How management accounting can be helpful for startup companies

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1 Introduction

The introduction to this dissertation serves two purposes. One purpose is to show our research motivation. The other purpose is to present the structure of this work, including a short description of each chapter, which will provide orientation to the reader. We start with our research motivation.

1.1 Research motivation

In this dissertation, we investigate the central question: *How can management accounting be helpful for startup companies*? Prior research has found some evidence that startups can benefit from adopting methods of management accounting. Most of these studies have looked at either accounting-based control activities (Davila & Foster, 2007; Davila & Oyon, 2009; Granlund & Taipaleenmäki, 2005; Sandino, 2007) financial accounting practices (Brinckmann, Salomo, & Gemuenden, 2011; Cassar, 2009), or business planning in young companies (Brinckmann, Grichnik, & Kapsa, 2010; Brinckmann & Kim, 2015; Delmar & Shane, 2003; Greene & Hopp, 2017). However, the literature remains unclear about how exactly management accounting can support startups and which instruments are suitable for this context.

Moreover, apart from academic literature, we find many other sources that point to the relevance of management accounting in startups. Regarding practical guidebooks, the well-known *Lean Startup* by Ries (2011) mentions that startups require a flexible and specific form of accounting which helps them to make decisions and keep track of business in the dynamic and fast-changing startup environment. Going one step further, Croll and Yoskovitz (2013) dedicate an entire book to how startups can benefit from introducing specific forms of performance measurement.

Other studies, backed by political institutions or the private sector, also refer to the importance of management accounting in startups. Recently, a major representative study among the German startup population (*Deutscher Startup Monitor 2017*) has placed emphasis on the use of key performance indicators (KPIs) in startups (Kollmann, Stöckmann, Hensellek, & Kensbock, 2017). The study points out that startups should adopt a management accounting system as early as possible, which is able to capture their specific characteristics and innovativeness (p. 42). Another study[1] investigating reasons for startup failure reports that 32% of startup fail because of insufficient knowledge on management accounting (p. 51). This is the fourth most common cause for failure overall.

Furthermore, we observe from our own research that some startups perceive management accounting as helpful for their business. This insight results from various activities which we conducted with startups. We interacted with founders at startup networking events. We directly interviewed founders. We also conducted small case studies in different startups with focus on

[1] Egeln, Falk, Heger, Höwer and Metzger (2010). Ursachen für das Scheitern junger Unternehmen in den ersten fünf Jahren ihres Bestehens. Bundesministerium für Wirtschaft und Technologie. http://www.zew.de/de/publikationen/ursachen-fuer-das-scheitern-junger-unternehmen-in-den-ersten-fuenf-jahren-ihres-bestehens/?cHash=7d3a3eeb9bc7b091c41a8606dcb28beb

management accounting. Similar to what we have seen in practical-oriented publications, we conclude from our interaction with founders that management accounting can be helpful and important for startups.

However, as current research can only partly explain the pivotal role of management accounting in startup companies, we found a clear gap in the literature. Hence, our research motivation in this dissertation is to reduce the gap in current knowledge. To do so, we contribute three research projects which look at management accounting in startups from different perspectives: a literature review, a case study, and a survey-based study. As a whole, the dissertation contributes a more nuanced understanding of how management accounting can be helpful for startup companies. We next turn to the structure of the dissertation and introduce the main chapters.

1.2 Structure

The dissertation is organized into five chapters as shown in Figure 1. We now present a short overview of chapter 2, 3, and 4 as these reflect the three research projects, which contribute to current knowledge.

The second chapter of this work is a systematic literature review on management accounting in startup companies. Approaching the topic as a managerial paradox, we investigate how management accounting, commonly seen as a set of *formal* and *static* practices to organize and control large established companies, can be helpful in a dynamic and unstructured startup environment. The literature review comprises 69 empirical papers in 27 leading journals in management accounting and entrepreneurship, which we analyze for theoretical constructs related to management accounting in startups. Based on this analysis, we conduct a two-step coding process to categorize the constructs into either different types of management accounting, their antecedents, or their consequences.

When it comes to management accounting in startups, we find that literature is concentrated on accounting-based management control activities and business planning. The review provides a structured overview of what can lead to management accounting in startups (antecedents) and what can be the outcome of using management accounting (consequences). Moreover, it makes clear that literature lacks a deeper understanding of what management accounting really does in startups and how it can help. As mentioned above, we also see that startup-specific performance measurement is hardly investigated in the literature. The literature

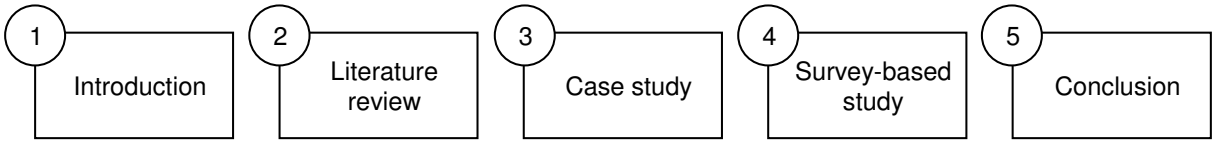

Figure 1. Five chapters constitute the dissertation

review emphasizes that management accounting is an under-researched area and offers suggestions to reduce this gap in future research.

The third chapter is a descriptive case study, in which we investigate the significance of management accounting for startups in a corporate context. The case study happens in an interesting corporate incubation program, which allows employees of a large corporation to launch new businesses and act as entrepreneurs within the corporation. We choose the research method of a descriptive case study since the research setting was special and current literature on this type of cooperation between large, established companies and startups is scarce.

The case study focuses on how exchanging management accounting information can facilitate the cooperation between startups, managers, and boards members of the incubation program. This focus is worthwhile because literature remains unclear about how exactly the exchange of management accounting information works in a corporate incubation program and how it can be beneficial for the parties involved.

We conducted the case study at the recently established Bosch startup platform (BOSP) and obtained the following insights. The exchange of management accounting information helps the corporate company to assess how well the startups progress. Also, the information is used to decide on the investment budget for the next time period. The startups also benefit as they can present their achievements, state their level of maturity, and address their resources needs towards the corporate company based on management accounting information. Overall, the case study contributes a more detailed understanding to the literature of how management accounting can be helpful in the startup context.

The fourth chapter is a survey-based study, in which we research how specific performance measurement helps startup companies to attract key resources. The study tackles the gap in literature initially identified. We start by drawing on two prominent resource theories, the resource-based view and resource dependence theory, to establish the connection between a startup's ability to attract important resources and its performance in terms of growth and market success. Based on our preliminary research activities with startups, we then develop a theoretical model which captures how *startup-specific performance measurement* can lead to the *attraction of key resources*. The model consists of 7 theoretical constructs and 8 hypotheses. The main part of the model contains the three central constructs *startup-specific performance measurement, information-based communication,* and *attraction of key resources*. The left part of the model consists of four antecedents: *perceived environmental hostility, use of web analytic tools, managerial experience of founders,* and *presence of external investment*. To test the hypotheses, we conduct a survey among young, technology-oriented companies in Germany. We create a unique startup database and design a professional survey to achieve a high response. We obtain 223 answers (37.5% useable response rate) and use structural equation modeling to analyze the data.

Our results show that startups who use specific performance measurement are able to quantify business activities, communicate on a factual, information-based level with co-founders and external partners, and benefit when it comes to the attraction key resources. Given the pivotal role of the attraction of resources for startups, our results suggest that management accounting, and specific performance measurement in detail, should be considered as a new antecedent of resource attraction in the literature.

2 Can management accounting be helpful for startup companies? The systematic review of a paradox

Abstract

This study reviews the paradox of why management accounting (MA), generally seen as a set of static and formal practices to organize and control large established companies, can be helpful in a dynamic and unstructured startup environment. The study reviews current knowledge on MA in startup companies, highlights similarities and gaps in the literature, and provides implications for future research and theory development. While MA implies potential benefits for large established companies, studies have rarely addressed its role in young and small startups. The purpose of this review is to understand the paradox and provide a structured overview of existing knowledge. A systematic literature search yielded 69 empirical papers in 27 journals. Drawing on the results of a transparent two-step coding process, this study proposes 20 novel second-level constructs around the types of MA, their antecedents, and their consequences to provide a more nuanced and broader conceptualization of MA in startups. The main results show that in discussing MA, the literature mainly refers to business planning, accounting-based management control activities, and financial accounting. MA can be of value for startups because it provides tools to overcome difficulties arising from company growth and to reduce the information gap with external partners. Moreover, the quality of definitions that describe theoretical constructs seems weak. As the empirical literature on this topic is very concentrated, indicates a poor quality of theoretical construct definitions, and lacks a clear understanding of what MA really does in startups, future research and theory development are warranted.

2.1 Introduction

Management accounting (MA) is commonly seen as a set of different practices which support managers of large and established companies to make decisions, plan, organize, and control (Chapman, Hopwood, & Shields, 2007, p. ix). Startup companies are typically perceived as the opposite of large, established organizations. They are often portrayed as *dynamic, unstructured*, or even *chaotic* organizations characterized by fast decision making and striving for high growth. Consequently, the rather *static* and *formal* methods of MA are usually not associated with *dynamic* and *unstructured* startups. Also, MA seems to not be among the most urgent matters for entrepreneurs when it comes to manage and grow their startup (Davila, Foster, & Jia, 2010).

Management accounting is fundamental to large, established companies because it helps to handle the complexity of these huge organizations. Large, established companies can consist of numerous interdependent business units, departments, and production sites which might be spread over different regions or countries. They can occupy thousands of employees and hundreds of middle and top managers. Moreover, they can offer a very diverse product portfolio with a broad range of different products and product variations. As an example, think of an automotive company headquartered in Europe that delivers dozens of different car models around the globe. Each car model offers countless alternatives for individual configuration to the customer, such as the choice of engine, transmission, color, interior, and equipment. The production plants are strategically located in different countries within and outside of the European Union and aim to ship their products to customers in America, Europe, and Asia. It is obvious that an organization of this dimension needs viable practices and methods to handle the complexity and to manage employees, products, and processes. To sum up, many things need to be coordinated. This is where MA comes into play.

Management accounting plays two key roles when it comes to coordinate large and established organizations: (1) facilitating decisions, and (2) influencing decisions (van Veen-Dirks, 2010, p. 143). The *first role* is essential to provide managers with information which helps them to make decisions (Burns & Scapens, 2000, p. 4). Due to the high degree of division of tasks, managers of departments or business units can hardly overlook everything what happens in their area of responsibility. Different research projects take place at the same time, a large number of sales representatives markets various products to customers, or an enormous production line manufactures hundreds of product batches per day. Management accounting methods capture information about various activities and aggregate it on department level or business unit level. Thus, management accounting enables managers in different areas to take informed decisions based on relevant facts. For example, performance measurement as a sub-discipline of MA is concerned with measuring the activities within an organization and reporting to decision makers (van Veen-Dirks, 2010).

This first role of MA does not appear to be particularly relevant for startup companies. Startups do not have a huge number of employees. They typically consists of an individual or team of founders and, depending on the stage of development, a small number of employees. Startups are not divided into business units or departments. Founders and employees are typically sitting together in the same working environment, they see what coworkers do, and hear each other's conversations and phone calls. Moreover, the managers of startups – being the founders in most

cases – do not have to overlook dozens of parallel product development projects or coordinate the manufacturing of a large number of different products.

The *second role* of MA is important for managers to guide the behavior of people in the hierarchy of a large, established organization. As just mentioned, MA is used to measure the performance of organizations. Based on this measurement, MA is then used to create incentives which make people do what the management expects them to do. MA helps managers to build huge and complicated systems of key performance indicators (KPIs) to motivate or put pressure on thousands of employees on all hierarchical levels in order to achieve organizational goals. It allows managers to evaluate the activities and examine the goal achievement within their area of responsibility (Bisbe & Otley, 2004; M. Wouters & Wilderom, 2008). Budgeting systems are a prominent example for the second role of MA. The purpose of budgeting systems can be seen in planning, managing performance, and incentivizing (Merchant, 1981). Budgets help managers to break down long-term, strategic plans into short-term goals, to allocate financial and human resources, and regulate how much can be expensed. Thus, budgets set the guidelines for employees. Moreover, managers can monitor actual achievements, compare them to the goals, and decide about rewards and bonuses. Thus, budgets are a worthwhile tool to create incentives and encourage an expected behavior.

This second role of MA also does not seem very relevant for startup companies either. Startups do not use elaborated budgeting systems to communicate their organizational goals. Founders and employees work on the same topics, communicate directly, shout at each other, and chat about the progress of a task over a cup of coffee. Startups do not need complicated KPI systems to incentivize their employees. Founders can motivate their coworkers with inspiring conversations, being part of an innovative business, and monetary rewards for successful results. They can put pressure on their employees by talking face to face or by stop employing them.

Taken together, management accounting seems to be not relevant for startup companies. It consists of *formal* and *static* practices which enable managers to handle the high degree of complexity in large, established companies. In *dynamic*, *unstructured*, or even *chaotic* startups, the settings that make MA vital for large organizations do not occur. Also, several studies in the literature supports this point of view. Some authors argue that detailed planning in startups should be neglected as the costs exceed the benefits (Bhidé, 2000, p. 53; Gumpert, 2003; Honig & Karlsson, 2004; Honig & Samuelsson, 2014; Sarasvathy, 2001, p. 254). Other authors find that long-term financial planning or budgeting are perceived by founders as 'frequently nonsensical' (Granlund & Taipaleenmäki, 2005, p. 35). So, MA is not important for startup companies.

However, there is also literature that shows the opposite. Some studies find that adopting management accounting methods is valuable for entrepreneurs or important for startup growth (Davila & Foster, 2007; Davila et al., 2010). Other studies find that planning yields benefits for entrepreneurs (Delmar, 2015; Delmar & Shane, 2003; Greene & Hopp, 2017). This seems surprising, contradicting, and paradoxical. When it makes no sense to use formal and static methods in young and small companies, how can it be that MA is valuable for startups? What makes MA useful in an organizational setting in which you would not expect it to be useful? Obviously, literature points out a management paradox with *'contradictory yet interrelated elements'* (Lewis, 2000, p. 760).

The purpose of this review is to understand the paradox and provide a structured overview of existing knowledge. While both elements of the paradox, management accounting and startup

companies, attract strong interest from researchers, the intersection of the two fields appears to have been rarely considered, with the result that the use of MA in startup companies is an under-researched area.

The paradox of MA in startup companies has to our knowledge not been addressed in the literature. As exploring a management paradox can provide new opportunities for theory building and empirical research (Shepherd & Suddaby, 2016, p. 3), it is important to review the current knowledge and clarify the role of MA in the startup context. This study complements other reviews in the broader field of management accounting in small and medium-sized enterprises (SMEs). For instance, Lavia López and Hiebl (2015) recently identified five key themes of MA in SMEs (company size, environmental issues, sectoral issues, organizational factors, and the adoption of new management accounting techniques) but offer no explanation for the startup environment. Another review hypothesizes that performance measurement provides guidance and orientation for managers in volatile and dynamic environments. However, the study does not explore the startup context, even though entrepreneurs can be considered to be managers operating under these turbulent conditions (Melnyk, Bititci, Platts, Tobias, & Andersen, 2014). Ireland and Webb (2007) review entrepreneurship from a management perspective and argue that 'significant research opportunities remain for scholars' at the intersection of accounting and entrepreneurship (Duane Ireland & Webb, 2007, p. 898). However, due to the explorative nature of the study, little details or structured knowledge is provided.

The neighboring literature underlines that research on the paradox of MA in startup companies is under-developed. For this reason, we aim to explore the paradox, summarize existing knowledge, and advance the understanding of the topic. Three research questions arise:

1. What leads to management accounting in startup companies (antecedents)?
2. What are the outcomes (consequences) of using management accounting in startups?
3. What makes management accounting useful in young and small organizations, in which you would not expect it to be useful?

To answer these questions, we conducted a systematic literature review of 69 empirical papers in 27 journals. Using a two-step coding process, we organized our results and established 20 novel second-level constructs for MA in startup companies. On this level, we were able to generate new insights and point out gaps in the literature.

Our review results in four main findings: (1) Regarding the management paradox, management accounting can be helpful for startups because it supports founders with tools to handle the managerial challenges associated with company growth. Also, management accounting serves as a tool to reduce the information gap between the startup and external partners, such as investors. (2) When talking about MA in startups, the literature is focused on business planning, accounting-based management control activities, and financial accounting. Startup-specific performance measurement is hardly investigated. While three antecedents for adopting PMM are most commonly researched (organizational characteristics, professional characteristics of founders, and presence of external investment), most studies refer to the consequences in terms of performance. (3) The literature lacks a clear understanding of the role planning and performance measurement actually play in startups. (4) Qualitative research on this topic is absent.

We contribute to the literature by providing a broader and more nuanced conceptualization of MA in young and small companies. We contribute to the understanding of a management paradox by tying together dispersed findings and synthesizing arguments in the literature. We

present 20 novel constructs for types of MA and its antecedents and consequences by critically reviewing and organizing results based on a clear research framework. The outcome is an enhanced understanding of MA in startups, a more comprehensive overview, and a disclosure of similarities and gaps in the literature. These contributions not only are useful for researchers in our field but also supply a vital base for theory development in this under-researched field of MA.

The remainder of this paper is organized as follows. In the next section, we describe the research method applied to answer the three research questions. We then present our findings, along with definitions of the novel 20 second-level constructs. In the last section, we discuss our findings and suggest implications for future research.

2.2 Method

To extract the literature around MA in startups, we conducted a systematic literature review according to the principles outlined by Tranfield et al. (2003) and Briner and Denyer (2012). Consequently, our approach consisted of three steps: planning the review, conducting the review, and organizing the results. In this section, we describe the research method in detail.

2.2.1 Planning the review

In the first step, we defined our research objective: to provide a systematic overview of the role of management accounting in startup companies in order to advance the understanding of this topic.

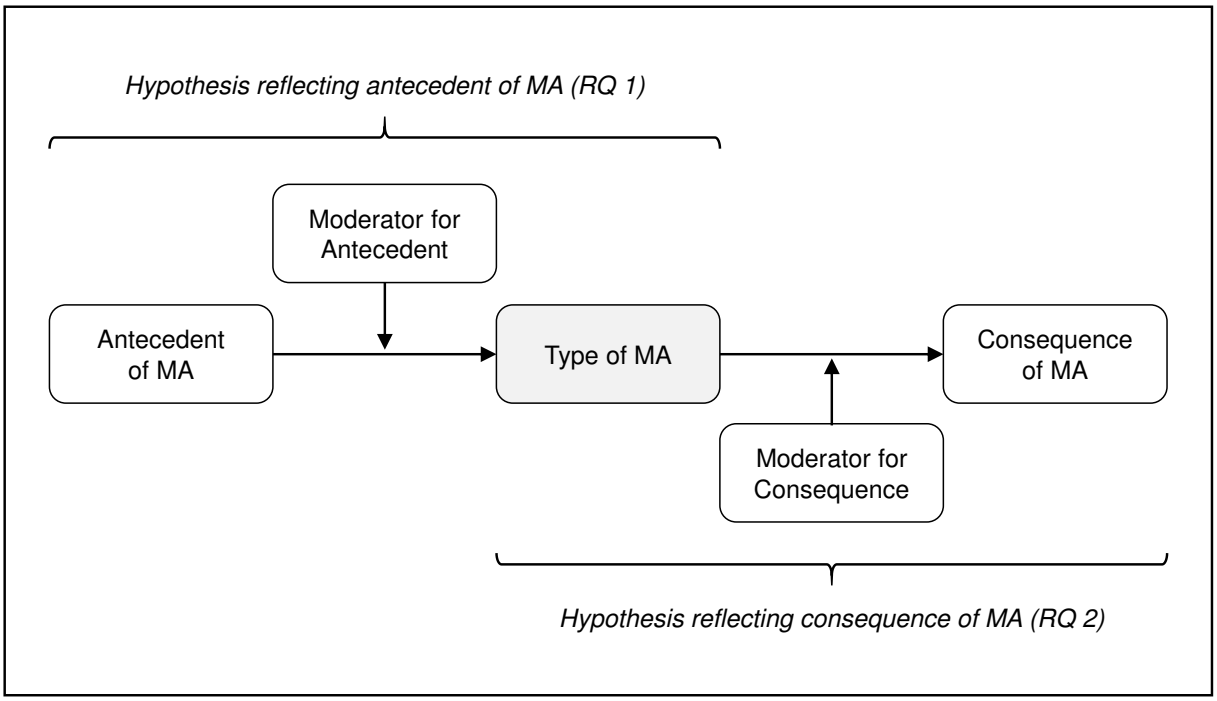

Figure 2. Framework for classifying hypotheses and theoretical constructs used in literature to answer the research questions (RQ)

To attain this goal we created a research framework (Figure 2), which illustrates the classification for hypotheses used in the literature and highlights the three research questions guiding this review: (1) What leads to management accounting in startup companies (antecedents)? (2) What are the outcomes (consequences) of using management accounting in startups? (3) What makes management accounting useful in young and small organizations in which you would not expect it to be useful?

It is necessary to clarify the terms *entrepreneurship* and *startup* as they are used frequently but vaguely. In line with other research, we understand *entrepreneurship* as management and ownership of new businesses (Unger, Rauch, Frese, & Rosenbusch, 2011, p. 346). Accordingly, we see an *entrepreneur* as a founder, owner, and manager of a startup company. By a *startup company* we understand a young, small, and independent organization which aims to market an innovative product or service, often following recent technological developments, and which aims to grow fast. Hence, our understanding is in line with numerous scholarly publications, focusing on fast-growing, innovative, young companies.

2.2.2 Conducting the review

In the second step, we employed a total of 21 search terms in a literature search in **25** leading academic journals. This initial search in the Scopus database yielded **785** publications, of which **20** were relevant to our topic. An extensive backward and forward citation analysis led to a final count of **69** empirical studies in **27** journals that deal with MA in young and small companies. Of these studies, **60** used quantitative research methods and **9** applied qualitative methods.

We limited the search to 11 journals in management accounting (10 journals listed by Hesford et al. (2006), plus the *European Accounting Review*) and 14 journals in entrepreneurship (11 journals listed by Dos Santos et al. (2011) and selected on the basis of the journal's rating by the German Academic Association for Business Research (2017), plus *Research Policy*, *Strategic Entrepreneurship Journal*, and *Small Business Economics*). We conducted the initial search in the Scopus database because it covered a wide range of journals and citation analysis and was found to be effective in literature search (Falagas, Pitsouni, Malietzis, & Pappas, 2008). Moreover, we found Scopus to be efficient as it allowed the direct export of the search results into a spreadsheet which was worthwhile to identify and organize relevant papers among the large number of initial search results.

To identify relevant publications at the intersection of both literatures, we searched the MA literature for startup-related search terms and then, vice versa, searched the entrepreneurship literature for accounting-related search terms. In the MA literature we used 10 startup-related search terms ('entrepreneurial', 'entrepreneurship', 'new venture*', 'small business*', 'small compan*', 'small firm*', 'startup*', 'start-up*', 'young compan*', 'young firm*'). Then, we scanned the entrepreneurship literature with 15 accounting-related search terms ('activity based cost*', 'activity based manage*', 'budget*', 'cash flow forecast', 'cost account*', 'cost manage*', 'financial control*', 'financial plan*', 'financial statement*', 'management account*', 'management control*', 'managerial account*', 'performance evalua*', 'performance manage*', 'performance measure*'). The asterisk (*) replaced multiple characters in the search; for example, 'budget*' comprised the terms *budget*, *budgets*, or *budgeting*. The selection of the startup-related search terms aimed to capture the term *startup company* and its synonyms. The accounting-related search terms were informed by

Lavia López and Hiebl (2015) and completed with additional terms which we found not sufficiently represented in their study.

We defined the following boundaries to include or exclude search results in this review. The search covered papers published up to September 2017. A paper had to be related to the research topic and published in a peer-reviewed journal (conference and working papers were therefore excluded). We included only papers using an empirical research method to investigate samples of young or small companies, or startups in particular. Most papers (84%) were excluded because they used a search term in another context. For example, "budget" yielded 113 papers referring to irrelevant topics (such as R&D budget, budget constraints in established companies, budgets for brand management, or budgets in new product development). Other excluded papers contained a search term that was separated by comma or full stop and therefore were not relevant (8%), were theoretical or mathematical (6%), or predated 1985 (2%).

For the 20 relevant studies, we analyzed the references (backward citation analysis) and used Google Scholar to identify more recent publications citing a paper (forward citation analysis). We applied the same procedure for new relevant papers and stopped after three iterations as the search results were stable. Through this search process, we obtained the final set of 69 relevant papers distributed over 27 journals (Table 1).

2.2.3 Organizing the results

In the third step, we identified hypotheses related to MA in young and small companies and conducted a two-level coding process to synthesize the knowledge according to our framework (Figure 2). In the first-level coding, we created an extensive database to capture all hypotheses. We categorized whether a hypothesis explored the relationship of an antecedent (reflecting the first research question) or a consequence (reflecting the second research question) and MA. We also dissected each hypothesis into its theoretical constructs (two theoretical constructs, one for the type of MA and one for either the antecedent or consequence; some hypotheses were also moderated by a third construct).

Altogether, we identified 203 hypotheses of which 97 captured antecedents and 106 consequences of MA. We further analyzed for each hypothesis whether the paper found empirical support. For each hypothesis, we noted whether the paper reported a statistically significant effect (*significant*) or not (*not significant*). For few hypotheses, the statistical result indicated a significant effect opposing to the expected direction (*opposing*). Moreover, we paid special attention to how clearly the theoretical constructs were defined in the papers. We assessed the quality of a definition according to five categories:

- *Defined from paper*: quote from the paper, theoretical construct explicitly defined
- *Inferred from paper*: quote from the paper, from which the theoretical construct definition could be inferred despite not being explicitly denoted
- *Equals measurement item*: quote from the paper, which consists of one or several survey items used in questionnaire, because no text in the paper itself (implicitly) defined the construct at a theoretical level
- *Reconstructed*: definition formulated by us as authors, because a theoretical construct definition could only be formed on the basis of information in the paper

- *Not defined*: definition not provided in this review paper, the construct's theoretical meaning remained too implicit

In the second-level coding, we arranged the previously identified and classified theoretical constructs into 20 novel second-level constructs that portray the existing knowledge. The purpose of the second coding step was to establish meaningful categories that tie together dispersed findings in the field. In a dynamic process, we subsumed those theoretical constructs that were apparently similar into categories. We evaluated each construct based on its definition and measurement items

Table 1. 27 journals yielded by the final search of 69 relevant publications

Journal title	Publication count	Journal rating (VHB)
Journal of Small Business Management	12	B
Journal of Business Venturing	6	A
Small Business Economics	6	B
Management Accounting Research	5	A+
The Accounting Review	5	A+
Accounting, Organizations and Society	4	A
Strategic Management Journal	4	A
Entrepreneurship: Theory and Practice	3	A
Contemporary Accounting Research	2	A
European Accounting Review	2	A
Journal of Management Studies	2	A
Long Range Planning	2	B
Strategic Entrepreneurship Journal	2	A
Accounting Perspectives	1	C
Advances in Accounting	1	C
Entrepreneurship and Regional Development	1	B
International Journal of Entrepreneurial Behavior & Research	1	C
International Journal of Entrepreneurship and Small Business	1	C
International Small Business Journal	1	C
Journal of Accounting & Organizational Change	1	B
Journal of Accounting and Economics	1	A+
Journal of Management	1	A
Omega	1	B
Qualitative Research in Accounting & Management	1	B
Research Policy	1	A
Technovation	1	C
Venture Capital	1	C
Total	69	

captured in our database. When constructs talked about irreconcilable ideas or when categories became too broad, we created new ones or split up current ones. This process went hand in hand with refining definitions for the established categories.

Through this two-level coding process we could cover a large number of findings within a comprehensive overview of what has been researched and tested. In this way we could talk about the adoption and consequences of MA on completely new level. In the last step, we connected the qualitative and quantitative research by linking the main findings of the case studies to our second-level constructs capturing the different types of MA. We consider this step to be important, as case studies can reveal interesting insights and contribute inspiring findings where quantitative papers fail to provide details. The distribution of all 69 relevant papers over the 27 relevant journals is given in Table 1.

2.3 Results

Overall, our review reveals that the literature on management accounting in young and small companies focuses on a few topics. According to our framework, we present the results in the following sequence: (1) descriptive statistics, (2) second-level constructs for MA in startups, (3) antecedents of MA, (4) consequences of MA, and (5) arguments explaining what makes MA useful in young and small organizations. This section concentrates on reporting the results, whereas the following section on discussion provides a constructively critical analysis of our findings. A complete list of the 69 relevant publications is provided in Appendix A.

2.3.1 Descriptive statistics

The results are dominated by five journals: the *Journal of Small Business Management*, the *Journal of Business Venturing*, the *Small Business Economics*, the *Management Accounting Research*, and *The Accounting Review*. These five journals published nearly half of all studies (48.5 %). The years of publication (Figure 3) can roughly be divided into two sections: 1988–2003 and 2004–2017. The first grouping

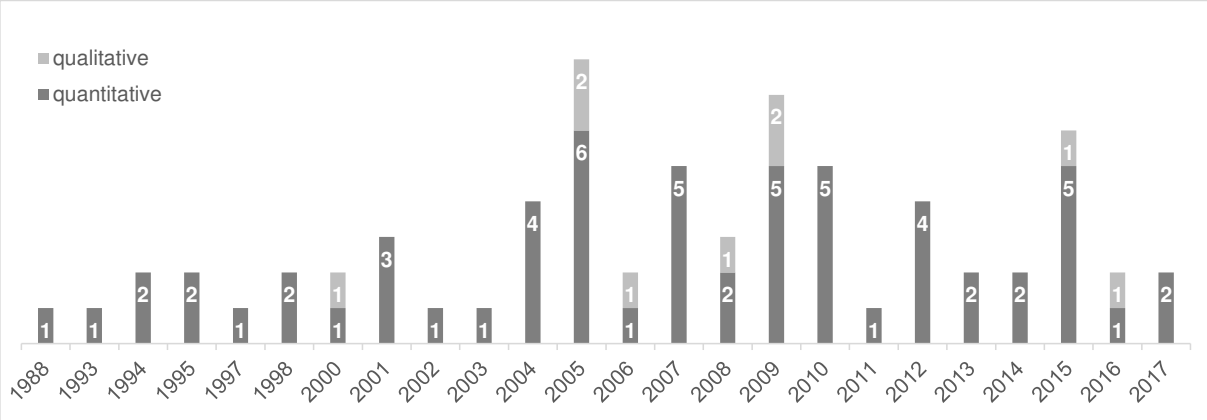

Figure 3. Distribution of 69 relevant studies by year of publication

Table 2. The research methods used by the 69 studies

Research method	Publications	Percentage
Empirical: qualitative, case study	9	13.0%
Empirical: quantitative, archival	5	7.2%
Empirical: quantitative, meta-analysis	3	4.3%
Empirical: quantitative, survey	32	46.4%
Empirical: quantitative, survey & archival	2	2.9%
Empirical: quantitative, survey & field-study	3	4.3%
Empirical: quantitative, survey, secondary	15	21.7%
Total	69	

shows not more than two publications per year, with the exception of three publications in 2001. The second grouping contains most of the publications, with a maximum of eight studies in 2005, followed by seven studies in 2009 and six studies in 2015.

In terms of regional distribution, most studies investigated company samples in the United States (31.6%), followed by Sweden (10.5%), Australia (8.8%), and Germany (8.8%). A further 7.0% of the studies contained samples covering more than one country. All other studies focused on samples in a single country.

Among the studies examined, qualitative research is sparse: less than 12% of the papers derived their findings through case studies on young and small companies. The research methods applied in most of the studies are obviously quantitative (Table 2). Two methods predominate: survey-based (47.1%) and survey-based with secondary data (22.1%). A prominent example for secondary data is the Panel Study of Entrepreneurial Dynamics (PSED) by the University of Michigan.[2] Six of 15 survey-based studies (Brinckmann & Kim, 2015; Cassar, 2009, 2010; Cassar & Ittner, 2009; Dimov, 2010; Greene & Hopp, 2017) used these secondary data on U.S. startups.

The examination of the construct definitions in the literature reveals a surprising result (Table 3). In quantitative studies, only 15% of the theoretical constructs constituting the 203 hypotheses are defined explicitly. The largest group of theoretical constructs utilizes survey items as definitions, with the result that no distinction is drawn between a theoretical construct's

Table 3. Type of construct definition for 203 hypotheses

Quality of construct definition	Percentage
Defined	15%
Equals measurement item	45%
Inferred	35%
Reconstructed	5%
Not defined	0%
	100%

[2] University of Michigan. (2017). *Panel Study of Entrepreneurial Dynamics*. Retrieved October 18, 2017, from http://www.psed.isr.umich.edu/psed/home

Table 4. Second-level constructs tie together similar types of MA as well as its antecedents, consequences, and moderators

Types of MA	Antecedents	Consequences	Moderators
Accounting-based management control activities	Environmental factors	Advancement of organization	Business planning
Business planning	Financial characteristics	Financial characteristics	Environmental factors
Freestyle management control activities	Non-financial relationships with external parties	Growth (performance)	Human resource management activities
Human resource management activities	Organizational characteristics	Performance (multiple measures)	Organizational characteristics
MA = FA	Personal characteristics of founders	Profitability (performance)	Presence of external investment
Management of liquidity	Presence of external investment	Subjective evaluation of performance	Strategic positioning
	Professional characteristics of founders	Survival (performance)	
	Strategic positioning		

definition and its items for operationalization. The second largest group of constructs does not provide an explicit definition (inferred).

2.3.2 Second level constructs for MA in startups

The main results of the present review emerge from examination of the 20 second-level constructs that classify the theoretical constructs used in 203 hypotheses in the literature. Each second-level construct captures similar MA practices (type of MA), antecedents, consequences, or moderators as shown in Table 4. The definitions for the 20 second-level constructs are provided in Table 5, whereby we show first the six constructs that refer to management accounting. We present these six constructs in more detail and point out the distinction from other constructs. Table 6 provides the distribution of hypotheses according to the different types of. The remaining constructs capture antecedents, consequences, or moderators. We refer to the definitions and omit a detailed explanation for the sake of the brevity.

Accounting-based management control activities. This construct refers to management control activities that follow well known accounting frameworks for either financial or management accounting. The decisive factor is that founders use common accounting techniques to facilitate or influence their internal decision making. They process information to better understand and manage the organization and follow exactly the same structures and rules that apply for large and established companies. Since in the early stages founders tend to handle the amount of information, the variety of tasks, and the number of employees with a personal and direct management style (Davila and Foster 2007), the adoption of management accounting and control is one stream of research in this field.

Table 5. Definitions of the 20 second-level constructs capturing management accounting in startups

Second-level construct	Definition of second-level construct
Accounting-based management control activities	Management control activities to facilitate or influence the startup's decision making that build on either financial or management accounting techniques. These techniques are part of well-known accounting frameworks and process information in order to better understand and manage the organization (such as annual reports, cash flow projections, product costing, or budgeting).
Business planning	Business planning is an activity that aims to enhance the future performance of the startup through the creation of formal plans and the reduction of uncertainty (Brinckmann & Kim, 2015).
Freestyle management control activities	Management control activities that are specifically developed by the startup to facilitate or influence decision making, such as the use of particular financial or non-financial key performance indicators. The startups deliberately decides which performance measures are introduced and which information used to manage business activities.
Human resource management activities	Activities related to improve the use or maximize the performance of human capital within the startup.
MA = FA	Management accounting is discussed in a way that is identical to what the startup does or would do as financial accounting. These constructs focus on the usage of financial information more than on their application to facilitate or influence decisions.
Management of liquidity	The management control activities are purely focused at cash flows, funding, or other short-term liquidity in order to maintain the solvency of the startup.
Advancement of organization	Activities to become better organized (responsibilities, tasks, processes, IT, etc.) in order to be more effective (for example, provide new or better products or services, or increase the number of customers).
Environmental factors	Factors related to cultural, economic, or industrial environment that affect the settings and markets the startup operates in.
Financial characteristics	Characteristics of the startup related to its internal financial structure as well as to its financial features (such as credit ratings, interest rates, or market valuation) determined by outside parties, apart from Presence of external investment.
Growth (performance)	Growth is one dimension of organizational performance which can occur in different areas of the startup, such as growth of employment, sales, or assets.
Non-financial relationships with external parties	Relationships between the startup and another external public or private organization or institution, apart from Presence of external investment.
Organizational characteristics	Internal characteristics of the startup, apart from Financial characteristics and Characteristics of founders (for example, related to resource availability, internal organizational structure, technology orientation, size, stage in life-cycle, or legal form).
Performance (multiple measures)	Economic success in two or more dimensions of organizational performance of the startup, such as different categories of growth or profitability.
Personal characteristics of founders	Human capital and characteristics of the startup's founders apart from Professional characteristics of founders.
Presence of external investment	The startup obtains financing (debt or equity) from external sources which can be combined with additional financial advice or expertise.
Professional characteristics of founders	Human capital in terms of work experience and education to help the founders to be better entrepreneurs.
Profitability (performance)	Profitability is one dimension of organizational performance of the startup related to obtaining profit or increasing margins.
Strategic positioning	The startup's positioning in order to obtain strategic objectives, such as low price strategies, growth and market entry strategies, or change in operations.
Subjective evaluation of performance	The current or future performance of the startup as well as the assessment of future business opportunities, perceived subjectively by the founders or an external party.
Survival (performance)	Survival is one dimension of organizational performance which implies that the founders do not stop the efforts to lead the startup to economic success.

Business planning. Some management accounting practices support managers to plan and organize. In the context of startups, planning is mostly referred to as either activities, outcomes, or the sophistication of planning. Activities can involve goal setting or the creation of plans. Outcomes refer to written planning documents produced by founders, such as business plans. Planning sophistication concerns the knowledge or ability of founders when it comes to the creation of plans. The key point about this construct is the engagement of founders in some kind of business planning in order to improve the performance of the startup.

Freestyle management control activities. Founders also use management control activities to facilitate or influence internal decision making. However, these activities extend beyond well-known accounting techniques and are specifically developed by the founders to reflect startup-specific business activities. We call these activities 'freestyle', because the founders deliberately decide which performance measures are introduced and which information is used to manage and control activities within the startup. These activities essentially follow the ideas and structures of financial and managerial accounting, but they differ from common accounting frameworks in several ways: (a) they are done at a more detailed level and can be more specific than common reports, (b) they are done more frequently than quarterly or yearly, as founders uses these freestyle management control activities regularly for decision making, (c) while well-known techniques often represent what has happened in an organization (ex post), freestyle activities are used to better manage and forecast future developments (ex ante), and (d) they can deviate from common accounting rules and structures.

Human resource management activities. These activities or practices are set in place by the founders in order to support or control the functioning of employees in a startup. The decisive factor is that the activities focus on how to influence or improve their behavior and performance of human resources within a young and small company.

MA = FA. Management accounting (MA) is discussed in a way that is identical to what the startup does or would do as financial accounting (FA). This construct focuses on the use of financial information for reporting to external parties, such as investors or suppliers, more than on the application to facilitate or influence decisions within the startup. While the two previously

Table 6. Distribution of MA-related hypotheses associated with either antecedents or consequences

	Number of hypotheses related to		
Type of MA	Antecedents	Consequences	Total
Business planning	38	55	93
Accounting-based management control activities	36	26	62
MA = FA	17	17	34
Human resource management activities	6	0	6
Freestyle management control activities	0	6	6
Management of liquidity	0	2	2
	97	106	203

mentioned constructs emphasize the use of information for startup-internal purposes, this construct captures the use of financial information for external demonstration.

Management of liquidity. To maintain solvency of the startup, management control activities are focused entirely on cash flows, funding, or other short-term liquidity. As the efficient management of financial resources is one of the biggest challenges to startups (Brinckmann *et al.* 2011), this construct refers to founders' activities solely aimed at handling the liquidity of the organization.

2.3.3 Antecedents of MA

Once the coding was completed, an analysis of the second-level constructs provided answers to our research questions. Bases on our coding, Table 7 provides an overview of hypotheses related to antecedents, Table 8 shows hypotheses related to consequences.

To answer the first research question, we inspect the 97 hypotheses of antecedents and MA that have been investigated in the literature. While four different types of MA have been investigated (accounting-based management control activities, business planning, human resource management activities, and MA = FA), two of them account together for 76%: (1) business planning (39%) and (2) accounting-based management control activities (37%), addressing common management control techniques. Together they outnumber the next two categories combined and are by far the most frequently addressed types of MA investigated with regard to antecedents in the literature. Financial accounting (18%) considers management accounting in the same way as financial accounting. Human resource management activities (6%) refer to practices to enhance the performance of employees.

The analysis revealed that three categories of antecedents are the largest group in terms of total count: (1) organizational characteristics (35%), which are related to the internal characteristics of a startup, apart from financial characteristics (Cassar, 2009; Davila & Foster, 2004, 2007; Davila, Foster, & Li, 2009; Gibson & Cassar, 2002; Greene & Hopp, 2017; King, Clarkson, & Wallace, 2010; Matthews & Scott, 1995; Mengel & Wouters, 2015; Moores & Yuen, 2001; Risseeuw & Masurel, 1994; Silvola, 2008b); (2) professional characteristics of founders (19%), which refer to the educational and work-related background of founders (Armstrong, Dávila, Foster, & Hand, 2007; Brinckmann & Kim, 2015; Cassar & Ittner, 2009; Davila & Foster, 2004; Davila et al., 2009; Gibson & Cassar, 2002; Greene & Hopp, 2017; Honig & Karlsson, 2004; Mengel & Wouters, 2015; Seghers, Manigart, & Vanacker, 2012); and (3) presence of external investment (12%), which capture whether the startup has received monetary support from outside investors, such as venture capitalists, business angels, or banks (Cassar, 2009; Davila, 2005; Davila & Foster, 2004, 2007; Silvola, 2008b; Wijbenga, Postma, & Stratling, 2007; Wongsunwai, 2013). Moderation is barely happening on the side of antecedents. Only one hypothesis researching the relationship between personal characteristics of founders and business planning is noticeably moderated by environmental factors (Rauch, Frese, & Sonnentag, 2000).

We now consider the empirical relationships between antecedents and types of MA. Of the 97 hypotheses tested 80% yield statistically significant empirical support (Table 7). Looking at the total number of hypotheses reveals the interesting finding that studies found empirical support for most of the hypotheses (80%) they investigated. Three categories of antecedents show significant empirical support in all hypotheses: non-financial relationships with external parties (100%),

personal characteristics of founders (100%), and strategic positioning (100%). The remaining categories show empirical support for most hypotheses explaining the adoption of MA in startup companies: financial characteristics (88%), presence of external investment (83%), environmental factors (80%), organizational characteristics (76%), and professional characteristics of founders (67%). As a side note, two studies found empirical relationship which were statistically significant but opposing the expected hypothesis (Mengel & Wouters, 2015; Wijbenga et al., 2007).

Table 7. 97 hypotheses investigate the relationship between different types of MA and antecedents

MA type	Antecedent	Number of hypotheses (significant)	References
Accounting-based management control activities	Environmental factors	2 (2)	King, Clarkson and Wallace (2010); Löfsten and Lindelöf (2005)
	Financial characteristics	2 (1)	Jänkälä and Silvola (2012)
	Non-financial relationships with external parties	2 (2)	Davila, Foster and Li (2009)
	Organizational characteristics	15 (11)	Davila and Foster (2005); Davila and Foster (2007); Davila, Foster and Li (2009); King, Clarkson and Wallace (2010); Moores and Yuen (2001); Silvola (2008b)
	Presence of external investment	6 (4)	Davila and Foster (2005); Davila and Foster (2007); Silvola (2008b); Wijbenga, Postma and Stratling (2007)
	Professional characteristics of founders	4 (3)	Davila and Foster (2005); Davila and Foster (2007); Davila, Foster and Li (2009);
	Strategic positioning	5 (5)	Davila, Foster and Li (2009); King, Clarkson and Wallace (2010); Löfsten and Lindelöf (2005); Sandino (2007)
Business planning	Environmental factors	7 (5)	Greene and Hopp (2017); Honig and Karlsson (2004); Matthews and Scott (1995); Peel and Bridge (1998); Risseeuw and Masurel (1994)
	Financial characteristics	2 (2)	Greene and Hopp (2017); Risseeuw and Masurel (1994)
	Non-financial relationships with external parties	1 (1)	Honig and Karlsson (2004)
	Organizational characteristics	13 (10)	Gibson and Cassar (2002); Greene and Hopp (2017); Matthews and

MA type	Antecedent	Number of hypotheses (significant)	References
			Scott (1995); Risseeuw and Masurel (1994); Silvola (2008b)
	Personal characteristics of founders	3 (3)	Brinckmann and Kim (2015); Rauch, Frese and Sonnentag (2000)*
	Presence of external investment	1 (1)	Silvola (2008b)
	Professional characteristics of founders	9 (5)	Brinckmann and Kim (2015); Gibson and Cassar (2002); Greene and Hopp (2017); Honig and Karlsson (2004)
	Strategic positioning	2 (2)	Gibson and Cassar (2002); Risseeuw and Masurel (1994)
Human resource management activities	Organizational characteristics	3 (3)	Davila (2005)
	Presence of external investment	3 (3)	Davila (2005); Wijbenga, Postma and Stratling (2007)
MA = FA	Environmental factors	1 (1)	Cassar (2009)
	Financial characteristics	4 (4)	Cassar and Ittner (2009); Van Caneghem and Van Campenhout (2012)
	Non-financial relationships with external parties	1 (1)	Cassar and Ittner (2009)
	Organizational characteristics	3 (2)	Cassar (2009); Mengel and Wouters (2015)
	Personal characteristics of founders	1 (1)	Seghers, Manigart and Vanacker (2012)
	Presence of external investment	2 (2)	Cassar (2009); Wongsunwai (2013)
	Professional characteristics of founders	5 (4)	Cassar and Ittner (2009); Mengel and Wouters (2015); Seghers, Manigart and Vanacker (2012)
Total		97 (78)	

2.3.4 Consequences of MA

To answer the second research question, we examined the 106 hypotheses on MA and its consequences found in the literature (Table 8). Five types of MA have been investigated (accounting-based management control activities, business planning, freestyle management control activities, MA = FA, management of liquidity). Again, the most frequently addressed type of MA

is business planning, accounting for more than half of all hypotheses (55%), followed by accounting-based management control activities (25%) and MA = FA (16%). Two types of MA have only been investigated in hypotheses with consequences: freestyle-management control activities (6%), which refer to practices specifically developed by the startup to facilitate or influence decision making; and management of liquidity (2%), which purely focuses at cash flows or other short-term liquidity in order to maintain the solvency of the startup.

The consequences focus mainly on company performance. The top three categories comprise 71% of hypotheses: (1) growth (performance) in terms of employees or sales (28%) (Berry, 1998; Bracker, Keats, & Pearson, 1988; Brinckmann et al., 2010; Brinckmann & Hoegl, 2011; Burke, Fraser, & Greene, 2010; Davila & Foster, 2004; Gibson & Cassar, 2005; Haber & Reichel, 2005; Jänkälä & Silvola, 2012; Lange, Mollov, Pearlmutter, Singh, & Bygrave, 2007; McMahon, 2001; McMahon & Davies, 1994; Mengel & Wouters, 2015; Rauch et al., 2000; Roper, 1997; Wijbenga et al., 2007; Wijewardena, De Zoysa, Fonseka, & Perera, 2004); (2) financial characteristics (22%), which are often related to success in attracting external funding (Allee & Yohn, 2009; Cassar, Ittner, & Cavalluzzo, 2015; Davila, Foster, & Jia, 2015; Hand, 2005; Kirsch, Goldfarb, & Gera, 2009; Moro, Fink, & Kautonen, 2014; Vander Bauwhede, De Meyere, & Van Cauwenberge, 2015); and (3) subjective evaluation of performance (21%), which implies that founders or managers provided a self-assessment of performance (Andersén & Samuelsson, 2016; Cassar, 2010; Cassar & Gibson, 2008; Dimov, 2010; Gruber, 2007; Haber & Reichel, 2005; Honig & Karlsson, 2004; King et al., 2010; Malagueño, Lopez-Valeiras, & Gomez-Conde, 2017; Peel & Bridge, 1998; Rue & Ibrahim, 1998; Upton, Teal, & Felan, 2001).

Moderation is happening on the side of consequences. The literature examines 20 hypotheses that are moderated by one of the following second-level constructs: environmental factors account for the largest group of moderators (30%) (Brinckmann et al., 2010; Cassar & Gibson, 2008; Davila et al., 2015; Gruber, 2007; Rauch et al., 2000), followed by organizational characteristics (25%) (Brinckmann et al., 2010; Burke et al., 2010; Malagueño et al., 2017), human resource management activities (20%) (Voss & Brettel, 2014), presence of external investment (15%) (Davila et al., 2015; Wijbenga et al., 2007), business planning (5%) (Brinckmann et al., 2010), and strategic positioning (5%) (Davila et al., 2015).

According the empirical relationships, we observe that studies have found empirical support for 64% of the hypotheses related to consequences of MA. Three categories of consequences have been found significant in more than 70% of the investigated hypotheses: survival (performance) (83%), growth (performance) (80%), performance (multiple measures) (71%). Other categories yield a lower percentage of significant hypotheses: financial characteristics (61%), subjective evaluation of performance (59%), advancement of organization (44%), and profitability (performance) (33%).

An interesting finding related to business planning is that the literature provides 31 statistically significant (56%) and 23 not significant hypotheses (44%). Accounting-based management control activities which is the second largest type of MA in terms of tested hypotheses shows 19 significant hypotheses (73%) and 7 not significant ones (27%).

Table 8. 106 hypotheses investigate the relationship between different types of MA and consequences

MA type	Consequences	Number of hypotheses (significant)	References
Accounting-based management control activities	Advancement of organization	4 (1)	Malagueño, Lopez-Valeiras and Gomez-Conde (2017)
	Financial characteristics	6 (5)	Cassar, Ittner and Cavalluzzo (2015); Davila, Foster and Jia (2015)
	Growth (performance)	5 (5)	Davila and Foster (2005); Jänkälä and Silvola (2012); Roper (1997); Wijbenga, Postma and Stratling (2007)
	Performance (multiple measures)	1 (1)	Chenhall and Morris (1995)
	Profitability (performance)	2 (1)	Jänkälä and Silvola (2012); Roper (1997)
	Subjective evaluation of performance	8 (6)	Andersén and Samuelsson (2016); Cassar and Gibson (2008); King, Clarkson and Wallace (2010); Malagueño, Lopez-Valeiras and Gomez-Conde (2017)
Business planning	Advancement of organization	5 (3)	Delmar and Shane (2003); Delmar and Shane (2004); Dimov (2010); van Gelderen, Thurik and Bosma (2006)
	Financial characteristics	7 (0)	Kirsch, Goldfarb and Gera (2009)
	Growth (performance)	17 (13)	Berry (1998); Bracker, Keats and Pearson (1988); Brinckmann, Grichnik and Kapsa (2010); Burke, Fraser and Greene (2010); Gibson and Cassar (2005); Haber and Reichel (2005); Lange, Mollow, Pearlmutter, Singh and Bygrave (2007); Rauch, Frese and Sonnentag (2000); Wijewardena, Zoysa, Fonseka and Perera (2004)
	Performance (multiple measures)	2 (2)	Mayer-Haug, Read, Brinckmann, Dew, Grichnik (2013); Schwenk and Shrader (1993)
	Profitability (performance)	5 (1)	Greene and Hopp (2017); Honig and Samuelsson (2012); Risseeuw and Masurel (1994)
	Subjective evaluation of performance	13 (7)	Cassar (2010); Dimov (2010); Gruber (2007); Haber and Reichel (2005); Honig and Karlsson (2004); Peel and Bridge (1998); Rue and Ibrahim (1998); Upton, Teal, Felan (2001)

MA type	Consequences	Number of hypotheses (significant)	References
	Survival (performance)	6 (5)	Delmar and Shane (2003); Delmar and Shane (2004); Honig and Karlsson (2004); Perry (2001); Shane and Delmar (2004)
Freestyle management control activities	Growth (performance)	2 (2)	Brinckmann, Salomo and Gemuenden (2011); Wijewardena, Zoysa, Fonseka and Perera (2004)
	Performance (multiple measures)	4 (2)	Voss and Brettel (2014)
MA = FA	Financial characteristics	10 (9)	Allee and Yohn (2009); Hand (2005); Moro, Fink and Kautonen (2014); Vander Bauwhede, De Meyere and Van Cauwenberge (2015)
	Growth (performance)	4 (2)	Brinckmann, Salomo and Gemuenden (2011); McMahon (2001); Mengel and Wouters (2015)
	Profitability (performance)	2 (1)	McMahon (2001); McMahon and Davies (1994)
	Subjective evaluation of performance	1 (0)	Cassar (2010)
Management of liquidity	Growth (performance)	2 (2)	Brinckmann, Salomo and Gemuenden (2011)
Total		106 (68)	

2.3.5 Why MA can be useful for startup companies

To answer the third research question, we synthesize explanations for why management accounting can be useful in the startup context in which it would not be expected to be useful. By summarizing argument in the literature, this section specifically explores the management paradox introduced initially in this review.

Business planning is most frequently addressed in the literature and has been subject to a lively debate in entrepreneurship research (Brinckmann et al., 2010; Delmar & Shane, 2003; Greene & Hopp, 2017; Honig & Karlsson, 2004). Business planning roots in the strategic management research where two opposing streams of literature are apparent: an *improvisational paradigm* (sometimes referred to as *learning school*) and a *rationalist paradigm* (sometime referred to as *planning school*) (Brinckmann et al., 2010; Greene & Hopp, 2017). In entrepreneurship, scholars representing the *improvisational paradigm* argue that planning hinders the startup's development and is of minute value to the founders because planning distracts the attention of founders and consumes their precious time needed for other important organizational tasks (Bhidé, 2000; Gumpert, 2003; Honig

& Karlsson, 2004). Moreover, sticking to a plan can create inflexibility, increase the bureaucracy, and slow down the speed of decision making (Greene & Hopp, 2017).

Scholars advocating the *rationalist paradigm* argue that business planning as an essential tool to support startup development with the main arguments referring to goal setting, speed of decision making, management of resources, and reducing uncertainty (Brinckmann et al., 2010; Delmar & Shane, 2003, 2004; Greene & Hopp, 2017; Gruber, 2007; Shane & Delmar, 2004). First, plans help founders to define systematic goals and understand the tasks and resources necessary for goal achievement. Plans help founders to focus their attention on the goals set, to stimulate their persistence, and create motivation towards goal achievement. Second, plans can increase the speed of decision making in startups because founders can anticipate and reduce information gaps better through planning than with and learning-by-doing approach. Third, business planning helps to manage scarce resources because founders can better recognize resource bottlenecks, address resource demands, and handle available resources within the startup. Last, plans can help to reduce the uncertainty in which startups operate. However, arguments explaining what business plans actually do in terms of reducing the uncertainty are rare.

Accounting-based management control activities represent the second largest group in terms of hypotheses in our review. Two streams of argumentation are evident in the literature: One stream argues that this type of MA helps startups to reduce information asymmetry with external partners and investors. The other stream explains that accounting-based controls foster startup growth. Davila et al. (2009) provide six reasons to explain the usefulness of this type of MA in more detail, the first two reasons are related to external factors, the others to internal factors. First, accounting-based management control activities help to legitimize an emerging venture externally because the formal processes and systems created through these activities are perceived by external partners as a sign of managerial competence (Davila et al., 2009). Second, management control activities facilitate contracting with external partners because external partners sometimes require formal process to enable their monitoring needs of the startup activities. The key point is that accounting-based management control activities within the startup reduce the information asymmetry between startup and external partners. This is especially the case for external investors, such as venture capital investors, as they often impose formal process upon startups to better control the money they invested (Davila & Foster, 2004, 2007; Davila et al., 2009; Wijbenga et al., 2007).

Third, startups adopt formal control activities when a new CEO enters who aims to increase the organizational capabilities and growth. Studies argue that a new manager typically has substantial past experience and considers management control activities as an important part of an organization's management practices (Davila & Foster, 2004, 2007; Davila et al., 2009). Yet, this reason explains solely the adoption and not the usefulness of MA. Fourth, accounting-based controls help founders or incumbent managers of startups to coordinate a growing organization. This can be the case when startups launch operations in other countries, increase their staff significantly, or feel the need to structure the internal communication (Davila & Foster, 2004, 2007; Davila et al., 2009; Moores & Yuen, 2001). Fifth, startups who face recurring failures, frequent problems or other undesirable event can opt for the introduction of accounting-based management control activities because the founders expect them to solve these problems (Davila et al., 2009). Last, in some startups accounting-based practices emerge not as a reaction to chaos or growth, but more as a byproduct of coordinating recurrently conducted processes or tasks. Thus, startups can use this type of MA to capture the internal learning with accounting-based control activities (Davila

et al., 2009). In addition to the arguments, management control activities are most helpful when they are in line with the startup's growth strategy (Sandino, 2007). Taken together, MA in the form of accounting-based management control activities provides structure when startups grow and need to overcome the informal and direct management style of the first days.

MA = FA stands for management accounting (MA) discussed in a way that is identical to what the startup does or would do as financial accounting (FA), e.g. preparing financial statements voluntarily. Using methods of financial accounting implies considerable costs in terms of time or money for startups. As startups are usually not compelled to use financial accounting for reporting purposes, the perceived benefit of this type of MA has to exceed the costs involved in the preparation (Cassar, 2009). Similar to accounting-based management control activities, some studies argue that using methods of financial accounting can reduce the information asymmetry between the startup and external partners as they provide worthwhile information to potential lenders (Allee & Yohn, 2009; Cassar, 2009). Another argument similar to the above type MA, is that financial accounting creates a signal of competence which induces a positive perception of the startup by external partners, such as investors or banks (Allee & Yohn, 2009).

Financial planning and control can also be worthwhile because it helps startups increase the consciousness of financial resources. Being aware of available and required resources can lead to a more efficient use. This is important as resources are typically scarce in startups (Mengel & Wouters, 2015). In addition to analyze the current situation, financial planning and control can also be used to predict and specify future resource needs (Delmar & Shane, 2003; Mengel & Wouters, 2015). Moreover, using financial planning methods can increase the financial knowledge of founders which can help them to identify different sources of financing (Seghers et al., 2012).

Studies on *human resource management activities* offer arguments similar to studies on accounting-based management control activities and are mostly referring to the growth of the startup. Human resources management activities are necessary when an indirect management style and personal communication becomes difficult. Hence, these activities help founders to handle an increasing number of employees in a growing organization (Davila, 2005). Moreover, startups introduce human resource management because external investors require these systems to monitor the efficiency of staff or to create incentives (Davila, 2005; Wijbenga et al., 2007).

Freestyle management control activities are specifically developed by the startup to facilitate or influence decision making, such as the use of particular financial or non-financial key performance indicators. This type of MA typically includes activities to monitor and analyze a specific part of company development - such as monitoring the number of failures per week in novel software program - control specific work results of employees, or influence the startup culture through creative incentives. This can help founders to reflect the startup's development and to find new opportunities for future business (Brinckmann et al., 2011; Voss & Brettel, 2014).

Management of liquidity focuses purely on cash flows to maintain short-term liquidity. This type of MA provides a way to finance the startup development through cash flows from operations. Financing from operations can be an alternative to the attraction of financial resources from external investors. Management of liquidity can help young companies to survive times of economic crises in which external financing is typically scarce. Also, management of liquidity increases the awareness of financial resources and, thus, can lead to a more efficient use (Brinckmann et al., 2011).

Turning next to qualitative findings, we summarize the nine case studies that contribute to a deeper understanding of the topic, without claiming statistical generalization, and relate them to the prior findings on the second-level constructs of management accounting. Six of the nine case studies refer mostly to accounting-based management control activities (Alattar, Kouhy, & Innes, 2009; Armitage, Webb, & Glynn, 2016; Collier, 2005; Granlund & Taipaleenmäki, 2005; Gumbus & Lussier, 2006; Perren & Grant, 2000; Silvola, 2008a), two studies refer to freestyle management control activities (Christner & Strömsten, 2015; Collier, 2005), another one refers to business planning (Karlsson & Honig, 2009).

Accounting-based management control activities eight New Economy Firms are studied by Granlund and Taipaleenmäki (2005). The activities are influenced through the speed of growth, technology orientation, presence of external investors, and the maturity of markets. The founders tend to prioritize business planning over management control activities when being exposed to high time pressure. Another study by Perren and Grant (2000) reports how the knowledge of founders or employees induce four small growth-oriented companies in the service sector to adopt management control activities. Through their flexible and less formal character, these control activities enable the companies to better react to external changes. Gumbus and Lussier (2006) describe how three small companies use a balanced score card (BSC) beneficially to sharpen their strategy and to improve their operational efficiency and profitability. Silvola (2008a) finds that the presence of external investors stimulates a recently merged small company to introduce accounting-based management control activities. As the activities are mostly dedicated to manage the company's liquidity, this case also emphasizes the importance of the management of liquidity in small companies.

Two other studies look at small but not necessarily young companies. Alattar et al. (2009) investigate the use of accounting information for planning, decision making, and control in five very small tourism businesses in a politically unstable environment. They find company size and the lack of accounting knowledge of the founder as limiting factors, while the uncertainty of the environment increases the use of MA. Armitage et al. (2016) investigate the use of 19 different accounting-based control activities in 22 companies, finding that one a few companies use these activities regularly. They point out that companies using MA have founders who perceive certain methods as worthwhile or operate in a complex environment, such as manufacturing.

With regard to freestyle management control activities, Collier (2005) describes how the strong personality of a founder determines to a large degree the management control and human resource activities. The founder uses a simple spreadsheet model to exercise management control and evaluate performance. His model focuses on market share as key performance measurement and can forecast the sales volume of the company. In a recent study, Christner and Strömsten (2015) portray the creation of a startup company in order to develop and market a biotechnological innovation. The essential point is how a specific performance measurement, the internal rate of return (IRR), becomes 'the dominant representation of the economy of the company' (p. 60) and how it is used to enhance the product development process and other startup activities. Hence, both studies are interesting examples for freestyle management control activities.

Business planning is addressed by Karlsson and Honig's (2009) qualitative study. Even though business plans have been prepared, the startups investigated in this case do not pursue their objectives set in these plans. They rather use business plans to create the impression of being structured and organized companies to external parties. This finding is similar to prior arguments

for accounting-based control activities and MA = FA, which emphasize management accounting's role to signal competence to external partners.

2.4 Discussion

By tying together dispersed findings in this field, we contribute to existing knowledge through identifying similarities and advancing the understanding of MA in startup companies. We thereby address the paradox of how *formal* and *static* methods of management accounting can be helpful for these *dynamic* and *unstructured* companies. Moreover, we critically discuss lacunas in the literature and point out gaps in knowledge that future research should address. We contribute specifically to the conceptualization of MA through the introduction of 20 second-level constructs, which help researchers to gain a broad view of the field, and through the synthesis of arguments in the literature, which clarify the paradoxical role of MA in startups in more detail.

The objective of this review was to understand the paradox and provide a structured overview of existing knowledge about MA in startups. Overall, our results indicate that the literature concentrates on a few topics related to business planning and accounting. A differentiated view of management accounting in a young and small company context is scarce, as is empirical work that clearly explains what MA really does in these organizations.

In this section, we summarize our most important findings and suggest directions for upcoming work related to four topics: (1) the conceptualization of MA in startups, (2) the quality of definitions for theoretical constructs, (3) the need for clear thinking and theory development, and (4) implications for qualitative work.

2.4.1 Addressing the paradox through the conceptualization of MA in startups

The presence of MA in young and small companies is limited. We have raised the question of whether startup companies benefit from the adoption of MA. Through an innovative coding approach, we have shown how MA is conceptualized in the literature, and we were able to tie together the fragmented knowledge relating to this topic. On the superior level of second-level constructs related to MA, we portrayed the current knowledge and derived novel insights for this interesting field of research.

In examining the literature to understand the paradox, we find that MA in startups comprises primarily business planning and accounting (either financial accounting alone or accounting in more detail). Very little research has addressed other types of management accounting in the startup context.

Consistent with the prominence of business planning in the creation of startups and in higher education, our findings also reflect the importance academic research in entrepreneurship and management accounting has bestowed on this topic. While the literature still argues about the value of business planning for the creation and growth of startups (Brinckmann et al., 2010; Delmar & Shane, 2003; Greene & Hopp, 2017; Honig & Samuelsson, 2012; Shane & Delmar, 2004), our findings show that only about half of all hypotheses related to business planning were found to be statistically significant (Table 8). This finding suggests that business planning attracts a remarkable amount of research attention without yielding detailed findings. We see a possible reason for this

in the fact that business planning has been investigated more broadly than in-depth. Although planning is the biggest topic in this field, its role in startups is ambiguous. Whether and how planning actually helps in dealing with uncertainty or scarce resources is unclear.

Therefore, future research needs to provide a deeper insight into the role of planning. Such studies should advance the understanding of planning by going beyond a mere debate on the benefits and futility of planning. With respect to the quality of theoretical construct definitions, future research should also motivate the development of more detailed constructs relating to business planning and relate them to what has been done previously. Only in this way can the vast amount of knowledge relating to this topic be channeled and offer a base for theory advancement.

While the role of planning in startups is not entirely clear, the role of accounting-related activities is more apparent. The analysis of second-level constructs and arguments contributes to the understanding of the managerial paradox. As the literature either investigates the adoption of financial accounting practices or the use of accounting-based management control activities in young and small companies, two main benefits of management accounting for startups become apparent. First, management accounting practices mainly serve reporting needs of outside partners, such as investors, or governmental institutions, because they can help to reduce information asymmetry between the startup and partners (Allee & Yohn, 2009; Cassar, 2009; Moro et al., 2014; Wijbenga et al., 2007).

Second, accounting-based management control activities are expected to support startups when their business is growing and becoming more complex, such as in the transition from a personal and informal management style to a more structured approach, in the efficient management of scarce resources, and as a signal to outside parties that the business is a well-run organization (Davila & Foster, 2004, 2007; Davila et al., 2009; Sandino, 2007). MA offers an important tool for the most widely adopted practices at an early stage of company development. These are typically techniques for management control, financial planning, and strategic planning, such as budgeting or cash flow projections (Davila & Foster, 2007).

Lewis (2000, p. 763) pointed out that 'managing paradox means capturing its enlightening potential.' It can be argued, in line with this statement, that management accounting in startups is helpful in situations where founders recognize its usefulness. The usefulness of management accounting in startups is based on its ability to handle growth and reduce information asymmetry with external partners to attract external resources.

With regard to empirical relationships, accounting-based management control activities show a statistically significant effect on performance and financial characteristics of startups. Owing to the concentration of accounting topics in the literature, we argue that researchers have applied to young and small companies accounting-related constructs that have been shown to be beneficial for established companies, but without considering the specificity of these organizations in more detail. We postulate that startups must be differentiated from SMEs and large established companies, taking into account their innovativeness and their special characteristics at an early stage of company development and growth. Thus, research should address management accounting in a broader perspective, being more open to what our discipline means in startup companies.

Research on the antecedents for adopting MA in startups is fragmentary, and studies concentrate on organizational characteristics, the founders' professional characteristics, or the presence of external investment. This focus gives rise to the suspicion that the motivation for

startups to adopt certain types of MA is only vaguely understood. Our finding that barely any moderation is happening on the side of antecedents supports our suspicion.

The consequences of MA refer mainly to company growth and financial characteristics, which are often related to success in attracting external funding. Although growth and the attraction of financial resources are crucial tasks for startups (Alsos, Isaksen, & Ljunggren, 2006; Brinckmann et al., 2011), the literature offers surprisingly little information as to what MA does besides support performance. We expect that MA in startups could have more nuanced consequences. For instance, it could influence the attraction of resources other than financial resources, enabling goal-oriented communication within a startup's management team, or signaling management competences to outside parties (Davila et al., 2009; Smith & Cordina, 2014). Moreover, it remains unclear whether startups grow because they adopt MA, or adopt MA because they grow. Thus, future research should also advance the understanding of why founders adopt MA and provide a more differentiated view of its consequences.

2.4.2 Quality of construct definitions in the literature

One of the most surprising and alarming findings is that the literature reflects an uneven quality in theoretical construct definitions. Our findings indicate that just 15% of all constructs have been explicitly defined. Many of the reviewed studies equate a theoretical construct with a single measurement item, a reliance that could lead to vague empirical results. Hence, the literature not only yields definitions of low quality but also shows a thin operationalization of theoretical constructs.

In management accounting research, the survey-based approach is one of the most important ways to investigate complex phenomena and claim statistical evidence for empirical relationships between theoretical constructs (Birnberg, Shields, & Young, 1990). Correctly applied, survey-based research is able to explore complex relationships while maintaining a level of standardization. Theoretical constructs constitute the currency researchers exchange to enable theory development in a research field. By basing new empirical studies on previously used theoretical constructs, a research field can advance as a whole (Bisbe, Batista-Foguet, & Chenhall, 2007).

However, this advantage only unfolds if the exchanged currency is solid and clear enough for further use. In other words, survey-based research is susceptible to its construct validity (Van der Stede, Young, & Chen, 2005), which is broadly defined as the 'extent to which an operationalization measures the concept it is supposed to measure' (Bagozzi, Yi, & Phillips, 1991, p. 421). To ensure quality and availability to other researchers, construct validity should start with a clear conceptual definition of the theoretical construct (Churchill, 1979; MacKenzie, 2003; Mackenzie, Podsakoff, & Podsakoff, 2011). Thus, the weak quality of construct definitions could be an explanation of why some of the empirical relationships using similar hypotheses do not yield similar results, such as the heterogeneous findings on business planning and startup performance.

In our review, the survey-based approach is the most widely represented research method. At the same time, we find an imprecise handling of theoretical constructs, missing construct definitions, or constructs mixed up with questionnaire items. These practices must immediately stop, for the benefit of the survey-based research in particular and for the research fields of management accounting and entrepreneurship in general.

2.4.3 Need for clear thinking and theory development

The literature not only requires a broader perception and theorization of MA, but also a deeper understanding of what MA actually does in startups. Even though our findings indicate that MA does play a role in young and small companies, exactly what that role is remains unclear.

Like other organizations, startups accumulate information related to business activities, customers, markets, and suppliers over time. As in established companies, this information can be used for MA practices, such as a specific performance measurement which is understood as a process of quantifying action, with action leading to performance (Neely et al., 1995) and which can help to formalize workflows, organize and control activities, and handle complexity in organizations (Adler & Borys, 1996; Ahrens & Chapman, 2007). In established companies, management accounting serves two purposes: it can facilitate decisions in the sense of providing 'information to guide decisions and managerial action' or it can influence decisions in the sense of using 'information for motivating and controlling managers and employees' (van Veen-Dirks, 2010, p. 142). We argue that neither of these purposes entirely captures the role MA plays in startup companies. Startups are characterized by a small number of employees, a direct and problem-oriented management style, and the absence of strict role descriptions (Davila & Foster, 2007; Marion, Friar, & Simpson, 2012). Translating the purposes of management accounting from established companies directly to startups seems questionable.

Moreover, we discovered a gap in academic literature with regard to startup-specific performance measurement. As pointed out in the above section, research has focused on accounting-based management control activities that follow well known accounting frameworks applied in large established companies. Only a very few constructs inform about freestyle management control activities, which go beyond common accounting practices and capture the specificity of a startup organization in order to support the founders' decision making.

This gap becomes more obvious in light of writings popular among entrepreneurs, such as those concerning the "lean startup" or "lean analytics" (Blank, 2013; Croll & Yoskovitz, 2013; Ries, 2011), along with whitepapers and online blogs of former founders and venture capitalists emphasizing the importance of startup-specific performance management.[3, 4, 5] Even though these sources lack any peer-review process and empirical evidence, they reflect the ideas, best practices, and experiences of practitioners and inspire a myriad of founders. However, the literature gives no answer as to which performance measures are specifically developed by founders to facilitate a startup's decision making.

Therefore, we call on researchers to explore the area of freestyle management control activities. A clearer understanding and in-depth thinking with respect to MA is necessary to point out the benefits for startups. Said differently, further research should extend existing theory: What is the role of management accounting? What is MA really doing for the management of scarce resources and the growth of startups? When does it help – and when does it not?

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3 Ehrenberg, D. (2014). *The Seven Startup Metrics You Must Track*. Retrieved October 22, 2017, from https://www.forbes.com/sites/theyec/2014/06/20/the-seven-startup-metrics-you-must-track/#3dc45c7d725e

4 Kaushik, A. (2015). *Six Web Metrics / Key Performance Indicators To Die For*. Retrieved June 12, 2015, from http://www.kaushik.net/avinash/rules?choosing?web?analytics?key?performance?indicators/

5 Suster, M. (2011). *How Startups Can Use Metrics to Drive Success*. Retrieved October 22, 2017, from https://bothsidesofthetable.com/how-startups-can-use-metrics-to-drive-success-d361b8989f5d

Davila et al. (2009) offer one of the few papers that consider the role of MA in startups in greater detail. Their paper could therefore be taken as an example of an approach that seeks a deeper and more nuanced understanding of management accounting in young and small companies. Drawing on both qualitative and quantitative research, they advance the thinking with respect to the adoption of management control systems in startups. They propose seven roles that these systems can play (make goals explicit and stable, code learning from the past, foster coordination, plan the sequence of steps, promote accountability and facilitate control, contract with external parties, and use symbols to legitimize) and explore how these roles are related to the first adoption of management control systems in product development (Davila et al., 2009).

For instance, making goals explicit and stable refers to the idea that the adoption of management control systems usually accompanies articulation of clear goals. Transparent and stable goals prevent a frequent change of management priorities, which might be caused by an uncertain environment of a startup. These goals create clarity and room for creativity of founders and employees, and can thereby facilitate innovation in product development. As another example, contracting with external parties refers to the idea that startups adopt management control systems because outside partners, such as investors or suppliers, require them in order to enable the monitoring of business activities and enhance the contracting. Using symbols to legitimize refers to management control systems' reflection of an organization's formal processes that outside parties perceive as a symbol of management competency and innovativeness.

More papers such as this one would help to explicate and capture on a theoretical level what management accounting brings about. Sharp thinking could facilitate theorization and advance our field of research.

2.4.4 Implications for qualitative research

Empirical literature contains a lacuna in qualitative research, as case studies made up less than 12% of our results. This scarcity of qualitative research might reflect the narrow view on single topics when talking about MA in startups. As survey-based studies have until now failed to develop a broad picture, case studies could contribute both a deeper and more varied understanding (Ahrens & Chapman, 2006; Eisenhardt, 1989). Thus, future research should challenge the current perspective by deducing new and fruitful insights through case studies of startups.

A last implication is possible directions for future work. As case study research explores an empirical phenomenon within a real-life organization when 'the boundaries between phenomena are not clearly evident' (Birnberg et al., 1990, p. 34), this type of research should be the method of choice to clarify what research has so far failed to reveal.

Given our findings, we encourage qualitative research in the following topics.

Business planning. What is planning really accomplishing in startups? For which things might it be helpful? When does it really influence a startup's operations and performance? And when is planning merely an isolated artefact that does nothing?

Freestyle management control activities. When do startups adopt startup-specific performance measurement? What is their role for decision making? Which role do they play for communicating within a startup, and which for convincing external investors?

Antecedents and consequences. What are the antecedents of MA? What consequences apart from performance flow from MA?

Social media and web analytic services. To the best of our knowledge, research has generally ignored the role of social media or other online tools that can support startups in their MA, such as web analytic tools to measure and report website traffic. Interviews with founders show that these tools are widely used by startups and also serve purposes other than marketing. However, their role for MA has not been addressed in research.

These topics relate to areas where qualitative research could produce empirical insights and advance the understanding of MA. By examining and sharpening the theoretical constructs in the literature, qualitative work could also support the development of theoretical models for quantitative papers. Again, (Davila et al., 2009) offer an example for combining qualitative and quantitative research for elucidating our conceptual understanding. The authors conducted a number of interviews with early-stage companies, which later inspired and guided the creation of their quantitative research on the adoption of management control systems. To advance the field, we need similar research to make clear what we mean by theoretical constructs and how to translate and measure them with empirical models.

2.5 Conclusion

In this systematic literature study, we have addressed the paradox of how management accounting (MA) can be helpful for young and small startup companies and reviewed the empirical literature for antecedents and types of MA, as well as consequences of its adoption. The purpose of the present review was to provide a structured overview of what the literature refers to regarding the adoption and use of MA in startups. To address the paradox and understand why something as formal and static as management accounting can be helpful in a dynamic and unstructured startup environment, we proposed 20 novel second-level constructs with respect to the types of MA, along with their antecedents and consequences. Moreover, we reviewed the empirical relationships between these second-level constructs that have been investigated in the literature.

Our search process yielded 69 papers in 27 journals, of which 60 papers comprised quantitative research and 9 applied qualitative methods. Five journals published more than half of all studies: the *Journal of Small Business Management*, the *Journal of Business Venturing*, the *Small Business Economics*, the *Management Accounting Research*, and *The Accounting Review*. One-third of the studies researched sample companies in the United States, followed by Sweden, Australia, and Germany. With respect to MA in startups, the literature focused on three topics: business planning, accounting-based management control activities, and financial accounting, altogether accounting for 93% of the results. Among the antecedents, the top three categories are organizational characteristics, professional characteristics of founders, and the presence of external investment, together amounting to 66%. Antecedents vary strongly across different categories, while moderating effects on the side of antecedents are rarely addressed. The top three consequences are growth (performance), financial characteristics, and subjective evaluation of performance, accounting for 71%. Environmental factors are the biggest group of moderators on the side of consequences. The empirical relationships between antecedents and types of MA show statistically significant effects in 80% of tested hypotheses. The relationships between types of MA and consequences lead to statistically significant effects in only 64%.

Principal findings. Our main findings were the following. First, regarding the management paradox, the main arguments in the literature for why management accounting can be helpful for startups are related to startup growth and reporting needs for outside partners. MA helps founders to handle the organizational challenges resulting from business growth. Also, management accounting serves as a tool to reduce the information gap between the startup and external partners, such as investors. Second, the review of the literature reveals a lacuna in the quality of theoretical construct definitions. Our findings yield a poor construct quality in the management accounting and entrepreneurship literature, indicating that just 15% of all constructs have been explicitly defined. Third, MA refers to business planning and accounting (either financial accounting or accounting in more detail). Fourth, the literature lacks a deep understanding and clear thinking as to the role of management accounting in startups in general and the different types of MA in particular. Our results reveal that the role of freestyle management control activities in startups remains imprecise. Last, the empirical literature shows a gap in qualitative research. While most studies used survey-based research methods, less than 12% of our results were case studies.

Contribution. We believe this structured overview of the use of MA in startups is a valuable contribution because it is – to our knowledge – the first study to systematically address this management paradox by tying together dispersed findings, highlighting similarities and lacunas in current knowledge, and improving the current understanding. Our study specifically contributes to the conceptualization of MA in startup companies through a clear research framework and the introduction of 20 second-level constructs. It further contributes to extant literature by synthesizing arguments and empirical findings for the usefulness of MA according to the framework. A limitation of the present review is that the results cover the literature of management accounting and entrepreneurship. Future research could also consider neighboring fields and advance the understanding of MA in the young and small companies by investigation through a different theoretical lens.

Implications. Overall, our systematic literature review underscores the need for both a broader and a deeper theoretical understanding of MA in startups, offering the following implications for future research. First, researchers in our field should develop a clear and concise definition and handling of theoretical constructs, as the presently vague handling of theoretical constructs in the literature is hindering the theoretical development of the entire field. Second, future research should strive for a broader understanding of MA in young and small companies to overcome the concentration on only a few topics. Startup-specific performance measurement seems to play a central role in practice for startups and external investors. However, this aspect is hardly addressed in the literature. Future research could investigate how and why startups adopt so-called 'freestyle management control activities'. Third, forthcoming studies should also offer clear and original thinking to advance in-depth understanding and enable further theorization. We need to comprehend in detail when MA is more than the pure quantification of numbers. What is it doing for the management of scarce resources and the growth of startups? Finally, researchers could contribute to progress in this field through qualitative research. Case studies could yield detailed empirical insights and provide answers to the questions raised above. Advancing the understanding of MA through qualitative insights could also provide an important base for development of an over-arching theory about the adoption and use of management accounting in startups.

3 Management accounting information exchange in the Bosch startup platform: Fostering corporate innovation by living apart together

Abstract

The exchange of management accounting information can play an important role when startups cooperate with large, established companies. The literature on management accounting in startups has focused on business planning, financial accounting, and accounting-based management control activities. However, current literature remains unclear about how the exchange of management accounting information can be helpful for startups. Also, literature can only partly explain how both startups and large, established companies benefit from this information exchange. We conduct a descriptive case study, which aims to reduce the knowledge gap by providing detailed insights into a corporate incubation program. This program allows employees of a large corporation to launch new businesses and act as entrepreneurs within the corporation. We focus in particular on the exchange of management accounting information between the startups and the large corporation. Our findings show that exchanging management accounting information helps the corporate company to assess how well the startups progress and to decide on the investment budget for the next time period. The startups benefit as they can present their achievements, state their level of maturity, and address their resources needs towards the corporate company based on management accounting information. We contribute a detailed understanding to the literature of how management accounting can be helpful in the startup context, and suggest opportunities for upcoming research.

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M. Wouters & M. Pelz (2018). Fostering corporate innovation by living apart together: Management accounting information exchange in the Bosch startup platform. Accepted for publication in *Accounting, innovation and the importance and challenges of inter-organisational relationships – Field study perspectives*, Håkan Håkansson, Kalle Kraus & Johnny Lind (Editors).

3.1 Introduction

As we have seen in the literature review (see chapter 2), research on management accounting in startups has mostly focused on business planning, accounting-based management control activities, or financial accounting. Prior work has shown that management accounting practices in startups serve reporting needs of outside partners, such as investors, because they can reduce information asymmetry between startups and their partners (Allee & Yohn, 2009; Cassar, 2009; Moro et al., 2014; Wijbenga et al., 2007). Moreover, accounting practices can help startups to cope with growth, move from an informal to a structured management style, and manage scarce resources more efficiently (Brinckmann et al., 2011; Davila & Foster, 2007; Davila et al., 2009; Sandino, 2007). However, we have also seen in the literature review that research on management accounting in startups has several gaps. Very little research has addressed management accounting from a perspective other than business planning, financial accounting, or accounting-based management control. Also, the literature shows a lack of qualitative empirical work that clearly explains what management accounting does in the startup context.

To reduce this gap in current literature, we present a descriptive case study of the exchange of management accounting information in a corporate incubation program. The study offers both a new perspective on management accounting and a deeper understanding of its usefulness in the startup context. By focusing on information exchange, the study investigates management accounting from a new perspective, which has been neglected in literature up to now. Based on the detailed analysis of the corporate incubation program, the study is able to provide a more nuanced understanding of management accounting's usefulness in the startup context.

The corporate incubation program in our case study lets employees of a large corporate company start new businesses as if they are independent startups, offering them the freedom to be entrepreneurs but at the same time allowing them to use resources of the corporation. Called the "startup corporation" (Davila & Epstein, 2014) or "inside-out" startup program (Weiblen & Chesbrough, 2015), this approach aims to combine the philosophy of the startup with the experience, resources, and network of an established company. From the perspective of the corporation, this process aims to support radical innovation that would otherwise be far less likely to happen successfully.[6]

The case study pertains to the Bosch startup platform (BOSP). We focus on the corporate startup activities that aim to support Bosch's innovation—innovations that are less likely to happen within the "normal" Bosch organizational R&D context. Thus, the "apart" in the title of this paper refers to the fact that people have moved to BOSP from the large corporate organization, Robert Bosch GmbH, but maintain an intimate relationship with Bosch (the "together" part). The case focuses on the exchange of information, in particular between the startups and the BOSP organization and between BOSP and the Bosch corporate organization.

Although some information about BOSP is publicly available on the internet, in the popular press and academic papers (Hank & Meck, 2015; Weiblen & Chesbrough, 2015), this paper provides more detailed information and discussion based primarily on several interviews with various employees and the CEO of BOSP and on information gathered through a research assistant

6 We thank Mr. Florian Müller for his assistance with the research and management and employees at BOSP for their openness to participate in this research.

who spent several months full-time on site. He talked with many people throughout the organization and could see examples of all the different kinds of management accounting reports produced.

The main findings show that both startups and the large, established company in an inside-out startup program can benefit from the exchange of management accounting information. The startups use management accounting information as an instrument to quantify and communicate both their current achievements and future resource needs. The corporate company uses management accounting information to regularly monitor and assess the progress of the individual startups it "invests" in. Also, the information helps the corporate company to compare the progress of all startups in the inside-out program to each other.

The case study offers a worthwhile contribution to the literature. First, we present a new perspective of management accounting in the startup context, specifically management accounting information exchange, which has been neglected in the literature until now. As our insights show, management accounting information exchange plays an important role for startups when it comes to communicate with resource providers. Second, we contribute a clear description of what management accounting does and why it can be helpful for startup. This is possible due to the specific research setting of our case study.

In the next section, we summarize briefly the literature on cooperation models for startups and corporate companies. Then we provide and discuss descriptive information about BOSP. We focus on the idea and organizational design of BOSP, and on the exchange of management accounting information between different organizations. Yet, before we move on, we would like to close the introduction with a little anecdote experienced by one of the authors to underline how special the research setting is.

"*Hello, I'm looking for number 5, the Bosch startup platform.*" "*Oh, that's here. With whom do you have a meeting?*" "*With Ms. Sauter.*" "*Oh, just step inside and I'll take you to her.*" Approximately this conversation (originally in German) occurred when I was in the right street but couldn't find the entrance. Finally I saw an open door, somewhere at the back of a building, walked to it and spoke to a man inside. As we walked together to look for my meeting, I realized this obviously was not a normal Bosch site, with gates and stern-looking men behind a security desk, where a visitor must be announced, fill out a form, show a photo ID, get a badge and be collected by a host. My curiosity about the place grew even stronger.

3.2 Startup cooperation models in the literature

Before we dive into the case, we briefly present four models for how startups and large, established companies can cooperate, as described by Weiblen and Chesbrough (2015), see Figure 4. In this case study, we focus on the "inside-out" startup program, which is one of the models. Moreover, it is the model for which Weiblen and Chesbrough (2015) provide the fewest examples, which reinforces the impression from the literature that the use of this program is still relatively rare.[7] Also, little is known in the literature about the exchange of management accounting information.

[7] We could identify only few examples of inside-out startup programs (such as Siemens' next47). Interestingly, most of these mentioned they are not exclusive to corporate employees founding a startup based on a

		Direction of information flow	
		Obtaining external technology	Commercializing internal technology
Corporate equity investment	Yes	*Corporate venturing*	*Inside-out startup program* (the focus of this paper)
	No	*Outside-in startup program*	*Startup platform program*

Figure 4. Models for startups and corporations to work together (Weiblen & Chesbrough, 2015)

Briefly addressing the other models is helpful to provide a better understanding of what is specific to the "inside-out" startup program. The models are differentiated in Figure 4 along two dimensions: whether the corporation has equity in the startups, and the direction of the information flow. Most of these models relate to acquiring external technology and information through the cooperation with startups. As mentioned, the focus of this paper is on the inside-out startup program.

Traditionally, programs with equity involvement have dominated. *Corporate venturing* involves investing in startups to obtain access to external technology that is strategically important for the corporate organization, for example because it can lead to disruptive innovations in the corporation's current markets. An example is the investment of Bosch in the startup SEEO in the US, which has a unique battery technology. This technology is strategically important in Bosch's traditional automotive business, where electric cars will become a growing part of that business.

The *outside-in startup program* is a form of non-equity-based partnership. The goal is also to acquire new technology and innovations from startups, but the corporation does not have a significant equity investment in a startup it cooperates with. The corporate organization and the startup work together on the basis of a joint development agreement. This cooperation may also include a form of limited exclusivity for the corporate customer, in return for which it provides various kinds of support to startups, such as technological expertise or equipment, application knowledge, or access to potential customers.

The *startup platform program* is also based on offering support, and the goal is to spur complementary external innovation to promote and improve an existing corporate innovation. The corporate organization provides a technology platform, such as software development tools, which startups can use to build their products. These products then strengthen the corporate innovation. The startups and corporation thus work together on a common technology platform. Weiblen and Chesbrough (2015) describe the example of the software company SAP, which supplied free

corporate technology (inside-out), but are also open to independent startups with an external technology who ask for support from the corporate organization (so outside-in), whereby the corporation may or may not have equity involvement.

developer software licenses and access to a development system to startups, so these could build their own software products for the new database technology HANA. The startups' customers for these software products with applications for HANA then became customers of SAP. Thus this model essentially also enables the corporate organization to tap into external ideas and innovations.[8]

Finally, the *inside-out startup program*, also called corporate incubation or corporate startup, works in the other direction. This program involves investing in new startups that aim to commercialize the corporation's internal technology in other markets because it does not fit the corporation's strategy (Davila & Epstein, 2014). This approach is an alternative for selling or licensing that technology to complete outsiders. We use the term inside-out startup program rather than corporate incubation because it more clearly describes that technology and people move from the corporation to the outside and become a startup, facilitated by the program the corporation puts in place for such transitions. Weiblen and Chesbrough (2015) discuss two important conditions for success of this kind of program. First, the startup should have more freedom than normal R&D projects in the corporate organization. While it should have the autonomy of a "normal" startup, so that the law and all normal rules for doing business apply, it should not have to comply with additional corporate guidelines, influence, and standard procedures. Second, it should have the ability to access corporate resources, since the point is to create an advantage by combining the agility of a startup with the resources of a large corporation. Having briefly addressed the characteristics of each model, we now turn to the case of the Bosch startup platform.

3.3 The case of the Bosch startup platform (BOSP)

The Robert Bosch Start-up GmbH is located in Ludwigsburg in Germany and was established in 2013 as a 100% subsidiary of the Robert Bosch GmbH. BOSP comprises seven startups (end of 2016) located in Germany, Austria and the US, and it employs around 65 people in Germany, of which seven are the central BOSP team and the others are working at the startups.[9] The objective of BOSP is to create an entrepreneurial environment for corporate startups within the Bosch Group. BOSP provides support and resources to motivated founder teams and their corporate startup ideas. BOSP's vision is to establish an entrepreneurial atmosphere in which tomorrow's breakthrough innovations can be developed by Bosch corporate startups. On its website, BOSP is described as follows: *"We are the professional home for start-ups which develop new, sustainable and profitable business in new markets based on Bosch technology innovation. Our teams are focused on radical innovations that don't find their way to market through existing Bosch business divisions. Their challenge is to develop the right product, build a suitable business model and find the right customers in order to enter business fields where Bosch isn't active yet."*

8 Although the term "platform" is used, the Bosch startup platform (BOSP) does not fall into this category.

9 The legal structure is a bit more complicated. For example, a separate legal entity exists in the US for Mayfield Robotics, and part of the startup Zenoway is located in Austria, where it legally belongs to another Bosch unit. These nuances are not important for this study.

3.3.1 How does it work?

The challenge of radical innovations

Why is developing radical innovations within Bosch difficult? Essentially, radical innovations make atypical demands on company resources. Suppose someone working in an R&D department within Bosch has an idea for developing a particular technology toward a new product or service offering. If this development fits into one of the company's current business areas, then the existing business processes work well. The result is an extension of the current product portfolio, which can be produced at the existing manufacturing sites and can be sold to customers Bosch is already doing business with. But radical innovations are more difficult for Bosch and many other corporate organizations. The eBike provides a good example. The electric bike idea was new in many ways, because this product involved a larger number of customers (bike manufacturers) that each purchase a smaller number of units compared to Bosch's normal automotive customers. The engine power is much less than that for cars, and while the quality requirements are lower the sales price is also lower. The project for developing the eBike was tried unsuccessfully in two business areas and became a winner only on the third attempt. While the eBike did become a success in the end, it could easily have failed. The innovation was too radical to easily fit the normal business processes with the rules, assets, and experience of people that are already in place.

Selecting and supporting startup ideas

The objective of BOSP is to overcome this problem by providing a more suitable environment for radical innovations. Let's take the same starting point: someone working in an R&D department within Bosch learns about a particular technology and has an idea for developing that technology toward a new product or service offering. That person or a small team can propose this idea to BOSP, which then applies a selection process for applicants. The first step is a six-week preparation and selection program called the "grow program," which prepares the team for a pitch of the startup idea to the BOSP board. At the same time, the grow program provides information about the candidates to assess their suitability to become internal Bosch entrepreneurs at BOSP. A very important criterion is how fired up the candidates are about the idea, and whether the individuals involved are actually ready to leave Bosch and move over to BOSP with the idea. Also, it's important that the candidates' focus extend beyond technology alone: *"They should have an entrepreneurial not a nerdy way of thinking,"* is how someone at BOSP expressed it.

Founders so far have come from central R&D departments at Bosch for five of the seven BOSP startups (Deepfield Robotics, Zenoway that is the result of merger of an original BOSP startup and an external startup acquired by Bosch, and two more from German R&D departments, along with Mayfield Robotics from the US R&D department). Another startup came from the Bosch Software Innovations department. A further startup (Cerix) had already developed beyond the initial idea within the R&D department at a Bosch production site and became part of BOSP that provided the suitable environment for this initiative. Experience so far suggests that a team of at least two and preferably three founders makes for a stronger start.

Several criteria apply to the ideas that are presented. Suitable projects fit the strategic vision of Bosch—which is summarized by the slogan "invented for life" (or *Technik fürs Leben* in German)—are based on technology that Bosch owns, start a business that is new for Bosch, and are scalable and have the potential to become large enough to be interesting for such a large

corporate organization as Bosch. Of around thirty ideas that are submitted to BOSP per year, about six are presented to the BOSP Board, and about two per year are accepted.

The founders move to the BOSP site and start developing the product, approaching customers and other business partners, experimenting with variations of the offering and adjusting it, selling to pilot customers, and expanding revenues from regular sales. The corporate startup founders not only move to BOSP in terms of location—they give up their jobs at Bosch and become employees of BOSP. There is no formal return guarantee if their startup would fail; they would have to apply for a new position at Bosch, although rather than being treated as outside applicants they would be more like applicants for internal job rotation. At BOSP they basically retain their original salary and benefits (although BOSP is not part of Bosch's collective labor agreement in Germany), so the downside risk is limited. On the other hand, they have no stock in their startup and receive an annual bonus based solely on their startup's success, so the upside potential is also limited, too.[10] As a result, unlike an independent startup this arrangement does not offer the high potential to become very rich—or lose it all. Bosch wants to tap into another kind of motivation: the opportunity to get the technology to work, to have more freedom to do something with their drive, to create something exciting.

BOSP is also set up to potentially work with external startups not owned by Bosch and to make available space and other services it provides to its own startups (for a fee). This is not happening yet, so this discussion is limited to the current situation of internal Bosch startups.

One of BOSP's startups, Deepfield Robotics, illustrates how startups can be quite different from the normal Bosch business in terms of product type or customer base. At the same time, its technology is "typical" for Bosch and it needs to have the potential to become very large, which is also typical for the huge corporation that Bosch is. Deepfield Robotics describes itself on its home page as an *"inspired team of engineers, software developers, robotics specialists and agricultural engineers (that) develops innovative solutions for the future of agriculture."*[11] Deepfield Robotics differs markedly from the normal Bosch business because it is about to enter the market of agricultural technology, which is completely new to Bosch. The startup offers new technology-based agricultural products, such as a sensor to monitor asparagus fields via a smartphone app, or a robot to extinguish weeds in fields. The products aim at a new customer base of farmers and strive for increasing their efficiency with technology. However, Deepfield Robotics is at the same time very typical for Bosch. The startup uses existing Bosch technology and patents for its products. For instance, the asparagus sensor box is a product Bosch previously developed for a non-agricultural application that has been adapted to agricultural use by the startup. The startup's business model is partly based on digitalization. Together with the asparagus sensor, farmers purchase a license for the corresponding smartphone app. This concept matches Bosch's strategy focus on digital business models and the internet of things, and it fits the "invented for life" slogan. Moreover, if the startup's technology achieves market success, it has the potential to be further extended, be scaled up, and become a large business. Future applications are already conceived, such as the monitoring of strawberry fields.

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10 BOSP plans to implement a bonus for all startup employees that depends on the duration of membership in the startup and the startup's exit performance. This policy would be very different from the financial incentives at Bosch, but BOSP would have the freedom to adopt it.

11 *Deepfield Robotics - Who we are.* Retrieved November 16, 2016 from https://www.deepfield-robotics.com/index-en.html

A basic rules company

A key difference between BOSP and Bosch is that BOSP has fewer rules, resulting in less "bureaucracy" for people who want to be innovative. BOSP is what Bosch calls a "basic rules" company, which means that the only rules that apply ensure BOSP operates legally and complies with general Bosch rules for doing business, such as those regarding health and safety. However, other rules that are more detailed regarding the specific development and production situation do not apply. For example, Bosch's detailed stage-gate process does not allow people to continue working on a development project beyond a particular stage until the customer has signed off on all the specifications. Those specs cannot be changed later in the process, and a stage that doesn't work out cannot be repeated. Such iterations would be considered failures in Bosch's normal R&D procedures and structures, which are intended for the regular innovation projects of Bosch. However, BOSP has different needs and can start working with customers on much more flexible basis. While expectations must be realistic, a fertile starting point can be the view that "we're not sure if it will work, but we have this idea." Regular customers do not usually expect that perspective from big Bosch, and usually do not want it as part of their R&D processes.

Experimentation with business ideas

BOSP encourages experimentation. The point is to quickly find out whether an idea works rather than to achieve perfection in product development. The website proclaims: *"We don't waste time making detailed plans too early. We focus on evidence-based progress in our teams — allowing them to keep focus and being able to communicate progress more effectively. This is why we don't play the crystal ball game."* Experimentation can also mean discontinuing a startup, or one of the major projects of a startup, although that's much more difficult, as we will discuss below.

The startup Deepfield Robotics also serves a good illustration of BOSP's understanding of learning and experimentation with the customer. The startup's initial idea was to develop a robot for various agricultural applications. The founders had in mind a robot that is able to sow, harvest, and spray herbicides. One idea was that the robot should be able to harvest asparagus. The founders spoke to farmers about their ideas, including a farmer specialized in asparagus. Through the conversation, the founders discovered that their potential customer was less interested in the robot than in monitoring the parameters of his field, such as the temperature, because these parameters mainly influence the growth of asparagus. He wanted to know which temperature the soil had so he could better decide which agricultural process needed to be carried out next (whether to wait, adjust the plastic cover on the fields, or start the harvest). On the basis of this insight, the startup changed its initial idea and started developing a sensor for asparagus fields combined with a smartphone app. The sensors would measure the temperature of the field and show the data on the app, which would give the farmer the information on his smart phone. Thus, Deepfield Robotics learned from communicating and experimenting with a potential customer and developed a new business model. As is typical for such experimentation, with hindsight the new offering may look quite obvious, but beforehand everyone had a different idea.

The startup mobikee provides another illustration of learning within BOSP. The startup's idea was to develop a single smartphone app with which users could find and use various mobility services in a city, such as car-sharing, bike-sharing, and scooter-sharing. With the support of BOSP, mobikee could approach Bosch employees as potential customers to try the initial version of the app and also to continuously test subsequent early versions of the app. mobikee gained two

important insights from these trials. First, they understood how they needed to change particular aspects of their maps, in particular: how the map showed for a vehicle if the location for dropping it off was flexible or not. Tests confirmed that customers understood the new depiction better. Second, mobikee understood how to improve the registration process for the application, more specifically: when and how to request payment information from potential new users.

3.3.2 Interorganizational information exchange

The focus of this section is on the interorganizational information exchange between the BOSP board, the Investor Boards, and the startups. However, first we will briefly also describe information exchange between BOSP and Bosch headquarters (HQ), although this, strictly speaking, not be part of this section on *interorganizational* information exchange, because both entities are organized within the same corporate hierarchy.

Information exchange between BOSP and Bosch HQ

For financial accounting consolidation purposes, BOSP is part of the normal accounting process. All financial BOSP data, such as monthly numbers on actual revenues and expenses, are basically available for Bosch HQ in the central accounting SAP database. Twice a year, BOSP must provide a report comprising its balance sheet, profit and loss account, and an analysis of the changes of assets. The report consists of year-to-date actual data and a forecast to the year's end. The profit and loss account shows the operative value contribution (OVC), which for BOSP is basically the same as EBIT. BOSP does not have to provide the extensive monthly business report required of most other units, which may include numbers on headcount, capacity utilization, cost of goods sold, production costs, and variance analysis, so here BOSP enjoys some special treatment.

As part of its huge R&D effort, Bosch provides BOSP with an annual budget of several million euros that BOSP can invest in its startups, and this budget is the allowable negative OVC result of BOSP. The request for the next year's budget is submitted in April and decided in June. Also important is that the startups generate revenues, which are another source of funding and which provide an indication the startups are developing viable business ideas for which real markets exist. This process differs considerably from how Bosch looks at its corporate venture capital department, which is evaluated on its return on investment. In addition, Bosch HQ makes occasional special requests for information, for example asking for a split of the purchases between German and non-German suppliers, or for a list of long-term purchase contracts that BOSP might have.

Information about the plans and results of a startup

The BOSP board reviews the initial proposals for new startups and the overall progress of the BOSP portfolio, which should be balanced in terms of startup maturity. In addition, every startup has its own investor board, which reviews that specific startup in more detail. In this section, we describe the different kinds of information that are produced. In the next section, we describe when this information is reported to the BOSP board and the investor boards.

One form of management accounting used consists of *a set of nonfinancial "readiness" KPIs*. The development process of a startup is defined in terms of nine milestones (after milestone 0 that is pre-discovery): 1–3 are discovery, 4–6 are incubation, and 7–9 are acceleration, also called "scaling." At each of the milestones, the maturity of the startup is measured on four key

performance indicators: Technology (readiness of technology), Market (evidence for real customer interest), Resources (availability of resources needed), and Organization (awareness of the business aspects such as strategy and business processes) (the "TMRO" performance indicators). For each KPI, nine levels of maturity are described in general terms to be able to assess the level of a given startup at a particular point (so after completing a milestone). Roughly, the project should move from level 1 to 9 on these readiness KPIs when going from milestone 1 to 9. Very important for BOSP is a *balanced* development, so that the project progresses on all four KPIs over time. Technology is often the driver, in the sense that technology provided the initial inspiration for the startup and is also what the founders know and like. However, technology is usually not the most difficult aspect to solve. Not uncommonly, the investor board must push team members to go out and talk to customers.

The *financial project net present value calculation* covers the first six years of the startup in terms of cash flows, leading to a NPV of the entire project. The initial project calculation needs to be approved by the BOSP board as part of the business plan. Later this calculation is updated with actuals and revised estimates (for example, because of revised sales forecasts or new approved funding levels). The different versions of the calculation are retained, with comments about their assumptions, opportunities, and risks.

Moreover, there is a *cash flow report for the current and next calendar year*. This cash flow report contains data about two components of the cash flow: the *funding* that Bosch provides and the *cash inflows* (or revenues—the timing difference between these two concepts can be ignored) the startups generate. These components can be shown at different levels: for an individual startup or aggregated for BOSP as a whole. For both funding and cash inflows, the report includes four different kinds of numbers, namely current forecast, actual, plan, and approved:

- "Current forecast" represents the actual up to that point in the current year (year to date) plus the estimates for the remainder of the current year (for example, based on purchase orders the startup has already placed).
- "Actual" refers to the realized cash flows of previous years.
- "Plan" for the next year represents the funding and cash inflow for that year as specified in the current version of the project calculation. (It may seem unusual that the plan column is still shown—after a target value has been fixed, most management control system would dismiss earlier numbers that may have been playing a role in the negotiations—but showing the plan number serves as a reminder that significantly less funding from Bosch was approved in 2016 than asked for based on earlier business plans.)
- "Approved" represents the allowed funding and targets cash inflows as decided by the BOSP board, which BOSP divides among the startups. After formal approval, these approved numbers become part of the updated project NPV calculations.

A special element of the cash flow report is the item "extra needed" for funding. Of the total funding provided to BOSP, a small part is kept centrally and not immediately allocated to the startups. If the total available budget for funding after the initial allocation creates particularly strong tensions for a particular startup, the startup may receive some additional funding in the form of two components: "approved" plus "extra needed."

Another report is the *actual cash outflow per milestone*. As soon as a purchase order is placed, the anticipated cash flow is included until (via "ordered" and "invoiced") it is actually paid. The

purpose of this report is to keep track of actual spending so the founders know how much spending is left for the current milestone. The cash flow is also broken down by month for the current calendar year. This report also shows the planned cash outflow for the next two milestones.

Furthermore, the *operating plan for next 15 months* basically shows a much more detailed calculation of the cash flows and includes different components for the cash inflows and the cash outflows. The purpose is to let the startup founders think in more detail and in financial terms about their business. This tool is customized for the different startups.

Several observations can be made with respect to these reports. First, the management accounting information for the startups is all based on cash flows. For example, if a startup spent €500,000 on equipment that will be fully and linearly depreciated in five years, only this investment cash flow appears in the various reports mentioned above and not the resulting yearly depreciation expense of €100,000. That depreciation expense will be part of BOSP's OVC result, which is accrual-based for consolidation purposes within Bosch but is not included in the management accounting information for startups described above. Similarly, if a startup sold equipment for €500,000 to a pilot customer and, as part of the deal, offered an extensive warranty, the full cash inflow of €500,000 is shown as the sales revenues. The resulting costs for providing the warranty will show up when costs for replacement parts, travel, and labor are incurred. Second, the various reports are produced at different times, because these are used for different purposes, making connection of the numbers difficult. For example, one would expect that the cash outflow for a particular month is the same in the actual cash outflows per milestone report and in the operating plan for the next 15 months. However, the most recently produced report will include the most up-to-date numbers, which may not be consistent with an earlier produced report. Third, the terminology in the reports is a mix of cash flow and accrual terms. "Sales," "costs," "expenses," "earnings," and "cash flows" are used interchangeably, which can be quite confusing for the startup founders, who typically have no business background.

Reporting information to the BOSP board and the investor boards

In this section we describe when the various reports are provided to the BOSP board and the investor boards. For the *initial proposal* (Milestone 0), a startup team presents to the BOSP board a business plan based on Osterwalder's business canvas (Osterwalder, Pigneur, Bernarda, & Smith, 2014). This business plan includes the initial financial project NPV calculation with estimates about sales prices, sales volume, and costs. However, because uncertainty is great, these numbers will not become targets for which people are going to be held accountable. Their more important purpose is to see whether the team is thinking about such issues—whether the team members at least have thought through how the business plan could work, not just technically but also financially. The team should have a specific "hypothesis" for its business model. If the hypothesis is accepted, the team gets permission to spend a certain amount of money in the early milestones, but that amount is not really a budget, and as the team usually cannot spend much money usefully anyway, one team spending more and others less is not problematic. Should a startup not develop successfully, the project may be terminated, which would also have to be decided by the BOSP board. Similarly, the board decides on the timing of exits that are successful. To date, termination and exits have not occurred.

Each startup's investor board meets when the startup has completed a milestone for *reviewing and supporting the progress of a startup*. The investor board assesses how well the startup is

progressing and decides on the cash flow budget for the next milestone. The team presents what is has achieved to its investor board, and states (sometimes implicitly) which maturity levels the team has reached on the four KPIs. The controller reports how much money has been spent getting to the milestone. The team also presents its plans for the next milestone and the controller presents how much money will be needed for that endeavor. The decision could also require repeating the same milestone. The startups have much freedom for what and how they present to their investor board. For example, there's much variation regarding the level of detail and how the information is structured and designed. These investor board meetings are not only to decide on further funding, but also about helping the startup. The board and startup management talk about ideas, problems, and solutions, for example who in the big Bosch corporation could help, how to get contacts to customers and other useful partners? The CEO of BOSP is not a formal member of these investor boards, because the relationship between BOSP and the startups is not strictly hierarchical. In fact, within BOSP, the CEOs of two of the larger startups are also in the management board of BOSP.

Most financial information is prepared by BOSP's controlling staff because the startups do not have their own staff (they are currently still too small for that). The controller discusses the plans with a startup for how it wants to get to the next milestone and estimates the various kinds of costs that will be incurred. The investor board looks only at the total costs for the next milestone, and at expected revenues (if already applicable) and number of staff. Actual expenses may differ from the budget, in mix or in total—that is considered alright—when that makes sense for the activities of the startup. For example, the plan might be to hire a software developer and then attracting such an employee may not be possible, so the work is outsourced, changing the expenses. This approach also differs significantly from the regular R&D structures and processes of Bosch. On the basis of these plans, the financial project NPV calculation is updated.

Reviewing and planning for BOSP is the task of the BOSP board. This board meets three or four times a year to evaluate initial proposals and to assess the progress of the portfolio of BOSP's startups. The emphasis is on BOSP as a whole rather than on individual startups, although the board may discuss some of these specifically.

The BOSP board receives information about the readiness KPIs, based on the evaluations the investor boards have made for the startups. For each startup, the information is presented in a slide with a 2x2 matrix with some qualitative information for the four TMRO areas, a statement about the levels the startup has achieved for each area, and suggested actions, such as how many pilot customers the startup should try to get. These actions should reflect the emphasis for further, balanced development towards the next period, until the BOSP board meets again. The BOSP board also gets a slide showing a funnel with all startups shown on it, so the four TMRO areas are aggregated into one overall readiness score per startup. In addition, the BOSP board receives the cash flow report for the current and next calendar year for each startup as well as for BOSP as a whole.

Information, expertise and other resources that BOSP provides to the startups

While BOSP provides various general resources to startups, such as financing, work space (office, workshop), furniture, equipment, and accounting, the key point is to have access to resources within Bosch, because that is potentially a unique advantage for these kinds of startup programs implemented by large corporations such as Bosch. Key examples in this case are:

- Bosch technology. The BOSP startups can use existing technology that Bosch owns, as in the Deepfield Robotics example that used an available sensor box (that wirelessly transmits the sensor data) to adapt for use in combination with the sensor in asparagus fields. Moreover, startups can ask for support of a Bosch R&D department to carry out development projects together.
- Bosch production resources. While small batches of a startup's product are produced manually in a first step, larger batches can be produced at one of Bosch's production sites.
- Legal services. For instance, a startup planning to extend its business internationally received expertise and support for writing contracts with international partners. This startup also had concerns about protection of data privacy and received advice from the legal department of Bosch, which turned to a specialized, external legal firm for this support. Bosch also takes care of all patents and other IP activities for the startups. Because Bosch is the trustee of the startups' patents, anyone checking patent ownership sees not the name of a small, unknown startup but that of the huge Bosch corporation.
- Human resource management systems and policies, such as for ongoing education. Also, the startups can advertise their job openings to Bosch employees.
- Startups can use the Bosch brand. Startups can present themselves as a Bosch company and in some cases can also use the Bosch brand for their products and services.
- Contacts with potential customers and other partners. For example, one startup founder explained that Bosch's key account management was very helpful when the startup needed to get in touch with automotive OEMs as potential customers. With the existing contacts of Bosch, the startup gained access to the OEMs much more easily than a non-corporate startup that has no early relationship to the automotive industry.
- Purchase contracts. Startups can use the conditions in the existing Bosch purchasing contracts when they buy things.
- Pilot customers. Lastly, startups can draw on Bosch employees as potential pilot customers. One of BOSP's startups will soon launch the beta version of its smartphone application for Bosch employees before approaching the whole market. In this way, employees will provide feedback for how to improve the product.

BOSP also offers mentors and partners in different stages of the startup development. In the phase of idea generation before a team becomes part of the BOSP organization, multiple internal and external mentors work with the teams of potential entrepreneurs to prepare them for their pitch. As soon as a startup is part of BOSP, it can choose Bosch-internal mentors (e.g., Bosch executives) and external mentors (e.g., former Bosch managers, such as the director of Bosch VC who recently retired, or professors for entrepreneurship). At an early stage startups receive additional mentoring by BOSP employees, such as the BOSP CEO.

3.3.3 Some diverse experiences thus far

Getting radical innovations

Attracting projects for radical innovations and getting these started at BOSP is not an easy task. Often, the proposed startup ideas need to be rejected. Many concern incremental innovations that would advance existing Bosch businesses but are not radical enough to become part of BOSP.

They are better situated in the Bosch departments where they originated. Others do not have enough growth potential to become interesting for Bosch.

Another reason for the slow growth of the number of startups is that motivating Bosch employees to take this step is difficult. The profile of an "average" employee at Bosch does not correspond with the profile of a "typical" entrepreneur. BOSP has concluded that employees consider the change from Bosch to BOSP a risk rather than an opportunity. From BOSP's point of view, this perspective is hard to understand since BOSP offers highly comparable working conditions and makes clear that it will take care of the startup founders and employees in the event of a startup failure (although exactly how this would unfold is still somewhat ambiguous, because it has not happened yet).

A positive experience for BOSP concerns the fast progress toward commercialization of some of its startups. As an example, one startup developed faster than expected and grew within six months to a team with two founders, nine employees, and students doing paid internships at the company. Another startup, Deepfield Robotics, exemplifies the fast commercialization of ideas. The speed of changing initial ideas in experimenting with customers and creating new business models is exceptional from BOSP's point of view. BOSP considers these results as evidence that the way BOSP operates is effective.

Experimenting and changing course

The experiences so far have shown that measuring the startups' progress in financial terms and determining how much more money to invest (or whether to stop the venture) are still very difficult. Accurate predictions of revenues and of how much further funding is needed are highly uncertain. Assessment of readiness on the TMRO items can be quite vague. Additionally, while experimentation and learning are encouraged, knowing when to stop is tricky—how many iterations (redoing the same milestone) should be allowed? To date, no startup has been terminated, even though some startups' financial forecasts do not look promising and reasons for continuing these ventures are not obvious.

Although experimentation, learning from that, and adjusting the business are taking place, some founders are challenged by the need to let go of the formal processes and extensive planning they were accustomed to as former Bosch employees. Additionally, some have difficulty letting go of their initial idea if results show that the idea might be not suitable for a startup business. BOSP seems to be challenged to make these would-be founders think like entrepreneurs in such a way that they actively learn and change their products according to the new insights they gain from learning and experimenting.

Working with basic rules

The basic rules seem to work well within BOSP, but matters become complicated if startups need access to Bosch resources outside BOSP. For instance, a startup for digital business models wanted to sell its service online, using an external service provider to manage the subscriptions and the internal Bosch accounting system in SAP to receive payments from customers. In this scenario, systems would have to be connected to enable the transfer of data. Moreover, these transactions, which involved many new customers and selling subscriptions instead of tangible product, were quite different from existing Bosch transactions, requiring changes in several procedures in the

Bosch SAP system and involving various Bosch departments to get approval for these changes. In all, this adjustment took over one year.

Tailoring of management accounting at BOSP

Another positive experience is that there are significant degrees of freedom for tailoring management accounting at BOSP. The controllers have flexibility to develop and try out new controlling practices that are suitable for the BOSP context. The Bosch strategy department has recognized this need and has asked about the experiences with the TMRO KPIs described above, which BOSP has implemented on the basis of a recent management book (Arteaga & Hyland, 2013). The strategy department now considers using these KPIs more widely within Bosch for tracking the progress of innovation projects, as they differ from the usual Bosch metrics. Such an exchange is positive, because BOSP is also expected to contribute to entrepreneurial thinking at Bosch.

Management accounting jobs at BOSP are quite broad and less specialized than at Bosch itself. The management accountants at BOSP estimated that only about 20% of their work consists of conventional controlling tasks. For example, they do not have to report on a monthly basis to the Bosch headquarters, as every other subsidiary has to do. The rest of the job consists of solving concrete problems for startups, such as finding more expert information and assistance within Bosch relating to taxation matters, legal issues, or planning product exhibitions. This role of the management accountants is also reflected by some of the founders, who appear to see controllers at BOSP as problem solvers and contact persons.[12]

Providing a startup environment

Some characteristics of BOSP are perceived as not yet fully compatible with a startup environment. BOSP requires a business forecast for the next six years—but founders have difficulty predicting the business development this far into the future. In addition, startups have to claim their financial needs for the following year very early—for example, in April/May 2016 for 2017.

Some startups are also challenged by Bosch's expectation that their business model will have to be able to yield very large revenues; otherwise it's not really interesting for a huge company such as Bosch. On the other hand, a startup's financial needs are minute in relation to the available budget of the Bosch organization. The difference between €1 million or €2 million of financing for a startup could be seen as insignificant in comparison to budgets for some large Bosch R&D projects, but the startups have to be very assertive in their attempts to achieve funding. This situation is sometimes perceived as a mismatch between the startup and the corporate incubator.

Another challenge is to create a true startup atmosphere that fits the context of a competitive marketplace for the new products and services these startups are working on. The

12 The following anecdote illustrates this perception of management accountants in the role of problem solvers. We participated in a meeting at BOSP with a startup founder, a management accountant, and a research assistant. The purpose was to test a new tool for evaluating a startup's market value. The founder was asked to provide numbers on expected revenues and costs for the 15 months, and to enter these into the tool. The founder went smoothly through his operating plan and could easily provide several numbers. But when he was asked to specify the expected fixed costs, he paused. He said he had no idea, immediately turned to the management accountant and casually asked her the help him with this. It seemed an open, friendly and appreciated way of asking her to support him.

startup employees are somehow still employees of a corporate company. The atmosphere is not too stressful, the pay and conditions are very good, and the founders have an employment contract for 40 hours per week. Some people felt that the pressured, busy startup atmosphere was absent, saying that the workplace was basically empty after 6 pm and on weekends.

3.4 Conclusions and suggestions for future research

In this section, we first discuss the findings related to the exchange of management accounting information. We then reflect on how the insights into the inside-out startup program contribute to the current knowledge on cooperation models between large corporates and startups. We conclude the study by offering suggestions for future research.

3.4.1 Exchanging management accounting information

Our research shows how both the startups and the large corporation in an inside-out startup program can benefit from the exchange of management accounting information. From the startup perspective, the obligation to prepare reports induces the startup teams to regularly quantify their progress. Although the preparation requires time and effort, the reports provide the startups with a formal and specific instrument to communicate both their achievements and needs for the next time period. Also, presenting management accounting information at board meetings can be seen as indication of the maturity level reached by the startup.

Davila et al. (2009) mention how management accounting information presented by startups can "*enhance the credibility of the company towards external parties – usually customers, partners, or investors*" (p. 335). This also applies to the inside-out startup program in our case because both the BOSP board and investor board base their funding decisions to a large extent on the information presented in the reports, which implies that board members perceive the information as credible and appropriate for decision making. In another study, Zott and Huy (2007) mention how entrepreneurs use different means of symbolic management to attract resources from resource providers. Our insights suggest that exchanging management accounting information can be seen as another instrument of symbolic management, which has not been recognized up to now, because the reports are an information-based symbol of progress and managerial competence of the startup teams, which helps them to communicate their achievements and to clearly specify resource needs towards the boards, being the resource providers in this scenario.

Moreover, exchanging management accounting information is more than a one-sided process being directed from the startups towards the corporate company. As we have witnessed during one of our research sessions, the startups can also draw directly on the expertise of the management accountants of the corporate company. At BOSP, the cooperation between startups and management accountants seems to be well-established, which is why startup teams can make use of the knowledge of the corporate company when specific information for planning is required. This aspect of benefiting mutually from the exchange of management accounting information has been omitted in the literature up to now.

From the corporate perspective, exchanging management accounting information is also worthwhile. The corporate company requests the information because it helps to assess how well

the startups progress. Without quantified information, the assessment of the startups could be difficult due to the lack of accurate information. Consequently, this information helps the corporate company to regularly monitor the progress of the startups it "invests" in. The insights are in line with what studies on management accounting information exchange have found in the venture capital context (e.g., Davila & Foster, 2007; Wijbenga et al., 2007; Wongsunwai, 2013). For instance, Wijbenga et al. (2007) argue that venture capital investors "*impose*" control systems to startups to monitor their development (p. 919). Wongsunwai (2013) indicates that specific information and regular monitoring activities can be a prerequisite for venture capitalists when funding is provided to the startup. Hence, the literature offers some explanations for venture capital investors which can be translated to the role of the corporate company in the inside-out startup program.

Two other insights provide a deeper understanding of the use of management accounting information compared to what has been mentioned in the literature. First, we see that management accounting information is explicitly used by the board to decide on the investment budget for the next time period. Also, the information is used to allocate a reserved budget to individual startups of the program in case the directly allocated money should not be enough. Although this seems rather logical, our study presents a level of detail which makes clear how this information exchange can really work in a corporate incubation program.

Second, exchanging management accounting information does not only enable the corporate company to assess the individual startups, but makes it also possible to compare the progress of all startups in the inside-out program to each other. Specifically, BOSP has found a way to break down the set of different *readiness KPIs* into a single performance indicator. This calculated score captures both the individual progress of each startup and the relative progress compared to the other startups. To our knowledge, this use of management accounting information goes beyond the current literature and could be further investigated in upcoming research. After having discussed the exchange of management accounting information, we now turn to how our insights into the BOSP inside-out startup program contribute to the current knowledge.

3.4.2 The inside-out startup program

BOSP is an example of an inside-out startup program. It is a separate organization, fully owned by Bosch, which Bosch employees can move to and found a startup built on their business ideas. The objective is to support radical innovations for Bosch, which are much more difficult to bring to fruition with the normal Bosch business processes and organizational structure. In the previous sections, we described how BOSP works in areas such as selecting ideas, working with basic rules, experimenting with the startup offerings, and the interorganizational exchange of information for supporting such activities. As this study was intentionally descriptive, focusing on how BOSP is designed and how information is exchanged, an interesting follow up would be to pursue this case over a longer time and to have more interaction with the various stakeholders, such as Bosch management, the BOSP and investor boards, and all the startups. Davila and Epstein (2014) mention that the largest impact of corporate startup programs *"lies in creating and growing markets that require the joining of diverse resources, knowledge, and networks"* (p. 71), and the various startups within BOSP illustrate this nicely.

Weiblen and Chesbrough (2015) mention two important conditions for startup programs like BOSP to work. First, the startups need sufficient *autonomy from corporate guidelines*, influence, and standard procedures. We have seen that BOSP and its startups have great freedom within the scope of the parent organization. This latitude pertains to various business processes and also to how management accounting is being done. BOSP did not have to produce detailed monthly reports for Bosch headquarters, it could focus on cash-flow-based instead of accrual-based financial metrics, and it could implement the TMRO nonfinancial metrics, which are not used elsewhere within Bosch. However, being part of Bosch meant the startups sometimes needed or wanted to interact with other Bosch entities that are not basic rules companies, and then the opportunities for doing things their own way were limited. Examples presented above related to the timeline for planning and budgeting within the Bosch planning and control methods and adjusting particular SAP procedures when payments needed to be processed by Bosch accounting departments. These constraints are inevitable, because the freedom only applies to the inside-out startup program organization. The case illustrates that the issue of autonomy is more subtle than perhaps previously understood.

Second, Weiblen and Chesbrough (2015) discuss that startups must have sufficient *authority to access corporate resources* when needed. Similarly, Davila and Epstein (2014) mention that providing resources is important for corporate startups, as *"these organizations combine tangible resources such as capital and access to suppliers and distribution channels with intangible ones such as brands, relationships, knowledge, and management"* (p.76). Another study (Gassmann & Becker, 2006) specifically focuses on the resource flow between startups and the parent incubator, and it differentiates between tangible and intangible resources flowing from the incubator to the startup.[13] Tangible resources comprise financial, physical (such as physical space, infrastructure and production facilities), and tangible knowledge resources (such as the use of databases or patents). Intangible resources comprise branding and knowledge (such as advice and coaching and contacts). The study includes many interesting examples of corporate incubators, and it provides a literature review and framework of resources that are important in corporate incubation, including resources that may flow back to the corporation. The results suggest that the corporate incubator is mainly associated with a physical resource flow, with less clear evidence on tangible and intangible knowledge. Our findings included several examples of resources and knowledge transfer to the BOSP startups.

The literature also mentions several important topics that may be more difficult to realize in practice. First, it is challenging to foster *balanced* experimentation in this context. Davila and Epstein (2014, p. 74) point out that experimentation and discovery are that a success factor for a corporate startup program. The program needs to move *"from the concept of planning as a blueprint for execution to planning as a discovery path"* (p. 74). This factor appears to be important for BOSP's corporate startup program as well, because BOSP encourages experimentation and learning with potential customers, as exemplified by Deepfield Robotics and mobikee. However, Davila and Epstein (2014, p. 78) also explain that a corporate startup program must balance market forces (especially in capital markets and product markets) and company forces because *"the innovation*

[13] In that study, a corporate incubator is more than an inside-out startup program: It provides resources to internal corporate ventures, because the corporation wants to extract value from its portfolio of technologies. However, a corporate incubator also provides resources to independent (external) startups, because the corporation wants to explore new technology for its core business.

process needs the creativity of markets as well as the destruction that happens within them. One typical effect of lowering market forces within organizations is that projects with little promise can be kept alive for too long." BOSP has not terminated any startup so far, and BOSP management indicates that financial analysis of this decision is difficult. Also, some of the founders perceived that the available financing is distributed indiscriminately among all startups and question whether it might be better to stop the less promising startups. These perceptions suggest that it is difficult for BOSP to balance market and company forces in an optimal way. Our study suggests that there seems to be a delicate balance for inside-out startup programs between, on the one hand, stimulating experimentation, changing course, and looking for other opportunities and, on the other hand, effectively creating market pressures and, if needed, stopping startup investments. The difficult challenge is to foster *balanced* experimentation.

Second, Davila and Epstein (2014, p. 80) discuss that "in contrast to startups where the stimulus to create is embedded in the forces of markets, established companies need to design how their employees will use their creativity." In the case of BOSP, seven proposals were accepted for the corporate startup program and relatively few new proposals for radical innovations have been submitted by Bosch employees. As mentioned above, BOSP sees obstacles to motivating Bosch employees to become entrepreneurs, persuading them to discard their normal working practices that focus mainly on incremental innovation, and inducing them to think and learn like a founder. These perceptions suggest that BOSP has to find a better way to stimulate Bosch employees to use their creativity. This challenging situation at BOSP underlines that the important objective of creating a stimulus for employees to use creativity can be quite difficult to realize (Davila & Epstein, 2014).

In sum, the most import insights from this study are that providing corporate resources to startups, which is a key idea behind the inside-out startup program, actually worked in this case. Also, giving startups considerable freedom took place, but this was limited to the "sheltered" startup program within the corporate organization. It was found to be difficult is to stimulate people to come up with radical innovation and to actually go over to the startup organization; another difficult point was to foster balanced experimentation.

3.4.3 Ideas for future research

As mentioned above, one idea for future research is to follow this case of BOSP over a longer time and to have more interaction with the various stakeholders, such as Bosch management, the BOSP and investor boards, and all the startups. From primarily describing the processes and interorganizational management accounting, the focus of the study could move to more theoretically grounded questions. For example, exploration of the motivational aspects of the corporate startup would be interesting. Which factors are currently increasing or diminishing the motivation and the efforts of the founders? Given that this setting has less upside potential but also less downward risk, which kinds and levels of incentives would be most appropriate? The study of Chesbrough (2000) describes the incentives that are provided as part of the inside-out program of the Lucent New Ventures Group and compares these to incentives that to private venture capital firms provide to startup founders.

Another idea is to describe more examples of inside-out startup programs in depth, because very few in-depth case studies have been done, even at a descriptive level. As mentioned earlier,

Weiblen and Chesbrough (2015) offered the fewest examples of this type of collaboration between startups and corporate organizations, and we could also find only a few examples in public sources. Most startup programs are essentially outside-in.

Our examination also suggests several ideas for future research more focused on management accounting. First, more studies could address the exchange of management accounting information with respect to corporate startup programs and how this exchange influences the success of corporate startup programs. The literature on inside-out startup programs is remarkably silent on this subject.

Second, an interesting comparison would be that of the use of management accounting at BOSP and perhaps other inside-out startup programs to the use of information by private venture capital firms. The parent firm implementing an inside-out startup program—Bosch in this case—may learn from VC firms that already have a lot of information concerning selecting, coaching, monitoring, funding, and terminating startups. What information and methods do these firms use (e.g., De Clercq, Fried, Lehtonen, & Sapienza, 2006; Heinzelmann, 2016; Smith, 2005)? Corporate venture capital may also offer an interesting comparison (e.g., Napp & Minshall, 2011), not only to see which existing management accounting practices of experienced parties could be adopted but also to develop ideas on how these practices would have to be adapted to the context of inside-out startup-programs.

Third, future research could focus on developing management accounting methods that help to monitor the development of startups in financial terms. A key question is how the impact of market uncertainty and technical uncertainty on the financial value of the venture can be modeled (M. J. F. Wouters, Roorda, & Gal, 2011). Another question is how management accounting may help to foster balanced experimentation and strike a balance between flexibility (experimentation) and endlessly trying. Modeling this balance through the lens of real options may be appropriate, but transferring the concepts of financial options to the far less clearly defined context of flexibility and experimentation of new ventures may be strongly limited (Adner & Levinthal, 2004; McGrath, Ferrier, & Mendelow, 2004; M. J. F. Wouters, 2010). Moreover, the consideration of sunk costs in management accounting calculations is intriguing. What might be the effect on sensible, balanced experimentation if sunk costs are immediately "forgotten" and the decision on additional investments is based on only the future investments and financial value of the venture?

A final idea for future research is look at how experiences with corporate entrepreneurship and the insights these experiences have generated can be used elsewhere within corporations. Of course, corporations have different needs for incremental innovation, but some factors may still apply. For example, these startups may be good at working with customers and the customer's customers and learning from them how to improve their own offering, something large supplier firms may also want to become better at (Anderson & Wouters, 2013). Similarly, Bosch wants to stimulate a more entrepreneurial attitude throughout the organization: *"Also in a startup, you should have a masterplan, but you have to accept that things turn out differently and you have to learn, sometimes painfully. We want to stimulate this attitude among our colleagues."*[14]

[14] Klaus Köster. *Interview mit Bosch-Macher – „Dass Projekte scheitern, gehört dazu"*. Stuttgarter Nachrichten. Retrieved October 19, 2016 from http://www.stuttgarter-nachrichten.de/inhalt.interview-mit-bosch-macher-dass-projekte-scheitern-gehoert-dazu.6b8add8e-b747-45ce-8787-c44805f1e910.html (translated from German).

4 Startup-specific performance measurement as management accounting practice to attract resources

Abstract

Startup companies need to attract resources and manage them efficiently to survive, grow, and achieve market success. Prior research has identified social ties and networks, entrepreneurial characteristics and behavior, and signaling quality as antecedents leading to resource attraction. However, the role of management accounting, specifically startup-specific performance measurement, has been neglected up to date. This lack is surprising because well-known practical guidebooks, online sources, and our own insights from interviews and case studies with founders, emphasize the relevance of specific performance measurement in startups. Thus, our study addresses the research question: *How does specific performance measurement help startups to attract key resources?* Drawing on the resource-based view and resource dependence theory, we develop a theoretical model to provide a deeper and more nuanced understanding of specific performance measurement in startups. We conduct a survey among an exclusive sample of 223 technology-oriented startup companies in Germany and use structural equation modeling to test the posited hypotheses. Our results show that startups who use specific performance measurement are able to quantify business activities, communicate on a factual, information-based level with co-founders and external partners, and benefit when it comes to the attraction key resources. Given the pivotal role of the attraction of resources for startups, our results suggest that management accounting, and specific performance measurement in detail, should be considered as a new antecedent of resource attraction in the literature. The impact of our findings could be meaningful to advance both entrepreneurship research and practitioners in startups.

Keywords: startup company, specific performance measurement, attraction of resources, resource-based view, resource dependence theory

4.1 Introduction

The attraction of resources has a pivotal role in both development and success of startup companies (Alvarez & Busenitz, 2001; Brush, Greene, & Hart, 2001; Hanlon & Saunders, 2007). At an early stage, startups typically have very limited resources at their disposal and need to attract financial, human, and other organizational resources to survive the first months, develop a product, and find the first customers. At a later stage, startups need to attract further resources to grow their business, increase the customer base, and achieve market success. Moreover, it is important for startups to manage resources efficiently once they have been attracted (Brinckmann et al., 2011).

In recent years, a considerable literature has grown around the topic of resource attraction in startup companies. Two prominent theories, the resource-based view (RBV) and resource dependence theory (RDT), provide the framework in which several studies have investigated antecedents (i.e., factors leading to) and consequences (i.e., factors resulting from) of resources attraction. Prior studies have focused on three streams of antecedents: social ties and networks (Hanlon & Saunders, 2007; Newbert & Tornikoski, 2013; Shane & Cable, 2002; Zhang, Soh, & Wong, 2010), entrepreneurial characteristics and behavior (Baron & Markman, 2003; Dunkelberg, Moore, Scott, & Stull, 2013; Starr & MacMillan, 1990), and signaling quality (Martens, Jennings, & Jennings, 2007; Zott & Huy, 2007). According the consequences, startup performance has been associated most frequently with resource attraction (Brinckmann & Hoegl, 2011; Cai, Hughes, & Yin, 2014; Edelman, Brush, & Manolova, 2005; Newbert, 2007).

Management accounting instruments, and in particular startup-specific performance measurement, have been ignored as antecedent of resource attraction in startups. This neglect is surprising for two reasons. First, well-known practical guidebooks, such as the *Lean Startup* (Ries, 2011) or *Lean Analytics* (Croll & Yoskovitz, 2013), as well as online sources and blogs of former founders[15, 16] point out the vital role that specific performance measurement can play in startups. Second, insights into startups obtained from interviews and small case studies with founders in our qualitative research revealed that specific performance measurement can be an important tool in a startup's daily business. Although practitioner-oriented literature and insights into startup practices indicate the importance of specific performance measurement, to our knowledge no studies in entrepreneurship research have been found to clarify the topic.

The purpose of this study is to investigate the role of specific performance measurement in the attraction of resources. We focus exclusively on resource attraction as representative of startup performance because prior research has shown how important resource attraction is for startups to be successful (Brinckmann & Hoegl, 2011; Cai et al., 2014; Edelman et al., 2005; Newbert, 2007). We understand specific performance measurement as a sub-topic of management accounting which depicts how startups capture particular business activities and objectives in measurements, figures, ratios, metrics, or qualitative information. We aim to provide a deeper and more nuanced understanding of specific performance measurement in startups to reduce the

15 Ehrenberg, D. (2014). *The Seven Startup Metrics You Must Track*. Retrieved October 22, 2017, from https://www.forbes.com/sites/theyec/2014/06/20/the-seven-startup-metrics-you-must-track/#3dc45c7d725e

16 Suster, M. (2011). *How Startups Can Use Metrics to Drive Success*. Retrieved October 22, 2017, from https://bothsidesofthetable.com/how-startups-can-use-metrics-to-drive-success-d361b8989f5d

knowledge gap in entrepreneurship research. Specifically, we contribute to the literature by answering the following research question:

How does specific performance measurement help startups to attract key resources?

To answer the research question, this study employs a survey-based research design. We first develop a theoretical model to capture startup-specific performance measurement as central construct and novel antecedent of resource attraction. The conceptualization of our model draws on resource theories (RBV, RDT), prior studies, and preliminary research activities (interviews with startups, small case studies). The model consists of seven theoretical constructs and eight hypotheses. We then conduct a survey among 613 technology-based startup companies in Germany which yields empirical data of 223 startups. We next use structural equation modeling (SEM) to statistically analyze the data and test our hypotheses.

The results show that specific performance measurement can help startup companies to attract key resources. Our theoretical model provides a deeper and more nuanced understanding of how startup-specific performance measurement enables founders to quantify business activities and to communicate on a factual, information-based level with co-founders and external partners. As a result, founders are more aware of the resources they require. They can use this awareness to convince partners of their resource needs and, thus, are successful in obtaining the resources. We find clear support for five of eight posited hypotheses; one hypothesis is partially supported, and two hypothesis are not supported.

This study offers the following four contributions to the literature. First, the main contribution is our theoretical model which clarifies how specific performance measurement helps startups to attract important resources. Together with the model, we add four new theoretical constructs and corresponding measurement scales to the literature (*startup-specific performance measurement, use of web analytic tools, information-based communication, and attraction of key resources*). Second, we suggest antecedents which explain the use of specific performance measurement in startups. Third, with *attraction of key resources* we contribute a more nuanced consequence to capture the performance of startups. Although the construct has been addressed in prior work, a clear measurement scale was missing up to date. Fourth, with *startup-specific performance measurement* we add a management accounting practice to the existing antecedents of resource attraction and, thereby, complement the knowledge of the RBV and RDT. Moreover, we will present some practical insights about survey-based research and point out the importance of a very professional survey design when working with startup companies as unit of analysis.

The remainder of this work is organized as follows. The second section puts our study in the context of the RBV and RDT to illustrate the importance of resources for startup development and success. The third section develops the theoretical model, clarifies the theoretical constructs, and posits eight hypotheses. In the fourth section, the research method is described. The fifth section demonstrates the results of the survey research which are then discussed in the sixth section. We end this study with a brief conclusion and provide further details in the appendices.

4.2 Theoretical background and literature overview

This section serves two purposes. The first purpose is to show how our study draws on two prominent resource theories, the resource-based view (RBV) and resource dependence theory (RDT), by highlighting the importance of resource attraction for startups. The second purpose is to describe the antecedents and consequences of resource attraction investigated by prior entrepreneurship research. Based on this, we will see that research has shown the positive effect of resource attraction on startup performance. However, research has neglected startup-specific performance measurement as antecedent up to date.

4.2.1 Drawing on resource theories

This study draws on two prominent resource theories, the resource-based view (RBV) and resource dependence-theory (RDT). Both theories place emphasis on the vital role of resources in organizational development and success. Moreover, the theories are helpful to understand the startup's need for resources.

Since Wernerfelt's (1984) seminal work, the RBV has become one of the most influential theories in both management and entrepreneurship research (Alvarez & Busenitz, 2001; Newbert, 2007). The RBV understand organizations as an accumulation of resources. Having specific resources can create an competitive advantage over other organizations (Wernerfelt, 1984). Similarly, RDT has gained considerable attention since the fundamental work by Pfeffer and Salancik (1978) and has recently been praised as "*one of the most influential theories in organizational theory and strategic management ever since [its publication]*" (Hillman, Withers, & Collins, 2009, p. 1404). The RDT goes one step further and argues that resource possession also creates dependencies between organizations (Pfeffer & Salancik, 1978). An organization with few resources, such as a startup company, can be dependent on an organization with a strong resource configuration, such as venture capital (VC) investors. Organizations need to manage the dependencies and convince other organizations to provide them with the required resources (J. B. Barney, 2001).

To distinguish the RBV and RDT, Figure 5 shows a simplified illustration of a startup, potential resource providers in the startup's environment, and the relationship between them. The RBV focuses on the resources available to the startup. The RBV argues that resources at the startup's disposal directly influence its development. The RDT, in contrast, focuses on the relationship between the startup and external, potential resource providers. Hence, RDT argues that the startup is dependent on external resources and needs to manage the relationship with resource providers. With Figure 5 in mind, we now turn to both theories in more detail, starting with the meaning of resources.

The meaning of resources

Being central to both theories, we should first clarify what the RBV and RDT understand by *resources*. The RBV comprehends an organization as an accumulation of resources (also called *bundles of resources*) which can be employed to achieve a competitive advantage over other organizations (Wernerfelt, 1984). The meaning of the term *resources* is rather broad. Resources are defined as "*anything which could be thought of as a strength or weakness of a given firm*" (Wernerfelt, 1984, p. 172) or as tangible and intangible assets of an organization (J. B. Barney, 2001; Lichtenstein & Brush, 2001).

Another author points up the desirable aspect of resources, defining them as "*any thing or quality that is useful, tangible or intangible*" (Dollinger, 2008, p. 35). In RDT, resources are also seen as a valuable asset which an organization requires to survive and prosper (Hillman et al., 2009; Pfeffer & Salancik, 1978).

Other studies provide a distinction between different types of resources. Barney (1991) separates physical capital resources, human capital resources, and organizational capital resources. In an entrepreneurial context, Dollinger (2008) distinguishes between physical resources, reputational resources, organizational resources, financial resources, intellectual (human) resources, and technological resources. According to Packalen (2007, p. 885), financial resources, human resources, and strategic partnerships are generally seen as the most important resources for startup companies. Examples of resources include specific knowledge, skilled and qualified employees, contracts with external partners, brand names, customers, working space, networks, contacts with external supporters, and, of course, financial capital. To sum up, both theories agree that resources are something of value or importance to an organization. Moreover, different types of resources can be important to different organizations.

Resource theories in entrepreneurship

Since both theories apply to organizations in general, we now describe how help to understand startup companies in particular. The RBV has a vital role in entrepreneurship research. Since Alvarez and Busenitz's (2001) influential work on the RBV in entrepreneurship[17], researchers have broadly acknowledged the importance of resources in the process of new venture creation. Resources enable entrepreneurs to recognize and exploit business opportunities, to acquire further resources to create new products or services, and to generate revenues by selling these products on

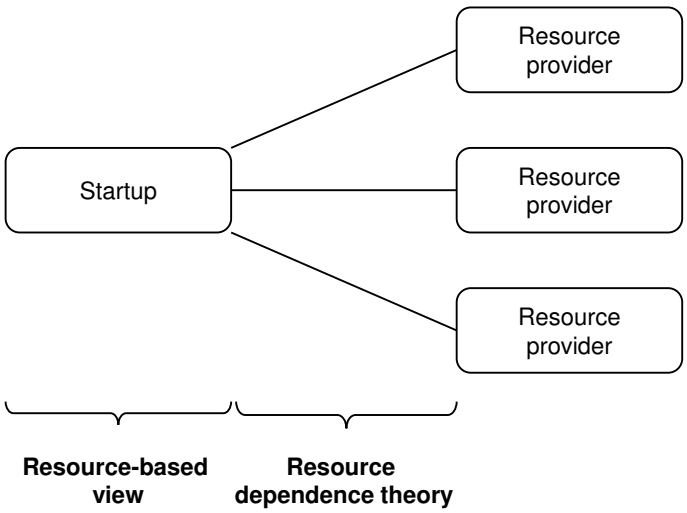

Figure 5. While the RBV focuses on the startup organization, RDT aims to explain the relationship between the startup and outside organizations, such as resource providers (own illustration)

[17] Alvarez and Busenitz (2001) originally referred to this theory as *resource-based theory* instead of *resource-based view*. However, as most of the studies we refer to use the term *resource-based view*, we also adhere to this practice.

the market. Alvarez and Busenitz (2001) observe that both RBV and entrepreneurship research "*adopt precisely the same unit of analysis — the resource*" (p. 756). Following Alvarez and Busenitz (2001), numerous studies have drawn on the RBV to explain the phenomenon of entrepreneurship (for example, see Cai et al., 2014; Edelman et al., 2005; Foss, Klein, Kor, & Mahoney, 2008; Powers & McDougall, 2005; Wu, 2007).

An interesting detail is that the term *resources* in is used frequently, but not systematically. Hence, the importance of resources comes along with a certain degree of ambiguity. While influential studies distinguish between *individually owned resources* and *company owned resources*[18] (Alvarez & Busenitz, 2001; Brush et al., 2001), subsequent research is less precise. *Individually owned resources* are referred to as characteristics of entrepreneurs that "*facilitate the recognition of new opportunities and the assembling of resources for the venture*" (Alvarez & Busenitz, 2001, p. 755). *Company owned resources* belong to the startup and allow entrepreneurs to build and grow the organization, execute strategic decisions, and acquire customers. Financial capital, human capital, and outside resources are the most important *company owned resources* (for a review, see Gilbert, McDougall, & Audretsch, 2006). This distinction is important when we turn to different antecedents of resource attraction (see tion 4.2.2).

As an example to illustrate the imprecise use, we briefly turn to human resources. In management research, *human resources* are mostly addressed in the sense of employees of an organization. However, in entrepreneurship, *human resources* can either refer to employees or qualified staff working in the startup (for example, see Edelman et al., 2005; Fields, Goodman, & Blum, 2005; Leung, Zhang, Wong, & Foo, 2006), thus, being a *company owned resource*. Or it can refer to cognitive or behavioral constitution of the entrepreneur in the sense of abilities and human capital (for example, see Brush & Chaganti, 1999; Grichnik, Brinckmann, Singh, & Manigart, 2014; Unger et al., 2011), thus, being an *individually owned resources*. The example shows that resources are used rather broadly than precisely.

We go back to the theories' relevance for entrepreneurship and turn to RDT. This theory has been found to be highly capable to explain the relationship between the leadership of new ventures and their performance because "*in the entrepreneurial firm, the resource dependence role may be even more critical than for larger, mature firms*" (Daily, McDougall, Covin, & Dalton, 2002, p. 403). Several studies have drawn on resource dependence theory to explain aspects of entrepreneurship. For instance, Wijbenga, Postma, and Stratling (2007) investigate the relationship between entrepreneurial control systems, venture capital investment, and new venture performance based on RDT, arguing that control systems in entrepreneurial firms enable growth "*as they promote efficient and effective use of the resources provided by the VC*" (p. 258). Drawing on RDT, social ties of entrepreneurs are a common topic to explain how startup can attract resources (Newbert & Tornikoski, 2013; Zhang et al., 2010). Thus, the RBV and RDT are essential to understand why resources matter for startups and why relationships with outside partners are crucial to attract resources.

Taken together, both theories highlight that resources are very important for startups. The theories provide the base for our study because we aim to contribute a novel construct to the literature which can lead to resource attraction. As a next step, we should examine the current state of knowledge.

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[18] Brush, Greene, and Hart (2001) use the terms *personal resources* and *organizational resources*.

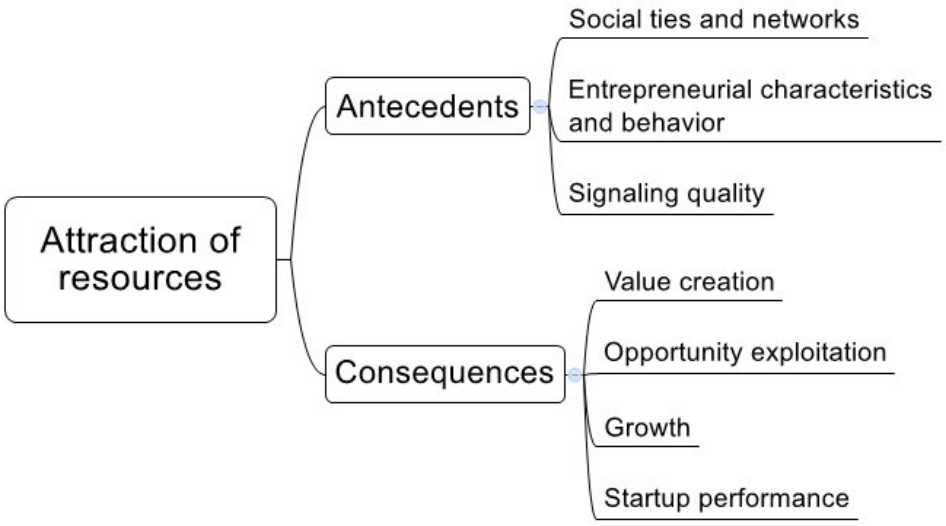

Figure 6. Streams in empirical research looking at antecedents (top) and consequences (bottom) of the attraction of resources

4.2.2 Previous research on resource attraction

We now relate our topic - to understand how *startup-specific performance measurement* can help startups to attract resources – to existing knowledge. Specifically, we report antecedents and consequences of resource attraction[19] identified in previous empirical studies. Figure 6 provides an overview of the corresponding research streams. Following this order, we commence with antecedents.

Antecedents of resource attraction

Prior empirical studies on antecedents of resource attraction can be categorized into three streams of research: *social ties and networks*, *entrepreneurial characteristics and behavior*, and *signaling quality*. Given the large number of empirical studies on this topic, scholars seem to share Brush et al.'s (2001) popular assumption that "*attracting resources into a fledgling venture is perhaps the greatest challenge faced by entrepreneurs*" (p. 72). Even though we focus on empirical studies, it should be mentioned that further studies tackle the topic from a conceptual perspective (for instance, see Maritan & Peteraf, 2011; Packalen, 2007; Sirmon, Hitt, & Ireland, 2007; Wernerfelt, 2011).

Social ties and networks. A big stream of literature aims to explain the attraction of resources through social ties and networks of founders. The first group looks exclusively at the attraction of *financial resources*. In an early study, Hall and Hofer (1993) find that founders who are known by the VCs are more likely to receive funding. Their results are based on the analysis of VCs' decision criteria, using interviews and verbal protocols as research method. Shane and Stuart (2002) also find that entrepreneurs who had relationships with VC investors are more likely to receive funding.

[19] Some studies also use the term *acquisition of resources*. While regarding both terms as synonyms, we adhere mostly to *attraction of resources* as this terminology captures more precisely the mechanisms of obtaining instead of purchasing resources.

Moreover, they are less likely to cease their business operations. Shane and Stuart (2002) study archival data of 134 entrepreneurs at the Massachusetts Institute of Technology (MIT) between 1980 and 1996, examining whether entrepreneurs could attract VC or failed. Another study by Shane and Cable (2002) highlights the importance of network ties for information transfer between venture capital investors and entrepreneurs.

As an interesting side note, social ties play also a vital role for resource attraction in low resource environments. While most research concentrates on developed economies, some studies also find social ties to be important in developing economies. Khayesi and George (2011) investigate the network ties of 242 Ugandan entrepreneurs and find that social ties have a positive effect on financial resources attraction. Another study by Khayesi, George and Antonakis (2014) finds that an increasing social network is associated with the amount of financial resources attracted by 188 Ugandan entrepreneurs. Even though the findings origin from a different economic and cultural background, they contribute to the importance of social ties for financial resource acquisition.

The second group researches the attraction of *human resources*. Zhang et al. (2010) investigate social ties between entrepreneurs and resource owners in the form of potential employees in a survey among 128 startups in Singapore and 250 startups in Beijing. They find strong ties to increase the attraction of human resources. Leung, Zhang, Wong, and Foo (2006) find in a case study with 20 entrepreneurial companies that with growing size and age entrepreneurial companies rely more on networks to find qualified staff.

The third group of studies focuses on the attraction of *other resources*. Hanlon and Saunders (2007) study 48 Canadian new ventures' relationship to resource providers. They show that social ties are essential to attract resources apart from financing and employees; for instance, advice, emotional support, or strategic information. Newbert and Tornikoski (2011) focus on the social embeddedness of entrepreneurs and their dependence on external partners. Drawing on secondary survey data of the popular Panel Study of Entrepreneurial Dynamics (PSED),[20] they find that a higher degree of social embeddedness is related to lower resource costs.

Entrepreneurial characteristics and behavior. Another stream of antecedents is dedicated to entrepreneurs' characteristics and behavior. The first group of studies investigates different types *individually owned resources* to explain the attraction of *company owned resources* (see section 4.2.1 for terminology). Baron and Markmann (2003) find a statistically significant relationship between social competence of 159 entrepreneurs in the cosmetic and high-tech industry and financial success of their startups. Although conceptual in nature, Packalen (2007) argues that the ability of entrepreneurs to obtain resources depends on their social capital, such as prior work experience, social status, and affiliations.

The second group of studies addresses behavior from different perspectives. An explanatory study by Starr and MacMillan (1990) finds social contracting as antecedent of resource attraction. Being different from networks, the authors understand social contracting as "*a set of obligations, expectations, and mutually developed norms and sanctions which evolved from prior social interaction*" (p. 85) between the founder and resource owner which enables the founder to attract resource.

[20] University of Michigan. (2017). *Panel Study of Entrepreneurial Dynamics*. Retrieved October 18, 2017, from http://www.psed.isr.umich.edu/psed/home

Another study by Dunkelberg, Moore, Scott, and Stull (2013) identifies the goal setting habits of entrepreneurs as antecedent of resource attraction.

The third group looks specifically at obtaining resources through bootstrapping. Bootstrapping is understood as an alternative resource management approach which aims to avoid the attraction of external resources and which enables a startup to exploit business opportunities without being limited by external resource constraints. As this stream of literature is very specific, we leave out details and refer the reader to the following studies. Winborg and Landström (2000) investigate different methods of bootstrapping to understand the resource acquisition of small business managers. Grichnik, Brinckmann, Singh, and Manigart (2014) research bootstrapping for resource acquisition in the context of a startup's environment. The authors emphasize the importance of the environment for resource acquisition.

Signaling quality. Another important stream of antecedents refers to signaling quality which can be seen as communicating certain strengths of the startup or entrepreneur to external resource providers. In their explanatory field research, Zott and Huy (2007) focus on seven British entrepreneurial companies to examine the role of symbolic management to acquire resources. They understand by symbolic management actions of entrepreneurs that aim to increase the meaning of an object or a situation and look at four categories: the entrepreneur's personal credibility, professional organizing, organizational achievement, and quality of stakeholder relationships. Based on their interviews and publicly available company data they find that entrepreneurs who perform symbolic management are more successful in attracting resources.

Two other studies focus on attracting resources by convincing resource providers through narratives. Lounsburg and Glynn (2001) analyze the role of anecdotal entrepreneurial stories in resource acquisition. They find that storytelling acts as mediator between available entrepreneurial resources and the acquisition of new resources. While they refer to available resources as both individually owned and company owned resources, the new resources acquired are primarily financial capital and legitimacy for the new venture. Martens, Jennings, and Jennings (2007) also research the relationship between storytelling and resource acquisition. Based on archival data of 169 U.S. technology-oriented startups which aimed to issue an IPO, they find that narratives have a positive impact on the resource acquisition. Delmar and Shane (2004) refer to a new venture's *business plan* as "*institutionalized mechanism for telling the founder's story about the future of the venture*" (p. 391). Based on findings from a survey among 223 Swedish entrepreneurs, they argue that completing a business plan helps founders to acquire and recombine required resources.

We conclude that prior research has found three main streams of antecedents: *social ties and networks*, *entrepreneurial characteristics and behavior*, and *signaling quality*. We further conclude that research up to date has not addressed *startup-specific performance measurement* as antecedent. We continue with the consequence of resource attraction.

Consequences of resources attraction

We next provide an overview of how empirical literature has looked at consequences of resource attraction. Prior studies have identified four streams of consequences: *value creation*, *opportunity exploitation, growth,* and *startup performance*. We will see that startup performance has been predominantly addressed in the literature. This is of key importance because we later build our theoretical model on the premise that prior work has demonstrated the positive effect of resource

attraction on startup performance. Before we turn to startup performance, we first illustrate the three other streams.

Value creation. The first stream suggests *value creation* as a consequence of resource attraction. Sirmon, Hitt and Ireland (2007) develop a model which aims to explain the dynamic resource management of companies. The model captures three aspects related to resources. One aspect is resource attraction, defined as "*the process of purchasing resources from strategic factor markets*" (p. 277). They argue that the attraction of resource determines the company's ability to create value. Being good at attracting resources, therefore, can lead to a higher value creation for both customers and owners of companies.

Opportunity exploitation. The second stream addresses *opportunity exploitation* as another consequence. Bhawe, Rawhouser and Pollack (2016) investigate the order of resource acquisition in new ventures. They distinguish between resources which help to identify business opportunities (called search resources) and resources that help to deploy opportunities (called execution resources). Based on a simulation, they find that acquiring search resources has a positive effect on new venture performance. Although both studies (Bhawe et al., 2016; Sirmon et al., 2007) offer interesting consequences, they do not provide sufficient empirical support for their propositions.

Growth. A third stream is dedicated to *startup growth* as a consequence of resource attraction. In their literature review on new venture growth, Gilbert, McDougall and Audretsch (2006) point out that resources are vital for entrepreneurs to execute decisions and to operate. They find resources as one of the most important predictors of new venture growth (along with characteristics of entrepreneurs, strategy, industry, and organizational structure). They further find that *financial capital* and *human capital resources* are "*the two resources examined most often and found to be most clearly related to new venture growth*" (p. 932). Alsos, Isaksen and Ljunggren (2006) investigate the acquisition of financial resources in business startups of 1,048 entrepreneurs in Norway. The authors find that lower levels of initial funding are related to a lower business growth in the first months.

Startup performance. The most frequently researched consequence of resource attraction is *startup performance*. Before we continue, we should first clarify this term. Even though performance is highly relevant in organizational research, many authors neglect its theoretical definition (Kirby, 2005). Richard, Devinney, Yip, and Johnson (2009) state that organizational performance is the "*ultimate dependent variable of interest for researchers concerned with just about any area of management*", yet "*its structure and definition are rarely explicitly justified*" (p. 719). Richard et al. (2009) define organizational performance as "*three specific areas of firm outcomes: (a) financial performance (profits, return on assets, return on investment, etc.); (b) product market performance (sales, market share, etc.); and (c) shareholder return (total shareholder return, economic value added, etc.)*" (p. 722). Kirby (2005) relates performance to success and argues that success is most frequently associated with cash "that comes to businesses in various forms" (p. 36). Based on this, we define *startup performance* as the extent of success a startup can achieve by marketing its products or services, with success being either financial (in terms of profits or returns) or product-related (in terms of sales or employee growth).

Prior studies have established the connection between startup performance and the attraction of resources. Newbert (2007) review empirical work from a resource-based view perspective and finds that 93% of articles (51 of 55) chose *performance* as dependent variable. Although the review does not focus specifically on startups, it underpins performance as the most frequently investigated outcome of resources attraction. Other studies address the resource-

performance relationship in the startup context. Chandler and Hanks (1994) argue that new ventures "*survive easily, grow more rapidly, are more profitable*" (p. 334) if resources are abundant. They expect startups with a strong resource base to "*have a broader range of possible actions*" (p. 335) and to enhance their organizational performance. Seeing resource-based capabilities as facilitators of opportunity recognition, the authors find empirical support for their arguments based on a survey of 115 U.S. nonhigh-technology ventures. Building on Chandler and Hanks (1994), a study by Edelman, Brush and Manolova (2005) confirms these findings. Using structural equation modelling to analyze a sample of 192 U.S. small nonhigh-technology companies, the study finds a significant effect of human and organizational resources on performance when mediated by strategy. Thus, they conclude that small companies should adapt their strategy to their resources.

The findings by Chandler and Hanks (1994) and Edelman et al. (2005) can be rephrased in the sense that the possession of resources does not guarantee startup performance. However, having sufficient resources is a strong prerequisite for startup performance. Molloy, Chadwick, Ployhart, and Golden (2011) use the analogy of team sport to illustrate this logic. We transfer his example to the world of football: The possession of resources is not equal to performance. Imagine a football team with one of the best players in the world. The presence of a superstar does not make the team successful per se. For instance, Lionel Messi was awarded the world's best football player four time in a row, from 2009 to 2012. He performed excellently for his football club FC Barcelona. However, in the Argentina national team, Messi could not unleash his full potential and the team was not successful in international tournaments, such as the World Cups 2010 in South Africa or 2014 in Brazil.

Another study by Cai, Hughes and Yin (2014) investigate three different methods of resource acquisition in relation to new venture performance: resource attraction (as the "*process through which new ventures buy target resources from the external factor market with their initial financial resources*"), resource purchase (as acquiring "*target resources from outside the firm indirectly through nonfinancial means*"), and internal resource development (as developing "*the firm's resource stock in a way that offers exclusive advantages to the firm"*) (Cai et al., 2014, pp. 367, 378). Using regression analysis, they find in a survey among 343 Chinese new ventures, that all three methods of resource acquisition are positively related to new venture performance.

We conclude this section on theoretical background and literature as follows. Both resource theories (the RBV and RDT) emphasize the pivotal role of resource attraction for startups. Both resource theories and prior empirical work show that resource attraction is closely connected to startup performance. Prior empirical work up to now has investigated three streams of antecedents of resources attraction. However, literature shows a gap when it comes to the role of startup-specific performance measurement as antecedent of resources attraction. We aim to reduce this gap and introduce our theoretical model next.

4.3 Model development

In this section, we introduce our theoretical model (Figure 7), define and describe the theoretical constructs (Table 9), and postulate relationships between them (hypotheses). The model provides a more nuanced understanding of *how specific performance measurement in startups helps them to attract key*

resources. In particular, it looks at how startup-specific performance measurement can improve the communication of startups and thereby increase the attraction of important resources. We first mention selection criteria to clarify the scope of the model. We then give definitions of the constructs. Next, we describe each construct in detail and motivate the hypotheses.

4.3.1 Model and construct definitions

Before we introduce the model, we should clarify the scope of the study. The unit of our analysis is the *startup company*. By a startup we understand a young and small company which has been launched by an individual entrepreneur or group of entrepreneurs and which is independent of a corporate company. Furthermore, we concentrate on startups with a particular set of characteristics and, therefore, define selection criteria below. This is necessary as startups can be very heterogeneous with respect to their organizational characteristics, and as academic literature seems to lack a generally accepted definition.[21]

Our study focuses on startups that fulfill the following *selection criteria* because we expect *startup-specific performance measurement* to be most relevant for these type of startups.

1. The startup requires a significant initial investment in a situation in which it is not trivial to attract financial resources.
2. Beyond an initial investment, the startup carries out operations which need to be quantified in order to manage them.
3. Beyond financial resources, the startup requires other resources that are not easy to attract, such as qualified staff, pilot customers, or access to technology.

Our model consists of seven theoretical constructs and eight hypotheses (Figure 7). A plus "+" indicates that we expect a positive effect between the two constructs of a hypothesis. One-sentence construct definitions are given in Table 9. After having emphasized the importance of resource attraction for startup performance, we now explain how *startup-specific performance measurement* can lead to resource attraction. We describe the conceptualization of the model step by step. The model can be seen as a front part and a core part. The front part consists of four exogenous constructs on the left side (*perceived environmental hostility, use of web analytic tools, managerial experience of founders,* and *presence of external investment*) which we propose as antecedents of the other constructs. The core part consists of three constructs (*startup-specific performance measurement, information-based communication,* and *attraction of key resources*) which aim to answer how specific performance measurement helps startups to attract resources. The dependent variable of the model is *attraction of key resources* because we have shown before the importance of resource attraction for startup development and performance.

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21 There is little agreement on a strict definition of the term startup. For instance, there is no widely accepted threshold for the age of a startup and authors' suggestions vary from 7 to 15 years. A number of authors lean on the following definition by the U.S. Small Business Administration: "*In the world of business, the word "startup" goes beyond a company just getting off the ground. The term startup is also associated with a business that is typically technology oriented and has high growth potential. Startups have some unique struggles, especially in regard to financing. That's because investors are looking for the highest potential return on investment, while balancing the associated risks.*" U.S. Small Business Administration. (2016). *Startups & High-Growth Businesses*. Retrieved July 29, 2016, from https://www.sba.gov/starting-business/how-start-business/business-types/startups-high-growth-businesses

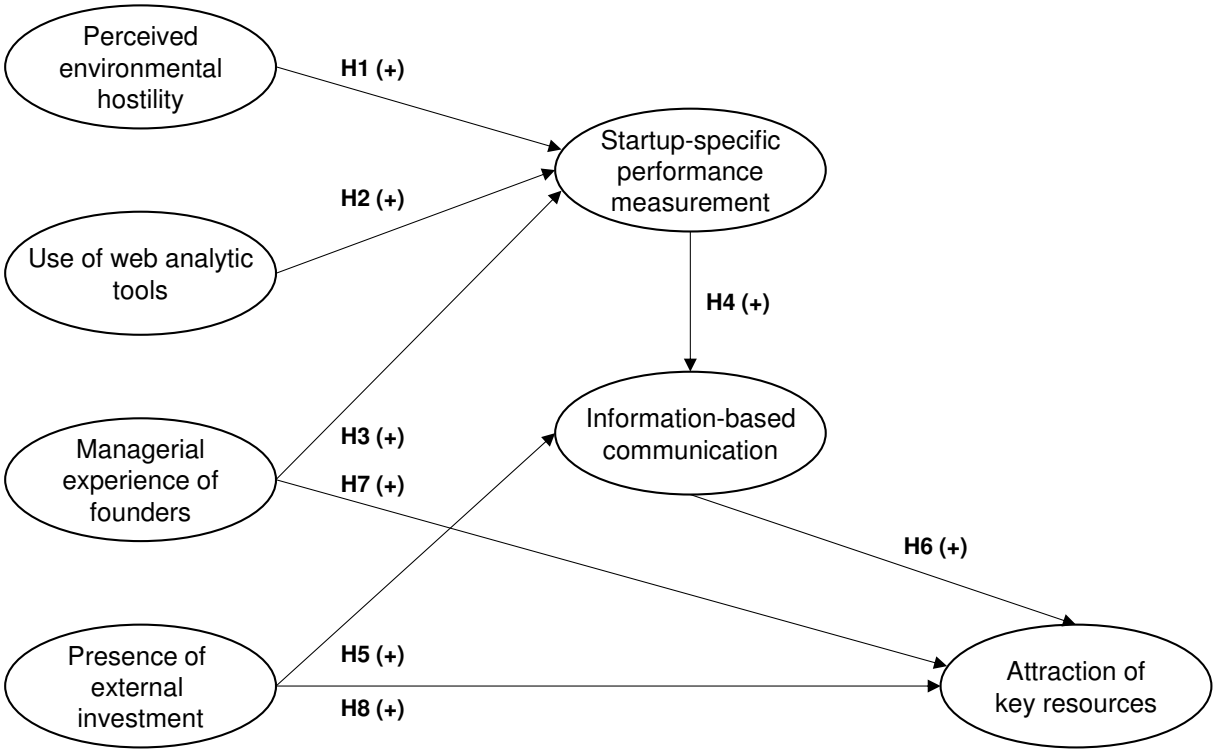

Figure 7. The theoretical model consisting of 7 constructs and 8 hypotheses

The model builds on existing knowledge in entrepreneurship and management research. Findings from previous studies helped to develop and sharpen the model as well as to anchor its constructs and hypotheses in the literature. Moreover, the conceptualization of the model was inspired by preliminary research activities with startups (see section 4.4.1). We conducted a number of interviews and small case studies with entrepreneurs in two very interesting startup environments. We interviewed entrepreneurs and carried out 16 small case studies in startups in the area of Karlsruhe, Germany, which is a well-known cradle for technology-oriented startups. We also interviewed entrepreneurs in Cape Town, South Africa, which is another vibrant hub for startup creation. Furthermore, we sharpened the model in discussions with experts in management accounting, entrepreneurship, and organizational research. The result of this conceptualization is presented now.

4.3.2 Startup-specific performance measurement and its antecedents

We go through the model in the following order. First, we look at startup-specific performance measurement, its three antecedents (perceived environmental hostility, use of web analytic tools, managerial experience of founders), and the corresponding hypotheses (H1, H2, H3). Then, we describe information-based communication, its antecedent presence of external investment, and related hypotheses (H4, H5). Last, we turn to attraction of key resources and the corresponding hypotheses (H6, H7, H8).

Table 9. List of theoretical constructs with names and definitions

Construct name	Construct definition
Perceived environmental hostility	The extent to which founders feel relentless threats to the viability of their business due to difficult external conditions.
Use of web analytic tools	The degree to which the startup utilizes online applications or software to measure website traffic and obtain information about its customers, such as Google Analytics, Adobe Analytics, or Facebook Analytics.
Managerial experience of founders	Professional skills and knowledge in the field of management or economics acquired by the founders prior to creating the startup.
Presence of external investment	The level to which a startup has been provided with financing from outside partners, such as venture capitalists, angel investors, or banks.
Startup-specific performance measurement	The extent to which founders capture the startup's business activities and objectives in measurements, figures, ratios, metrics, or qualitative information.
Information-based communication	The extent to which founders mobilize company-specific and largely quantitative information about the startup in their interaction with co-founders or external partners, such as investors, business advisors, suppliers, or customers.
Attraction of key resources	The level of success in obtaining important tangible and intangible assets, which are essential for the startup's development and growth, from external parties.

Perceived environmental hostility

We define *perceived environmental hostility* as the extent to which founders feel relentless threats to the viability of their business due to difficult external conditions. *Perceived environmental hostility* captures a situation in which the startup faces a harsh and competitive environment. A hostile environment is characterized by a high intensity of competition and scarce available resources. Hence, it is more difficult for a new company to obtain important resources or find new customers. The startup has to resist this additional pressure and find ways to cope with it. *Perceived environmental hostility* can influence the decision making of entrepreneurs (Lindelöf & Löfsten, 2006) as they constantly have to worry about how to survive, attract resources, and grow their venture in the face of competition.

Perceived environmental hostility can also affect the availability of resources to startups. Financial resources are commonly seen as the most important resource for startups growth (Alsos et al., 2006). A hostile environment can make it more challenging for founders to obtain financing. Moreover, other important resources, such as human resources or strategic partnerships (Gilbert et al., 2006), can be hardly available to founders when founders perceive their environment as hostile. Suppose a situation in which a software startup aims to grow, but can hardly find qualified software developers to hire because many other young and established companies compete for qualified software developers. Furthermore, *perceived environmental hostility* is not limited to the initial

stage of the startup development. Suppose a situation in which a startup has already been successful in obtaining financial resources for a highly technological product. Now the startup could require further financing because the initial money might not have been enough. However, as the competition is strong and investors are scarce, it might be difficult to attract the next round of external financing.

Previous studies have investigated *perceived environmental hostility*. Zahra and Garvis (2000) understand environmental hostility as "*unfavorable external forces for a firm's business*" (p. 475) and argue it can impede entrepreneurial activities. Löfsten and Lindelöf (2005) research the relationship between *environmental hostility* and management accounting methods in 183 Swedish new technology based firms. They understand *environmental hostility* as competition and economic constraints. Based on contingency theory, they argue that best way for companies to make decisions or organize resources is contingent, meaning dependent, on the company's internal setting and environment (Otley, 1980; Reid & Smith, 2000). Hence, Löfsten and Lindelöf (2005) infer management accounting methods should be dependent on the environmental hostility experienced by a new technology-based firm, and find a direct effect of environmental hostility on management accounting in their empirical data.

Our understanding of *perceived environmental hostility* is similar to Grichnik, Brinckmann, and Singh (2014) who investigate the role of *perceived environmental hostility* in the context of resource acquisition practices used by 298 nascent entrepreneurs in Germany and Austria. In hostile business environments entrepreneurs can obtain required resources less easily and face a higher degree of competition. Grichnik et al.'s (2014) understand *perceived environmental hostility* in the sense of Covin et al. (2000) as a highly competitive environment for entrepreneurs in which resources are harder to attract.

Other studies turn to scarce financial resources in the context of management control activities. As the insufficient availability of financial resources can be seen as a form of a hostile environment, these studies are interesting as well. Granlund and Taipaleenmäki (2005) research management control activities in nine startup companies in the information, communication, or biotechnology industry which strive for fast growth. Using an exploratory case study, they identify scantiness of financial resources as stimulus to the use of financial controlling practices (p. 35). Mengel and Wouters (2015) study financial planning and control systems in startups and postulate *scantiness of financial resources* as antecedent of financial planning and control. They argue that when financial resources are scarce, planning and controlling of available financial resources is important. Thus, they posit that the efficient handling and wise use of scarce resources can maintain liquidity and help to achieve organizational goals. Mengel and Wouters (2015) find empirical support for their hypotheses, using path analysis in a sample 42 young and small technology-based startups in Germany. While their argumentation and findings are in line with our study, their construct *scantiness of financial resources* is limited to financial aspects while *perceived environmental hostility* goes beyond financial resources.

As an example to underline the relevance of *perceived environmental hostility*, one of the startup founders we interviewed said it would be the hardest challenge for his startup to find new qualified employees that are both highly educated and blessed with an adequate working attitude. He explained that labor costs were a major expense. As he could not afford idle human resources, it was crucial for him to find qualified employees that fulfilled their tasks efficiently. Hence, the founder was facing environmental hostility with respect to human resources on the labor market.

In summary, *perceived environmental hostility* builds on prior research (Grichnik et al., 2014; Löfsten & Lindelöf, 2005; Mengel & Wouters, 2015). We investigate this construct again due to its meaningfulness in the entrepreneurial context and because we expect it to lead to *startup-specific performance measurement*.

Startup-specific performance measurement

The central construct of our model, *startup-specific performance measurement*, is defined as the extent to which founders capture the startup's business activities and objectives in measurements, figures, ratios, metrics, or qualitative information. Founders are free to decide which measurements they use to keep track of their business. The measurements can be financial and non-financial numbers, key performance indicators (KPIs), or even qualitative information as long as they help to understand the startup's specific situation. Single measurements can be aggregated to reports or dashboards. It is important for *startup-specific performance measurement* that the measurements captures *specific aspects* of the startup, such as certain business activities, organizational goals, financial situation, available or required resources, marketing and sales activities, or customers. Based on available data, founders can decide on their own what to capture with specific measurements. Or, as we show in a following part, they can draw on information created by software or online tools, such as web analytic tools or solutions for e-commerce.

Startup-specific performance measurement is different from traditional financial accounting methods because it is tailored to specific aspects of the startup, such as business activities, goals, or customers. *Startup-specific performance measurement* can include methods of traditional financial accounting without being restrained by them. This means startups can also create traditional profit and loss statements, balance sheets, or cash flow statements if founders find them helpful. However, *startup-specific performance measurement* goes beyond such traditional methods as it is more flexible and not bound to accounting principles. The following points highlight the main characteristics of *startup-specific performance measurement*:

Specific analysis. Founders can tailor performance measurements according to their needs. They decide on its scope and level of detail. Specific performance measurements can address various specific aspects of the startup, such as the business model, organizational goals, finances, product development, customers, or ongoing operations. The specific measurements provide the base for a more specific analysis than traditional accounting numbers.

Deviation from accounting rules. Startup specific performance measurement is not bound to rules, requirements, or structures of traditional financial accounting. Founders can follow the ideas and concepts of financial accounting, but they are free to deviate from accounting rules and make up their own unique measurements. For instance, they can decide to value the startup's fixed assets, but they can value them differently than they would have to when complying with accounting rules for the valuation of the assets in the balance sheet. The degree of deviation can be slightly different (in such a way that it would still comply with financial accounting rules) or it can be considerably different (in such a way that it would no longer be allowed according to financial accounting rules).

Frequent analysis. Some traditional accounting statements are produced at certain time intervals, such as an income statement is typically produced monthly, quarterly, or yearly depending on the company's preferences and legal obligations. Specific performance measurement, in contrast, can be produced more frequently. Founders can deliberately decide on the frequency of preparation and use specific measurements whenever up-to-date information is needed.

Units of measurement. Specific performance measurement can show different units of measurement which can either be financial or non-financial. While financial measurements use currencies, such as dollars or euros, non-financial measurements can refer to any information which is not primarily related to finance; for example, the number of new customers obtained through a marketing campaign, the expected number of sales for the upcoming months, or qualitative customer feedback on the product.

Ex ante measurements. Startup specific performance measurement can be used to either help to understand what happened in the past (ex-post purpose) or to predict future developments (ex-ante purpose). This is different to traditional accounting practices which are typically used to report the past development of an organization (ex-post). Specific performance measurement can serve both purposes. Based on available data, it helps to understand the past, and it facilitates estimations about future business development or expected behavior of customers. Thus, its purpose can be both ex-post and ex-ante.

Two streams in literature are related to *startup-specific performance measurement*, one stream is business planning, the other stream are management control systems. It is necessary to compare both streams with *startup-specific performance measurement* to understand similarities and differences.

Business planning. This topic has gained great attention among entrepreneurship researchers (Brinckmann et al., 2010; Delmar & Shane, 2003; Gibson & Cassar, 2002; Gruber, 2007; Honig & Karlsson, 2004; Shane & Delmar, 2004; Upton et al., 2001). Some studies refer to business planning in a way which sounds very similar to *startup-specific performance measurement*. For instance, Delmar and Shane (2003) define business planning as "*efforts by firm founders to gather information about a business opportunity and to specify how that information will be used to create a new organization to exploit the opportunity*" (p. 1165). More recently, Brinckmann and Kim (2015) speak of business planning as "*an activity that is directed to predict the future and develop an appropriate course of action*" (p. 154). Also, some of the studies investigate how business planning can help founders to make decisions, manage resources, and translate business goals into specific actions (Delmar & Shane, 2003, 2004; Gruber, 2007; Shane & Delmar, 2004). In these cases, business planning and *startup-specific performance measurement* could be seen as complementing because they both aim to create specific information to help entrepreneurs.

Other studies are less clear about the underlying mechanisms of business planning. If studies focus on the presence of business planning in startups, a closer look is necessary. The key point of *startup-specific performance measurement* is that the *information is up-to-date and regularly used* by entrepreneurs. Suppose a situation in which a startup aims to receive external funding from venture capitalists. If the founders show a set of slides or put a printout on the table, which contains specific information, financial forecasts, and KPIs, it could be either a business plan or specific performance measurement. If the information has only been prepared to show to investors, is slightly outdated, and apparently not used by the entrepreneurs for management purposes, we could conclude it belongs to a business plan. Contrarily, if the information is recent and entrepreneurs emphasize to use it actively for decision making and monitoring purposes, we look at *startup-specific performance measurement*. Hence, if studies are not explicit on the mechanisms behind business planning and only focus on its existence (for example, see Gibson & Cassar, 2002; Honig & Karlsson, 2004; Upton et al., 2001), they might talk about something different than *startup-specific performance measurement.*

Management control systems (MCS). The other research stream related to startup-specific performance measurement, is seen as "formal, information-based routines and procedures

managers use to maintain or alter patterns in organizational activities" (Davila & Foster, 2007, p. 908). Studies frequently investigate how MCS can reduce information asymmetry with external partners and facilitate decision making in startup companies (Davila & Foster, 2005, 2007; Davila et al., 2009; Granlund & Taipaleenmäki, 2005; Moores & Yuen, 2001; Sandino, 2007). Research on MCS covers a relatively broad set of practices and methods to manage and control various aspects of a company. While some methods can be seen as a form of startup-specific performance measurement, others are less in line. It is again necessary to look into more detail at other studies to distinguish both topics.

Davila and Foster (2007) analyze management control systems in 78 U.S. startups with technology orientation. They identify *eight* different categories of MCS adopted in the companies: financial planning, financial evaluation, human resource planning, human resource evaluation, strategic planning, product development management, sales/marketing management, and partnership management (p. 914). As each category consists of individual sub-systems, the study covers a total number of *46 individual* MCS. A closer look reveals that some of the individual systems are to *startup-specific performance measurement*. For instance, the category of financial planning comprises operating budgets, cash flow projections, and sales projections; financial evaluation includes routine analysis of financial performance against target, product profitability analysis, and customer profitability analysis. These methods require specific information on the same level as *startup-specific performance measurement*. Other MCS categories, however, contain methods which can be valuable to startups but are less similar to specific performance measurement because they do not quantify specific information into measurements. Examples mentioned by Davila and Foster (2007) are mission statements, written job descriptions, or individual incentive programs.

Davila Foster and Li (2009) offer a worthwhile study on the roles of MCS in emerging companies. Drawing on both qualitative and quantitative research, they propose seven roles that MCS can have (make goals explicit and stable, code learning from the past, foster coordination, plan the sequence of steps, promote accountability and facilitate control, contract with external parties, and use symbols to legitimize) and explore how these roles are related to the initial adoption of MCS. For instance, making goals explicit and stable refers to the idea that the adoption of management control systems usually accompanies articulation of clear goals. Transparent and stable goals prevent a frequent change of management priorities, which might be caused by an uncertain environment of a startup. These goals create clarity and room for creativity of founders and employees, and can thereby facilitate innovation in product development. As another example, contracting with external parties refers to the idea that startups adopt management control systems because outside partners, such as investors or suppliers, require them in order to enable the monitoring of business activities and enhance the contracting. Using symbols to legitimize refers to management control systems' reflection of an organization's formal processes that outside parties perceive as a symbol of management competency and innovativeness (Davila et al., 2009).

Summarizing MCS, some studies refer to MCS on a very detailed level and describe situations in which MCS and *startup-specific performance measurement* can complement each other (Davila & Foster, 2005, 2007; Davila et al., 2009). Other studies talk about MCS as a broad range of practices or focus on individual systems, such as costing and revenue systems (Cassar & Gibson, 2008; Moores & Yuen, 2001; Sandino, 2007). In these cases, MCS and *startup-specific performance measurement* can mean different things.

After looking at academic literature, we now turn to *practical guidebooks* and *online sources*. We find numerous sources in practitioner literature which support the importance of *startup-specific performance measurement*. We now talk about this literature, first about practical guidebooks, then about online sources. As a side note, many author use synonyms for *startup-specific performance measurement*, such as analytics, metrics, dashboards, or key performance indicators (KPIs).

Practical guidebooks. First, *Lean Startup* by Ries (2011) is a well-known book which provides practical guidance to entrepreneurs by offering methods to shorten the product development, increase the management efficiency, and accelerate the growth of a startup. Ries (2011) argues that a startup requires an efficient and dynamic management, different to the management practices for established companies. More than this, entrepreneurs need management methods tailored to a startup's product development and operations. Ries (2011) also argues that accounting is vital for startups, however, "standard accounting is not helpful" (p. 115). This is why he suggests *innovation accounting* as one of five principles of the *Lean Startup* concept. Ries (2011) underlines that entrepreneurs "*need to focus on the boring stuff: how to measure progress, how to set up milestones, and how to prioritize work*" (p. 9). They should learn how to create a "*new accounting system for evaluating whether [they are] making progress, and a method for deciding whether to pivot (…) or persevere*" (p. 10) with their business. This flexible, specific accounting which helps entrepreneurs to make decisions and captures a startup's progress is in line with what we understand by *startup-specific performance measurement*.

As an example of our research activities, some of the founders we interviewed were familiar with the *Lean Startup*. The book is well-known among entrepreneurs all around the world (Blank, 2013). We noticed in our interviews that some of the entrepreneurs knew the book and its main ideas. Some of them even stated that they would apply methods of the *Lean Startup*. One of the startups we had access to developed online games for smartphones. The two founders showed us a process they had created to constantly improve their products. The process was based on *Lean Startup* methods and the founders used it to collect and quantify customer feedback on a weekly base. This specific information on their products help the startup decisively to improve their products in a very short time, react immediately to customers' needs, and get inspiration for new product developments.

Lean Analytics by Croll and Yoskovitz (2013) is another practical guidebook. It carries the promising subtitle *Use Data to Build a Better Startup Faster* and looks particularly at the use of specific performance measurement in startups. *Lean Analytics* is part of a series of practical guidebooks around the *Lean Startup*. It focuses on how entrepreneurs can create specific information about their startups, how they can use and analyze this information, and how they improve their decision making with it. Referring to *startup-specific performance measurement* as *analytics*, they argue that "*analytics is the necessary counterweight to lying"* (p. 3) and prevents entrepreneurs from lying to themselves when it comes to assessing their products or business models. They see data-driven learning as *"the cornerstone of success in startups"* (p. 3) and argue that KPIs are essential for data-driven learning because they help to find the "*the right product and market before the money runs out*" (p. 9). Hence, specific performance measurement might serve entrepreneurs as an important management tool.

Online sources. Apart from textbooks, web sites and blog posts offer inspiration for the importance of *startup-specific performance measurement*. Several authors underscore the importance of *startup-specific performance measurement* to achieve startup success. Some authors of online sources base

KEY FIGURES

	JAN 1 – DEC 31, 2016	JAN 1 – DEC 31, 2015	Change
Group key performance indicators			
Site visits (in millions)	1,991.6	1,656.4	20.2%
Mobile visit share (in %)	65.6	57.1	8.5pp
Active customers (in millions)	19.9	17.9	10.9%
Number of orders (in millions)	69.2	55.3	25.2%
Average orders per active customer	3.5	3.1	12.9%
Average basket size (in EUR)	66.6	67.8	–1.8%

Figure 8. Excerpt of Zalando's annual report 2016 (p. 4) with specific performance measurements

their arguments on their own experience as entrepreneurs,[22, 23] others base their insights on common sense and examples of startups.[24] Referring to entrepreneurs under constant pressure who multiple tasks and, hence, many distractions, Suster[23] states that "*having a set of metrics that you watch & that you feel are the key drivers of your success helps keep clarity*". Smith[24] adds that "*to make better business decisions, you need information*" and that "*you have unprecedented access to the information you need; you just have to know what to pay attention to*". Other sources emphasize that not using *startup-specific performance measurement* could even be detrimental. For example, Ehrenberg[22] claims that "*not spending enough time gauging your business's progress can be just as harmful as wasting your time with needless emails*". To sum up, popular textbooks and online source suggest strongly that *startup-specific performance measurement* is beneficial for startups.

To give an example of the importance of startup-specific performance measurement in young companies, we look at the annual report of a very famous online business in Germany, called Zalando. The company was launched as a prominent startup project in 2008 and captured the market for selling shoes online since then. In 2015, Zalando generated more than 1 billion Euros in revenues and was among the top-3 online shops in Germany as measured by revenues.[25] As shown in Figure 8, Zalando places strong emphasis on startup-specific performance measurement to capture its business activities. The numbers reflect Zalando's most important performance

22 Ehrenberg, D. (2014). *The Seven Startup Metrics You Must Track*. Retrieved October 22, 2017, from https://www.forbes.com/sites/theyec/2014/06/20/the-seven-startup-metrics-you-must-track/#3dc45c7d725e

23 Suster, M. (2011). *How Startups Can Use Metrics to Drive Success*. Retrieved October 22, 2017, from https://bothsidesofthetable.com/how-startups-can-use-metrics-to-drive-success-d361b8989f5d

24 Smith, G. (2013). Key Performance Indicators: 9 Business Metrics Every Startup Should Watch. Retrieved October 22, 2017, from http://yfsmagazine.com/2013/04/27/key-performance-indicators-9-business-metrics-every-startup-should-watch/

25 Gründerszene. *Die Top 10 Online-Shops in Deutschland*. Retrieved May 27, 2017, from http://www.gruenderszene.de/galerie/die-top-10-online-shops-in-deutschland-2?pid=12596

indicators and are part of the 2016 annual report.[26] It is obvious that the numbers are an example of the above mentioned startup-specific performance measurement; for instance they deviate from accounting rules and use non-financial units of measurement. How important these numbers are to Zalando becomes clear if one looks at the annual report: The *group key performance indicators* are the first numbers mentioned in the entire report, even preceding the results of operations and financial numbers.

Hypothesis H1

We now come back to the argumentation of why *perceived environmental hostility* is antecedent to *startup-specific performance measurement*. A hostile environment is characterized by a high competition for customers, investors, and resources (Grichnik et al., 2014). A hostile environment is typically results from a large number of competitors, high demands of potential investors, legal obstacles, or restricted resources. Hence, a startup has to make a greater efforts to acquire customers, convince investors, or obtain certain resources. One way to manage these efforts can be the use of *startup-specific performance measurement*. As *startup-specific performance measurement* offers a flexible method to gather information about the startup itself and its environment, it can be used to better understand the hostile environment, develop strategies, and act accordingly.

Suppose a startup aims to be successful and grow fast in a hostile environment. The startup has to develop a strategy and means to cope with the competition and scarcity of resources. By quantifying organizational goals, measuring ongoing operations, assessing goal achievement, and keeping track of resources the startup can capture its success and growth with numbers. The startup can use specific performance measurement in the form of a benchmarks to keep an eye on competitors. And it can use specific performance measurement to better understand and anticipate needs of customers. Moreover, *startup-specific performance measurement* can enhance the management of resources because it helps to quantify both available and required resources, and to avoid waste when resources are scarce.

Other studies offer empirical support for this relationship. Consistent with our argument, Grichnik, Brinckmann, and Singh (2014) find that entrepreneurs place significantly more emphasis on methods to attract resources if they operate under perceived *environmental hostility*. Their empirical findings show a significant relationship between a hostile environment and an increasing degree of bootstrapping methods which aim to manage resources efficiently within the startup. Clarysse, Bruneel and Wright (2011) study the growth paths of six young technology-based firms in Belgium. They find that a competitive environment was associated with placing greater emphasis on resource management and resource acquisition in these companies. Using secondary survey data of 200 startups, Cassar (2009) discovers a relationship between perceived competition and the frequency of financial statement preparation. Although financial statements are different, their preparation requires practices to quantify business activities which could be similar to *startup-specific performance measurement.*

However, another study challenges the argument. Mengel and Wouters (2015) find minor support for the relationship between scantiness of financial resources and the use of financial planning and control systems in startups. Surprisingly, they find that the direction of the

[26] Zalando (2017) *Annual Report*. Retrieved May 27, 2017, from https://corporate.zalando.com/en/annual-reports?field_publication_date_value%5Bvalue%5D%5Byear%5D%3D=2016

relationship is opposite to what they hypothesized initially. Hence, they discuss that scarce financial resources could also be a barrier for financial planning instead of a reason to explain its use. Acknowledging this finding, hostile environment could also hinders founders to use *startup-specific performance measurement*. In an environment in which resources are scarce, they could perceive *startup-specific performance measurement* as something they cannot afford. Due to the strong arguments in favor, we a positive effect of *perceived environmental hostility* on *startup-specific performance measurement* because we suppose that latter helps the startup to quantify needs, manage scarce resources, and cope with competition. Thus, we propose the following hypothesis:

H1. *Perceived environmental hostility* leads to *startup-specific performance measurement*.

Use of web analytic tools

The second exogenous construct, *use of web analytic tools*, is antecedent to *startup-specific performance measurement*. To our knowledge, *use of web analytic tools* is a novel construct and has not been used in entrepreneurship or management research up to date. We define *use of web analytic tools* as the degree to which the startup utilizes online applications or software to measure website traffic and obtain information about its customers (such as Google Analytics, Adobe Analytics, or Facebook Analytics).

Web analytic tools allow founders to track various activities on the startup's website, gather information, and help to measure the behavior of customers on the website. For example, web analytic tools can collect data about the number of visitors during a time period, how much time they spend on which parts of the website, which geographical region they come from, and how many of them turn into customers. Moreover, web analytic tools can serve to better understand the behavior of current customers. The frequency and intensity of using web analytic tools varies with the business model and industry focus of a startup. We assume that startups are more likely to apply web analytic tools if they operate in a business-to-customer (B2C) environment and aim to sell a high quantity of products to end consumers. We also expect startups with IT focus to be more inclined to use these tools. Startups in end consumer market or with IT focus should place emphasis on their online shop or website and, hence, have an infrastructure in place which makes it easier to utilize web analytic tools. However, we assume that startups in a business-to-business (B2B) environment or with different industry focus could also benefit from the *use of web analytic tools*.

The decisive point is the active use and integration of web analytics into the startup's business activities. The sheer presence of web analytic tools is not sufficient to add any value to the startup. This is important because startups might have such tools in place without actively using them. Even though the tools gather a large amount of information, they do not tell founders how to manage or take decisions. The tools can be seen as an instrument to measure and quantify online activities which founders can use to support decision making. Hence, our construct places emphasis on the active use of web analytic tools.

Web analytic tools are either offered as an individual product or come as part of e-commerce software. Numerous individual products are offered. Google Analytics, Adobe Analytics, Facebook Analytics, or AT Internet Analyzer are popular web analytic tools. Smaller software companies offer further tools, such as XiTi, etracker Analytics, Econda, comScore Analytics, Piwik, Clicky, or Clicktale. The tools differ in their price, ranging from free in a basic

version (such as Google Analytics, Facebook Analytics, or XiTi) to relatively pricy (such as Adobe Analytics or AT Internet Analyzer). Web analytic tools can also be part of e-commerce software.

As an example, one of the startups we conducted a small case study with focused on selling high-quality coffees online. The founders used an open source software for their online shop, called Magento, and valued this e-commerce software for various reasons: The software offered built-in functions to capture different key performance indicators; it offered a tool to create an individual reporting of sales and customers' behavior; and it was connected with Google Analytics in such a way that the entrepreneurs could obtain additional specific measurements. The founders, for example, were interested in the costs for customer acquisition through advertisement, or the customer conversion rate (which tells how many visitors of the online shop turn into buying customers). The entrepreneurs stated that the e-commerce software in combination with web analytics was of great value for their startup because it offered a simple and very effective way to generate important KPIs of their business.

Our literature search for similar constructs for the *use of web analytic tools* yields a relatively limited number of publications. We find studies that underline the increasing meaning of web analytics for online marketing (Chaffey & Patron, 2012; Järvinen & Karjaluoto, 2015; Simmons, Armstrong, & Durkin, 2011), the assessment of web site performance (Welling & White, 2006), and organizational strategy development (Nakatani & Chuang, 2011; Phippen et al., 2004). However, we find no quantitative work using a similar construct and no work which operationalizes the construct in the context of entrepreneurship research. Hence, we share Phippen et al.'s (2004) early remark that "*the literature around Web analytics is growing but highly industrial in nature (…). However, there is very little academic or empirical work examining how Web analytics might impact on an organisation and what benefits they might bring.*" (p. 287). By the term *industrial*, the authors refer to non-academic literature. Apart from academic literature, numerous blog posts[27, 28] and practical guidebooks are available (for example, see Kaushik, 2010). We omit a detailed review of these practical sources. Readers interested in web analytic tools can, for instance, turn to the Digital Analytics Association who recommends readings.[29]

We focus again on our theoretical construct and turn now to the three roles of web analytic tools identified in academic literature. First, web analytic tools are used to *measure the digital marketing performance*. Järvinen and Karjaluoto (2015) describe web analytic tools as a worthwhile source which creates a metrics system for a company. The authors investigate in a case study among 3 large Finnish companies how this metric system is used to measure marketing performance and find that companies need to understand how and what to measure to benefit from web analytic tools and metrics. Chaffey and Patron (2012) offer a conceptual study and argue that companies often fail to use web analytic tools to their full potential and, therefore, do not receive the full benefits of their usage.

Second, web analytic tools are used to *measure and optimize the performance of company web pages*. Welling and White (2006) find in a qualitative field study among 25 web site managers of retailing

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27 Kaushik, A. (2011). *Best Web Metrics / KPIs for a Small, Medium or Large Sized Business*. Occams Razor, 1–39. Retrieved from http://www.kaushik.net/avinash/best-web-metrics-kpis-small-medium-large-business/

28 Kaushik, A. (2015). *Six Web Metrics / Key Performance Indicators To Die For*. Retrieved June 12, 2015, from http://www.kaushik.net/avinash/rules?choosing?web?analytics?key?performance?indicators/

29 Digital Analytics Association. (2017). *Recommended Readings*. Retrieved April 20, 2017, from http://www.digitalanalyticsassociation.org/recommended_readings

and business-to-business companies that companies rely on the use of performance measures to determine the value of their website for their business. The web site managers use web analytic tools to create the metrics which are base for the performance assessment of the web sites. Simmons, Armstrong, and Durkin (2011) explore the web site optimization of 20 small companies in the food industry. In semi-structured interviews, they find that web analytic tools are used to create information which then is used to optimize the web presence.

Third, web analytic tools are used to *develop competitive strategies*. Phippen et al. (2004) analyze different applications of web analytic tools in business-to-customer companies and find that some companies use the tools because they help them to improve the online strategy and marketing of products. Nakatani and Chuang (2011) offer an overview of web analytic tools and develop a framework which should help organizations to introduce the most suitable tool for their situation. They argue that introducing web analytic tools has far-reaching strategic implications because they "*provide foundations for making competitive decisions*" and because they "*might be interwoven with the organizational internal decision making processes*." (p. 172).

To conclude, the *use of web analytic tools* is addressed in the field of marketing and informatics. In entrepreneurship research, the construct has been neglected up to date. Literature indicates the importance of web analytic tools and their ability to create specific information as base for decision-making and performance enhancement. Also, research until now has only been qualitative and, thus, lacks constructs of *use of web analytic tools*. We argue next how *use of web analytic tools* can lead to *startup-specific performance measurement*.

Hypothesis H2

The *use of web analytic tools* is antecedent to *startup-specific performance measurement*. Web analytic tools are an ideal source of specific information because they come at a low cost and affordable effort. The main purpose of web analytic tools is to collect information about customer behavior and the performance of online marketing (Järvinen & Karjaluoto, 2015). Using these tools can help the startup to better understand its customers and develop adequate strategies for future growth (Phippen et al., 2004).

One of the entrepreneurs we interviewed was explicit about the importance of web analytic tools and gave us an interesting example. He was involved in a startup which created a new music streaming service for South Africa. He told that one of the co-founders worked for another music streaming service before and, therefore, perceived the use of web analytic tools as vital for the success of music streaming services. The startup used the tools to measure, for instance, the success of a marketing campaign. The startups handed out vouchers for new customers at a music festival. Each voucher was tagged with an individual code which new customers could use to register online. Using web analytics and the code from the vouchers, startup could assess how many new customers they gained through a campaign, how much revenues these customers created, and how many costs occurred through a campaign. Hence, the found a way to use web analytics and specific information to assess the profitability of marketing efforts.

Using quantified information about specific aspects of the startup is what we understand by *startup-specific performance measurement*. If founders actively draw on web analytic tools to receive specific information, we argue that web analytic tools provides the base for specific measurements, thus, we propose the following hypothesis:

H2. The *use of web analytic tools* leads to *startup-specific performance measurement*.

Managerial experience of founders

We propose *managerial experience of founders* as the third antecedent of *startup-specific performance measurement*. We define *managerial experience of founders* as professional skills and knowledge in the field of management or economics acquired by the founders prior to creating the startup.

Founders can gain the skills and knowledge which constitute *managerial experience* in two different ways. They can either gain it through studies or educational courses on business, management, or economics in which they acquire knowledge related to the direction of organizations and to different strategic and operational methods of management. Or they can gain *managerial experience* through working in positions which are associated with management or executive tasks, such as any kind of management positions, assistant positions which interact frequently with executives, project managers, consultants, accountants, et cetera. We follow Gartner, Starr, and Bhat (1999) who point out that "*an entrepreneur's knowledge and ability should not be considered in some broad manner, like years of previous industry experience, but as specific kinds of knowledge and ability*" (p. 219). As we show next, our construct captures specifically the managerial experience and is different from other types of work experience.

Previous studies have mostly addressed three types of experience related to entrepreneurs: managerial experience; startup-specific experience; and industry experience. *Managerial experience* is similar to our construct. Other studies refer to it in the sense of management skills and knowledge. Brinckmann and Kim's (2015) look at *pre-founding managerial experience* of entrepreneurs and capture with the construct "*individuals who have gained managerial experience in an established organization*" (p. 156). Mengel and Wouters (2015) capture the *educational background of founders* in the sense of "*the startup's founding team education in business or economics*" (p. 194). Davila and Foster (2005) capture CEO experience as the number of years a CEO had when he or she became CEO of a startup company.

Startup-specific experience refers to this type of experience as knowledge which founders gain through learning by doing in other startups prior to establishing the current one (Cassar, 2014). Startup-specific experience improves entrepreneurial judgement and evaluation and, hence, enables founders to learn from mistakes and enhance current decision-making. *Industry experience* investigates experience in the sense of knowledge which is obtained through learning about a certain type of business and its environment. This type of experience is assumed to reduce environmental uncertainty in a certain industry sector as founders are familiar with industry-specific processes, market characteristics, customers, and competitors (Cassar, 2014). While both *startup-specific experience* and *industry experience* can be helpful for founders, we focus in our study on *managerial experience*.

Hypothesis H3

We argue that *managerial experience of founders* is positively related to *startup-specific performance measurement* because founders with management background are more likely to recognize the usefulness practices for measuring, monitoring, and reporting business activities and goal achievement (Brinckmann & Kim, 2015). It can be assumed that founders are more likely to be exposed to performance measurement practices with increasing time in management-related positions. Similarly, they are more likely to acknowledge potential benefits of these practices comparted to founders that have no prior managerial experience. Moreover, founders are more likely to recognize the value of specific information for decision-making if they gained experience as decision makers before.

Our research activities support the argumentation. One of the founders we interviewed emphasized that his academic education helped him to recognize the potential of specific performance measurement. Together with co-founders he created an online platform on which small companies could rent some space within a retail store to promote new products.[30] Prior to launching a startup, the founder obtained a degree in business studies and participated in several entrepreneurship and management courses. He stressed that his education led him to capture as many aspects of his startups as possible with specific measurements and numbers. He added that he perceived the use of specific performance measurement as a key to the success of his startup.

Literature offers further support. Davila and Foster (2005) investigate the adoption of management control systems in 78 technology-oriented startups in the U.S and find evidence that increasing experience of the startup's CEO was related to the adoption and intensity of management control practices. As management control practices also generate specific information for decision-making, this finding supports our argumentation. Thus, we propose the following hypothesis:

H3. *Managerial experience of founders* leads to *startup-specific performance measurement*.

4.3.3 Information-based communication and its antecedents

Information-based communication

To show how *startup-specific performance measurement* can enhance communication, we next introduce the second central construct of our model, *information-based communication*. We define *information-based communication* as the extent to which founders mobilize specific information about the startup in their interaction with co-founders or external partners, such as investors, business advisors, suppliers, or customers. The key of *information-based communication* is that entrepreneurs share and discuss explicit information about the startup with others. *Information-based communication* can take place in a more systematic way, such as in a weekly management meeting with co-founders or in order to convince potential investors of the strengths of the business. Or it can happen in a less formal way, such as in an ad-hoc discussion with co-founders or mentors about the last week's drop of sales figures. In any case, the specific information is vital for the communication.

We use an example to illustrate *information-based communication* and derive its key aspects. Suppose a team of entrepreneurs which strives for new external funding. They meet with a venture capital investor and start to advertise their startup. Before the meeting, the investor had gone through the startup's application and now points out that he would not be convinced about the business model. The entrepreneurs contradict and intend to convince him of their point of view. Hence, one of them pulls out of his pocket a set of slides, puts it on the table, and points to some specific measurements about the last week's business developments. This could have various effects. First, they could get into a discussion about the specific information which could eventually convince the investor to reassess his option of the business model. It could also create the impression of the managerial competence of the entrepreneurs in the eyes of the investor. Or, given the investor does not change his mind, it could create new insights for the entrepreneurs to improve their business model. Whatever the case may be, it is essential that communication is

[30] Burfeind, S. (2016). *Internet zum Anfassen*. Retrieved from http://www.sueddeutsche.de/wirtschaft/sz-serie-gipfelstuermer-internet-zum-anfassen-1.3140326

based on facts about the startup and might lead to valuable insights for both founders and resource providers. This example highlights the following three key aspects of *information-based communication*.

Higher transparency of information. Presenting not only a good story but specific information about the startup is an important leverage to reduce information asymmetry. Specific information creates transparency about the startup's business model, enables a more accurate assessment of the current situation, and allows a more realistic forecast of business development. If numbers and facts are presented and visualized on paper or slides they are easier to follow in comparison to a situation in which they are only mentioned acoustically. This makes information-based communication clearer and more transparent than communication without specific information.

Two empirical studies support the relevance of transparent information. Accounting information can help startups to overcome a missing track record in terms of customer and supplier relationships (Wiklund, Baker, & Shepherd, 2010). Based on the analysis of 37,782 Swedish startups registered between 1994 and 1996, the authors find accounting information, such as financial indicators, to reduce the challenges resulting from the startups' newness and lack of reputation when it comes to attract customers or suppliers. Another study argues that information from management accounting systems help startups to "*make goals explicit and stable"* (Davila et al., 2009, p. 329). Both studies show that transparent information, such as financial indicators or explicit goals, reduces information asymmetries between the startup and outside partners.

Going deeper into discussion. When specific information is on the table, it is possible for participants to address it directly in a discussion. The discussion can reach important points faster because startup-specific facts are presented and visible. Reaching faster the important points can save time and enhance the exchange of information. Imagining a situation in which a startup and venture capitalists debate about potential funding. When facts are visualized and on the table, founders can communicate more clearly what they require. The venture capitalist is able to ask better questions. The founders in turn can respond more precisely when referring to facts. In this way, both parties can come directly to a much deeper level of discussion.

Specification of needs. Startups can formulate their resource needs more precisely and thereby increase the specificity of a request to external partners. The reasoning and motivation for why startups request certain resources becomes more comprehensive when it is based on facts. Instead of asking roughly for financial or other resources, the startup can elaborate in detail why and how much of a resource is necessary. It can articulate its resource needs more specifically, and present a stronger argumentation to external partners. Let's imagine a meeting between a startup and a potential investor. Instead of asking for a lump sum of € 1 million for a year, the startup could present its motivation based on specific facts and ask more in detail, such as € 325,000 for the first quarter plus legal help, either in the form of a lawyer providing a certain amount of hours or an equivalent of money to pay for a lawyer. Communicating on this level is only possible if startups use specific information. Moreover, communication on this level is expected to be more convincing.

Prior work has addressed another form of communication, so called visionary communication, which we should distinguished from *information-based communication*. While visionary communication and *information-based communication* are not the same, they can complement each other, and one form of communication does not exclude the other one. Entrepreneurship literature often refers to visionary communication in the sense of storytelling and narratives. Being that "*entrepreneurial narratives are the stories that are told about entrepreneurs and/or their firms*" (Martens et al.,

2007, p. 1109), visionary communication is based on the imagination of the storyteller and listener. Studies have argued that storytelling can help entrepreneurs to attract resources. Lounsbury and Glynn (2001) offer a framework and theoretical argumentation on how storytelling can increase a startup's legitimacy and lead to the acquisition of resources. Based on archival data of 169 U.S. startups in the internet, semiconductor, and biotechnology industry, Martens et al. (2007) find that effective storytelling is associated with the attraction of financial resources. Acknowledging that visionary communication has been shown to lead to resource attraction, we argue below that information-based communication can lead to resource attraction as well. After having presented the construct and its connection to the literature, we continue with why *startup-specific performance measurement* leads to *information-based communication*.

Hypothesis H4

We understand *startup-specific performance measurement* as an instrument to enhance the internal and external communication of startups. Accordingly, we propose a relationship between *startup-specific performance measurement* and *information-based communication* because startups who can draw upon specific information are more likely to recognize its value for communication. Founders might be more aware of how they can use information to improve their own business as well as persuade external partners of their points of view. Hence, we expect them to mobilize and regularly integrate specific information in the interaction with others and suggest three main reasons for why *startup-specific performance measurement* can lead to *information-based communication.*

Reducing overoptimism. Entrepreneurial intuition is a characteristic that is often associated with successful founders because it helps them to detect market opportunities and create innovative products (Allinson, Chell, & Hayes, 2000; Mitchell, Friga, & Mitchell, 2005). However, a strong intuition can also correspond with a founder's overly optimistic view of the own startup. If intuition and overoptimism are dominant, founders can be biased and attribute a higher value to their products or business model than people outside the startup (Cassar, 2010). Also, founders can be tempted to take decisions which are not founded on facts. Croll and Yoskovitz (2013) claim that founders lie permanently to themselves if they do not base decisions on facts.

Information-based communication can be a counter-weight to intuition and overoptimism because it integrates facts about the startup's current into decision making and communication. It can reveal facts that founders might have neglected if biased by overoptimism. By reducing the bias of founders, *information-based communication* can lead to a more realistic perception of the resources which are necessary for future business development. Thus, *information-based communication* is the mirror that founders have to look into and ask themselves if their decisions are justified or dictated by overoptimism.

Talaulicar, Grundei, and Werder (2005) investigate the quality of decision making in teams of startup managers and look at the relationship between debate and comprehensiveness of decision-making. Debate is "*the process of discussion and information exchange among the group members at executive meetings*" (p. 525) and comprehensiveness of decision-making "*the degree to which a choice is based on a thorough problem analysis*" (Talaulicar et al., 2005, p. 522). They find based on survey data from 56 German startup companies that founders who take about the decision also take more comprehensive decisions. Forbes (2005) analyses the relationship between decision making and entrepreneurial self-efficacy. Based on survey data and archival data of 95 U.S. entrepreneurial firms, he finds that decision-making, which is based on comprehensive and up-to-date information,

is positively associated the entrepreneurial self-efficacy. This can be interpreted that more precise information gives reassurance with regard to decisions and future actions. Hence, literature also shows that involving specific and fact-based information can improve decisions taken in startups.

Assessing goal achievement. While *startup-specific performance measurement* is useful to define goals, *information-based communication* is useful examine goal achievement. If founders define specific goals they intend to achieve, specific information is necessary to evaluate the progress, to adapt goals, and to formulate further actions. With *information-based communication* founders can discuss goals internally on a regular base which should help them to identify problems in time and decide on how to handle them. We further expect that presenting goal achievement to outside partners can be seen as a signal of managerial quality. Thus, if the startup mobilizes this kind of specific information in external communicating, it could positively influence the willingness of outside partners to provide resources.

As mentioned above, Davila et al. (2009) see *making goals explicit and stable* as one role of management control systems in startups. This role refers to the idea that the adoption of management control systems usually accompanies the articulation of clear goals. Transparent and stable goals prevent a frequent change of management priorities, which might be caused by an uncertain environment of a startup. These goals create clarity and room for creativity of founders and employees, and can thereby facilitate innovation in product development (Davila et al., 2009). Another study shows that resource providers value specific information. Davila et al. (2015) find support for their hypothesis that equity holders, such as venture capital investors, see the presence of management control systems as a valuable signal of quality. Therefore, companies which are able to communicate specific information should appear more valuable to resource providers than companies without them.

Improving the business model. Startup-specific performance measurement can demonstrate the strengths of a business model as well as reveal its weakness. Business models can be seen as "*intelligent collective devices in contexts of uncertainty*" with quantitative and qualitative information which should help entrepreneurs to market their product and make money (Doganova & Eyquem-Renault, 2009, p. 1560). Entrepreneurs can enhance and fine-tune their business model by challenging it with specific measurements. Suppose a team of entrepreneurs that start a business with a great idea and is seeking for financing. The first question they will hear from external investors is *how does your business make money*? If they can present convincing facts to potential investors, they show that they have put more thoughts into the model and that it is more than a brilliant idea. Finding a successful business model is one of the most important tasks for a startup (Blank, 2013). Typically, startup do not have a successful business model straight from the beginning. The lack of stability offer simultaneously the advantage to discover improvements, adapt, and change the business model. *Startup-specific performance measurement* helps to discover deficiencies and point to promising improvements. Yet, founders need to discuss or reflect about specific information to advance their business model, which is equal to *information-based communication*.

We provide an example of an entrepreneur we interviewed to give an idea of how discussing specific information can help to improve the business model. Based on his experience in the field of emotional intelligence, he established a startup which provided online courses to employees of corporate companies. The value proposition was that training employees in emotional intelligence would lead to a benefit for the companies. The startup designed the online courses in a way that

employees could take one lesson every day at a time convenient to them. The startup analyzed among other measurements the time when the courses were taken. The entrepreneur told us that by discussing this information with a co-founder, they realized that employees tended to either take the courses early in the morning or late at evening. This was surprising because they were allowed to do the courses as well during working hours. Based on this particular time pattern, the startup recognized that a large group of employees preferred to take the courses when they were with their partners. This insight was so striking that the entrepreneur decided to develop a new type of product, namely a course specifically designed for couples.

As a small side step, let us look at established companies. In contrast to startups, established companies are excellent at executing a successful business model which they have developed over years and established with a large number of customers. But, they also often face problems when it comes to the development of innovations. Davila and Epstein (2014) call this phenomenon *innovation paradox* because executing and improving an existing business model makes established firms focusing on incremental innovations. Startups with dynamic business model can grow dynamically and identify undiscovered market needs. Through their flexibility, startups have the capability and organizational setting to develop radical innovation (Davila & Epstein, 2014). *Startup-specific performance measurement* builds the foundation for *information-based communication* which in turn helps to identify undiscovered market needs.

Taken together, we expect *startup-specific performance measurement* to create the necessary information which enables a fact-based communication. Founders should be aware of the value of specific information and subsequently use it as base for discussions and decisions. Thus, we propose the following hypothesis:

H4. *Startup-specific performance measurement* leads to *information-based communication*.

Presence of external investment

The fourth exogenous construct, *presence of external investment*, is antecedent to *information-based communication* and the *attraction of key resources*. We define *presence of external investment* as the level to which a startup has been provided with financing from outside parties, such as venture capitalists, angel investors, or banks. At an early stage, when revenues of operations do not cover costs yet, external investment can be crucial for the startup to survive, create a convincing product, and build launch marketing and sales activities. At a later stage, external investment can fuel product development, the recognition of new business opportunities, and the augmentation of the customer base. Accordingly, our construct captures the availability of an external investment at the time of investigation which means that a startup has outside financing at its disposal. Hence, *presence of external investment* does not capture a situation in which founders expect to receive external investment in the future, but have not received any payment yet.

Several studies have researched the *presence of external investment*. One stream of literature studies the relationship between *external equity financing* and management control systems in startup companies. Granlund and Taipaleenmaki (2005) study eight technology-oriented startups and identify the presence of venture capital investors as relevant factor for the development of formal control systems. Davila (2005) finds a relationship between the presence of venture capital investment and the adoption of human resource management control systems in 95 technology-oriented startups in California's Silicon Valley. Two other studies (Davila & Foster, 2005, 2007) complement the findings on external equity financing as they find venture capital to increase the

number of management control systems adopted by 78 technology-oriented startups. Wongsunwai (2013) recently researched how the quality of venture capital investors influences control systems dedicated to earnings management in 1,226 U.S. companies that conducted initial public offerings (IPOs). He finds that high-quality venture capital investors are more likely to induce realistic control systems for earnings in their portfolio companies than low-quality ones.

Another stream of literature investigates *debt financing* in small companies. Some studies argue that accounting information, such as the voluntary disclosure of financial statements or the use of accrual accounting, can reduce information asymmetry between small companies and debt providers (Allee & Yohn, 2009; Cassar et al., 2015; Minnis, 2011). Minnis (2011) find that privately held companies in the U.S. have significantly lower costs of debt when they provide audited financial statements to banks. Cassar et al. (2015) research the relationship between accounting practices and debt financing in 855 U.S. small companies and find that sophisticated accounting methods, such as accrual accounting, are associated with a lower costs of debt. They argue that accounting information signals the management sophistication of small companies to lenders, which reduces information asymmetry and leads to lower interest rates charged for a loan.

With *presence of external investment* we would like to capture exceptional situations of debt financing. We assume that debt financing in startup does not always come with a thorough monitoring by the bank. However, we assume situations in which a bank investing in a startup does the same critical and challenging assessment as an angel investor or venture capitalist would do. We aim to capture these situations in which the startup has really been challenged by the bank in order to obtain financing.

A recent example illustrates that some banks pay special attention to specific information used by startups. A popular online magazine on entrepreneurship published an interview[31] with one of Germany's largest banks, Deutsche Bank. The interview was conducted with some of the bank's experts for startup financing and comprised a list of 14 critical questions they would ask startups which seek for financing. The experts pointed out that three of the questions were explicitly directed at how the startup utilized specific information. One question asked if a detailed planning of liquidity and cash flows was in place. Another question asked which KPIs were crucial to the startup and why. A third question explored if the startup was able to create a regularly reporting with startup-specific performance measurements. The interview demonstrates precisely what we understand by a bank which challenges a startup in order to invest and why we consider startup-specific performance measurement to be a highly relevant topic.

A further stream of research looks at *both equity and debt financing*. Mason and Stark (2004) compares how business plans determine the investment decision of venture capitalists, angel investors, or banks. They find that the different investors put emphasis on different aspects of business plans. While banks focus on the financial site of business plan, venture capitalists and angel investors focus on both financial and market information in the plans when it comes to investment decisions. Cassar (2009) studies the influence of debt and equity financing on the preparation of financial statements in small companies. He argues that, due to information asymmetry and high uncertainty, the "*ability of a venture to attract funds for investment rests critically on the*

31 Gründerszene. *Diese Fragen schärfen jede Startup-Idee*. Retrieved May 23, 2017, from http://www.gruenderszene.de/allgemein/geschaeftsmodell-erfolg-14-fragen-an-gruender-deutsche-bank-2017-8691

provision of information by the firm to potential financiers" (p. 31). Another study by Davila et al. (2015) analyzes which role MCS play for the evaluation of external investors. The authors argue that external investors associate these systems with better decision making and decision execution in startups. And that MCS send a signal of managerial quality and potential company growth to external investors.

In summary, other studies look at both external equity and debt financing suggesting that specific information produced by startups lowers information asymmetry and enhances the communication between startup and potential investors. Banks pay attention to financial and accounting information when it comes to a lending decision (Cassar et al., 2015; Minnis, 2011). Equity investors have "*an even greater demand for monitoring and accounting information*" (Cassar, 2009, p. 31) because they engage in the management of the companies they invest in and request specific information to keep track of them.

Hypothesis H5

We argue that the *presence of external investment* can lead to an *information-based communication* because a startup has to provide specific information to satisfy external investors' needs for information and risk assessment. External investors require specific information on a regular basis to monitor and control the progress of their investment. Thus, we expect their presence to lead to an information-based communication style between founders and investors.

Other studies support this argument. Granlund and Taipaleenmäki (2005) find in a case study of eight technology-oriented and fast-growing new ventures that the introduction of management control systems was a response to pressure from outside investors to show specific information. Wijbenga et al. (2007) argue, based on RDT, that a venture capital investor "*should be able to align its governance activities to the information or resource needs revealed by these systems*" (p. 258). They also find that the presence of venture capitalists stimulates the use of control systems in startups. Davila and Foster (2007) investigate 78 technology-oriented startups of which 60 are financed by VC, and draw three conclusions. First, VC-backed startups grow faster and adopt more management control systems than startups without VC. Second, as VC investment is typical for companies with initial cash constraints, VC-backed startups make better use of financial planning systems to express and negotiate their financial needs. Third, sometimes VCs "*impose*" control systems, mostly for financial planning, financial evaluation, and strategic planning (Wijbenga et al., 2007, p. 919).

Further studies also find a positive effect of external investment on information-based communication. Cassar (2009) finds that nascent entrepreneurs who receive outside funding are more engaged in the preparation of financial statements. Wongsunwai (2013) indicates that specific information and regular monitoring activities can be a prerequisite for venture capitalists when funding is provided to the startup, based on archival data of 1,226 startups that went public between 1990 and 2004. A qualitative study by Smith and Cordina (2014) discovers common accounting information to be less relevant to venture capital investors in the high-technology field. Based on seven exploratory interviews among venture capitalists in the U.K., they find common accounting information is only of limited importance because venture capitalists require a considerable amount of additional information before they make an investment decision. However, the study aims to generate prepositions to be tested by future research and does not provide

empirical support. We still consider *presence of external investment* to have a positive effect on fact-based communication. Thus, we propose the following hypothesis:

H5. The presence of external investment leads to information-based communication.

4.3.4 Attraction of key resources as consequence of startup-specific performance measurement

Attraction of key resources

We now introduce *attraction of key resources* which is the main consequence in our model. This is necessary to later understand the influence of *managerial experience* on the *attraction of key resources*. After having shown initially how our model draws on resource theories, this construct is the link between our model and the resource theories. We first describe the construct, then we argue how *managerial experience of founders* can lead to the *attraction of key resources*.

We define *attraction of key resources* as the level of success in obtaining important tangible and intangible assets, which are essential for the startup's development and growth, from external parties. The construct is labeled *attraction of key resources* because it places emphasis on obtaining the resources which are most important for the startup's development at a certain point in the startup lifecycle. As startups develop and change over time, new types of resources can become key resources while others lose their importance. Financial resources, human resources, and strategic partnerships are generally seen as the most important resources for startups (Packalen, 2007, p. 885). Financial resources in the form of cash or cash equivalents are vital because they enable the startup's ongoing operations. Financial resources are also the most flexible type of resource and essential for the acquisition of other types of resources (Alsos et al., 2006). Company-owned human resources are important to manage an increasing workload and to introduce new knowledge into the organization (Gilbert et al., 2006). Strategic partnerships are worthwhile because they provide advice and guidance to the startup.

Having a solid resource base is important for startups at any point of business development. At an early stage, founders might struggle to receive external financing (financial resources as key resource). At a later stage, founders might search desperately for qualified staff (human resources as key resource) or pilot customers for product testing (strategic partnership as key resource). If a startup is not able to attract resources, it is very likely to stop business operations and fail eventually. If a startup is not able to manage its available resources efficiently, it is also very likely to run out of resources and fail eventually.

However, as we see from interviews with entrepreneurs, key resources can be manifold and depend on the situation and special needs of the startup. As an example, the manager of a startup accelerator program explained in one of our interviews that she observes how the importance of resources varies from startup to startup. Based on the experience of the accelerator program, she showed us examples of resources that could be key resources for startups. These could be contact with venture capital investors; access to working space; partnership with mentors; contact with lawyers and accounting organizations; workshops; and the participation in the accelerator program itself. We see that these resources are more likely to be key resources for startups at an early stage. Still, the examples illustrate the possible variety of key resources.

We also argue that further resources could be key resources for startups, such as the access to laboratories, equipment, machinery, or production inputs; collaboration agreements with universities or corporate companies; or pilot customers which help the startup to shape a product

and bring it to the market. An example to support this point is based on one of our interviews with the manager of a startup incubation program. The manager had organized and actively participated in various incubation rounds with university-related startups in Cape Town. Based on four years' experience in her position, she told us six factors which she found most helpful for startups participating in the incubation program. One very important factor was expert mentorship. Another one were open events. Both factors were knowledge-related resources. One was knowledge from experts to push startups into the right direction. The other one was practical knowledge on best practices from peers and founders in similar positions. As both resources are neither financial nor human workforce, we suggest that key resources can distinguish significantly, varying from startup to startup.

We now look at the literature on resource attraction to provide a brief overview of other studies that investigate the construct. Given that "*attracting resources into a fledgling venture is perhaps the greatest challenge faced by entrepreneurs*" (Brush et al., 2001, p. 71), one could expect *attraction of key resources* to have been frequently used in prior work. Paradoxically, we find only a small number of studies that capture the construct[32] with quantitative research methods. Cai et al. (2014) come closest to what we understand by the *attraction of key resources*. The authors conduct a survey among 343 Chinese startups and research three different methods of resource acquisition of which one is *resource attraction*. They define the construct as the "*process through which new ventures buy target resources from the external factor market with their initial financial resources*" (p. 367) and operationalize it using a 12-item measurement scale based prior work (Brush et al., 2001; Sirmon et al., 2007).

Constructs used in prior studies do not capture adequately what we understand by *attraction of key resources*. First, a main problem is that other studies do not focus sufficiently on the aspect of *attraction*. Although the construct by Cai et al. (2014) is close to our construct, it is operationalized in a way that concentrates on *how available resources* support resource attraction instead of *how new resources* are attracted. We find a similar, insufficient understanding in studies by Chandler and Hanks (1994) and Edelman et al. (2005). Second, some studies capture resource attraction not with quantitative but qualitative methods as the apply field or exploratory research methods (Hanlon & Saunders, 2007; Leung et al., 2006; Zott & Huy, 2007). The authors aim to rather identify the construct instead of measure it with a survey study. Third, some studies operationalize resource attraction in a way that the construct captures both the perspective of startup and resource provider (Villanueva, Van de Ven, & Sapienza, 2012). This research design is hard to imitate as it requires peers of startups and investors and does overemphasize the venture capital-backed startups.

Fourth, some studies use secondary survey data or archival data (Dunkelberg et al., 2013; Martens et al., 2007; Newbert & Tornikoski, 2013; Shane & Stuart, 2002). This leads to a relatively vague operationalization of the construct and is not suitable for our purposes. Fifth, studies focus exclusively on financial resources (Baron & Markman, 2003; Shane & Cable, 2002; Wry & Lounsbury, 2013) which is in our opinion a too narrow understanding of the construct. Last, some studies are conceptual or use simulation (Bhawe et al., 2016; Brush et al., 2001; Lounsbury & Glynn, 2001; Packalen, 2007; Sirmon et al., 2007; Starr & MacMillan, 1990; Wernerfelt, 2011). After having

[32] While some studies refer to the construct with the term acquisition of resources, we prefer the term attraction. This is because acquisition can easily get mixed up with the purchase of resources. We do not exclude the purchase, but we expect startup-specific performance measurement to have further positive effects on the attraction of resources which are not included in the process of purchasing a resource, such as signaling managerial competence or convincing others.

shown that literature does not offer any construct which is close enough to our understanding, it becomes obvious why we have to establish a novel construct and measurement scale in this study.

Hypothesis H6

Three hypotheses are posited for the attraction of key resources which we motivate in the following. Let us start with the most important argumentation, namely how *information-based communication* can lead to the *attraction of key resources*. We expect startups that use *information-based communication* to be more likely to attract important resources. *Startup-specific performance measurement* is as a tool to create specific information about the startup. Entrepreneurs can use the specific information when communicating with outside parties. We argue that this has two main effects.

First, the use of specific information in communication can *reduce the information asymmetry* between the startup and potential resource providers (Davila & Foster, 2004, 2007; Zott & Huy, 2007). Founders have superior knowledge about their business and product, which they need to communicate to resource providers. The startup has a lack of reputation and short track record which creates the perception of risk among resource providers (Brush et al., 2001). Fleming (2009) argues that one way for the startup to reduce the information gap is to disclose quantified information, and that founders might "*increase the persuasive power (…) by providing "verifiable" quantitative data (…) rather than qualitative "soft talk" disclosures*" (Fleming, 2009, p. 18). Also, he finds support for this argument based on a survey among 62 U.S. VC investors located in California and the Mid-Atlantic region.

Second, information based-communication sends a *signal of managerial competence*. External partners might have resources to offer, but have to decide between multiple startups. As information asymmetry hinders the exchange of promising business ideas and available resources, the startup should take actions to reduce it and find a way to lower the risk perceived by resource providers. Mobilizing specific information in the communication can be perceived as a *signal of managerial competence*. Presenting meaningful and specific information about the startup can be an important signal for outside parties and convince them of the entrepreneurs' managerial skills. Drawing on tailored information can underscore the impression that entrepreneurs are competent managers and have control over their business.

Previous studies underline the argument. Davila et al. (2009) analyze different roles of management control systems in startup companies. One of seven identified roles of MCSs refers to *symbols to legitimize*. This means that MCSs do not only fulfill practical needs in the sense of a management tool. They are as well "*symbolic to externally legitimize the innovation process of the organization through an appearance of competency"* (Davila et al., 2009, p. 329). Moro et al. (2014) investigate the role of voluntarily disclosed information in obtaining external financing. They find that founders appear to be more competent if they offer convincing information and obtain a lower interest rate charged by the bank.

Taken together, we argue that *information-based communication* reduces information asymmetry and risk perceived by resource providers. Moreover, it can be seen as a signal of managerial competence. Thus, we propose the following hypothesis:

H6. *Information-based communication* leads to the *attraction of key resources*.

Hypothesis H7

We now clarify the next hypothesis related to *attraction of key resources*. We expect *managerial experience of founders* to lead to the *attraction of key resources*. Founders who have gained experience in management are more likely to benefit from their knowledge in various aspects compared to founders without prior knowledge. We therefore expect *managerial experience* to positively influence various other factors in a startup that mediate the experience-performance relationship and can lead to a better overall performance. Hence, we argue that *managerial experience of founders* is positively related with *attraction of key resources* as this is the main dependent variable in our model.

Examples in the literature offer empirical support. Mengel and Wouters (2015) find that educational background in business and economics is antecedent to the use of financial planning and control in startups. As well, they offer empirical support that the use of financial planning and control is antecedent of startup performance. In the before mentioned logic, the use of financial planning and control positively mediates the relationship between managerial experience and performance. Cassar (2014) theorizes and finds empirical support for the relationship between industry experience and reduced overoptimism among nascent entrepreneurs. Although not tested, it can be assumed that a less biased perception of opportunity recognition could increase the number of successfully established startup; in other words, the performance of these entrepreneurs. In line with recent work, we expect a positive effect of *managerial experience* on *attraction of key resources*. Thus, we propose the following hypothesis:

H7. *Managerial experience of founders* leads to the *attraction of key resources*.

Hypothesis H8

As the last hypothesis, we expect the *presence of external investment* to be related to *attraction of key resources*. We assume that startups with external investors are more likely to obtain the resources they require. It is conceivable that startups with external funding have shown their ability to convince outside partners of their business. Hence, they might be also more likely to attract other important resources by convincing other external partners. Davila, Foster, and Gupta (2003) find a positive relationship between the presence of venture capital and the growth of startups. Drawing on signaling theory, they argue that "*VC funding events are important signals about the quality of the startup*" (p. 689) and find empirical support in archival data of 494 startups.

It is important to mention that this relationship is not a self-fulfilling prophecy. When thinking vaguely about the constructs *presence of external investment* and *attraction of key resources*, the reader could assume both variable are two sides of the same coin and reinforce each other. However, this is not the case. It becomes clear when we keep in mind that *attraction of key resources* is not a variable to capture the *track record* of a startup's past funding. As we show in detail below, this variable describes how successful startups are in obtaining the resources they most urgently require. Imagine a situation in which a startup might already have received external equity funding, but requires additional financial capital or highly-qualified employees to achieve the next breakthrough in product development. In such a situation, external investment could be present while the attraction of key resources could create problems for a company. In summary, we distinguish the two constructs but expect them to be related. Thus, we propose the following hypothesis:

H8. The *presence of external investment* leads to the *attraction of key resources*.

Thus far, the study has motivated how the research topic draws on resource theories, why resource attraction is key to startup performance, and why specific performance measurement has been neglected as antecedent of resource attraction until now. The study has also presented the theoretical model and the underlying argumentation for why *startup-specific performance measurement* and can help startups to *attraction of key resources*. The next section clarifies the research method which has been used to test the model's posited hypotheses.

4.4 Method

We used an online survey to collected data in order to test our hypotheses. In this section, we give details about the sample and respondents, questionnaire development, survey instrument, and data analysis. However, before we look at the survey, we would like to shed light on the research activities prior to the survey which provided inspiration and helped us to conceptualize the underlying theoretical model.

4.4.1 Preliminary research activities

To guide the conceptualization of our model, we interviewed founders and conducted small case studies with startups (Table 10). The purpose of these preliminary research activities was to understand how management accounting was used and perceived by entrepreneurs. We conducted the interviews and case studies during a period of two and a half years between 2015 and 2017. The insights obtained substantially informed our theory development and helped us to shaped our model.

We began to interact with founders at networking events in the area of Karlsruhe, Germany, which is known for its favorable incubation environment for technology-oriented startups. As a side note, a recent report on the development of startups in Germany found Karlsruhe's technology-oriented university (Karlsruhe Institute of Technology, KIT) to yield the second largest number of startups of all universities in Germany (Kollmann et al., 2017, p. 30). The events generally consisted of the presentation of a startup-relevant topic and a subsequent part of socializing and networking. Each event made it possible to get in touch with many different founders and other startup-related people. Hence, we used these network events to create contacts within the startup environment and exchange ideas about management accounting with founders. The large number of conversations with different founders were an appropriate way to approach our research topic.

To refine the understanding of the topic, we conducted small case studies and interviews. Small case studies helped us to understand in greater detail how management accounting and performance measurement in startups worked in practice. The case studies were conducted by research assistants who participated in a seminar (14 case studies) or who wrote their master's thesis (2 case studies) at our chair. Interviews were conducted with founders or experts, such as academics who had specific knowledge on entrepreneurship and management research or practitioners who worked intensively with startups, such as a startup advisor and a manager of a startup incubation program. All interviews were performed by the author, face-to-face with the interviewee and with

Table 10. A total number of 42 interviews, small case studies, and other preliminary research activities guided the conceptualization of our model

Type of activity	Number
Small case studies	16
Interviews with founders	12
Network events with multiple conversations per event	7
Interviews and discussions with experts	7
Total number	42

the help of a semi-structured interview guideline. Notes were taken during and after the interviews to capture the conversation.

While most of the preliminary research activities took place in Germany, we also had the opportunity to gain insights from interviewing entrepreneurs in Cape Town, South Africa. This was possible during several research stays at the Graduate School of Business (GSB) of the University of Cape Town (UCT). Similar to Karlsruhe in Germany, Cape Town is one of the two important locations for startup creation in South Africa (together with Johannesburg).[33, 34] Moreover, the GSB offers its own incubation program and individual co-working space for startups. The GSB's startup environment enabled us to connect with founders and startup advisors in Cape Town and to conduct interviews. Being well aware of the Germany and South Africa differ strongly in terms of economy, politics, society, and culture, the insights we gained from the interviews in Cape Town provided a worthwhile source of inspiration and were in line with what we found out in Karlsruhe.

What we learnt from the conversation with founders helped us to shape the understanding of how they used certain methods of management accounting. We further discovered how some of the founders perceived these methods as helpful to manage their startup. The interviews and short case studies provided meaningful inspiration to inform our theory development. We discovered that what founders told us was not satisfyingly covered by academic literature. The interviews also showed that some of the founders agreed to what practical guidebooks and online sources postulated about management accounting and performance measurement in startups (see section 4.4.1). Hence, the preliminary research activates encouraged us to address the gap in the literature and to develop a novel theory. We therefore consider these activities as vital element and inspiring base of our study.

4.4.2 Sample frame recruitment

To collect data from founders, we complied a database of 613 young, technology-oriented startup companies in Germany. We used an existing database that was hand-picked in a prior research

33 Coetzee, J. (2015). *Why Cape Town has emerged as the biggest startup hub on the African continent*. Retrieved November 14, 2017, from http://ventureburn.com/2015/11/why-is-cape-town-a-world-class-hub-for-tech-startups/

34 Featherstone, E. (2016). *How Cape Town's tech entrepreneurs are solving problems for small business*. Retrieved November 14, 2017, from https://www.theguardian.com/small-business-network/2016/jul/12/cape-towns-tech-entrepreneurs-solving-problems-for-small-business

project and updated it. We gathered up-to-date information on startups from publicly available sources with focus on technology-oriented startups, especially venture capital investors, startup incubators related to universities or research centers, government-funded investment funds, and industry organizations focusing on startups.[35] These organizations listed startups who were part of their program.

To be included, startups had to (1) focus on a field commonly seen as high technology, for instance biotechnology, medical technology, or information and communication technology; (2) offer at least one product based on a new technology or were in the process of developing such a product; and (3) be 10 years or younger at the time of our survey. We chose this cut-off criteria for startup age in line with recent studies on startups (Kollmann, Stöckmann, Hensellek, & Kensbock, 2016; Kollmann et al., 2017).

We did not use a cut-off criteria for company size in terms of employees. From a theoretical standpoint, we were interested in how well startup-specific performance measurement could foster the performance of startup companies. We understood employee growth as one form of a positive startup performance. Hence, if we had applied a threshold for employees, we would have excluded startups with strong performance and, thus, also omitted their perception of specific performance measurement. Moreover, recent research recommended to account for non-normally distributed data because important variables in entrepreneurship have been shown to follow power law distributions instead normal distributions (Crawford, Aguinis, Lichtenstein, Davidsson, & McKelvey, 2015; Crawford, McKelvey, & Lichtenstein, 2014; Shim, 2016). These studies supported our decision.

Our unique database included contact details and specific company information for each of the 613 startups. As contact details, we listed the name and title of the founder. If the startup's website mentioned more than one founder, we chose the one who was mentioned as CEO, CFO, or associated with the leading management position because we expected them to know best about specific performance measurement. We also collected email address, postal address, and telephone number of each startup. This was necessary for the sophisticated system of reminders which we applied.

For company specific information, we included information from the startup websites on products, business partners, received funds and subsidies, or pilot customers. Moreover, we formulated a so called *hook* for each startup in the database. Each hook consisted of one or two tailor-made sentences, based on publicly available information on the startup's website, which captured a specific company characteristic, such as an interesting product or the technology behind, and explained why the company was interesting to our research. We later used the hooks in the communication with survey participants to explain why their company sparked our interest (as explained in section 4.4.4). The reason for this laborious procedure was that we expected to increase the participants' willingness to respond to our survey.

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35 Our final database contained information provided by the following organizations: Fraunhofer-Gesellschaft, High-Tech Gründerfonds, Max-Planck-Gesellschaft, Munich Biotech Cluster, RWTH Aachen, Science City Berlin Adlershof, Technische Universität Berlin, Technische Universität Braunschweig, Technische Universität Darmstadt, Technische Universität München, Universität Berlin, Universität Hannover, Universität Stuttgart

4.4.3 Questionnaire development and substantive validity assessments

The purpose of this subsection is to describe how we obtained our final questionnaire. First, we present which measurement scales we used for the model constructs. Second, we report how we conducted a pretest to assess the validity of newly developed scales, following the substantive validity assessments by Anderson and Gerbing (1991). Third, we talk about how the questionnaire design aimed to reduce common method bias.

Measurement scales

The questionnaire consisted of measurement scales for all of our seven model constructs, control variables, and open fields where respondents could leave comments. We started by collecting similar scales from the literature for each construct. We used our definitions and theoretical understanding of each constructs to decide whether an existing scale was suitable or not to our questionnaire.

Following Churchill (1979), we aimed to find established measurement scales in the literature which have been validated in prior research. We expected to find existing scales for at least some of the more common constructs. When we could not find an existing or similar scale, we developed a new scale considering common advice for questionnaire development (Krosnick & Presser, 2010). All novel measurement scales were designed as reflective, multi-item scales (Jarvis, MacKenzie, & Podsakoff, 2003). We further decided to use a 5-point Likert response scale where appropriate, and binary items elsewhere. In line with Krosnick and Presser (2010, p. 270), we found 5-point Likert scales to be more comprehensive for respondents because a clear meaning can be assigned to each step of the Likert scale (1 – strongly disagree, 2 – disagree, 3 – neutral, 4 – agree, 5 – strongly agree). Our decision was also in line with other studies in leading entrepreneurship journals who recently employed 5-point Likert scales (see, for example, Gielnik, Uy, Funken, & Bischoff, 2017; Lerner, 2016; Stenholm & Renko, 2016).

In total, we could use established scales for three constructs (perceived environmental hostility, managerial experience of founders, presence of external investment) and developed four new scales (use of web analytic tools, startup-specific performance measurement, information-based communication, attraction of key resources). Appendix B lists all scales and measurement items. Appendix C provides an overview of the scale reliability (Cronbach's alpha) before and after the respecification of the measurement model.

Perceived environmental hostility. We used an existing 6-item scale by Grichnik et al. (2014) to measure *perceived environmental hostility* as it captures exactly our understanding of the construct. We translated the six items from English into German language by a German native speaker. Although Grichnik et al. (2014) used a 7-point Likert scale, we employed a 5-point Likert scale due to the before mentioned reason. Moreover, Grichnik et al. built on scale for perceived environmental hostility by Covin et al. (2000) who originally used a 5-point scale as well. To assess their validity, we included the six translated items in our pretest, even though they had been previously validated (Grichnik et al. (2014, p. 317) reported a Cronbach's alpha score of 0.76).

Use of web analytic tools. We developed a new scale to measure *use of web analytic tools*. As shown above, research on web analytic tools seemed to still be in its infancies. Likewise, we could not find similar measurement scales to build on. We used a 3-item scale which captured whether a

startup used web analytic tools (binary item), how frequently the tools were utilized, and how important the tools were for the founders (both on 5-point Likert scales).

Managerial experience of founders. We measured *managerial experience of founders* with 3 items. Each item was drawn from a different study with similar scales (Brinckmann & Kim, 2015; Davila & Foster, 2007; Mengel & Wouters, 2015), translated to German, and slightly adapted in wording to the meet the focus of our work. One item was measured on a ratio scale (years of managerial experience), one item as interval scale (highest academic degree), and one item was binary (educational focus on economics or management).

Presence of external investment. We used a 3-item scale for *presence of external investment* which built on an existing measurement item (Davila & Foster, 2007; Davila et al., 2015). Since the existing item focused exclusively on external investment from venture capital investors, we added two very similar items which focused on external investment from business angels or banks. Each item was binary for two reasons. First, prior research has used binary items to capture the construct. Second, from a theoretical point of view we wanted to capture the presence or absence of external investment. This was reflected best by a binary item. However, binary items cannot be used as reflective measurement items in structural equation modeling. Hence, for the analysis we calculated a new score by summing up the three binary questionnaire items. This was also in line with our theoretical understanding because we expected startups with different external investors to have a stronger need for communication based on information and facts.

Startup-specific performance measurement and *information-based communication.* We could not find existing constructs in the literature which were similar to startup-specific performance measurement and information-based communication. As we considered both as novel construct to research, this was less surprising. Hence, we used a self-constructed 4-item scale for each of the constructs. We illustrate the creation of new constructs in the following subsection on questionnaire development and pretesting.

Attraction of key resources. We used a self-constructed 4-item scale for our dependent variable. As shown above (see section 4.2.1), the attraction of key resources is based on two major theories, the resource-based view (RBV) and resource dependence theory (RDT). Thus, we expected to find similar constructs in the literature. However, and to our surprise, we could not find a similar construct or existing scale which captured our dependent variable adequately. To make sure we did not miss an existing scale or construct in the literature, we conducted a systematic literature search as described next.

Table 11. Of the 234 search results no study yielded a construct or measurement scale similar to our construct *attraction of key resources*

Result of systematic literature search	Number
Studies matching search criteria	234
of which were survey-based	136
of which contained resource-related constructs	23
of which contained resource-related measurement items	6
of which were similar to our construct	0
Number of relevant studies	0

As a brief side step, we now illustrate our systematic literature search for resource-related constructs (Table 11). The purpose was to either find an existing scale for *attraction of key resources* or to make sure the literature did not offer a scale which suited our theoretical construct. Before we started the systematic search, we had already conducted various broad and less structured searches on scales for *attraction of key resources*. As the first searches did not yield a suitable outcome, we decided to conduct a final search using a systematic and structured approach similar to Tranfield et al. (2003). The main idea was to retrieve all studies which contained a measurement scale and cited an influential work on either the RBV or RDT. Using the Scopus database by Elsevier, we searched for studies which met the following criteria:

- They contained "survey" or "questionnaire" as key word.
- They mentioned at least one of five highly-cited papers on the RBV or RDT in their references (J. Barney, 1991; Brush et al., 2001; Pfeffer & Salancik, 1978; Starr & MacMillan, 1990; Wernerfelt, 1984).
- They were published in one of the following leading academic journals on management or entrepreneurship: *Journal of Business Venturing, Entrepreneurship: Theory and Practice, Strategic Entrepreneurship Journal, Journal of Management, Academy of Management Review*.

As shown in Table 11, a total number of 234 papers met our inclusion criteria. We then analyzed these papers in detail. After excluded papers that mentioned a key word but did not conduct empirical survey research, 136 studies were left. After excluding papers whose constructs were not related to resources, 23 papers were left. Of these 6 papers offered measurement scales related to resources (Brush & Chaganti, 1999; Chandler & Hanks, 1994; Dunkelberg et al., 2013; Edelman et al., 2005; Fields et al., 2005; Zhang et al., 2010). We then examined these measurement scales and were astounded to discover that none of them captured the meaning of our construct. As no result can sometimes still be a result, the systematic search confirmed the lack of an adequate construct for the *attraction of key resources* in the literature.

Control variables. We used 10 control variables in the survey of which 6 were open questions (startup age, number of employees, number of founders actively managing the startup, industry, number of different products, main customers in business-to-business (B2B) or business-to-customer (B2C)) and 4 binary questions (spin-off of university or research center, spin-off of another company, founders obtained startup-specific coaching, founders obtained public subsides). However, the only variable we required was startup age because it determined whether a startup was meeting our 10-year age threshold. We collected the other control variables even though our theoretical model did not require them. On the one hand, gathering control variables beforehand is a common practice in entrepreneurship research (for example, see Delmar & Shane, 2003, p. 1174; Greene & Hopp, 2017, p. 9; Gruber, 2007, p. 795). On the other hand, we wanted to prevent a situation in which we would have completed the data collection but would realize that any important information was missing. Moreover, we expected to require some information for triangulation issues between what a startup offered on its website and what the founders responded, such as obtaining funds from public sources.

Pretest for substantive validity assessments

We used reflective multi-item scales to measure each construct. Multi-item scales can be considered a standard practice in business research using structural equation modeling (Diamantopoulos, Sarstedt, Fuchs, Wilczynski, & Kaiser, 2012). Also, the overall reliability of a measurement increases

with additional items while the measurement error tends to decrease (Churchill, 1979, p. 66; Moosbrugger & Kelava, 2012) We followed common recommendations for scale development, such as the entire width of the construct should be covered, same expressions should be used for the same issues, and short and clear sentences without negations and jargon should be used. All items were in German language.

To keep the questionnaire attractive for respondents, however, it is important to not have too many items per scale. Thus, we initially created 9 items per new scale and used a pretest to narrow down their number to 4 items in the final survey. The purpose of the pretest was to reduce the number of potential items for each construct, to achieve a high construct validity, to minimize a thinkable overlap between constructs, and to reduce the risk of a poor item performance in the main survey (Anderson & Gerbing, 1991). We used an item-sort task as recommended by Anderson and Gerbing (1991). The main advantage of this approach was that we could assess how often an item was assigned to its intended construct. We could determine the statistical significance of correct item assignments and decide which items performed best.

The pretest consisted of 42 items which reflected our seven constructs. Among these 42 items were also the items of the three existing scales we used. Even though the scales had been validated before, this was necessary to avoid an overlap between the constructs. Based on Anderson and Gerbing's (1991) item-sort task, we asked participants to assign each of the 42 items to one construct of our model. We told them to choose the construct which in their opinion reflected an item best. Before we approached founders, we conducted a pre-pretest with 12 students of industrial engineering and management. This pre-pretest was worthwhile to gain experience for the following pretest. The students obtained the same items and instructions as the real participants. As the students did not form part of our survey's target group (founders of technology-oriented startups), the statistical results were not representative. However, the results of the pre-pretest yielded already a substantive validity of measurement scales which was a positive sign. The students obtained ice-cream as reward for participating in the test on a hot summer afternoon.

The 20 participants of the pretest were founders of technology-oriented startups in the area of Karlsruhe and Pforzheim. Eight of them were involved in prior interviews or small case studies. None of the 20 participants or the startups they represented formed part of our final survey sample.

The procedure of the pretest was as follows: We met with each participant either in person or via online conference (in 3 of 20 cases). Each participant received two sheets of paper. One sheet contained the 7 constructs with definitions. The other sheet contained the 42 items which were to be assigned during the pretest. Construct names, definitions, and items were in German. On both sheets the order of constructs and the order of items were randomized to prevent effects of positioning. Such effects could be that participants get better at assigning items during the test, leading to more misallocations at the beginning. Or their concentration could decrease during the test, leading to more misallocations at the end. By analyzing the final assignments, we found that neither of the two effects was significant in our pretest.

Item-sort tasks can be imagined as different baskets into which an item should be put. The task was to write the "correct" construct number (meaning the number which participants believed to suit best) next to each of the 42 items. To visualize the image of baskets we installed small shot glasses with numbers and construct names in front of a participant. We created a mental image in this way and participants could imagine to put an item into one of the "shot glass basket". Some participants gave us feedback that this visualization helped them to perform the task.

To evaluate the pretest, we calculated the proportion of substantive agreement (PSA) and the substantive-validity coefficient (CSV) (Anderson & Gerbing, 1991, p. 734). First, the PSA is the number of participants who assigned an item to its intended construct divided by the total number of respondents (in our case N = 20). The PSA can range from 1.0 to 0.0 with a value close to 1.0 indicating a high validity. As an example, one item of the construct *attraction of resources* was assigned correctly 15 times, yielding a PSA value of 0.75. Second, the CSV accounts for the overlap of constructs by exploring whether an item was systematically assigned to a wrong construct. It is calculated as the number of correct assignments minus the maximum number of wrong assignments to a wrong construct and then divided by N. The CSV can range from 1.0 to -1.0. A value close to 1.0 indicates a high substantive validity for the correct construct. A value close to -1.0 indicates still a high substantive validity, but for a wrong construct. Thus, negative values show that an item taps into another than the intended construct. As another example, one item of the construct *startup-specific performance measurement* was assigned correctly in 14. Of the 6 misallocations, it was assigned 4 times to one construct (maximum number of wrong assignments), thus, yielding a CSV of 0.5 (= (14-4) / 20). According to Anderson and Gerbing's (1991, p. 735) formulas (5) and (6), the critical value for CSV was 0.6 in our case (with m = 16 as the critical number of correct assignments). Based on this cut-off criteria we excluded 6 of 42 items with a CSV value of 0.6 or below.

The remaining 36 items fulfilled the pretest's criteria for inclusion as they were assigned correctly 16 times or more by the 20 participants. Furthermore, for each of the three self-constructed scales were 4 or more useful items left. Hence, we could choose the 4 items we perceived most suitable to capture the full width of a construct. Our decision for the final items was based on qualitative considerations. The judgement was informed by giving meticulous thought to each construct's theoretical notion and by discussion in detail which set of items would capture the construct best.

Common method bias

We used a proactive survey design to prevent common method bias. In the results section we also present the tests for common method bias (see section 4.5.3). We sought to reduce common method bias to a minimum through following recommendations by Podsakoff, MacKenzie, Lee and Podsakoff (2003) and Conway and Lance (2010). Our survey was a single informant survey which means that we surveyed exclusively one of the founders or CEO of each startup. This self-report was appropriate for two reasons. First, founders or CEOs can be expected to be the best informed individuals with regard to organizational practices (Flatten, Engelen, Möller, & Brettel, 2015, p. 1122; Kumar, Stern, & Anderson, 1993, p. 1634). Thus, we expected them to be best informed about the use of specific performance measurement and the attraction of important resources. Second, it is a practical problem in entrepreneurial research that founders are extremely busy and comparably hard to survey. Thus, we expected that urging more than one founder of a startup to answer would decrease their benevolence and willingness to respond.

Regarding the proactive survey design, we used a pretest to achieve a high construct validity and to minimize the overlap between the constructs. Moreover, the order of constructs in the questionnaire was randomized and thereby measured in an order different to the model. We also randomized the order of items within each construct. In the online survey, each construct and its associated items were displayed on an individual page. In the mail survey, each construct and its

items were clearly identifiable through a frame. We formulated a short introduction to each construct to clarify its meaning. These design features should help respondents to understand the survey better and, thus, lead to a higher data quality of answers. Last, we put emphasis on the confidential handling of data and offered respondents to answer anonymously. We expected all these features to reduce common method bias and yield a high quality of responses.

4.4.4 Data collection

Our unit of analysis was the startup company represented by its founder or CEO. As collecting data from founders can be challenging, we now describe the process used to overcome this hurdle and collect a sufficient number of responses for statistical analysis. The process was largely based on the approach of a prior research project at our institute.

Surveying startups can be tough for two reasons. First, technology-oriented startups have attracted a strong interest of researchers over the last years. In addition to research, the private and public sectors have developed a growing interest in startups (Kollmann et al., 2017). As a consequence, founders receive dozens of survey invitations each month. Many of the founders we contacted personally for our pretest complained about the amounts of surveys they received each week. Some of them also told us that they decided to refuse surveys as a consequence of this overload. Second, founders are generally very busy as they have to manage a broad variety of tasks within their startup. Some founders told us that they perceive their time as scarce and try to carry out important activities only. Two founders explained that they generally rejected surveys because the saw no benefits from participating. We concluded we had to design our survey carefully and make it as attractive as possible to founders.

All in all, we put great emphasis on a professional appearance and formulation of our communication and survey. We chose the following survey design. We contacted the startups in a sequence of three events: (1) via email, (2) via postal mail, and (3) on the phone. The first contact via email consisted of a message which personally addressed the founder or CEO of each startup. We did what one of the founders in our pretest recommended: to include the contact person's name directly in the subject line of the email because the founder argued he perceived this to clearly stand out from the large amount of impersonal emails he received on a weekly base.

The first paragraph of the email emphasized that we selected the startup deliberately due to its proximity to technology. This statement was underscored by the so-called *hook* (which were one or two tailor-made sentences based on publicly available information on the startup's website, which explained why we were interested in a startup, as described in section 4.4.2). We used the hooks whenever we contacted the startups (via email, postal mail, or phone) because we expected them to increase the startups' willingness to participate in our survey. The second paragraph explained our research project, pointing out that it built on a prior successful project and that it was part of a dissertation. The third paragraph stated that we were aware of the recipient's situation of scarce time and the overflow of survey invitations. We called recipients upon their benevolence to support research which would not be possible without their support. We then described the incentives for participants: we would share the results of our study, we would offer a webinar on the topic, and we would raffle one Apple iPad among participants. The last paragraph made clear that participating in the survey would take less than 10 minutes. The email ended with a link to our

Figure 9. We designed the icon to spark the interest of founders upon receiving our postal survey.

institute's website where we offered a short introduction to participants and then referred them to the online survey.

As a short side step, the following occurrence illustrates how important a professional communication and survey design are. Roughly two weeks before we planned to launch our survey, we found out that two students had sent out an online survey in the name of our chair. The survey was tackling a similar topic, management accounting in startup companies, and sent to roughly 1,500 startup companies. To our great displeasure, the invitational email to the survey was written in a highly unprofessional manner, causing one of the startups to respond literally the following: "Stop emailing us. This is spam! We have no interest in your survey." The story behind was that the two students created this survey within a seminar at our chair and without coordinating with their supervisor. We feared for the worst, namely that our carefully established and updated database could have been spoilt by this misfortunate action[36]. Luckily, only 5 of our sample companies had been contacted by the students because they used other, less specific startup databases to contact companies. To regain these five startups' goodwill, we contacted each of them personally and apologized for the survey obtained. We also pointed out that within short time they would receive another, highly professional survey by our chair. Yet, none of the five startups was part of the non-anonymous participants in our final sample, which is why we could not draw inferences about whether our crisis intervention was successful or not. Still, this example made clear how important professional communication is to the success of a survey. Also, it showed how important it is to plan a survey meticulously to achieve a high response rate. However, certain events (such as this one) cannot be controlled for and require a flexible handling.

The second contact via postal mail took place 10 days after the first contact. Those startups who had not responded yet received an envelope in A4 format containing a cover letter, the questionnaire in paper form, and an envelope to send back the completed questionnaire at no charge. The cover letter contained a personalized message very similar to the first email and was signed by hand. Furthermore, we strived to spark the recipients' interest upon receiving the mail

[36] It should be mentioned that the uncoordinated survey did not influence the students' seminar grade negatively. However, future generations of seminar participants will need to coordinate survey projects with their supervisor beforehand.

survey. For this reason, we designed an icon that illustrated the focus of our study: how startups can use specific performance measurement to attract resources (Figure 9). We put the icon as a sticker on each envelope so it would distinguish from other incoming mail. The icon we designed can be also seen on the cover of this work.

The third contact on the phone aimed to offer startups who had not responded yet the possibility to conduct the survey on the phone or to remind them to respond online. This step was strongly supported by uzbonn GmbH. Founded in 2011 as a spin-off of the University of Bonn, uzbonn focused on performing telephone surveys for academic purposes. Before uzbonn started to contact the remaining sample companies, we conducted about 35 calls to gain experience. We then created a document with instructions for uzbonn to describe our survey project up to date and our experiences with the first calls. We then sent this document, another document to state the research purpose of the survey, and our database to uzbonn to start the telephone interviews. As told by uzbonn, the company-specific hook was particularly helpful to emphasize our academic interest to the contacted startups. Upon receiving a call, a startup could choose to reject participation, understand the call as a reminder to fill out the questionnaire online or via mail, complete the questionnaire on the phone directly, or schedule an appointment to complete it on the phone later on.

To collect data, participants completed either an online or printed questionnaire. Both questionnaires contained exactly the same questions and had the same structure. For the online questionnaire we used the survey software Questback EFS Summer 2017. For the printed version we developed an Excel spreadsheet. In both questionnaires the order of constructs was randomized as well as the order of survey items within each construct. Participants responding to our first contact filled in the online questionnaire. The ones responding to our second contact filled in the printed version or the online version. To complete the telephone interviews uzbonn used again the online version to capture respondents' answers.

Our survey yielded a response rate of 40.5% (241 of 595 contacted companies) as shown in Table 12**.** The initial sample of 613 companies was reduced by 18 startups we could not reach because the provided contact details were either incorrect or incomplete, such as erroneous postal addresses or undisclosed telephone numbers. 241 of the 595 contacted startups completed our questionnaire. 139 questionnaires were completed online (57.7%), 68 by phone (28.2%), and 34 via postal mail (14.1%). Of the 241 responses 29 questionnaires were completed anonymously (12.0%).

Table 12. Overview of the data collection which led to a response rate of 37.5%

Steps to filter responses	Number of startups
Initial sample size	613
Minus undeliverable questionnaires	18
Contacted sample size	595
Complete responses received	241
minus companies ≥ 10 years	15
minus cases with missing data ≥ 10%	2
minus inactive companies	1
Final set of usable responses	223

Upon closer examination, we had to remove 18 responses for the following reasons: 15 companies were older than 10 years which violated our previously defined criteria for inclusion; 2 cases due to missing data over 10%; and 1 case in which a respondent completed the questionnaire although the startup had ceased operations before the time of the survey. We checked the comments to identify respondents who explicitly wished to be excluded from the survey. However, none of the respondents indicated a misfit of the survey with their situation or wished to be excluded for a specific reason. Thus, our survey yielded 223 usable responses as final sample size (37.5% usable response rate).

4.4.5 Analyses

We performed the analysis of survey data using structural equation modeling (SEM) with maximum-likelihood estimation provided by the programs SPSS and AMOS 24. We started with modifications to the raw data to prepare it for statistical analysis. Appendix D provides a transparent overview of the modifications. We continued with screening variables for missing data, outliers, and normality (Kline, 2011, pp. 51–64). We then we analyzed the data following the two-step approach by Anderson and Gerbing (1988).

Missing data was a minor issue because participants using our online questionnaire were urged to answer all questions. Still, we observed missing data in four variables (EnHos_1, WebAna_2, WebAna_3, ExInv_1) which resulted from incomplete answers of paper questionnaires. Each variable had exactly one missing value and each missing value pertained to a different case, i.e. a different row in the data set. Due to the minute number, we deemed appropriate to impute the missing values and retain the corresponding cases in the sample. For WebAna_2 we looked at the surrounding variables for the latent construct *use of web analytic tools* and used the value of WebAna_1 to impute the missing value because the respondent indicated the absence of web analytic tools. For the other variables, we replaced the missing values with the mean value of each variable to make sure the imputed values would not influence or bias our further analysis.

We observed outliers in one variable, number of employees, which had a mean value of 13.36 and a median of 9.0. The analysis identified 19 companies with more than 30 employees as outliers. As mentioned earlier, recent research highlighted the non-normality of some entrepreneurial variables, such as the number of employees, and counseled to include them in statistical analysis (Crawford et al., 2015; Shim, 2016). Hence, we retained the 19 cases in our sample when assessing the measurement and structural model. Yet, to account for strict rules of normality, we conducted a separate analysis (see section 4.5.5, model variation 1) with companies of 30 employees or less. As we will show below, this analysis emphasized the robustness of our model.

The variables showed fairly normal distributions. However, we observed mild skewness and kurtosis for variables reflecting *attraction of key resources* and *managerial experience of founders*. The values for skewness and kurtosis ranged from benign to 1.4. While strict rules of normality reject values over 1.0, our variables are within more liberal rules suggested by Kline (2011, p. 63) who recommends 3.0 as threshold for skewness and Sposito, Hand and Skarpness (1983, p. 266) who recommend 2.2 as threshold for kurtosis. Once these steps were completed, our data was ready for statistical analysis.

To analyze our data, we conducted an exploratory factor analysis as recommended for new data sets (Ferguson & Cox, 1993, p. 85; Schumacker & Lomax, 2010, p. 164). We continued with

the two-step approach for SEM by Anderson and Gerbing (1988). In the first step, the fit of the confirmatory measurement model is estimated by employing confirmatory factor analysis. While the confirmatory measurement model allows each indicator[37] to only load on its own latent variable, loadings to other factors are restricted to zero. Latent variables can correlate freely with each other. Through the respecification of the measurement model, an appropriate fit can be achieved. In the second step, the structural model and measurement model are estimated simultaneously. Resembling the theoretical model, the structural model only allows hypothesized relationships between the factors. So, the simultaneous estimation of structural and measurement models assesses the posited relationships between constructs (Anderson & Gerbing, 1988).

To determine model fit, we followed Hu and Bentler's (1999) recommendation and calculated different measures, specifically *chi-square/degrees of freedom* (CMIN/DF), the *comparative fit index* (CFI), the *standardized root mean squared residual* (SRMR), and the *root mean squared error of approximation* (RMSEA) with significance level (PCLOSE) (Blunch, 2013; Hu & Bentler, 1999; Kline, 2011; Schumacker & Lomax, 2010). The recommended threshold values for excellent model fit are

- CMIN/DF $\in (1, 3)$,
- CFI > 0.95,
- SRMR < 0.08,
- RMSEA < 0.06,
- PCLOSE > 0.05.

Hu and Bentler (1999) have recommended to use a combination of fit indices as well as thresholds to compare how well a model fits the observed empirical data. Other researchers, however, have counseled to avoid an overly strict application of fit indices and thresholds. Instead, they have argued to use the indices to compare alternative models based on the same empirical data (Marsh, Hau, & Wen, 2004). We follow Marsh et al.'s (2004) recommendation and use the fit indices to assess model respecification. Having clarified the data analysis, we now proceed with the results.

4.5 Results

This section is structured as follows: We begin with descriptive statistics to characterize our sample. We then turn to the confirmatory measurement model, followed by the structural model. We last report variations of our structural model to demonstrate robustness.

4.5.1 Descriptive statistics

The company characteristics revealed that our sample contained the kind of startups we intended to focus on. The 223 companies in our sample had a mean age of 5.3 years (median of 5.0), employed on average 13.4 people (median of 9.0), and were led by 2.0 founders on average (median of 2.0). 55.6% of companies were spin-offs of universities or research centers; 80.3% had other businesses as customers (B2B); 30.9% of founders had an academic education with focus on

[37] In the context of structural equation modeling some terms are used interchangeably. To prevent confusion, we here clarify these terms. The terms *observed variable*, *indicator*, and *item* can be used synonymously. Also, *latent variable*, *construct*, and *factor* can be seen as synonyms of each other.

economics; 54.7% of founders had received startup-related coaching; and 70.9% received startup-related funds from public sources.

4.5.2 Exploratory factor analysis

We conducted an exploratory factor analysis (EFA) with promax rotation and maximum likelihood extraction based on eigenvalues above 1. As the EFA requires two or more items to identify a factor, *presence of external investment* could not be included because it was a calculated scale with only one item (see section 4.4.3). The EFA uncovered issues with *perceived environmental hostility* and suggested to reduce *managerial experience of founders* to a single-item construct. The same issues also occurred in the confirmatory factor analysis, which is why we report on them in detail in the next section 4.5.3.

The EFA resulted in the identification of five factors, accounting for 60.83% of variance. The factors corresponded to the five multi-item factors of our model. Also, the pattern matrix showed that each item only loaded on its intended construct with loadings above .6, indicating good reliability and consistency (Hair, 2010). The Kaiser-Meyer-Olkin (KMO) measure was .787, indicating the data was suitable for the factor analysis (Kline, 2011; Schumacker & Lomax, 2010). We now turn to the confirmatory measurement model, which was estimated by using confirmatory factor analysis, and report on how we dealt with factor issues.

4.5.3 Confirmatory measurement model

The evaluation of the initially specified measurement model resulted in acceptable values for model fit, even though the chi-square value was significant ($\chi^2 = 324.55$, d.f. = 169, $p < .01$). The SRMR value was .063 and the CFI value was .910. In the initial measurement model and in all of the following models, the chi-square test remained significant with a probability < .01, pointing to a difference between model-implied and observed covariance matrix. However, a significant chi-square test can be misleading as this test is sensitive to sample size. The test tends to give a significant probability for sample sizes above 200 (Schumacker & Lomax, 2010, p. 86). As our sample exceeded this level, a significant chi-square level can be expected.

The examination of factor loadings and modification indices suggested three valuable respecifications of the initial measurement model. First, we deleted one item of *attraction of key resources* due to model fit issues. As shown by modification indices, one item (AttRes_4) inflated the chi-square value. As the item belonged to a latent reflective factor with four items and showed similar wording to the other items, we perceived it as redundant and felt justified to drop it.

Second, the items of *perceived environmental hostility* showed fairly low factor loadings (only two of six items loaded above .6) and poor reliability (Cronbach's alpha of .553), even though the scale had been established in prior research (Covin et al., 2000; Grichnik et al., 2014). As suggested by the analysis, we removed four items due to low loadings and kept two (EnHos_3, EnHos_5). While the modification could improve the factor loadings, the reliability remained at the borderline (Cronbach's alpha of .641 after modification). Hence, we decided to keep *perceived environmental hostility* in our model, but we accounted for its weak performance in both model variations and the discussion of this work.

Third, we deleted one of the two items[38] of *managerial experience of founders* due to its poor factor loading (ManEx_2). When we checked the wording, we noticed that the weak item captured the highest degree of academic education. Since academic education does not necessarily correspond with experience in management, we felt justified to drop the item. Even though deleting the item reduced *managerial experience of founders* to a single-item construct, we perceived the modification as theoretically meaningful because the remaining item (ManEx_1, capturing the years of managerial experience) represented most precisely the underlying theoretical construct (Hayduk & Littvay, 2012).

Using single-item constructs can be appropriate to capture clearly defined, concise constructs (Hayduk & Littvay, 2012). Also, models with both single-item and multiple-item constructs can be an adequate approach when specified correctly in terms of factor loadings and reliability of single-items constructs (Diamantopoulos, Riefler, & Roth, 2008; Hayduk & Littvay, 2012). Using single-item constructs requires to fix their factor loading and error variance at a specific value to achieve model identification (Fuchs & Diamantopoulos, 2009). Assessing the reliability of single-item constructs deserves particular attention (Fuchs & Diamantopoulos, 2009) because common reliability measures, such as Cronbach's alpha or composite reliability (CR), cannot be determined as their calculation requires two or more items. Hence, the reliability of a single measure has to be established in a different way. Literature suggests three approaches.

The first approach is to assume perfect reliability. The factor loading of the item is fixed to *one* and the error term to *zero*. Although we would have felt justified to assume perfect reliability as the questionnaire items were very clear and offered minute room for misinterpretation, we decided to follow a more conservative approach.

The second approach is "to assume a certain level of reliability [for the measure] and use this to set the error variance to a specific value" (Fuchs & Diamantopoulos, 2009, p. 197). We did not use this approach for our initial model, but for a model variation to demonstrate robustness of the model (see section 4.5.5, model variation 2).

The third, most conservative approach by Anderson and Gerbing (1988, p. 415) is to fix the factor loading at $.95s_D$ and error variance at $.1s_D^2$, with s_D being the standard deviation of the single item. We decided to follow the third, most conservative approach. Consequently, we fixed the factor loading of *managerial experience of founders* at .778 and error variance at .067.

At this point, we should briefly look at how we dealt with *presence of external investment*. As mentioned above, we used one calculated score (ExInv_sum) as variable for this construct because the three binary questionnaire items could not be used directly for structural equation modeling. The new variable was *zero* for companies without any external investment and took on higher values with increasing presence of external investment (with a maximum value of *three*). This score reflected precisely the underlying construct and was therefore suitable to be used as a calculated scale. Reliability issues for calculated measures are the same as for single-item measures, as discussed above. Consequently, we fixed the factor loading of *presence of external investment* at .806 and error variance at .072.

The evaluation of the respecified measurement model resulted in a relatively good model fit, even though the chi-square value was significant ($\chi^2 = 153.88$, d.f. = 101, $p < .01$). The SRMR value was .046 and the CFI value was .965. The standardized estimates of factor loadings as well

[38] The third item of *managerial experience of founders* was binary, which is why it could not be considered for analysis.

as construct correlations of the final measurement model are presented in Table 13. The assessment of significance was based on unstandardized estimates and showed significant relations of each item to its intended construct. Yet, we report standardized estimates for the sake of a clear interpretation.

Table 13. Estimated factor loadings and construct correlations for the measurement model

Item	Specific PM	Info-based comm.	Attract. of resources	Web analytics	Environm. hostility	Managerial experience	External investment
Factor loadings (a)							
SpecPM_1	,817						
SpecPM_2	,898						
SpecPM_3	,774						
SpecPM_4	,890						
InfCom_1		,694					
InfCom_2		,828					
InfCom_3		,764					
InfCom_4		,716					
AttRes_1			,757				
AttRes_2			,854				
AttRes_3			,599				
WebAna_2				,812			
WebAna_3				,840			
ExInv_sum					,948 (b)		
EnHos_3						,714	
EnHos_5						,664	
ManEx_1							,948 (b)
Construct correlations (c)							
Specific PM	1.000						
Info-based communication	0.374	1.000					
Attraction of resources	0.292	0.306	1.000				
Web analytics	0.565	0.084 (ns)	0.134 (ns)	1.000			
Environmental hostility	0.180	0.317	0.215	0.106 (ns)	1.000		
Managerial experience	0.107 (ns)	0.093 (ns)	0.278	-0.066 (ns)	0.224	1.000	
External investment	0.284	0.160	0.281	0.046 (ns)	0.050 (ns)	0.085 (ns)	1.000

(a) While standardized estimates are reported, unstandardized estimates were used to assess statistical significance. Each measure is significantly related to its intended construct ($p < .001$).

(b) Factor loading have been fixed and were not estimated for single-item constructs and calculated scales.

(c) Construct correlations are statistically significant ($p < .05$), unless when indicated (ns) – not significant.

To establish reliability, convergent validity, and discriminant validity, we assessed the measures presented in Table 14 following the recommended thresholds by Hair (2010). The factors of our model showed good reliability as evidenced by the composite reliability (CR) of above 0.7, except *perceived environmental hostility* which was at the borderline with a CR value of .644. Reliability for *managerial experience* and *presence of external investment* could not be determined, as discussed above (indicated with 'n/a' meaning 'not applicable' in Table 14).

Convergent validity was established as evidenced by the average variance extracted (AVE) of above 0.5 for all factors, except *perceived environmental hostility* which yielded an AVE value of .476. Since *perceived environmental hostility* was close to the recommended thresholds of CR and AVE, we retained the construct as we continued with the structural model.

Discriminant validity was established in two ways. First, the model showed discriminant validity because the MSV was below the AVE for all factors, and the square root of AVE for each factor was larger than correlations with other factors (as shown in Table 13). Second, Anderson and Gerbing (1988) suggested to assess the standard errors of factor correlations. The sum of the largest correlation plus two times standard error should not exceed 1.0. Our largest correlation (.565) was between *startup-specific performance measurement* and *use of web analytic tools* with a corresponding standard error of .076. The suggested sum of .717 was well below 1.0. Hence, both ways provided strong statistical support for discriminant validity.

Since we used a self-report survey, we tested our final measurement model for common method bias. A self-report survey collects data from a participant by using the same method of interrogation for all variables of interest. While some researchers fear overly biased responses (Podsakoff et al., 2003), other researchers argue common method bias would be overstated, "reaching the status of urban legend" (Spector, 2006, p. 221) and counsel to neglect the corresponding investigation. Still, we did a test where we estimated our measurement model together with a common latent factor (CLF). The loadings of each item onto the CLF were unconstrained and the CLF was uncorrelated with other factors in the model. The chi-square difference test of the model with CLF ($\chi^2 = 105.71$, d.f. = 84, $p < .055$) and the model without CLF, equaling our final measurement model, ($\chi^2 = 153.88$, d.f. = 101, $p < .01$) was significant

Table 14. Overview of composite reliability (CR), average variance extracted (AVE), square-root of AVE, and maximum shared variance to establish reliability, discriminant and convergent validity

Construct	CR	AVE	MSV	SQRT(AVE)
Startup-specific performance measurement	0.909	0.716	0.319	0.846
Information-based communication	0.838	0.566	0.140	0.752
Attraction of key resources	0.785	0.554	0.094	0.744
Use of web analytics	0.811	0.682	0.319	0.826
Perceived environmental hostility	*0.644*	*0.476*	0.100	0.690
Managerial experience of founders	n/a	0.605	0.077	0.778
Presence of external investment	n/a	0.650	0.081	0.806

When indicated 'n/a' (not applicable), CR could not be determined due to single-item construct.
Numbers in italics indicate that the value was below a recommended threshold.

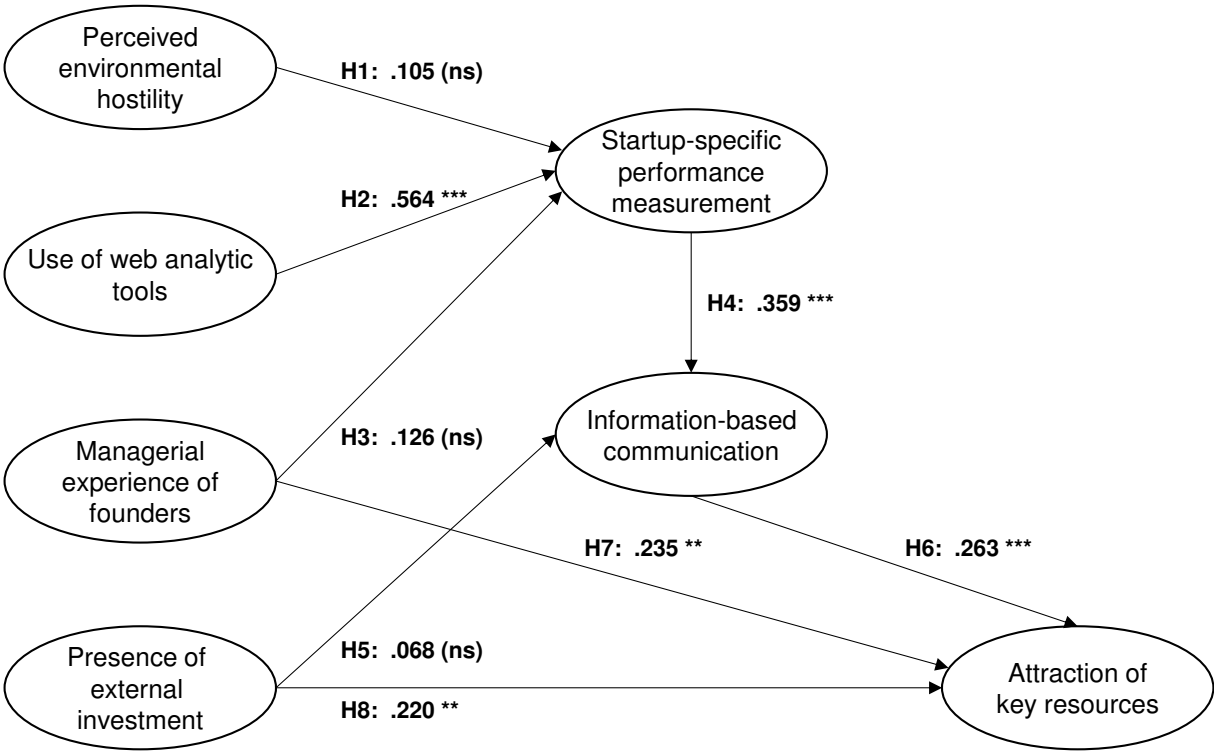

Figure 10. Initial structural model with standardized estimates and p-values (*: $p \leq .05$, **: $p \leq .01$, ***: $p \leq .001$)

($\chi^2 = 48.2$, d.f. = 17, $p < .001$). However, we considered this test less meaningful due to the large sample size and paid our attention to the comparison of the CFI values. The CFI was .986 for the model with CLF and .965 for the model without (final measurement model). The difference of .021 between the CFI values revealed that adding a common latent factor could explain merely 2% of the observed covariance (Anderson & Gerbing, 1988). As test results indicated innocuous common method bias, we proceeded to the structural model.

4.5.4 Structural models

The evaluation of the initial structural model corresponding to our theoretical model (Figure 10) resulted in reasonable values for model fit, even though the chi-square value was significant ($\chi^2 = 185.46$, d.f. = 108, $p < .01$). The SRMR value was .072 and the CFI value was .949. We checked for multivariate outliers as well as multi-collinearity to make sure the variances of the factors in our model did not overlap significantly (O'Brien, 2007). To determine if any multivariate influential outliers existed, we ran a Cook's distance analysis. As we did not observe a Cook distance greater than 1, in most cases Cook's distance was below .1, multivariate outliers were not of concern. To determine multi-collinearity, we examined variable inflation factors (VIF) for all predictors of our latent variable factors. We observed no VIF greater than 2, which is well below the recommended threshold of 10 (Kline, 2011, p. 54).

After this initial evaluation, we checked the modification indices of the initial structural model to see whether a meaningful respecification was suggested. The modification indices

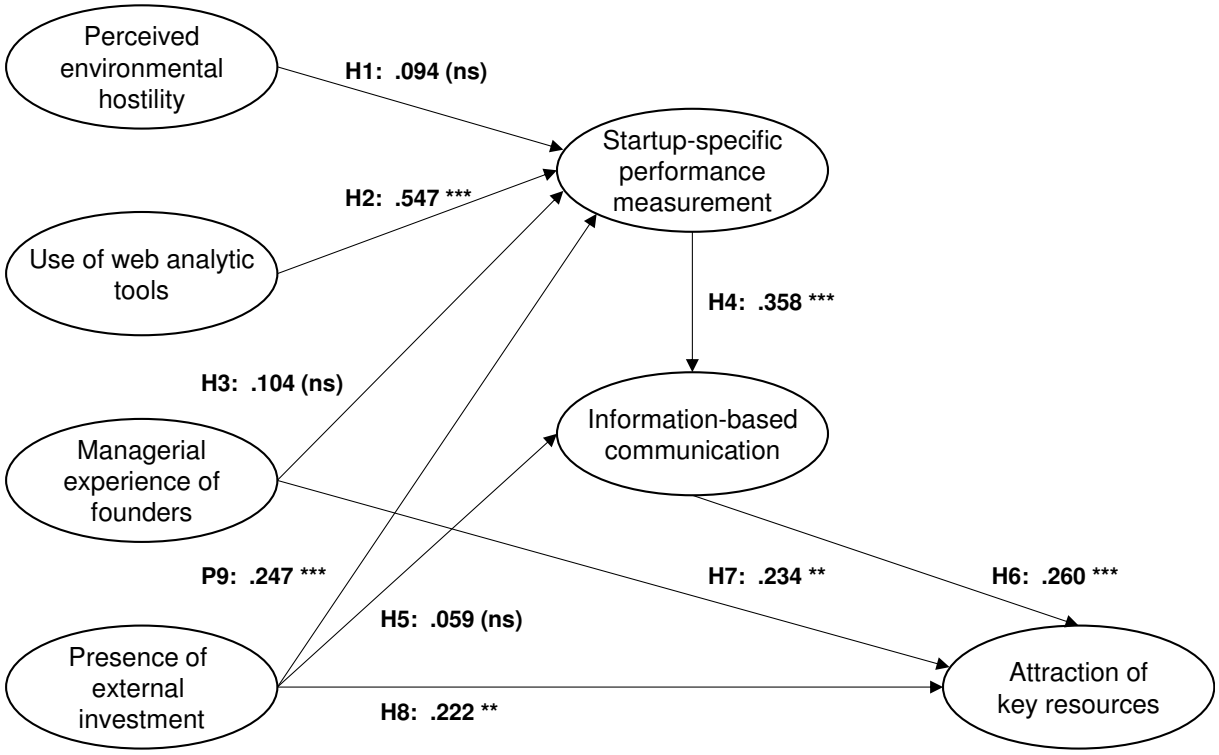

Figure 11. Respecified structural model, standardized estimates and p-values (*: $p \leq .05$, **: $p \leq .01$, ***: $p \leq .001$)

suggested one worthwhile respecification, a direct path from *presence of external investment* to *startup-specific performance measurement*. Since this respecification was reasonable from a theoretical point of view and enhanced model fit significantly, we included the new path, called *P9*, into our *respecified structural model.* (Figure 11).

The evaluation of the respecified structural model resulted in a relatively good model fit, even though the chi-square value was significant ($\chi^2 = 170.27$, d.f. = 107, $p < .01$). The SRMR value was .062 and the CFI value was .958. Compared to the initial structural model, the chi-square difference value was 78.19 with one degree of freedom ($p < .001$). This showed that the respecified model could provide a significantly better explanation of the estimated covariances between the constructs. Compared to the confirmatory measurement model, the difference in CFI values was .007, which indicated a difference of less than 1% with regard to explaining the observed covariances (Anderson & Gerbing, 1988).

Five of eight proposed hypotheses were found statistically significant as evidenced by the estimated regression weights and corresponding level of significance (p-value below .05) (see bottom of Table 15). The five hypotheses supported showed estimates of reasonable size. Two of the estimated were comparatively large: the direct effect of *use of web analytic tools* on *startup-specific performance measurement* (H2) was .547 and *startup-specific performance measurement* on *information-based communication* (H4) was .358 (both standardized estimates). One of the three rejected hypothesis was at the borderline of significance: the direct effect of *managerial experience of founders* on *startup-specific performance measurement* (H3) was .104 with a p-value of .112. Two hypotheses were clearly not supported (H1, H5). Neither the direct effect of *perceived environmental hostility* on *startup-specific*

Table 15. Comparison of model fit and significance of hypotheses for the respecified model and three variations

Model fit index	Respecified model	Variation 1 (30 or less employees)	Variation 2 (reliability of single measures)	Variation 3 (drop hostility)
CMIN	170.27	167.77	169.37	127.65
DF	107	107	107	81
CMIN/DF	1.591	1.568	1.583	1.576
CFI	.958	.957	.959	.968
SRMR	.062	.065	.061	.051
RMSEA	.052	.053	.051	.051
PClose	.413	.364	.429	.446
Hypothesis	Standardized estimates / p-values (a, b, c)			
H1	.094 / .222 (ns)	.105 / .189 (ns)	.080 / .308 (ns)	n/a
H2	.547 / ***	.522 / ***	.544 / ***	.557 / ***
H3	.104 / .112 (ns)	.107 / .119 (ns)	.115 / .131 (ns)	.126 / .044
H4	.358 / ***	.364 / ***	.349 / ***	.355 / ***
H5	.059 / .437 (ns)	.042 / .594 (ns)	.074 / .408 (ns)	.060 / .431 (ns)
H6	.260 / .001	.275 / ***	.240 / .003	.261 / .001
H7	.234 / .002	.215 / .006	.264 / .002	.233 / .002
H8	.222 / .003	.217 / .006	.254 / .003	.221 / .003
P9	0.247 / ***	0.253 / ***	.281 / ***	.249 / ***

(a) While standardized estimates are reported, unstandardized estimates were used to assess statistical significance.
(b) When indicated 'n/a' (not applicable), the estimate could not be determined due to absence of a construct.
(c) ***: $p \leq .001$; when indicated (ns) – not significant.

performance measurement (H1) nor *presence of external investment* on *information-based communication* showed statistical significance.

4.5.5 Model variations to demonstrate robustness

After having obtained promising results for our respecified structural model, we continued with three model variations. The purpose was to check the robustness of results. It was appropriate to assess each variation for a specific reason, as presented in the following. Table 15 compares the results of the respecified model to the results of the three variations. All variations demonstrated the robustness of our respecified model. Specifically, variation 3 yielded an enhanced model fit. Moreover, Appendix E shows the same three model variations for the initial structural model, which complements the demonstration of robustness.

Variation 1 (called *30 or less employees*) consisted of the respecified model but we limited the data set to companies with 30 or less employees. The reason was to investigate whether strictly normal-distributed data would yield a different result. As mentioned above (see section 4.4.2), we

argue from a theoretical point of view that strong employee growth in the first years is not a criteria for excluding startups from our sample because recent research has shown that outliers from normal distributions can be meaningful in entrepreneurship research (Crawford et al., 2015; Shim, 2016). The initial data screening revealed 19 outliers with respect to the number of employees when following a strict interpretation of normality. Removing these 19 outliers reduced the data set to 204 cases. The evaluation of model variation 1 resulted in a reasonable model fit, even though the chi-square value was significant ($\chi^2 = 167.77$, d.f. = 107, $p < .01$). The SRMR value was .065 and the CFI value was .957. The results of model variation 1 were very similar to the respecified model. Therefore, we did not observe a significant difference when reducing the sample to companies with 30 or less employees.

Variation 2 (called *reliability of single measures*) based on the respecified model with initial data but we assumed a low reliability at the threshold value of .7 for single-item constructs and calculated scores (*managerial experience of founders*, *presence of external investment*). The reason was to demonstrate robustness of the model with respect to reliability because reliability of singe-item constructs and calculated scores was sometimes considered an issue in the literature (Fuchs & Diamantopoulos, 2009; Hayduk & Littvay, 2012). As said above (see section 4.4.5), we already followed a conservative approach in our structural model (Anderson & Gerbing, 1988, p. 415). Still, we wanted to apply another recommended approach which assumes a certain level of reliability for constructs with single measures. We fixed the factor loadings to the value 1.0 and fixed the error variances to a value which was calculated based on an item's standard deviation (SD) and assumed reliability (Fuchs & Diamantopoulos, 2009, p. 197). For *managerial experience of founders* the SD was .819 and reliability was .7, thus, the error variance was fixed to .201; for *presence of external investment* the SD was .848 and reliability was .7, thus, the error variance was fixed to .216.

The evaluation of model variation 2 resulted in a reasonable model fit, even though the chi-square value was significant ($\chi^2 = 169.37$, d.f. = 107, $p < .01$). The SRMR value was .061 and the CFI value was .959. The result was very similar to the initial model. Two hypotheses related to constructs with single measure and calculated score remained statistically significant (H7, H8), another two hypotheses remained not significant (H3, H5). Interestingly, the standardized estimates of construct correlations (H7, H8) yielded slightly higher values than in the respecified model (Table 15). Hence, variation 2 made two points clear: (1) assuming a low reliability of .7 for single-item constructs did merely influence the results; and (2) the approach by Anderson and Gerbing (1988, p. 415) we used for the respecified model assumed already a low level of reliability for single-item constructs as indicated by lower standardized construct correlations in the respecified model.

Variation 3 (called *drop hostility*) consisted of the respecified model with initial data but we dropped the construct *perceived environmental hostility* (Figure 12). The reason was that the construct previously caused some problems due to a low reliability as well as poor factor loadings which made us drop 4 of 6 items. Hence, we analyzed the model without this construct. The evaluation of model variation 3 resulted in a relatively good model fit, even though the chi-square value was significant ($\chi^2 = 127.65$, d.f. = 81, $p < .01$). The SRMR value was .051 and the CFI value was .968. In contrast to the respecified model, H3 was now supported, as indicated by the statistically significant effect of *managerial experience* on *startup-specific performance measurement*.

Variation 3 could estimate more precisely the correlation between the constructs as evidenced by the difference in chi-square compared to the respecified model (delta in chi-square

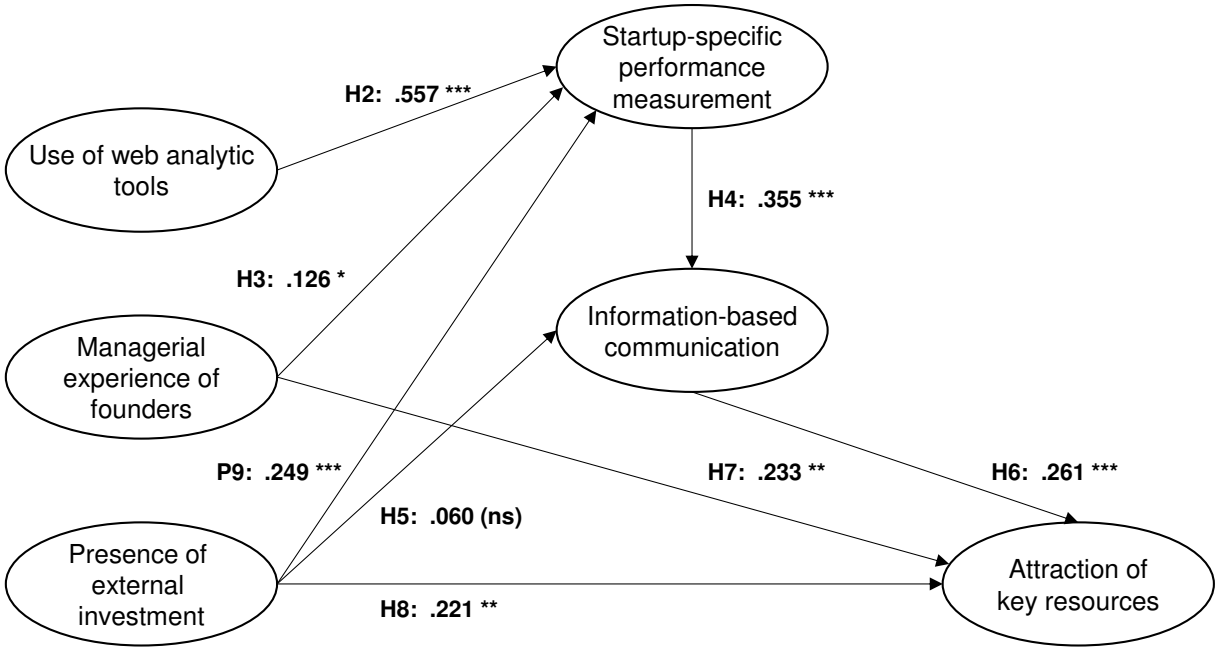

Figure 12. Model variation 3 with standardized estimates and p-values (*: $p \leq .05$, **: $p \leq .01$, ***: $p \leq .001$)

was 42.62 with 26 degrees of freedom). The CFI was slightly higher compared to the initial model (delta in CFI was .010) and clearly above the recommended threshold of .95. Therefore, dropping the construct *perceived environmental hostility* enhanced model fit, underlining that this construct should be treated with caution by future research.

So far, we have shown the results of our statistical analysis. We have presented the confirmatory measurement model and the corresponding construct correlations. We have assessed the statistical significance of our posited hypotheses in the structural model, and have demonstrated the robustness of our results with three model variations. In the next section, we turn to the discussion of our findings.

4.6 Discussion

Our research makes the following contributions which we discuss in this section: (1) we have shown that startup-specific performance measurement plays an important role for resource attraction in startups, (2) we have shown antecedents of startup-specific performance measurement, (3) we have presented the consequences of startup-specific performance measurement, and (4) our research has established the connection between startup-specific performance measurement and important resource theories. Moreover, we will present some practical insights from our research design. The conclusion in the next section then summarizes the study and points out some limitations.

4.6.1 The role of startup-specific performance measurement for resource attraction

The first and central contribution is our theoretical model which explains how specific performance measurement can help startup companies to attract important resources. The model provides a deeper and more nuanced understanding of the relationships between startup-specific performance measurement and other theoretical constructs. Startup-specific performance measurement enables founders to quantify business activities and to communicate on a factual, information-based level with co-founders and external partners. As a result, founders are more aware of the resources they require. They can use this awareness to convince partners of their resource needs and, thus, are successful in obtaining the resources.

The theoretical model consisted of an interesting balance of novel and well-established constructs which enabled us to test the hypotheses developed. As can be expected for a model with novel constructs in an under-researched area, some interesting insight as well as issues occurred. We turn to the insights and issues now.

4.6.2 Antecedents of startup-specific performance measurement

The second contribution are the findings on antecedents. Our model can roughly be seen as two parts, a *front part* and a *core part*. The front part presents factors which we expected to lead to specific performance measurement in startups, so called *antecedents*. We here reflect on the interesting results we obtained for the antecedents.

To establish the link to prior knowledge, we drew upon established constructs and measurement scales for three of the four antecedents. The most surprising result came from *perceived environmental hostility* which was taken as a whole from prior work (Grichnik et al., 2014). *Perceived environmental hostility* yielded a surprisingly poor reliability and very low factor loadings which forced us to drop four of six items from the scale to rescue the construct and retain it in our model. Moreover, we found the posited effect of *perceived environmental hostility* on *startup-specific performance measurement* (H1) to not be significant in any of our models, neither in the respecified model nor in a model variation. We can imagine two reasons for that. One reason could be that, opposed to our argumentation, *perceived environmental hostility* does not lead to *startup-specific performance measurement*. This would contradict similar argumentations in previous studies (Grichnik et al., 2014; Löfsten & Lindelöf, 2005). As we did not find a significantly negative effect for H1 either (i.e. no negative structural parameter estimate for H1), we also cannot confirm the contrasting suggestion by Mengel and Wouters (2015) who conjecture that scarce resources could hinder financial management in startups. Another reason could be that due to the weak performance of the measurement scale we were not able to capture the intended underlying theoretical construct and, thus, could not find statistical significance for a potentially valid effect. In either way, our findings could not confirm the convincing reliability and validity the construct had yielded before (Grichnik et al., 2014).

Although not hypothesized, we found a direct effect of *presence of external investment* on *startup-specific performance measurement*, as suggested by modification indices. We did not postulate this relationship because we saw no theoretical reason for why external investment should directly lead to the presence of specific performance measurement in startups. More accurately, we expected external investment to influence the way in which startups communicated with investors (captured by H5). In retrospect, the direct effect of *presence of external investment* on *startup-specific performance measurement* seemed plausible and also justifiable from a theoretical point of view. For instance,

prior work has found that the presence of venture capitalist investors stimulates the presence of control systems in startups (Wijbenga et al., 2007) and comes with an increased demand for specific information and regular monitoring activities (Wongsunwai, 2013). Moreover, the unexpected effect added another antecedent to *startup-specific performance measurement*, which made our model more capable of explaining its occurrence.

Opposed to what we expected, the effect of *presence of external investment* on *information-based communication* (H5) was not supported in any of our models. This was surprising because our findings were not in line with prior research who found external investment as a driver for fact-based communication, such as reporting to investors based on MCS (Granlund & Taipaleenmäki, 2005; Wijbenga et al., 2007). Instead, *presence of external investment* had a positive effect on *startup-specific performance measurement*, as just mentioned. Since *presence of external investment* was a calculated score based on established scales, we had no reason to doubt the measure's adequacy. The measure resulted from the summation of three binary questionnaire items, which was reasonable because they captured the presence or absence of different types of external investment. The calculated scale could account for the extent of external investment because startups with more external financial supporters were characterized by a higher score. Also, the positive effect of *presence of external investment* on *attraction of key resources* (H8) was clearly supported. As startups who had obtained external investments also had attracted resources, this result confirmed a rather obvious and logical relationship, as well as the adequacy of the measure.

Another established construct, *managerial experience of founders*, led to interesting results. Initially planned as a reflective construct with two measurement items, we had to drop one item representing the highest degree of founders' academic education because it did not load sufficiently on the construct. Since the wording of the item was very clear, we ruled out a measurement error. We rather concluded that academic education is barely related to managerial experience. By dropping the item we could not support prior research that found a significant relation between financial planning and the 'startup's founding team education in business or economics' (Mengel & Wouters, 2015, p. 194). However, the retained item representing the years of managerial experience prior to startup launch was in line with other studies (Brinckmann & Kim, 2015; Davila & Foster, 2004).

Interestingly, the posited effect of *managerial experience of founders* on *startup-specific performance measurement* (H3) was at the borderline of significance. While being not significant with a p-value slightly above .1 in our respecified model, the effect turned significant in the model variation 3. One possible interpretation would be that the change in variation 3 improved the overall model fit, also providing a better explanation of the estimated construct covariances. Together with support for H7, we argue that our overall results are in line with prior research that found *managerial experience of founders* to be an important factor for the adoption of management accounting practices in young companies (Davila & Foster, 2004; Davila et al., 2009).

The only novel construct among the antecedents, *use of web analytic tools*, performed particularly well. Both items yielded factor loadings above .8. Also, the effect of *use of web analytic tools* on *startup-specific performance measurement* (H2) was clearly significant. This showed that web analytics are a worthwhile, and relatively simple, way to measure online business activities. Founders who track their online activities seem to also employ *startup-specific performance measurement* to a larger extent. We assume that *use of web analytic tools* sharpens the founders' perception of the usefulness of performance indicators.

The last interesting finding on antecedents is related to the model variations we performed (Table 15). Two of three model variations considered exclusively changes of antecedents of *startup-specific performance measurement*. Only variation 1 resulted from a modification of the underlying data set. Variation 2 assumed a different reliability for antecedents with the single measure or calculated scale. Variation 3 dropped the problematic antecedent *perceived environmental hostility*. On the one side, variations were conducted to demonstrate robustness of results. One the other side, most variations were related to antecedents. Hence, it can be argued the front part of our model (the antecedents) was the main cause of model issues. Although causing issues, we still regard all antecedents as an important contribution. Much more than lowering the results on antecedents, this insight shows that the core part of our model was strong in explaining the covariances in the empirical data. Speaking of a strong core, we turn next to this part of the model.

4.6.3 Consequences of startup-specific performance measurement

The third contribution are the findings on the core model which demonstrate that *startup-specific performance measurement* has a positive effect on two consequences of interest. One consequence is the direct effect *information-based communication*. As we posited before, capturing a startup's business activities and objectives with measurements leads to the mobilization of company-specific and largely quantitative information about the startup when founders communicate with co-founders or external partners. As theorized, *startup-specific performance measurement* has a positive effect on *information-based communication* (H4).

The other consequence of *startup-specific performance measurement* is the indirect effect on *attraction of key resources* through *information-based communication*. To quantify a startup's business activities and objectives does not explain directly how founders obtain resources. But, taking into account the mediating role of *information-based communication* makes this relationship clear. As we hypothesized, both direct effects, *startup-specific performance measurement* on *information-based communication* (H4) and *information-based communication* on *attraction of key resources* (H6), are significant which also provided support for the indirect effect of *startup-specific performance measurement* on *attraction of key resources*. This result plays a central role our contribution to resource theories, as we show next.

4.6.4 Startup-specific performance measurement and resource theories

The fourth contribution is the relevance of our findings for resource theories. As pointed out before, our work drew on the resource-based view (RBV) and resource dependence theory (RDT) to establish the important role of resources for startup performance. The theories have focused on three streams of antecedents for resource attraction: social ties and networks (Hanlon & Saunders, 2007; Newbert & Tornikoski, 2013; Shane & Cable, 2002; Zhang et al., 2010), entrepreneurial characteristics and behavior (Baron & Markman, 2003; Dunkelberg et al., 2013; Starr & MacMillan, 1990), and signaling quality (Martens et al., 2007; Zott & Huy, 2007). Based on our results, we now contribute *startup-specific performance measurement* as novel antecedent of resource attraction in startups. To our knowledge, this is the first antecedent of resource attraction related to a management accounting practice. Thus, we would consider it a virgin and promising fourth stream.

We not only contribute a novel construct as antecedent for resource attraction, but also three corresponding, newly-developed measurement scales. Each of the scales for *startup-specific*

performance measurement, *information-based communication*, and *attraction of key resources* showed relatively good reliability and validity (see Table 13 and Table 14). Two scales (*startup-specific performance measurement*, *information-based communication*) were novel because we also had to develop the underlying theoretical construct. The third scale (*attraction of key resources*) was newly developed because existing scales in the literature did not capture the construct sufficiently. Based on our results, we believe these scales are a worthwhile contribution for future research.

Apart from a novel antecedent, our research has also established the construct *attraction of key resources* as an interesting consequence. As mentioned in the theory part of this work, research up to now has focused on four consequences of resource attraction: value creation (Sirmon et al., 2007), opportunity exploitation (Bhawe et al., 2016), growth (Alsos et al., 2006; Gilbert et al., 2006), and most frequently on startup performance (Cai et al., 2014; Edelman et al., 2005; Newbert, 2007). We believe *attraction of key resources* is a worthwhile contribution because it is a rich and more nuanced consequence which has not been captured clearly in the RBV and RDT up to now.

4.6.5 Insights about the research method

Some practical insights resulted from our research design. One insight was that we found the preliminary research activities very helpful to guide the conceptualization of our topic. The interviews with founders and small case studies illustrated the understanding of practitioners about specific performance measurement and pointed to what was important to them. This hands-on approach also equipped us with worthwhile contacts on which we could draw in our substantive validity pretest-assessments.

Another insight was that our results underlines the importance of a professional and well-prepared survey design for empirical research in entrepreneurship. Our survey achieved an exceptionally high response rate (37.5%), which we attribute to three main points. First, the tailor-made database with specific information assured that we surveyed the correct target population. Specifically, creating the so called *hook* (a short company-specific explanation for why we selected each startup for our survey; see section 4.4.2), helped to understand each of the contacted startups. Second, a recipient-oriented and clear communication can increase the willingness to respond. In particular, we believe that the hook as well as offering incentives were helpful to emphasize our professional intentions and distinguish our survey from the large number of survey requests received by founders. Third, the last reminder via phone (conducted by uzbonn GmbH, a company specialized on phone surveys) generated a large number of responses. Also, some of the founders expresses explicitly their thanks for contacting them via phone because they perceived this type of surveying as the most comfortable one.

We conclude the discussion as follows. Our model has shown that specific performance measurement plays an important role for resource attraction in startups. We have identified both expected and unexpected antecedents of *startup-specific performance measurement*. We have linked our study to prominent resource theories, and we have derived some practical insights from our research method. Now, we turn to the conclusion of this study.

4.7 Conclusion

This study set out to investigate how specific performance measurement in startup companies can help them to attract important resources. The research was inspired by interviews and small case studies with founders which indicated the relevance of startup-specific performance measurement. A review of literature found that studies up to date had focused on social ties and networks, entrepreneurial characteristics, and signaling quality as antecedents of resource attraction in startups. However, literature showed a clear gap with respect to the role of startup-specific performance measurement.

The purpose of this quantitative study was to achieve a richer and more nuanced understanding of startup-specific performance measurement. Hence, a theoretical model was developed which consisted of seven constructs and eight hypotheses describing the relationship between the constructs. The model posited four antecedents of startup-specific performance measurement and, moreover, predicted that specific performance measurement would enable founders to quantify business activities, communicate on a factual, information-based level with co-founders and external partners, and benefit when it comes to the attraction key resources. To test the hypotheses, empirical data was gathered from 223 technology-based startup companies in Germany. The data was analyzed using structural equation modeling. The results provided clear statistical support for our hypotheses that startup-specific performance measurement leads to an information-based communication and, thereby, helps startups to attract the resources they require.

The main contribution of this study was to establish startup-specific performance measurement as novel construct in the literature and show its pivotal role in the attraction of resources. The findings extend our knowledge on the antecedents of resource attraction and deepen our understanding of how prominent resource theories, specifically the resource-based view and resource dependence theory, can work in in startups. Overall, this study strengthens the idea that management accounting method can support startups and foster their development and success.

The implications of this study are suitable for both researchers and entrepreneurs. First, researchers in both entrepreneurship and management accounting could continue to elucidate how management accounting practices really work in startups. From a management accounting view, specific performance measurement in startups adds another practices apart from business planning and management control systems which could be worthwhile to investigate. From an entrepreneurship point of view, the study could encourages researchers to further explore the rarely tackled role of management accounting in startups. Future quantitative studies could build on this work and contribute even deeper insights into this practices in startup companies. Second, practitioners and most of all entrepreneurs in startups could be inspired to either introduce or intensive startup-specific performance measurement into their company. They could use the inspiration obtained from our findings to quantify the most important business activities and to elevate the startup-internal communication as well as communication with external partners onto a more fact-based level. As a consequence, they should be able to specify their resource needs and attract resources more efficiently.

The study has some limitations. The first limitation is related to the newness of our research. Our model has tackled a topic on which very little research has been conducted up to now. Wherever possible, we used established theoretical constructs. Yet, it was necessary to

establish a number of novel constructs to capture the richness and newness of the topic. We provided clear definitions, drew on resource theories, and prior empirical studies to position the constructs in the literature. The constructs also worked well in explaining the role of specific performance measurement in startups. Still, upcoming research has to use and strengthen the new constructs we introduced.

The second limitation is related to measurement scales. As new constructs also required new measurement scales, some of our scales could be refined. For instance, we had to drop one of four items for *attraction of key resources*. So, the measurement scale for this construct could be further improved. We have also seen the limitation of an establish scale in the case of *perceived environmental hostility*. Furthermore, we used one single-item construct and one calculated scale whose reliability could not be measured but only assumed. We accounted for the reliability issue with a robustness check (section 4.5.5, model variation 2). Still, each of the issues could be addressed in other studies by refining the used measurement scales.

The third limitation is related to the sample. The first years of startups are highly dynamic and can be seen as 'a struggle for resources to assure survival and growth of the young organization' (Brinckmann & Hoegl, 2011, p. 37). Hence, startups can differ greatly from each other. A variation in terms of startup characteristics could also be present in our sample. Although we used a 10-year threshold for age (Kollmann et al., 2017) and control variables to discover differences, companies might be at different stages of development. We could also imagine a difference between companies based on the field of technology they operate in. Even though structural equation modeling can analyze of sub-samples, it requires relatively large sample sizes (Kline, 2011, p. 11). So, our complete sample of 223 cases could have been too small to divide into specific sup-samples.

In summary, we believe that the limitations are important to advance research on specific performance measurement. However, we are confident that our study has shown compelling results despite these limitations. We would be happy to see this study as incentive for upcoming research on specific performance measurement because the topic has rarely been addressed so far. We also hope that entrepreneurship research will establish the attraction of key resources as another central construct, side by side with startup performance. This conclusion completes the survey research.

5 Conclusion

The purpose of this dissertation was to determine *how management accounting can be helpful for startup companies*. Three research projects have been conducted to explore the topic from different perspectives - a literature review, a case study, and a survey-based study - each of which has generated multiple answers to our central question. In this conclusion, we briefly summarize our main findings. We then look at limitations, suggest opportunities for future research, and show practical implications of our work.

5.1 Summary of findings

First, in our literature review we examined current knowledge on management accounting in startup companies, highlighting similarities and gaps in the literature. The main purpose was to provide a structured overview of what the literature refers to regarding the adoption and use of management accounting. We identified different types of management accounting, as well as their antecedents and consequences. We found that management accounting in startups mainly refers to business planning and accounting (either financial accounting or accounting-based control practices). The antecedents most frequently researched were organizational characteristics, professional characteristics of founders, and the presence of external investment. The consequences most commonly investigated were growth (performance), financial characteristics, and subjective evaluation of performance.

Moreover, we found that most arguments for why management accounting was used by startups are related to startup growth and reporting needs for outside partners. As another finding, our review uncovered a poor quality of theoretical constructs used in the management accounting and entrepreneurship literature. We also found that literature lacked a deep understanding and clear thinking as to the role of management accounting in startups in general and the different types of management accounting in particular. Interesting practices, such as startup-specific performance measurement, were neglected in the literature.

As to the significance of findings, we could identify different types of management accounting in startups, their antecedents, and consequence. However, it remained unclear how management accounting could really help startups. Hence, our results stated a clear gap in the literature, which was worthwhile to be further investigated.

Second, in our descriptive case study we qualitatively analyzed the exchange of management accounting information between startups and a large, established organization to obtain a more nuanced understanding of how management accountings can be useful. We conducted the research in a recently established corporate incubation program, the Bosch Startup Platform (BOSP), which allowed employees of Bosch to launch new businesses and act as entrepreneurs within the corporation. This special setting permitted us a deep insight into the use of management accounting information. We found that management accounting information exchange was worthwhile for both the corporate company and the startups within the corporate incubation program.

Startup teams used the information to present their achievements and state the startup's level of maturity. Also, startups could draw on the corporate knowledge when they were lacking accounting expertise for financial planning issues. The corporate company used the management accounting information to assess the startup portfolio. Information was used to assess both the individual progress of each startup as well as the relative progress of all startups in the portfolio. Moreover, the corporate company determined the amount of funding for the next time period based on the exchanged management accounting information.

The findings enhanced our understanding of how management accounting can support startup development. Moreover, our qualitative research contributed a detailed description of how management accounting can foster corporate innovation in a so called *inside-out startup program* (Weiblen & Chesbrough, 2015), of which literature offers surprisingly few examples.

Third, in our survey-based study we investigated how specific performance measurement can help startups to attract important resources. We developed a theoretical model which contained the core constructs *startup-specific performance measurement, information-based decision making*, and *attraction of key resources*, as well as four antecedents. The model drew on two prominent theories, the resource-based view and resource dependence theory, because they explained the importance of resources for startups and established the connection between resource attraction and startup performance.

The quantitative study based on our own empirical data obtained from a survey among 223 German technology-oriented startups. Using structural equation modeling to assess the proposed hypotheses, we found clear statistical support for five of eight hypotheses. Most important was the finding that *startup-specific performance measurement* had a direct effect on *information-based communication*, which in turn had a direct effect on the *attraction of key resources*. Taken together, these results suggested startup-specific performance measurement as novel antecedent to resource attraction, which has been omitted in the literature until now.

The study made several noteworthy contributions. First, we contributed a theoretical model which clarified how specific performance measurement helps startups to attract important resources. Second, we suggested antecedents to explain the use of specific performance measurement in startups. Third, with *attraction of key resources* we contributed a more nuanced consequence to the literature to capture the performance of startups. Fourth, with *startup-specific performance measurement* we added a management accounting practice to the existing antecedents of resource attraction and complement the knowledge of the RBV and RDT. Moreover, we showed some practical insights about survey-based research and pointed out the importance of a professional survey design when working with startups.

5.2 Limitations of work

The limitations of this dissertation are related to our research methods and foci of the three studies. Since each method and research focus has its own advantages and disadvantages, we have already addressed the limitations in each of the studies. We here recap the main points briefly.

A limitation of the literature review was that our results only covered the literature of management accounting and entrepreneurship. Neighboring fields of literature, such as marketing

or information technology, that could also talk about different types of management accounting in startups were not considered.

A limitation of the case study was the focus on a single corporate incubation program, which does not allow the assessment or generalization of results based on statistical methods. However, as commonly known, this apparent weakness of the case study method is its strengths at the same time. Due to the strong focus, we were able to obtain detailed insights into the case company which a quantitative study could not have provided.

One limitation of the survey-based research was the need to create some novel theoretical constructs to capture the richness and newness of our research because prior studies were lacking appropriate constructs. We accounted for this by providing clear definitions, drawing on resource theories, and using prior empirical studies to position the novel constructs in the literature. Another limitation was directly related, namely the development of new measurement scales for some of the constructs. We accounted for this by conducting a pretest (Anderson & Gerbing, 1991) and we were able to refine some of the scales based on our results. A last limitation was related to the organizational characteristic of our sample because startups can differ significantly from each other in their development during the first years. This is why the startups in our sample could be more heterogeneous than we were able to observe in our survey. To account for this limitation, we chose a 10-year threshold for startup age (Kollmann et al., 2017) and examined the control variables to identify differences within the sample.

Despite these limitations, we believe that the dissertation is a worthwhile contribution to current knowledge, from which interesting inferences for both future research and startup practice can be drawn.

5.3 Suggestions for future research

Numerous implications can be drawn from the dissertation. We first suggest opportunities for future research, then we look at practical implications. In general, the dissertation emphasizes the need for both a broader and a deeper theoretical understanding of MA in startups. To achieve a broader understanding, future research in management accounting and entrepreneurship should define and handle theoretical constructs more carefully compared to the presently vague handling. This could advance the field since researchers would be able to assess more precisely what type of management accounting other studies really investigate. Also, research should set out to explore further methods of management accounting valuable to startups.

To increase the in-depth understanding of the topic, forthcoming studies should offer a clear and original thinking to enable further theorization. It would be meaningful to comprehend in detail what management accounting does in startups, and how this can be related to startup performance. As we have shown in our case study, this research method can produce worthwhile contributions to the field as case studies provide detailed empirical insights. Advancing the understanding of MA through qualitative insights could also provide an important base for development of an over-arching theory about the adoption and use of management accounting in startups.

Future research could build on our findings on startup-specific performance measurement and resource attraction. More research is needed to better understand other management accounting practices in startups. It would be a fruitful area for further work to explore practices apart from business planning, accounting-based control, and specific performance measurement because, given the remarkable gap in literature, it could be assumed that other types of management accounting can be important in startups which have not been researched up to date.

Moreover, it would be interesting to examine the use of startup-specific performance measurement in a longitudinal case study. Also, researchers and startups could join forces in an interventionist case study with focus on the introduction of startup-specific performance measurement in a case company. These case studies could produce an even more nuanced understanding of antecedents and consequences of the adoption of specific performance measurement.

Looking at future survey-based research, it would be interesting to establish the attraction of key resources as another construct to capture startup development, side by side with performance. As we argued above, the construct and measurement scales of startup performance have some shortcomings. Hence, a number of possible future studies could use our construct *attraction of key resources* as interesting consequence because we presume it offers less shortcomings as a construct due to its clear definition. We do not claim that our construct should replace performance as ultimate measure of startup success. Yet, we would recommend to establish another, but clearly defined and concise construct, which is also a worthwhile consequence in the startup context.

As another suggestion, we encourage research in entrepreneurship and management accounting to tap into the field of online tools and social media. As we saw in our interviews and small case studies with startups, a considerable part of business is based on innovative software or can take place online. At the same time, research is remarkably scarce when it comes to this topic. Hence, future studies could usefully explore how online tools or social media can be applied in startups and how they serve the purpose of management accounting.

5.4 Practical implications

Moreover, our findings have a number of practical implications. Since we have shown that startup-specific performance measurement can be helpful for startups to attract important resources, we now would like to give some recommendations to startup founders or managers based on our research.

First, startups should use a number of specific performance measures which put emphasis on the most important business activities, such as product development, financial management, marketing and sales, or customers. It is more important to have a set of precise and meaningful measures than having a large set of vague ones because this can help the startup to focus on its key activities and goals. To create specific performance measures, startups should predominantly use data which is already available (such as from web analytic tools) or easy to obtain (such as from own databases) because this helps to limit the effort to create them.

Second, having a nice set of performance measures is not enough. The startup founders or managers should actively include them in their communication. As we have seen, involving specific information and facts about the startup is a worthwhile habit for communication because it creates a common ground to discuss about. Specific performance measures are, of course, a good example of valuable information which could be regularly discussed among the founders themselves, or externally with mentors and investors.

Third, startups should talk about their resource needs as specific as possible. Our findings suggest that attracting required resources can be a result of a specific and information-based communication. Hence, startups should outline their needs precisely and enrich their argumentation with specific information when talking to resource providers. Being specific in discussion means that the type, amount, and purpose of required resources are clearly stated, e.g., showing a precise estimation of how much money will be needed for major steps in product development for each of the next three months. Being specific should help to convince resource providers or, in case of different opinions, enable a discussion about the presented facts to review the startup's resource needs.

This concludes the dissertation. As a final remark, our research has shown how management can be helpful for startups. Our findings contribute to current knowledge and suggest research opportunities to an interesting field. This is why we would like to encourage other researchers to explore management accounting and performance measurement in startups. We would be delighted if our work provided inspiration for startups, too.

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Appendices

Appendix A. Overview of relevant publications included in the literature review

The following table shows all papers that we have included in our literature review. The table is sorted by type of management accounting (first column). It contains information on authors, the journal, and research methods. It also lists the antecedents and consequences of management accounting identified in each of the papers. Due to its magnitude, we start presenting the table on the next page.

Type of management accounting (MA)	Author (Date)	Journal	Research method	Antecedents of MA	Consequences of MA
Accounting-based management control activities	Andersén and Samuelsson (2016)	International Journal of Entrepreneurial Behavior & Research	Empirical: quantitative, survey		Subjective evaluation of performance
	Cassar and Gibson (2008)	Contemporary Accounting Research	Empirical: quantitative, survey, secondary		Subjective evaluation of performance
	Cassar, Ittner and Cavalluzzo (2015)	Journal of Accounting and Economics	Empirical: quantitative, survey, secondary		Financial characteristics
	Chenhall and Morris (1995)	Omega	Empirical: quantitative, survey		Performance (multiple measures)
	Davila and Foster (2004)	The Accounting Review	Empirical: quantitative, survey	Presence of external investment; Organizational characteristics; Professional characteristics of founders	Growth (performance)
	Davila and Foster (2007)	Accounting, Organizations and Society	Empirical: quantitative, survey	Organizational characteristics; Presence of external investment; Professional characteristics of founders; Presence of external investment; Professional characteristics of founders	
	Davila, Foster and Jia (2015)	European Accounting Review	Empirical: quantitative, survey		Financial characteristics
	Davila, Foster and Li (2009)	Accounting, Organizations and Society	Empirical: quantitative, survey & field-study	Non-financial relationships with external parties; Professional characteristics of founders;	

Type of management accounting (MA)	Author (Date)	Journal	Research method	Antecedents of MA	Consequences of MA
				Strategic positioning; Organizational characteristics	
	Jänkälä and Silvola (2012)	Journal of Small Business Management	Empirical: quantitative, survey & archival	Financial characteristics	Growth (performance), Profitability (performance)
	King, Clarkson and Wallace (2010)	Management Accounting Research	Empirical: quantitative, survey	Organizational characteristics; Strategic positioning; Environmental factors	Subjective evaluation of performance
	Löfsten and Lindelöf (2005)	Technovation	Empirical: quantitative, survey	Environmental factors; Strategic positioning	
	Malagueño, Lopez-Valeiras and Gomez-Conde (2017)	Small Business Economics	Empirical: quantitative, survey & archival		Subjective evaluation of performance; Advancement of organization
	Moores and Yuen (2001)	Accounting, Organizations and Society	Empirical: quantitative, survey & field-study	Organizational characteristics	
	Roper (1997)	Entrepreneurship and Regional Development	Empirical: quantitative, survey		Growth (performance); Profitability (performance)
	Sandino (2007)	The Accounting Review	Empirical: quantitative, survey & field-study	Strategic positioning	
	Silvola (2008b)	Advances in Accounting	Empirical: quantitative, survey	Organizational characteristics; Presence of external investment	
	Wijbenga, Postma and Stratling (2007)	Entrepreneurship: Theory and Practice	Empirical: quantitative, survey	Presence of external investment	Growth (performance)

Type of management accounting (MA)	Author (Date)	Journal	Research method	Antecedents of MA	Consequences of MA
Business planning	Berry (1998)	Long Range Planning	Empirical: quantitative, survey		Growth (performance)
	Bracker, Keats and Pearson (1988)	Strategic Management Journal	Empirical: quantitative, survey		Growth (performance)
	Brinckmann and Kim (2015)	Strategic Entrepreneurship Journal	Empirical: quantitative, survey, secondary	Personal characteristics of founders; Professional characteristics of founders	
	Brinckmann, Grichnik and Kapsa (2010)	Journal of Business Venturing	Empirical: quantitative, meta-analysis		Growth (performance)
	Burke, Fraser and Greene (2010)	Journal of Management Studies	Empirical: quantitative, survey		Growth (performance)
	Cassar (2010)	Strategic Management Journal	Empirical: quantitative, survey, secondary		Subjective evaluation of performance
	Delmar and Shane (2003)	Strategic Management Journal	Empirical: quantitative, survey		Survival (performance); Advancement of organization
	Delmar and Shane (2004)	Journal of Business Venturing	Empirical: quantitative, survey		Survival (performance); Advancement of organization
	Dimov (2010)	Journal of Management Studies	Empirical: quantitative, survey, secondary		Advancement of organization; Subjective evaluation of performance
	Gibson and Cassar (2002)	Journal of Small Business Management	Empirical: quantitative, survey, secondary	Organizational characteristics; Strategic positioning; Professional characteristics of founders	
	Gibson and Cassar (2005)	Small Business Economics	Empirical: quantitative, survey, secondary		Growth (performance)

Type of management accounting (MA)	Author (Date)	Journal	Research method	Antecedents of MA	Consequences of MA
	Greene and Hopp (2017)	Strategic Entrepreneurship Journal	Empirical: quantitative, survey, secondary	Professional characteristics of founders; Organizational characteristics; Environmental factors; Financial characteristics	Profitability (performance)
	Gruber (2007)	Journal of Business Venturing	Empirical: quantitative, survey		Subjective evaluation of performance
	Haber and Reichel (2005)	Journal of Business Venturing	Empirical: quantitative, survey		Growth (performance); Subjective evaluation of performance
	Honig and Karlsson (2004)	Journal of Management	Empirical: quantitative, survey	Non-financial relationships with external parties; Environmental factors; Professional characteristics of founders	Survival (performance); Subjective evaluation of performance
	Honig and Samuelsson (2012)	Journal of Small Business Management	Empirical: quantitative, survey, secondary		Profitability (performance)
	Kirsch, Goldfarb and Gera (2009)	Strategic Management Journal	Empirical: quantitative, archival		Financial characteristics
	Lange, Mollow, Pearlmutter, Singh and Bygrave (2007)	Venture Capital	Empirical: quantitative, survey		Growth (performance)
	Matthews and Scott (1995)	Journal of Small Business Management	Empirical: quantitative, survey	Environmental factors; Organizational characteristics	
	Mayer-Haug, Read, Brinckmann, Dew, Grichnik (2013)	Research Policy	Empirical: quantitative, meta-analysis		Performance (multiple measures)

Type of management accounting (MA)	Author (Date)	Journal	Research method	Antecedents of MA	Consequences of MA
	Peel and Bridge (1998)	Long Range Planning	Empirical: quantitative, survey, secondary	Environmental factors	Subjective evaluation of performance
	Rauch, Frese and Sonnentag (2000)	Journal of Small Business Management	Empirical: quantitative, survey	Personal characteristics of founders	Growth (performance)
	Risseeuw and Masurel (1994)	Small Business Economics	Empirical: quantitative, survey	Environmental factors; Organizational characteristics; Strategic positioning; Financial characteristics	Profitability (performance)
	Schwenk and Shrader (1993)	Entrepreneurship: Theory and Practice	Empirical: quantitative, meta-analysis		Performance (multiple measures)
	Shane and Delmar (2004)	Journal of Business Venturing	Empirical: quantitative, survey		Survival (performance)
	Silvola (2008b)	Advances in Accounting	Empirical: quantitative, survey	Organizational characteristics; Presence of external investment	
	Upton, Teal, Felan (2001)	Journal of Small Business Management	Empirical: quantitative, survey, secondary		Subjective evaluation of performance
	van Gelderen, Thurik and Bosma (2006)	Small Business Economics	Empirical: quantitative, survey		Advancement of organization
	Wijewardena, Zoysa, Fonseka and Perera (2004)	Journal of Small Business Management	Empirical: quantitative, survey		Growth (performance)
Freestyle management control activities	Brinckmann, Salomo and Gemuenden (2011)	Entrepreneurship: Theory and Practice	Empirical: quantitative, survey		Growth (performance)

Type of management accounting (MA)	Author (Date)	Journal	Research method	Antecedents of MA	Consequences of MA
	Voss and Brettel (2014)	Journal of Small Business Management	Empirical: quantitative, survey		Performance (multiple measures)
	Wijewardena, Zoysa, Fonseka and Perera (2004)	Journal of Small Business Management	Empirical: quantitative, survey		Growth (performance)
Human resource management activities	Davila (2005)	Accounting, Organizations and Society	Empirical: quantitative, survey	Organizational characteristics; Presence of external investment	
	Wijbenga, Postma and Stratling (2007)	Entrepreneurship: Theory and Practice	Empirical: quantitative, survey	Presence of external investment	
MA = FA	Allee and Yohn (2009)	The Accounting Review	Empirical: quantitative, survey, secondary		Financial characteristics
	Brinckmann, Salomo and Gemuenden (2011)	Entrepreneurship: Theory and Practice	Empirical: quantitative, survey		Growth (performance)
	Cassar (2009)	The Accounting Review	Empirical: quantitative, survey, secondary	Presence of external investment; Environmental factors; Organizational characteristics	
	Cassar (2010)	Strategic Management Journal	Empirical: quantitative, survey, secondary		Subjective evaluation of performance
	Cassar and Ittner (2009)	European Accounting Review	Empirical: quantitative, survey, secondary	Financial characteristics; Professional characteristics of founders; Non-financial relationships with external parties	

Type of management accounting (MA)	Author (Date)	Journal	Research method	Antecedents of MA	Consequences of MA
	Hand (2005)	The Accounting Review	Empirical: quantitative, archival		Financial characteristics
	McMahon (2001)	Journal of Small Business Management	Empirical: quantitative, survey, secondary		Growth (performance); Profitability (performance)
	McMahon and Davies (1994)	Journal of Small Business Management	Empirical: quantitative, survey		Growth (performance); Profitability (performance)
	Mengel and Wouters (2015)	International Journal of Entrepreneurship and Small Business	Empirical: quantitative, survey	Organizational characteristics; Professional characteristics of founders	Growth (performance)
	Moro, Fink and Kautonen (2014)	International Small Business Journal	Empirical: quantitative, survey		Financial characteristics
	Seghers, Manigart and Vanacker (2012)	Journal of Small Business Management	Empirical: quantitative, survey	Professional characteristics of founders; Personal characteristics of founders	
	Van Caneghem and Van Campenhout (2012)	Small Business Economics	Empirical: quantitative, archival	Financial characteristics	
	Vander Bauwhede, De Meyere and Van Cauwenberge (2015)	Small Business Economics	Empirical: quantitative, archival		Financial characteristics
	Wongsunwai (2013)	Contemporary Accounting Research	Empirical: quantitative, archival	Presence of external investment	
Management of liquidity	Brinckmann, Salomo and Gemuenden (2011)	Entrepreneurship: Theory and Practice	Empirical: quantitative, survey		Growth (performance)

Type of management accounting (MA)	Author (Date)	Journal	Research method	Antecedents of MA	Consequences of MA
Case studies	Alattar, Kouhy and Innes (2009)	Journal of Accounting & Organizational Change	Empirical: qualitative		
	Armitage, Webb and Glynn (2016)	Accounting Perspectives	Empirical: qualitative		
	Christner and Strömsen (2015)	Management Accounting Research	Empirical: qualitative		
	Collier (2005)	Management Accounting Research	Empirical: qualitative		
	Granlund and Taipaleenmäki (2005)	Management Accounting Research	Empirical: qualitative		
	Gumbus and Lussier (2006)	Journal of Small Business Management	Empirical: qualitative		
	Karlsson and Honig (2009)	Journal of Business Venturing	Empirical: qualitative		
	Perren and Grant (2000)	Management Accounting Research	Empirical: qualitative		
	Silvola (2008a)	Qualitative Research in Accounting & Management	Empirical: qualitative		

Appendix B. List of scales and measurement items

This table presents the scales of the seven constructs used in the survey-based study as well as the measurement items, which constitute the scale. The survey was conducted in German language, which is why the actual measurement items used are shown in the third column. Since the thesis is written in English language, we also provide the English translation of each item in the second column.

The survey measured the response of participants on a 5-point Likert scale (1 – strongly disagree, 2 – disagree, 3 – neutral, 4 – agree, 5 – strongly agree) for most of the items. The mean value of 223 usable responses of the final sample is reported in the fourth column (mean). The fifth column (stdev.) reports the corresponding standard deviation for the same sample. Those items that were measured on a different scale (WebAna_1, ManEx_1_years, ManEx_3, ExInv_1, ExInv_2, and ExInv_3) are marked accordingly in the table.

Item	English	German	Mean	Stdev.
EnHos_1	The failure rate of firms in my industry is high.	Der Anteil an Unternehmen, die scheitern, ist in unserer Branche hoch.	3.41	1.04
EnHos_2	My industry is very risky such that one bad decision could easily threaten the viability of my business unit.	Unsere Branche ist sehr riskant, so dass eine Fehlentscheidung leicht das Überleben unseres Unternehmens gefährden könnte.	3.30	1.18
EnHos_3	Competitive intensity is high in my industry.	Die Wettbewerbsintensität ist hoch in unserer Branche.	3.47	1.10
EnHos_4	Customer loyalty is low in my industry.	Die Kundenbindung ist gering in unserer Branche.	2.05	1.17
EnHos_5	Severe price wars are characteristic of my industry.	Harte Preiskämpfe sind typisch für unsere Branche.	2.93	1.16
EnHos_6	Low profit margins are characteristic of my industry.	Geringe Gewinnmargen sind typisch für unsere Branche.	2.34	1.12
WebAna_1 (binary)	Do you use web analytic tools in your company?	Verwenden Sie Web Analytic Tools in Ihrem Unternehmen?	0.58	0.49
WebAna_2	How often do you use information from web analytic tools?	Wie häufig nutzen Sie Informationen von Web Analytic Tools?	1.88	0.98
WebAna_3	How important do you consider the usage of web analytic tools in your company?	Für wie wichtig halten Sie den Einsatz von Web Analytic Tools in Ihrem Unternehmen?	2.70	1.33

Item	English	German	Mean	Stdev.
ManEx_1 _years (ratio)	For how many years have you had managerial or leadership responsibilities prior to the entry to your company?	Wie viele Jahre hatten Sie Management- oder Führungs-verantwortung vor der Gründung bzw. dem Einstieg bei Ihrem Unternehmen?	6.91	8.19
ManEx_2 _clean	Which is your highest academic degree?	Was ist Ihr höchster akademischer Abschluss?	3.84	1.23
ManEx_3 (binary)	Does your education focus on the area of management or economics?	Liegt der Schwerpunkt Ihrer Ausbildung im Bereich Management oder Wirtschaftswissenschaften?	0.31	0.46
ExInv_1 (binary)	We had financial support from venture capital investors.	Wir hatten finanzielle Unterstützung durch Venture Capital Investoren.	0.45	0.50
ExInv_2 (binary)	We had financial support from angel investors.	Wir hatten finanzielle Unterstützung durch Business Angels.	0.26	0.44
ExInv_3 (binary)	We had crucial financial support from a bank, which was very important to our company.	Wir hatten ausschlaggebende finanzielle Unterstützung durch eine Bank, die sehr wichtig für unser Unternehmen war.	0.17	0.38
SpecPM_1	Through performance measures we know exactly what happens in our company.	Durch Kennzahlen wissen wir genau, was in unserem Unternehmen passiert.	3.35	1.22
SpecPM_2	We use performance measures to capture our business activities.	Wir nutzen Kennzahlen, um unsere Geschäftsaktivitäten zu erfassen.	3.58	1.25
SpecPM_3	Due to our performance measures we can better predict the future business development.	Aufgrund unserer Kennzahlen können wir die künftige Geschäftsentwicklung besser vorhersagen.	3.22	1.27
SpecPM_4	The achievement of company goals we determine through our performance measures.	Das Erreichen von Unter-nehmenszielen messen wir durch unsere Kennzahlen.	3.46	1.29
InfCom_1	To make clear to others what we require, we use company-specific information.	Um Anderen klarzumachen, was wir brauchen, verwenden wir unternehmensspezifische Informationen.	3.85	0.93
InfCom_2	In case of differences of opinion, we use company-specific information to convince others.	Bei Meinungsverschiedenheiten nutzen wir unternehmens-spezifische Informationen, um Andere zu überzeugen.	3.72	0.95

Item	English	German	Mean	Stdev.
InfCom_3	If we want to solve problems with business partners, we try to get further with company-specific information.	Wenn wir mit Geschäfts-partnern Probleme lösen wollen, versuchen wir mit unternehmensspezifischen Informationen weiterzukommen.	3.77	0.93
InfCom_4	In case of disputes, we try to convince business partners by discussing with them company-specific information.	Bei Streitigkeiten versuchen wir Geschäftspartner zu überzeugen, indem wir mit ihnen unternehmens-spezifische Informationen diskutieren.	3.61	0.96
AttRes_1	The attraction of resources was an essential part of our business success.	Die Beschaffung von Ressourcen war ein wesentlicher Bestandteil unseres Unternehmens-erfolgs.	4.02	1.06
AttRes_2	It was clear to us how important the attraction of resources was for the development of our business.	Es war uns klar, wie wichtig die Beschaffung von Ressourcen für unsere Unternehmens-entwicklung war.	4.15	1.03
AttRes_3	After we had received important resources, we felt much more confident regarding the future of our company.	Nachdem wir wichtige Ressourcen bekommen hatten, fühlten wir uns sehr viel sicherer bezüglich der Zukunft unseres Unternehmens.	3.87	1.08
AttRes_4	After we had obtained certain resources, we had the feeling of being successful.	Nachdem wir bestimmte Ressourcen erhalten hatten, hatten wir das Gefühl erfolgreich zu sein.	3.51	1.07

Appendix C. Scale reliability (Cronbach's alpha) for multi-item constructs

To complement the reliability assessment, this table shows Cronbach's alpha (Cronbach's α) for the five multi-items scales used in the survey-based study. Cronbach's alpha could not be calculated for *managerial experience of founders* (single-item construct) and *presence of external investment* (calculated scale) and is therefore not included in the table.

The top row of each scale reports the Cronbach's alpha. The first value (*initial scale*) is calculated based on the initially defined measurement items of each scale. Since we dropped items of two scales during the research process (*perceived environmental hostility*, *attraction of key resources*), the second value (*modified scale*) only includes items which have not been dropped. To make clear which items have been used, the item-total correlation for each item of a scale is given. Items marked with a minus symbol ("-") have not been included in the calculation.

Scale / measurement items	Cronbach's α of initial scale	Cronbach's α of modified scale
Perceived environmental hostility	**.553**	**.641**
EnHos_1	.282	-
EnHos_2	.289	-
EnHos_3	.406	.472
EnHos_4	.223	-
EnHos_5	.385	.472
EnHos_6	.197	-
Use of we analytic tools	**.789**	
WebAna_2	.682	
WebAna_3	.682	
Startup-specific performance measurement	**.909**	
SpecPM_1	.771	
SpecPM_2	.833	
SpecPM_3	.742	
SpecPM_4	.830	
Information-based communication	**.837**	
InfCom_1	.622	
InfCom_2	.729	
InfCom_3	.671	
InfCom_4	.653	
Attraction of key resources	**.807**	**.780**
AttRes_1	.648	.649
AttRes_2	.619	.663
AttRes_3	.649	.546
AttRes_4	.577	-

Appendix D. Preparation of survey data for statistical analysis

The following list provides a transparent overview of the modifications we made to the raw data obtained from our survey. The modifications were necessary to conduct the analysis.

- We *removed* cases (equaling rows in our data set) which either belonged to test data or to incomplete answers. Incomplete answer resulted from companies who started the survey but did not finish.
- We *deleted* columns from the data set which added no value to the statistical evaluation (external_number, tester, disposition_code, last_page, quality, browser, device_type, session_id).
- We *changed* variable names in the data set in such a way that they would reflect the theoretical construct they belonged to, for instance changing *v_042* to *SpecPM_1*.
- We *added* a column *Response_type* which captured whether the questionnaire was completed via online survey, postal mail, or telephone.
- We *deleted* placeholders that the program generated to display missing values in order to obtain empty cells.
- We *added* a new column *Age_years* which showed numerical values of the company age. This was necessary because some of the respondents answered with the year of foundation (such as "2012"), a string (such as "5 Jahre"), or intervals (such as "1-2"). We *replaced* year of foundation and strings by the equivalent number of years from the foundation of the company to the time of the survey. We further replaced intervals with the mean value, for example "1-2" became "1.5".
- Similarly, we *added* a new column *Employees_count* with the numerical value of the number of employees. This was necessary because some of the respondents indicated the number of employees with a string term (such as "3 Mitarbeiter"). We *replaced* strings by the equivalent numerical count of employees.
- Similarly, we *added* a new column *ManEx_1_years* which showed respondents' management experience as number of years. This was necessary because some respondents answered with strings (such as "~20" or "5 Jahre Gruppenleitung") that we replaced by numerical values. We then did a *linear transformation* by dividing the numerical values by 10. This was necessary to adjust the range of the variable to the other variables in the dataset (range before was [0, 35], range after was [0, 3.5]).
- We *added* a new column *ManEx_2_clean* which contained the respondents' highest degree of academic education. We deleted responses who did not specify a degree ("Anderer Abschluss") because this answer was not useful for the analysis and *replaced* it with the mean value of the variable to make sure these cases would not affect the calculations. Moreover, one respondent specified his degree hand-written on a paper questionnaire as "Staatsexamen". We felt justified to *recode* the answer as master's degree or diploma which we considered comparable.

Appendix E. Model variations of initial model to demonstrate robustness

Similar to section 4.5.5, we here present variations to our structural model to demonstrate the robustness of results. However, as opposed to section 4.5.5, we here refer the variations to our *initial* structural model (Figure 13), without the direct effect of *presence of external investment* on *startup-specific performance measurement*, and not to the respecified structural model. As we will show in the following, the three additional model variations also show the robustness of our results obtained in the main part of this study.

We calculated three model variations of the initial structural model, each of which was appropriate to assess for a specific reason. Table 16 compares the results of the initial structural model to the three variations. All variations demonstrated the robustness of our model.

Variation 1 (called *30 or less employees*) consisted of the initial model but we limited the data set to companies with 30 or less employees. The reason was to investigate whether strictly normal-distributed data would yield different results, as mentioned above (see section 4.4.2 and 4.5.5). We reduced the initial data by 19 companies with more than 30 employees. The evaluation of model variation 1 resulted in a reasonable model fit, even though the chi-square value was significant (χ^2 = 181.80, d.f. = 108, p < .01). The SRMR value was .074 and the CFI value was .947. The results for model variation 1 were very similar to the initial model with the main difference that H3 turned statistically significant. Hence, it could be interpreted that the relationship between *managerial experience* and the use of *startup-specific performance measurement* was more meaningful to the subsample of companies with 30 employees or less.

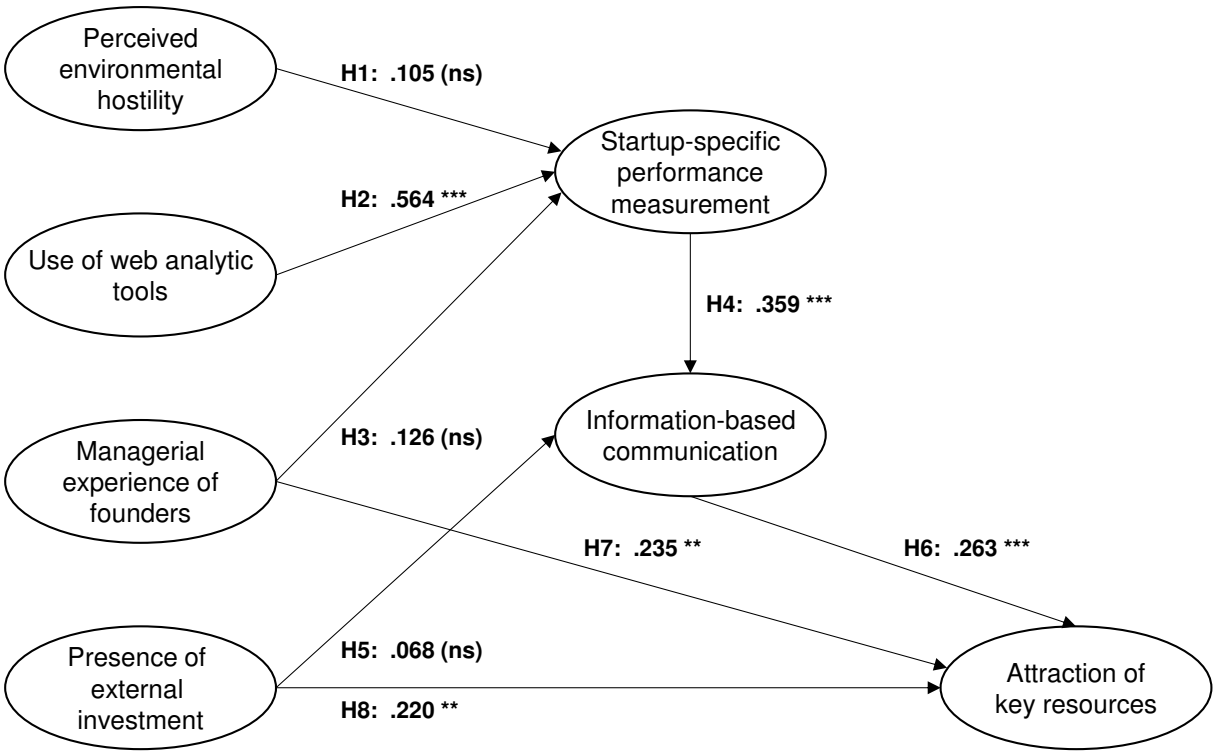

Figure 13. Initial structural model with standardized estimates and p-values (*: p ≤ .05, **: p ≤ .01, ***: p ≤ .001)

Table 16. Comparison of model fit and significance of hypotheses for initial model and three variations

Model fit index	Initial model	Variation 1 (30 or less employees)	Variation 2 (reliability of single measures)	Variation 3 (drop hostility)
CMIN	185.46	181.80	184.47	143.01
DF	108	108	108	82
CMIN/DF	1.717	1.683	1.708	1.744
CFI	.949	.947	.950	.958
SRMR	.072	.074	.070	.066
RMSEA	.057	.058	.056	.058
PClose	.202	.179	.215	.198
Hypothesis	Standardized estimates / p-value (a, b, c)			
H1	.105 / .185 (ns)	.108 / .189 (ns)	.091 / .262 (ns)	n/a
H2	.564 / ***	.537 / ***	.568 / ***	.576 / ***
H3	.126 / .061 (ns)	.138 / .050	.159 / .041	.152 / .019
H4	.359 / ***	.365 / ***	.357 / ***	.357 / ***
H5	.068 / .354 (ns)	.052 / .492 (ns)	.075 / .364 (ns)	.068 / .355 (ns)
H6	.263 / ***	.278 / ***	.249 / .002	.264 / ***
H7	.235 / .002	.215 / .006	.265 / .002	.234 / .002
H8	.220 / .003	.215 / .006	.244 / .005	.219 / .003

(a) While standardized estimates are reported, unstandardized estimates were used to assess statistical significance.
(b) When indicated 'n/a' (not applicable), the estimate could not be determined due to absence of a construct.
(c) ***: $p \leq .001$

Variation 2 (called *reliability of single measures*) based on the initial model with initial data but we assumed a low reliability of .7 for the single-item construct *managerial experience of founders* and the calculated score *presence of external investment*. We fixed the factor loadings to 1.0 and fixed the error variances to a value which is calculated based on an item's standard deviation (SD) and assumed reliability (Fuchs & Diamantopoulos, 2009, p. 197). For *managerial experience of founders* the SD was .819 and reliability was .7, thus, the error variance was fixed to .201; for *presence of external investment* the SD was .848 and reliability was .7, thus, the error variance was fixed to .216. The evaluation of model variation 2 resulted in a reasonable model fit, even though the chi-square value was significant ($\chi^2 = 184.46$, d.f. = 108, $p < .01$). The SRMR value was .070 and the CFI value was .950. The results were very similar to the initial model. In contrast to the initial model, H3 was supported again. Two hypotheses related to the single measures were statistically significant (H3, H8), another two hypotheses remained not significant (H1, H5). Interestingly, the standardized estimates of construct correlations yielded slightly higher values than in the initial model (Table 15). Hence, variation 2 made two points clear: (1) assuming a low reliability of .7 for single-item constructs did change the results only marginally with the main difference of H3 turning significant;

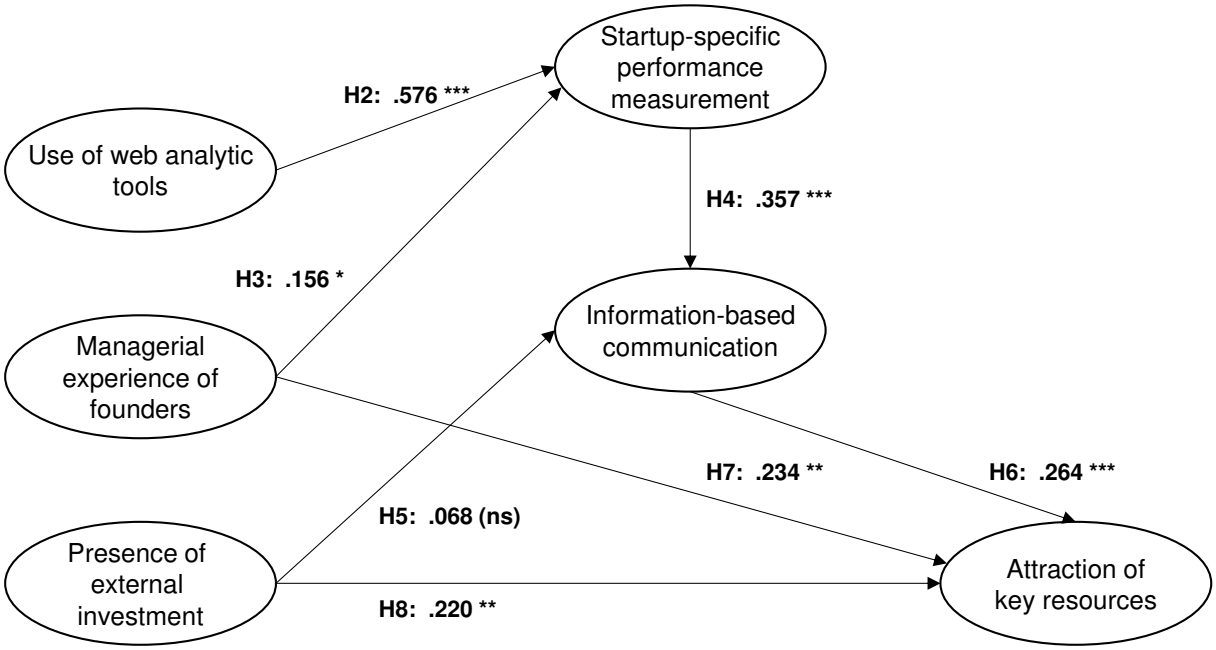

Figure 14. Model variation 3 with standardized estimates and p-values (*: $p \leq .05$, **: $p \leq .01$, ***: $p \leq .001$)

and (2) the approach by Anderson and Gerbing (1988, p. 415) we used for the initial model assumed already a low level of reliability for single-item constructs as indicated by lower standardized construct correlations in the initial model.

Variation 3 (called *drop hostility*) consisted of the initial model with initial data but we dropped the construct *perceived environmental hostility* (Figure 14). The reason was that the construct previously caused some problems due to a low reliability as well as poor factor loadings, as described above. The evaluation of model variation 3 resulted in a relatively good model fit, even though the chi-square value was significant ($\chi^2 = 143.01$, d.f. = 82, $p < .01$). The SRMR value was .066 and the CFI value was .958. Variation 3 could estimate more precisely the correlation between the constructs as evidenced by the difference in chi-square compared to the initial model (delta in chi-square was 42.45 with 26 degrees of freedom). Again, H3 was now supported. The CFI was slightly higher compared to the initial model (delta in CFI was .009) and clearly above the recommended threshold of .95. Dropping the construct *perceived environmental hostility* enhanced model fit, underlining that this construct and measurement scale should be treated with caution by future research.

Versicherung an Eides Statt

The following documents state that the author has complied with the rules by the Karlsruhe Institute of Technology (KIT) when conducting research and writing this dissertation.