.	3.0

Expert B: For my stance, the positioning of the tool as a consulting project would be too much to raise interest. But I would think and position it more as an enterprise software introduction. This is also complex and requires coaching at the beginning. Further, you will need a degree of standardization, otherwise you get into trouble.

Interviewer: How much would you agree with the following statement?

The organizational structures and the required change are the core challenge for a useful investor reporting solution.	3.0

Expert B: Primarily yes, but the technology is also important. The technology needs to cope with the requirements that processes, and organizational aspects dictate (e.g., reminder, role-managements).

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit industry-wide investor requirements.	5.0

Expert B: The basic design and the conceptualization are essentially identical to a product or offering of [a venture that we have funded] – so it is very nice. Flexibility about which KPIs are collected is important, otherwise tools become outdated.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits industry-wide investor requirements.	3.0

Expert B: We funded and built a startup that addresses the same market with a similar product. Originally this startup came from the fund operations direction. We always though "how to avoid providing just the next tool?". Therefore, we aim to integrate as many accounting systems and functions as possible on the platform. We also include explanations for performance [i.e., qualitative aspects] and enable communications between the investor and the founders. This has also the benefit of creating a pull effect. Startups who perceive reporting usually as a burden, can now also use the tool to address tasks they have anyways. For instance, the management of ESOPs. By that, we motivate the startups to use the tool. Overall, taking our own fund portfolio, about 50% of startups properly report their figures. The other 50% are managed internally in the fund's back office. This is achieved as our offering is free of charge for ventures, only the investors pay. We hope that ventures using our reporting platform can eventually use the same reporting for several investors when market penetration grows.

Interviewer: I understand that you would include additional reporting functionalities, and qualitative aspects, what about budgeted figures, and how do you perceive the monthly reporting?

Expert B: Yes. Monthly reporting is key, otherwise the data is always outdated. Budgeted figures should also be included […]. The KPIs for our solution are very similar, we also collect the EBITDA as a profitability figure, we do not collect account receivables though.

Interviewer: What do you think, would investors be willing to pay for such a reporting solution?

Expert B: Yes, I would be interested if we would not have a tool already. But of course, for you it would be more attractive to charge a recurring fee rather than an upfront fee for the setup. Further, you should not underestimate the value of standardization of your product. This enables future automation, extensions, and scaleups.

Expert C interview: Investor Reporting Tool   Date: 26th of January 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for an early-stage investor reporting tool that creates transparency and enables data-supported decision-making.	5.0

Expert C: First of all, the tool looks great. Way too few VCs have functioning reporting either because it is too expensive or too bad.

Interviewer: How much would you agree with the following statement?

The service-oriented approach with upfront development and implementation effort is suitable to solve the need for a broad investor base.	3.0

Expert C: I would expect some push back from ventures, as many entrepreneurs tell stories about double reporting, without a benefit.

Interviewer: How much would you agree with the following statement?

The organizational structures and the required change are the core challenge for a useful investor reporting solution.	5.0

Expert C: 100%. The relationship between VCs and startups works differently on different levels and on different topics. Reporting topics are in exception of some urgent reporting cases seldom of highest priority, therefore creating a persisting solution will be difficult.

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit industry-wide investor requirements.	4.5

Expert C: As mentioned before, the tool looks really good and though through, it is a clean design. Personally, I would add more reporting requirements.

Interviewer: Okay, then how much would you agree with the following statement?

The comprehensiveness of the artifact suits industry-wide investor requirements.	3.0

Expert C: Well, I have heard from cases in which ventures overstated their performance, therefore I would add sanity checks. Also, LP-investors request from GP-investors some qualitative explanations for their performance on a venture-by-venture base. I have repeatedly heard that GPs struggle to provide these [qualitative] information – therefore ventures should provide a summary of last important events.

Interviewer: What about the budgeted figures collected?

Expert C: I think this is very useful to track performance, not for forensic purposes but from a broader perspective.

Interviewer: According to my understanding, many VCs hesitate to implement a reporting because the worry about their reputation as being "bureaucratic", what do you think?

Expert C: I know, I know, but this is interesting right? Sequoia Capital is known for being one of the most standardized and bureaucratic investors of them all. Sequoia has implemented extremely standardized venture selection and reporting processes, and certainly has no worries to be viewed as bureaucratic, or, due to this, to be rejected by any venture. I think that especially VCs with limited reputation think this way.

Interviewer: What about the monthly reporting, would quarterly figures be enough?

Expert C: We request reporting on a quarterly basis. However, for GPs I think monthly is better otherwise timely interventions becomes impossible.

Interviewer: What do you think, would investors be willing to pay for such a reporting solution?

Expert C: I think it is a raising topic, so yes. But I understand that you want the data from the GPs, right? In this case, if you want to monetarize the data then give the reporting basically for free and let someone else pay for the service, e.g., later stage investors, exit candidates such as SMEs looking for innovation.

Expert D interview: Investor Reporting Tool   Date: 26th of January 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for an early-stage investor reporting tool that creates transparency and enables data-supported decision-making.	4.5

Expert D: From a VC perspective, definitely – it is also requested from LPs and regulators. Further, in the last years the European VC scene professionalized, and the players grow. This increase in portfolio sizes and fund complexity needs to be matched by mature processes. […] It is a bit like "the winner takes it all game". If one template, one standard, is used by all players in the industry, adaption and implementation become easy.

Interviewer: How much would you agree with the following statement?

The service-oriented approach with upfront development and implementation effort is suitable to solve the need for a broad investor base.	2.5

Expert D: Individualization is important. Otherwise, the solution is not used, if it does not suit the individual needs. But it is also important that "standards" emerge.

Interviewer: How much would you agree with the following statement?

The organizational structures and the required change are the core challenge for a useful investor reporting solution.	5.0

Expert D: Absolutely, the mindset super important, if the tool is good but it is not used or entered figures are not accurate […]. The output can only be as good as the input. The IT solution is not difficult. […] But creating a standard is not easy, as a CEO of a group of about 30 entities I know quite well how hard it is to synchronize all entities to consolidate group information. In this kind of setup, you have to decide which data you want. Then the business units, or in the case of VCs the startups, must deliver what you request.

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit industry-wide investor requirements.	5.0

Expert D: Again, absolutely. The conception is very good and looks like the product of a venture that we [the VC the expert holds a director seed in] have funded. I like the mix of standard and specific KPI. Also, the weight and amount of each six KPIs is reasonable.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits industry-wide investor requirements.	3.0

Expert D: You should think about how the ventures could benefit from the tool. Maybe you also create some visual dashboards and analyses for them. […] Investors could also benefit from more integrated solutions, such as venture-valuations, IRR, and fund management functionalities in general [including regulatory-related functions]. What I really like a lot is the integration of the budgeted figures. This review "closes the circle" and enables constructive discussions.

Interviewer: What do you think about the monthly reporting frequency and about venture reporting on qualitative aspects, such as relevant events?

Expert D: Yes, you should collect that qualitative information, if it is not too much effort for the ventures. Monthly reporting is the perfect. For me, spending 0.2 FTE on venture reporting for a portfolio size of about 50 ventures sounds really good.

Interviewer: What do you think, would investors be willing to pay for such a reporting solution?

Expert D: Yes, I think investors need such a solution, either they build it themselves or they pay for one. For an attractive rate, I recommend to extent the tool and to package the tool into a software.

Expert E interview: Investor Reporting Tool   Date: 1st of February 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for an early-stage investor reporting tool that creates transparency and enables data-supported decision-making.	3.0

Expert E: Yes, I personally dictate a quarterly reporting to my ventures. One problem though is the potential double reporting when other investors also request their reporting format.

Interviewer: How much would you agree with the following statement?

The service-oriented approach with upfront development and implementation effort is suitable to solve the need for a broad investor base.	3.0

Expert E: Yes, I like it. The coaching is paramount. It is a process for itself. The ventures as well as the investors need to understand that with growth and professionalization reporting obligations come along. However, for many investors large implementation costs are not bearable. They want tools that are immediately usable.

Interviewer: How much would you agree with the following statement?

The organizational structures and the required change are the core challenge for a useful investor reporting solution.	5.0

Expert E: I fully agree.

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit industry-wide investor requirements.	4.5

Expert E: First of all, congratulations. The tool impresses, very good. The presented three-layer structure with the data responsibility at the venture level is a good fit to what many investors need. The mentioned 0.2 FTE effort to maintain the tool for a portfolio size of about 40 – 50 ventures is reasonable. […] The usage of Google could be a concern for some investors, in terms of data protection.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits industry-wide investor requirements.	5.0

Expert E: I dictated to my ventures a quarterly reporting. For my purposes this is enough as I steer my ventures from milestone to milestone [note: investor E is a business angel investor]. I would like to add a milestone tracking into the reporting.

Interviewer: So, you would like to add qualitative aspects?

Expert E: Only the progress towards defined milestones. But it is better to start the reporting on a lean basis without too many reporting obligations. In a next step the tool can be further developed. […] Have in mind, the tailoring of the tools brings always associated costs along – standardization is a valuable good.

Interviewer: What about the integrated budgeted figures?

Expert E: I would like to have them – they are certainly valuable.

Interviewer: Would you include any other reporting functionalities, such as forensic, or regulatory topics?

Expert E: No, the tool needs to be lean and create a minimum of administrational effort.

Interviewer: What do you think, would investors be willing to pay for such a reporting solution?

Expert E: In fact, I am really interested in the tool. Ideally we find a way to collaborate. For instance, I could pay via the provision of data or other forms of cooperation.

Expert F interview: Investor Reporting Tool   Date: 2nd of February 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for an early-stage investor reporting tool that creates transparency and enables data-supported decision-making.	3.0

Expert F: At [our VC] the status quo is that every venture has its own reporting format. This is chaotic. Therefore, we plan to introduce a self-built solution such as the presented. […] But frankly, if GPs would not have other stakeholders, such as LPs, I would say that many GPs would rather forgo the reporting topic. […] Monitoring remains a challenge, with or without a reporting tool.

Interviewer: How much would you agree with the following statement?

The service-oriented approach with upfront development and implementation effort is suitable to solve the need for a broad investor base.	3.0

Expert F: I see the benefits of the strong alignment over the implementation, but of course, incorporating an external people into the venture reporting is also a matter of trust. Potentially, some investors are more hesitant to open their books and thoughts on which KPIs capture their portfolio performance.

Interviewer: How much would you agree with the following statement?

The organizational structures and the required change are the core challenge for a useful investor reporting solution.	4.0

Expert F: I would say yes, but IT is also part of the challenge as many early-stage ventures do not have the required infrastructure in place for recurring reporting tasks or to setup an intercept [between their inhouse tools and an investor reporting tool].

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit industry-wide investor requirements.	5.0

Expert F: the conception is well done – basically what is needed. […] The standard KPIs are the right choices. I would recommend adding to each venture one or two metrics which can be seen as "north star" KPIs. By that, the board seat owner has the performance always at hand.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits industry-wide investor requirements.	5.0

Expert F: I think qualitative aspects, or some relevant milestones are important too. Otherwise, the LP-reporting is a nightmare. Also, venture debt becomes more and more relevant for the industry. Therefore, and due to regulatory purposes, I like that you also collect the balance sheet figures once a year. But keep in mind that startups must focus on the business – so, do not overload them, this also bears the risk of being perceived as an [bureaucratic]administrator.

Interviewer: Would you include any other reporting functionalities, such as forensic, or regulatory topics?

Expert F: For later stage ventures this could be useful, but in general, the early-stage scene largely relies on trust.

Interviewer: What about the monthly reporting frequency and about our approach integrating budgeted figures?

Expert F: Both is good to have. Well, monthly reporting is a must. LP-reporting is only quarterly, but venture developments have often a high pace.

Interviewer: What do you think, would investors be willing to pay for such a reporting solution?

Expert F: In general, yes. There is a need, and the product suits the requirements. Though, the willingness to pay for the tool would be limited. Maybe more if it is canned into a proper software. […] We have to introduce a tool in the near future. So, if you could share some information about the tool, or if you could provide something it would be great. Alternatively, we have to build it by ourselves.

Expert G interview: Investor Reporting Tool   Date: 11th of February 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for an early-stage investor reporting tool that creates transparency and enables data-supported decision-making.	5.0

Expert G: […] extremely useful, having the venture data on demand available enables fund raising, investment decisions, and benchmarking within the portfolio. I believe the industry faces somewhat of a "chicken-egg-problem". A "standard" needs to prevail but everyone hesitates until it becomes clear which solution it is. […] Ideally, the standard is a neutral ground, a third-party provider. See DATEV [German accounting software provider] for instance, they are basically perceived as an almost government-alike institution. This would be what is needed in the market and by the way a very attractive positing.

Interviewer: How much would you agree with the following statement?

The service-oriented approach with upfront development and implementation effort is suitable to solve the need for a broad investor base.	4.0

Expert G: […] I like the consulting approach, as changes in the organization and mindsets of VCs and startups are required. But realistically […] the solution as it is, is very nice, but remains a self-built solution. Hence, when you like to commercialize the tool, potential customers will have concerns over the robustness and stability of the tool. Maybe you should [...] package the IT part of your presented offering into a closed software application, simply to improve the first-look impression and to reduce potential issues at intercepts in the long run. As I understand the tool, no maintenance hotline can be called and fluctuation on the finance department could harm the long-term success of the reporting tool. [...] Therefore, from my perspective, you can increase robustness by penetrating the market. When more startups and investors are aware of and used to the tool, basically "pulling" or requesting the tool, concerns about stability will diminish.

Interviewer: How much would you agree with the following statement?

The organizational structures and the required change are the core challenge for a useful investor reporting solution.	5.0

Expert G: Absolutely, the core problem is within the VC-venture relationship, […] it is not always healthy. […] If the VC dictates a reporting tool to the ventures it is often perceived as a burden. Therefore, […] position your tool as a third party – a "neutral ground" like an "online banking" could potentially solve the tensions. But to your question, […], durability of such a reporting solution is key as many investors simply have an unprofessional knowledge management […].

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit industry-wide investor requirements.	4.5

Expert G: The base design, architecture, structure, are all spot-on. [Our VC] also built something like that, but by far not that nice. Also, that ventures have the data responsibility, governed by the investor, is very important. The same holds for the KPI selection, very nice. I also liked the visuals. As mentioned earlier, from the concept perspective, the only change I would recommend, is regarding the positioning. Think of position the tool as a third-party provider which then also manages the data flow, i.e., "reporting as a service".

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits industry-wide investor requirements.	5.0

Expert G: You mentioned the KPIs, the selection and number suit the requirements. The chosen KPIs are valuable as they also allow prevention in case that ventures run into liquidity issues – therefore I agree with you that the reporting needs to take place on a monthly base.

Interviewer: What is your take on the inclusion of budgeted figures, and would you also incorporate qualitative aspects into the reporting obligations, what about additional accounting services?

Expert G: The comparisons of actual versus budgeted figures makes board discussions much more constructive – that is a very good idea. Qualitative aspects are nice to have for

the investor, but I could imagine that the effort at the venture level becomes immense, especially when we have in mind that other investors request similar reports. In terms of additional accounting services or tools, my take would be: If you position your tool more towards the ventures, than these additional services are a good idea to create a demand from their side.

Interviewer: What do you think, would investors be willing to pay for such a reporting solution?

Expert G: First of all, the tool is very important as reporting is often only a "second" to do on the list of investors due to ever recurring hot topics such as fund raising, or investment decisions. So, my answer is yes, but with a competitive pricing! I would suggest building a two-level offering. First, you offer the base version of the reporting packaged in a closed software solution, which increases the willingness to pay. […] Second you offer the benchmarks, which you collect in a pan-investor setup as a premium subscription. In the end, your tool should become the DATEV or SAP for startups, in other words, the market standard.

Appendix 2: Startup Benchmark Tool
– edited expert interview transcripts –

The transcribed interviews below represent accurate scripts focused, formalized, and edited for readability and clarity. The transcription occurred immediately after the interview. Before each transcribed session, the artifact was conceptually presented and demonstrated in detail.

Expert A interview: Startup Benchmark Tool   Date: 22nd of January 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for a Startup Benchmark Tool that creates orientation on performance indicators and enables data-supported decision-making for entrepreneurs	4.0

Expert A: Well, for many ventures the core issues at early stages are more related to product-market fit that to how much revenue do my competitors have. However, in general there is definitely a need. […]. But you should be very precise in where your data come from and on the peers. By that I mean, compare only ventures with similar go-to-market strategies (i.e., no "intellectual property driven ventures"), growth paths, company profiles. I recommend starting rather narrow [for selected venture clusters] and to be transparent […]. The need is strongest after first investors entered – between seed and series A. Here it is all about numbers.

Interviewer: Given this comment, do you believe that the benchmarks could become more than guidance?

Expert A: The outputs are orientational only. The tool would need much more context to actually advice someone [based on artificial intelligence]. But this is fine, this is what the tool should be – just be clear about data limitations and flag for whom the tool is applicable. For instance, startups with deep-tech or biotech business cases will have less predictable go-to-market roadmaps than an online app.

Interviewer: How much would you agree with the following statement?

The venture life cycle approach with few essential differentiation factors, built on investor portfolio data, is suitable to calculate the benchmarks.	5.0

Expert A: Actually, the design is very beautiful. I mean, the time axis is of course one of the most important determinants and the selected differentiators are also relevant. A weakness will be the sample size. The good point is, that the VC data is in general an aspiration for other ventures. The bad is, that your benchmarking is only applicable for ventures that suit the investment strategy of your collaboration partner.

Interviewer: How many ventures are needed to build resilient benchmarks?

Expert A: I Think, for every point in time and every vertical you need about 30 ventures. Although actually, it is not an absolute figure, right? You could also defend the statement that if you do not know at least 30% of a market you do not know the market right?

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit general requirements of entrepreneurs.	5.0

Expert A: […] The overall concept is simple but very nice, simple is nice … but of course more data is needed to be accurate. I also like how you use analytical curves and smooth the data given your limited data availability. But this should the more reduced the more actual data back the curves. In the end, ideally you use "moving averages" as trend curves. […] In terms of benchmarks, for most use cases the median curves are more relevant but for orientation purposes it is good to have both. [Further,] it is interesting to have a perspective on future funding events. […] Again, be super transparent on for whom this tool is applicable.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits general requirements of entrepreneurs.	3.0

Expert A: I mean, more KPIs are better. But it all depends on data availability. I think the presented KPIs belong to the most frequent and relevant KPIs, […] we discuss them for startups' current states and future states. […] More benchmarks on customers/users could be added as the next KPIs.

Interviewer: What about monetarization? Would startups pay for such a tool?

Expert A: I expect rather no, as relative performance is often not the biggest issue for founders. Founders are focused more on product-market fits at the beginning and after that they see whether they fail or not. If they succeed they then have experienced investors backing them, who tell them where they are going. Therefore, I expect a limited willingness to pay but usage if it is offered for free […]. For other stakeholders [investors] it would be a different picture. But I really like would you developed here if you want to publish and share this knowledge [about how to conduct venture reporting and to benchmark ventures]. You could publish your insights on my website.

Expert B interview: Startup Benchmark Tool   Date: 25th of January 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for a Startup Benchmark Tool that creates orientation on performance indicators and enables data-supported decision-making for entrepreneurs	5.0

Expert B: Totally, this idea is spot on – and the need and market clearly given. Though, I see the need much more from the investor than from the startup side, especially when we talk about monetization. I see in particular two use cases. First, benchmarks would provide ranges for KPIs where startups should be to secure a follow-up funding. Second, benchmarks also add value at board meetings where, for instance SaaS pricing topics are often discussed. Here, benchmarks would make discussion more objective. In practice, often a founder comes up with a reference figure from a random *internet blog* article".

Interviewer: How much would you agree with the following statement?

The venture life cycle approach with few essential differentiation factors, built on investor portfolio data, is suitable to calculate the benchmarks.	4.0

Expert B: I like the approach. I see the need the most for startups being between the seed stage and startups striving for the series B round. Whereas the key question remains: "what do I need to get a series A funding?". [..] However, more data is needed. Usually, VCs in their silos do not have sufficient data to come up with a solid solution. [Our investment firm] had back then 100 ventures available as a data base, but eventually we abandoned the idea due to limited data. […] It would be great though if some VCs pool their anonymous data. However, in the German-speaking area this would pose the challenge that the industry knows itself too well, which eliminates the anonymity.

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit general requirements of entrepreneurs.	4.0

Expert B: The factors you have chosen are the right ones, no question. Also, that you have a separated category for eCommerce and marketplaces is great. Maybe you should consider to breakdown the FinTech category, as FinTech becomes more and more diverse – so, it is maybe better to pool them with [Universal] "others" rather than being spuriously accurate.

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Regarding the analytics, do not smooth too much, as you want to keep the data-richness high. You could also add a [differentiation] factor for the geographical location – as startups from Eastern Europe behave differently than from the Silicon Valley.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits general requirements of entrepreneurs.	4.0

Expert B: The integration of [both static and dynamic] future benchmarks is great idea. Maybe you could show them versus extrapolated data, assuming current growth rates. This being said, I like that you include both absolute figures and growth figures, the momentum of a startup puts the data into the right perspective.

Interviewer: Do we have chosen the right, or most relevant KPIs?

Expert B: Yes, these KPIs belong to the standard KPIs [from the investor reporting tool] for a reason. Plus, MRRs and GMVs as top-line figures are also good to compare. I really like that you also ask for growth figures. These are really important to better bench a venture, i.e., does it have excess growth or does it fall behind. Also, of interest would be to collect CACs [customer acquisition costs] and customer life-time values. Also, […] we […] collect the EBITDA as a consistent profitability figure. For benchmarking the EBIDTA, or some other margins, such as gross and, or contribution margins would be great.

Interviewer: What do you think about the willingness of startups to pay for such a solution?

Expert B: Startups would maybe up to a one-off payment. But frankly, none of our early-stage startups pays for data providers, they all navigate through trial versions, or receive data somehow through investors. Investors, however, are the real target group. Also, business partners of startups. They would also pay to anticipate when the next funding round nears, and financial slack is at their customer's end available. […] I like the benchmarking idea a lot and would stay in touch about this matter – great tool, it will be a door opener for relationships to many VCs.

Expert C interview: Startup Benchmark Tool   Date: 26th of January 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for a Startup Benchmark Tool that creates orientation on performance indicators and enables data-supported decision-making for entrepreneurs	5.0

Expert C: This is a great tool. Especially for the non-US VC industry there is barely any benchmark data available. I think that many users, founders, could benefit from those benchmarks as they live in silos. The idea is great […] the data is also very exciting to other stakeholders in the VC industry. Investors and strategists. I could imagine that later stage investors [also called growth funds] and SMEs looking for innovation are interested. […] These stakeholders should than pay for the service.

Interviewer: How much would you agree with the following statement?

The venture life cycle approach with few essential differentiation factors, built on investor portfolio data, is suitable to calculate the benchmarks.	5.0

Expert C: Sure, investors even group themselves by focusing on certain segments of the venture life cycle. Given the diversity among ventures, the few factors […] are good for [the] orientation [of the users], but the tool will always remain a supporting tool, a data perspective – final decisions are taken by the decision makers.

Interviewer: Which stage along the life cycle will benefit most of such as tool?

Expert C: Series A, from series A on it is all about numbers, before it is more about execution, prototypes, etc. Whereas I could imagine that after series B you will have trouble to find sufficient comparable ventures to perform benchmarking.

Interviewer: How many ventures are needed to build resilient benchmarks?

Expert C: […] I think you should have at least 15 data points to build a benchmark for a homogenic venture group.

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit general requirements of entrepreneurs.	4.5

Expert C: The few factors you use belong definitely to the most relevant ones that investors evaluate first. I also like a lot that you show benchmarks for future points in time, as many ventures ask, "what do I need" [for the next funding event].

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits general requirements of entrepreneurs.	4.0

Expert C: […]. Build the tool with the data. I understand that this is a minimum viable product, the idea is great, but you require more data. So, extent and build the tool with the incoming data.

Interviewer: What about the selectable KPIs in the tool, which ones should we also include?

Expert C: […]. Also, this answer will come with your future data collection, right? Actually, you did exactly that, right? You built this version based on KPIs that are common and requested by investors or the industry. So, I agree with the current KPIs and recommend proceeding as you started.

Interviewer: What do you think about the willingness of startups to pay for such a solution?

Expert C: Yes and no, founders are usually very stingy when it comes to spending money. So, the price is relevant. GPs and other potential investors on the other hand could use the information as marketing instruments, when pitching in front of LPs, or make investment decisions based on the benchmarks. As far as I know, the EIF [European Investment Fund] owns a lot of data, this could be a game changer, if the EIF makes these data somehow available.

Expert D interview: Startup Benchmark Tool   Date: 26th of January 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for a Startup Benchmark Tool that creates orientation on performance indicators and enables data-supported decision-making for entrepreneurs	3.5

Expert D: Exciting question, many founders would benefit from benchmarks about their valuation and relevant KPIs. Personally, I think the usage will be more event driven. I mean, founders will use the tool when a next funding round nears, but not on a day-to-day basis for operational tracking of KPIs. […] What I think is that the presented data require some form of analyses or interpretation.

Interviewer: How much would you agree with the following statement?

The venture life cycle approach with few essential differentiation factors, built on investor portfolio data, is suitable to calculate the benchmarks.	3.0

Expert D: The tool falls and rises with the data. The quality of the benchmarks depends on the user and the related factors, how resilient they are.

Interviewer: How many ventures are needed to build resilient benchmarks?

Expert D: Per cluster, or per vertical, I would say 20-30 ventures are needed to create comparability.

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit general requirements of entrepreneurs.	4.0

Expert D: For me, the current version of the tool is a good heuristic into the direction of a valuation tool, less for operational steering, for the latter the robustness or resiliency is missing. The categories and the differentiation factors, industry, revenue model, customer focus, that you use are really, really great. Those are things that are always discussed when getting an impression of a given startup. Also, the deep dive on eCommerce and marketplaces fits to current market needs.

The points in time of the benchmarks are also all relevant, especially the focus on the next funding event is of great value to many startups. […] A potential avenue to take could be – similar to the presented reporting tool – to provide a service that helps founders to interpret the KPIs and to draw conclusions from them, a bit like a consulting service.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits general requirements of entrepreneurs.	3.0

Expert D: I think even better would be to go the next step and to offer valuation multiples (e.g., x Euro valuation for 1 Euro in MRR), creating causal relationships between the KPIs. Then, in a next step you could even derive the valuations in form of a valuation range, given the entered operational and financial KPIs.

Interviewer: Understood, would about the chosen KPIs, are these a good starting point for this endeavor?

Expert D: Absolutely, the presented KPIs are what is constantly discussed in the industry. Other KPIs could include CACs, churn, or margins.

Interviewer: What do you think about the willingness of startups to pay for such a solution?

Expert D: A small one-off fee for the event driven solution. Only a limited willingness to pay on a recurring basis for startups. This changes if you make a repositioning of the tool towards a real valuation-tool. [Further,] certain investors, such as VCs, and business angels, could be interested too.

Expert E interview: Startup Benchmark Tool   Date: 1st of February 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for a Startup Benchmark Tool that creates orientation on performance indicators and enables data-supported decision-making for entrepreneurs	2.0

Expert E: To be frank, I think the explanatory power is too limited at this point in time. A benchmark calculated in a 'black box' is not a strong argument in actual price negotiations. The idea is great, but you need to reach a certain critical reputation. Until then, it is like whenever a startup is above your benchmarks they use it as a marketing tool, if not they leave it aside. […] My ventures have other problems [relating to product-market fits].

Interviewer: How much would you agree with the following statement?

The venture life cycle approach with few essential differentiation factors, built on investor portfolio data, is suitable to calculate the benchmarks.	5.0

Expert E: The idea in general is a good one. But it will be difficult get a weight in discussions and to become the bases for important decisions.

Interviewer: How many ventures are needed to build resilient benchmarks?

Expert E: Either a lot or you are to a maximum transparent on which ventures are in your sample. For instance, increase the robustness of the benchmarks by showing on how many ventures the user is benched. Even better, which ventures, e.g., "you are compared to five ventures among those are Uber, Lift, and …".

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit general requirements of entrepreneurs.	5.0

Expert E: It is nice. Simple and nice. You have also chosen the right venture characteristics. And smoothening the noise in the data makes absolute sense to me. […] I could imagine though that valuation figures are maybe hard to get. Many ventures have signed nondisclosure agreements about valuations. Maybe one remark, make sure that the benchmarks are not spuriously detailed.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits general requirements of entrepreneurs.	5.0

Expert E: I like that you focus on financial figures, both in absolute terms in growth terms. Maybe you should focus on either the median or the average. As I said, the design and the prioritization of the venture characteristics is great. If such a tool becomes a market champion, gains its reputation, then this is huge. […] Eventually the benchmarks for several stages along the [venture] life cycle will be useful, [but] for now, you can only be transparent about the data, and aim for growth. Then, maybe somewhen no questions are asked anymore about "where the data comes from". […] You could also think of focusing on a few business models such as SaaS, this makes it easier.

Interviewer: What do you think about the willingness of startups to pay for such a solution?

Expert E: Lets phrase it like this: I would be a follower but not a pioneer when it comes to applying your benchmarks, but when the tool matures it has its value and its price. [But] if you target the investors industry I am confident that you find some customers.

Expert F interview: Startup Benchmark Tool   Date: 2nd of February 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for a Startup Benchmark Tool that creates orientation on performance indicators and enables data-supported decision-making for entrepreneurs	3.0

Expert F: I would love to simply buy monthly recurring revenues based on a solid multiple valuation, but ventures are so different and reliable benchmarks are not available. In my opinion your tool should solve the need to provide data and by that orientation and not recommendations. […] I further potentially the tool faces – from an investor perspective – an adverse selection problem. I think that the Rockstar ventures do not need the tool. They know that they are strong. In contrast, weaker ventures or at least unsecure entrepreneurs might need the information, as they do not get it from investors – the crème-de-la-crème does not need the tool.

Interviewer: How much would you agree with the following statement?

The venture life cycle approach with few essential differentiation factors, built on investor portfolio data, is suitable to calculate the benchmarks.	4.0

Expert F: For me, between seed and series B. Could have the strongest interest in the tool. Series B rounds are much more data driven.

Interviewer: How many ventures are needed to build resilient benchmarks?

Expert F: On average 20 per vertical, more for more heterogeneous clusters. At the lower end I would say for SaaS businesses the critical sample size is at around 15 to 20. For eCommerce maybe 15. However, we talk about real eCommerce, which is very homogenic. Marketplaces on the other hand differ already somewhat more. [...] Airbnb has other metrics than eBay, or B2B marketplaces such as shipping ventures for metal parts. I think eCommerce and SaaS are the best applications for such a tool. FinTech which you have as an option in your tool could be too heterogeneous for my taste. NeoBanks and NeoBroker differ substantially, so maybe you create sub-categories, or you omit the industry category – again, depending on the data [availability].

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit general requirements of entrepreneurs.	4.0

Expert F: I like the focus. Using standard KPIs, recurring business models and eCommerce / marketplace […], differentiating between customer foci […] I think that is it. Also, the calculation is good, of course you need more data, so your tool should be able to grow over time. […] That you offer benchmarks at various points in time is also great – it is a very good idea to use the age of a venture, by that, you can basically "walk along the benchmark lines".

Interviewer: Are there any relevant differentiation factors missing?

Expert F: Well, keep it simple, this is great, but be transparent on for whom the tool is useful. […] But you could incorporate team qualities. For instance, whether a founder is a serial entrepreneur, measure the industry experience and incorporate the academic background. […] The location of a startup also matters, maybe you incorporate that [as a differentiation factor] […] I like that you incorporate growth figures in your tool. The momentum of ventures is extremely important.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits general requirements of entrepreneurs.	3.0

Expert F: I would not build a tool for many business models. This becomes too heterogeneous. Maybe instead you could build two separated tools. One for SaaS. One for eCommerce. These have the most standardized businesses. As I said, even marketplaces are already quite heterogeneous. Then depending on the tool and the data, relevant KPIs would be CAC [customer acquisition costs] and CLTV [customer life-time value] for both business models, churn for SaaS business models, and contribution margins for eCommerce businesses models.

Interviewer: What about the willingness of startups to pay for such a solution?

Expert F: Yes, I think so, shape the tool a bit and you could charge s small fee. But […], the big fishes might not need the tool. They know what they are worth and find the information elsewhere. [But] the data and potential derivative analyses could be interesting towards investors.

Expert G interview: Startup Benchmark Tool   Date: 11th of February 2021

Interviewer: How much would you agree with the following statement?

There is relevance and a market-wide need for a Startup Benchmark Tool that creates orientation on performance indicators and enables data-supported decision-making for entrepreneurs	5.0

Expert G: Yes, the market is there. I think both startups and investors are looking for such a tool. Startups could use the information clearly for funding events. But also, within the startup. Sometimes, in team discussions the management struggles to communicate why they have to growth at a certain KPI. Here the tool can really help, by providing external evidence. […] Static but in the same direction, the SaaS Napkin of Point Nine [an early-stage investor] also addresses this need.

Interviewer: How much would you agree with the following statement?

The venture life cycle approach with few essential differentiation factors, built on investor portfolio data, is suitable to calculate the benchmarks.	3.5

Expert G: The tool will play an important role, only after a certain threshold is reached. The data from one VC will not be sufficient. But the beta version, or the prototype is already very exciting and provides a first peek of what could be. […] You should label the prototype version accordingly […] [and] further develop the tool.

Interviewer: How many ventures are needed to build resilient benchmarks?

Expert G: This is tough to estimate, you have to ask a statistic expert for this. You need to incorporate the sample size and the variance. Alternatively, you ask someone from the field of medicine, someone who investigates causal relations within the human body. Actually, your case [of a venture with a benchmark report] is quite similar to the case of a human with his or her patient files. Both cases are complex, in both cases there are many hidden variables.

Interviewer: How much would you agree with the following statement?

The design choices and the conception of the artifact suit general requirements of entrepreneurs.	5.0

Expert G: Absolutely, the way how you think about the data and the idea is really good. The relevant differentiation factors should evolve from practice – so basically […] you did that, and the presented factors are certainly among the most relevant factors. I especially like how you incorporate besides the current benchmarks the benchmarks for future valuation events.

Interviewer: How much would you agree with the following statement?

The comprehensiveness of the artifact suits general requirements of entrepreneurs.	2.0

Expert G: The quick tool that you presented will not survive in the long run. It has to growth with new data, and from learnings of other investors and startups. For instance, which additional factors you should consider, which KPIs you should incorporate.

Interviewer: What do you think, which additional KPIs, factors, should be included to lift the tool from a quick tool to a proper solution?

Expert G: This answer will emerge with your growing sample. I think that the larger this gets the easier it gets too. Especially in combination with a venture reporting. Therefore, I think the currently included KPIs are a good choice, you have valuations, revenues, cash, growth figures.

Interviewer: What do you think about the willingness of startups to pay for such a solution?

Expert G: The framing is relevant, if you would ask ventures directly whether they would pay for the app, then they will most likely say no. Ventures are an unattractive customer group anyways, as they never have much money left. Therefore, […] the benchmarks are very interesting for investors and potential investors. I think of both tools [the Investor Relation Tool and the Startup Benchmark Tool] as one. Let the ventures use the tools, let the VCs pay for the tool and try to become the market standard – positioned as a third-party service provider such as DATEV, or SAP.

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List of publications, articles, and practice tools

Research papers

Wolff, Y., Hess, M., Grichnik, D., Wincent, J. (2021). Looking behind closed Doors at Venture Capital Investments.

Preparing the submission to the MIT Sloan Management Review.

Wolff, Y., Hess, M., Grichnik, D., Wincent, J. (2021). An Agency Framework on Venture Selection in VC Funding Decisions.

Accepted at the 2021 BCERC.

Submitted to the 2021 Academy of Management.

Preparing the submission to the Journal of Business Venturing.

Wolff, Y. (2021). Venture Performance Indicators: Two Artifacts towards enhanced Transparency in the Venture Capital Industry.

Published as a working paper on www.alexandria.unisg.ch.

Tools

Wolff, Y. (2021). Startup Benchmark Tool.

Published as online tool on benchmark.stgaller-navigator.com.

Wolff, Y. (2021). Investor Reporting Tool.

Instantiated as a proprietary reporting solution – not published.

Curriculum Vitae: Yaro Wolff

Academics / Education

09/2018 – Present   **University of St. Gallen** – *St. Gallen, Switzerland*
- PhD Student at the Chair of Entrepreneurship
- Focus: Investment Decision-Making and Venture Performance Indicators in the Venture Capital Industry

10/2013 – 04/2016   **Goethe-University** - *Frankfurt Main, Germany*
- Master of Science in Management with focus on Finance & Accounting
- Final GPA: **1.2** (Student of the Dean's List)

10/2009 - 04/2013   **European-University Viadrina** - *Frankfurt (Oder), Germany*
- Bachelor of Science in International Business Administration
- Final GPA: **1.1** (Passed with Distinction)

08/2011 - 12/2011   **Copenhagen Business School** - *Copenhagen, Denmark*
- ERASMUS Exchange Semester: Financial Markets related curriculum

08/2007 - 09/2009   **Deutsche Bank** - Private & Business Clients - Apprenticeship - *Frankfurt Main, Germany*
- Counseled and advised clients about investments and financing options
- (CCI) Grade: **1** (First Honors)

Professional Experience

07/2016 - Present   **McKinsey & Company** – Management Consulting - *Frankfurt Main, Germany*
- Conducted in-depth studies in the functions of Operations, Marketing and Sales, Strategy and Corporate Finance for large international clients in the industries of Chemicals, and Automotive
- Larger tasks during study work included in particular:
  - Build extensive data cubes for spend optimization programs incl. buildup of program tracking tools
  - Optimized sales departments across multiple dimensions (i.e., coverage model, discount grids, etc.)
  - Conducted intrinsic and relative financial valuation and company analysis
  - Contributed to the evaluation of strategic growth-options for international clients

01/2015 - 04/2015   **Goldman Sachs** – Securities Division - *Frankfurt Main, Germany*
- Prepared research, newsletters, marketing materials, market updates and in-depth market- and company analysis for clients on behalf of my colleagues
- Identified potential investment ideas for asset managers and introduced them to the sales force

10/2014 - 12/2014   **Blackstone** – Blackstone Advisory Partners (M&A and Restructuring) - *Frankfurt Main, Germany*
- Prepared business development materials, company profiles and market analysis
- Screened potential acquisition and divestiture targets for buy- and sell-side transactions
- Conducted intrinsic and relative financial valuation and company analysis

08/2014 - 10/2014   **Deutsche Bank** – Group Strategy (Corporate Strategy and M&A) - *Frankfurt Main, Germany*
- Supported in strategic analysis and guidance for Deutsche Bank Group's senior management
- Analyzed strategic options for Deutsche Bank in a changing regulatory environment
- Participated in the process of (potential) acquisitions and disposals for Deutsche Bank

05/2013 - 07/2013   **Rothschild** – Global Financial Advisory (M&A) - *Frankfurt Main, Germany*
- Prepared in depth market- and company analysis as well as thorough market research - especially for companies in the logistics, construction & engineering, PPP as well as oil & gas industry
- Prepared financial models and presentations, including adjustments of financials and company profiles of potential buyers and targets for pending deals or pitch books

07/2012 - 10/2012   **Deutsche Bank** – Corporate and Investment Bank (Equity Research) - *Frankfurt Main, Germany*
- Was tasked with an initiation of coverage for a tech company with focus on IT services; this entailed in depth market- and company analysis, an elaborate peer group evaluation as well as the ultimately construction of a financial model, backed by an extensive research report

Extra-Curricular Activities

Awards

- "Student of the Dean's List" – since 2014
- "Bachelor of Science – Passed with Distinction" in 2013
- "Deutschland Stipendium" (Germany's National Scholarship) in 2011/2012, 2013/2014 and 2014/2015
- "Apprentice of Distinction" in 2009 (awarded by the German Chamber of Commerce and Industry)

Skills and Interests

Language Skills:
- German (native speaker), English (fluent)

IT Skills:
- Advanced Microsoft Office user; basic Stata, Bloomberg, and Datastream knowledge