



A guide to becoming green: Insights from angel investors developing sustainability-specific knowledge

Meike Siefkes

To cite this article: Meike Siefkes (04 Mar 2024): A guide to becoming green: Insights from angel investors developing sustainability-specific knowledge, Journal of Small Business Management, DOI: [10.1080/00472778.2024.2319777](https://doi.org/10.1080/00472778.2024.2319777)

To link to this article: <https://doi.org/10.1080/00472778.2024.2319777>



© 2024 The Author(s). Published with license by Taylor & Francis Group, LLC.



Published online: 04 Mar 2024.



Submit your article to this journal [↗](#)



Article views: 671



View related articles [↗](#)



View Crossmark data [↗](#)

A guide to becoming green: Insights from angel investors developing sustainability-specific knowledge

Meike Siefkes 

Department of Industrial Economics and Technology Management, Norwegian University of Science and Technology (NTNU), Norway

ABSTRACT

This paper explores how business angels develop the knowledge necessary to offer sustainability-value-adding activities, thereby becoming green angels. A multiple case study was conducted based on five investors from Germany and Sweden who offer sustainability-value-adding activities without having had explicit previous sustainability experience. Bringing together the empirical findings and literature on angel learning and sustainability competences, the introduced model illustrates that angels continuously apply a combination of hybrid strategies. The result of these learning strategies is sustainability-specific knowledge in a complex entrepreneurial context, including conceptual and systemic sustainability knowledge, critical thinking, ethical considerations, and capabilities for change. This study adds to the business angel literature as it empirically demonstrates how business angels go beyond the experiential, informal, and individual learning centered by existing literature and include a combination of vicarious, collective, and formal strategies.

KEYWORDS

Angel learning;
entrepreneurial learning;
green start-ups;
entrepreneurial finance;
cognitive resources

Introduction

Entrepreneurship as a phenomenon has become more complex and as a consequence business angels (BAs) need to keep pace with constant developments (Avdeitchikova & Landström, 2022; Mason et al., 2019). The green start-up context is characterized by an additional level of complexity (Gaddy et al., 2017; Ghosh & Nanda, 2010; Randjelovic et al., 2003). Nonetheless, the interest among BAs for green investment opportunities has recently increased as climate change has become central in the public attention (Botelho, Harrison, et al., 2023; Croce, Ughetto, Scellato, et al., 2021; de Lange, 2019; Siefkes et al., 2023). BAs that invest in green ventures and offer sustainability-value-adding activities, for example, by holding a dedicated sustainability-focused board position and providing strategic sustainability advice, are “green angels” (Siefkes et al., 2023). By sharing a knowledge base and mindset

CONTACT Meike Siefkes  Meike.siefkes@ntnu.no  Department of Industrial Economics and Technology Management, Norwegian University of Science and Technology (NTNU), Alfred Getz veg 1, Trondheim 7034, Norway

© 2024 The Author(s). Published with license by Taylor & Francis Group, LLC.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

for sustainability, they have the potential to overcome knowledge gaps (Bergset, 2018; Siefkes et al., 2023).

As it is widely acknowledged that BAs offer value-adding involvement based on social and human capital (Politis, 2008), the existing literature presupposes that BAs have developed the knowledge necessary for this involvement during previous entrepreneurial and/or managerial experience. Correspondingly, green angels should have had sustainability experience that allows them to offer sustainability-value-adding activities. Yet, the sustainability field is rather young and empirical evidence suggests that some BAs offer these activities without having had decades of sustainability experience. BAs investing in green ventures face the double challenge of less investment experience and less formalized markets. They cannot simply reproduce own existing knowledge to manage these uncertainties and there is only limited existing knowledge available (Botelho, Harrison, et al., 2023). To overcome knowledge gaps, these inexperienced BAs must find other ways to develop the knowledge necessary. Since knowledge is dynamic mental constructs and patterns that differ from one person to another and constantly evolve as a function of personal experience and learning (Fransman, 1994), knowledge gaps can only be reduced through time-consuming, and thus costly, learning (Bonnet & Wirtz, 2012).

The existing angel learning literature is scarce and is dominated by separately investigated informal and individual approaches applied during either a linear angel journey as individuals become BAs (Politis & Landström, 2002; Qin et al., 2021), or to improve their opportunity recognition during the investment decision-making (Botelho et al., 2021; Harrison et al., 2015; Smith et al., 2010). Illuminating how knowledge about sustainability in entrepreneurship travels between actors is central in gaining a comprehensive understanding of the complex intersection between sustainability and entrepreneurship (Audretsch et al., 2023). There have been recent calls for more research on nuances of how investor experience itself is shaped and developed (Harrison et al., 2015), as well as on the interaction between informal and formal strategies in angel learning (Botelho et al., 2021). Furthermore, there is very little research on the multifaceted phenomenon of value-adding involvement of BAs (Politis, 2016), neither in the traditional context nor sustainability-specific. Studying angel learning in a green context is beneficial because the novelty and immaturity of the markets necessitates explorative learning strategies. Consequently, this study aims to explore how BAs become green angels, asking:

How do BAs develop the knowledge necessary to offer sustainability value-adding activities post-investment?

For this, a multiple case study is conducted based on interviews with five BAs from Germany and Sweden, conducted in three rounds over 1.5 years. They

were identified in a previous study, where they were observed to offer sustainability-value-adding activities without having had specific sustainability experience. The multiple case study design enables the exploration of this anomaly by collecting rich contextual insights while also upholding a holistic perspective (Yin, 2009). The developed model gives crucial insights into the hybrid learning strategies BAs apply to continuously develop knowledge. The proposed model suggests that in addition to informal, experiential, individual strategies, BAs also pursue formal, vicarious, and collective approaches which have been underdeveloped in existing research. Contributing to the intersection of green entrepreneurial finance and angel learning, this study further contextualizes green angels. The antecedents igniting this knowledge development are identified: encountering specific challenges with the start-ups, the constant exposure to new topics, and unexpected encounters outside of the green bubble. Finally, the outcome of this learning is specified and connected to the sustainability competence literature, thereby explicating the sustainability-specific knowledge in an entrepreneurial context that enables BAs to offer sustainability value-adding activities.

Conceptual background

Business angels and post-investment involvement

BAs are high net worth individuals who invest on their own or with others in unquoted companies in which they have no family connection (Mason & Botelho, 2018). They are characterized by their own entrepreneurial background and management expertise which enables them to add value through hands-on involvement, offering resources that start-ups initially lack (Kelly, 2007; Mason, 2006). They apply their managerial and entrepreneurial experience in the firms they back, for example, by providing human capital, that is, knowledge and skills, and/or social capital, that is, the reputation of “a trustworthy and competent businessperson” (Politis, 2008, p. 139).

Even though BAs are characterized by their heterogeneity, four value-adding roles held by BAs can be synthesized: sounding board/strategic role, supervision and monitoring role, resource acquisition role, and mentoring role (Politis, 2008). To mitigate information asymmetries, BAs engage in various governance processes in which the value-adding roles can overlap (Fili & Grünberg, 2016). These processes have both material dimensions, that is, financial flows and physical resources, as well as cognitive dimensions, that is, microprocesses of sense-making and feeling, and macro aspects, such as the institutional and cultural context (Fili & Grünberg, 2016).

This involvement can result in competitive advantages (Barney, 1991). Companies backed by experienced BAs receive higher valuations than those who are not (Croce et al., 2018; Croce, Ughetto, Bonini, et al., 2021; Hoyos-

Iruarrizaga et al., 2017). Offering human and social capital can be rewarding for both the entrepreneur and the investor (Collewaert & Manigart, 2016), as they can shape the venture's development together (Cohen & Wirtz, 2022). Investees perceive investors holding specialized experience and networks to provide more value-adding involvement (Bjørgum & Sørheim, 2015; De Clercq & Fried, 2005; Sætre, 2003).

It is generally understood that entrepreneurs have better information about their company than their investors. This can lead to information asymmetries complicating investor and entrepreneur relations (Carpenter & Petersen, 2002; Hall & Lerner, 2010). In addition, cognitive approaches have been introduced that propose knowledge asymmetries when not only information is distributed asymmetrically, but also knowledge (Bonnet & Wirtz, 2012; Wirtz, 2011). While information is objective data that can be monitored, knowledge is dynamic mental constructs and patterns that differ from one person to another and constantly evolve as a function of personal experience and learning (Fransman, 1994). Knowledge asymmetry (or cognitive heterogeneity) may be a source of mutual misunderstanding, and it even occurs in circumstances where information is evenly distributed. It cannot be reduced through monitoring and due diligence alone but requires time-consuming, and thus costly, learning (Bonnet & Wirtz, 2012).

Environmental circumstances and conditions are critical in the angel involvement (Fili & Grünberg, 2016; Politis, 2008). Often, BAs are highly specialized in the sector or technology they invest in (Berger & Udell, 1998), especially in high-tech environments (J. B. Barney et al., 1996). For example, technology-focused early stage ventures require specialist BAs that understand their particularly complex financing and market development needs (Owen & Mason, 2017). Thus, understanding is key to achieve this competitive advantage (Barney, 1986), as entrepreneurs' and investors' context-specific mindsets are central for the construction and perception of growth opportunities (Penrose, 1959). When their mindset are closely aligned, BAs' can ascertain the value of entrepreneurs' knowledge about strategic opportunities (Wirtz, 2011). Hence, BAs' level of involvement and their value added as well as the development of such knowledge is a complex and diverse phenomenon where context matters (Politis, 2016).

The green context and BAs offering sustainability-value-adding activities

The context chosen in this study are green start-ups, that is, start-ups that commercialize innovations that “promote environmental welfare generally and address various sustainability problems specifically, while being financially sustainable” (O’Neil & Ucbasaran, 2016). While adding sustainability value is but one of many possible activities that necessitate angels' development of specific knowledge, it has some characteristics that make is useful for

this purpose: The green start-up context is characterized by a unique level of risk, uncertainty, and complexity (Gaddy et al., 2017; Ghosh & Nanda, 2010; Randjelovic et al., 2003). Not only products and services are new, for example, new ecofriendly materials, but also the markets themselves, such as emissions trading and sharing-platforms, are immature and fast-paced (Cohen & Winn, 2007; Dean & McMullen, 2007). High-regulation levels increase the complexity. Green start-ups' complexity amplifies knowledge gaps, making their markets difficult to navigate for founders and investors alike (Bergset, 2018; de Lange, 2017). Not all investors are prepared to assess certain types of green start-ups' technologies and business models (Bergset, 2015; de Lange & Valliere, 2020; Kuckertz et al., 2019). Investors can perceive hybrid business cases as risky and difficult to understand, thus hesitating to invest (de Lange, 2017; Gaddy et al., 2017). If conventional investors invest, context-specific knowledge is needed – otherwise the danger of a mission drift toward short-term profit rather than long-term sustainability persists (Bergset, 2018).

Green angels are such specialized investors. Like conventional BAs, green angels provide financial, human, and social capital. Beyond that, green angels offer sustainability-value-adding activities, for example, by holding a dedicated sustainability-focused board position, preparing the start-ups for the requirements of sustainability-focused follow-on investors, and monitoring the sustainability performance of the venture (Siefkes et al., 2023). Green angels invest in green start-ups with the motivation to understand the markets these ventures are operating in (Botelho, Mason, et al., 2023). While there may be a mismatch between the requirements of a green entrepreneur and the skillset of traditional investors who lack the understanding of sustainability specific aspects (Bergset, 2015; Ghosh & Nanda, 2010; Owen & Mason, 2017), green angels can overcome the context-specific challenges differently than conventional BAs, by inhibiting sustainability competences (Bergset, 2018; de Lange, 2017).

Sustainability competences have been explored in the entrepreneurship context (Patzelt & Shepherd, 2011), in (entrepreneurship) education (Ploum et al., 2018; Wals, 2015), and in the managerial context (Laasch et al., 2022). In addition to fundamental entrepreneurial knowledge and a motivation going beyond personal economic gain, knowledge of the natural environment is central to identify sustainable business opportunities (Patzelt & Shepherd, 2011). Other scholars have explicated sustainability competences to encompass intertwined intellectual competences (including systems thinking, an understanding of interconnectedness and interdisciplinarity, foresighted strategic management competences, and critical thinking), behavioral competences (action-orientation and change-agent skills, transformation capabilities), and (inter-) personal competences (stakeholder engagement and group collaboration, introversion, continuous maturing) (Laasch et al., 2022; Ploum et al., 2018; Wals, 2015).

Angel learning

BAs are a heterogeneous group (Mason et al., 2016), with a variety of different paths shaping their experience prior to investing and their approaches to learning during BA activity. A few empirical studies have investigated how individuals become BAs, and how the experiences they gain through angel investing shape their future investment decision-making. Consolidating the existing literature on angel and entrepreneurial learning, a preliminary model emerges, portraying a linear angel journey focused on experiential learning mostly through individual and informal strategies (see Figure 1).

Politis and Landström (2002) describe three angel learning phases. All BAs rely on fundamentals from previous experience when making the first investment. The corporate career and the entrepreneurial learning phases shape the BAs' managerial capabilities, including financial preparedness, competence building, network establishment, and legitimization of reputation as well as their ability to create new businesses and understand entrepreneurial processes. Here, vicarious learning, for example, from the experience of other investors, plays a significant role (Bonnet & Wirtz, 2012; Harrison et al., 2015), especially from more experienced BAs and like-minded individuals (Botelho, Harrison, et al., 2023; Mason et al., 2016). Research on formal¹ BA learning investigates BA academies as a vehicle to enable the exchange of experiences and closer collaboration (San José et al., 2005). This knowledge is applied in the investor career phase. From the first investment onwards, BAs continuously improve their decision-making (Harrison et al., 2015). Events can impact experiential learning (Cope, 2003), especially failed investments (Harrison et al., 2015). Botelho, Harrison, et al. (2023) show how informal learning shapes the way in which BAs assess new investment opportunities. The collective learning aspect, that is the role of cocreation with other investors and the social environment for entrepreneurial learning, is relevant but underdeveloped in angel learning (Qin et al., 2021; Smith et al., 2010; Toutain et al., 2017). An experiential perspective on angel learning as an individual

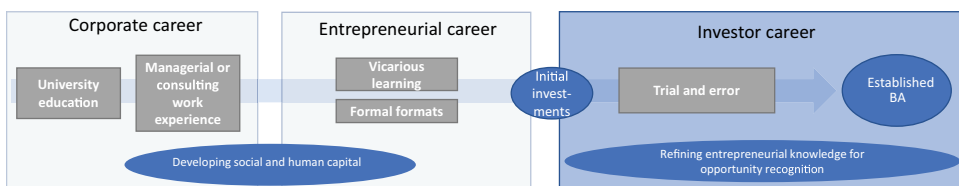


Figure 1. Preliminary model of angel learning derived from Politis and Landström (2002).

¹Formal learning is seen as the acquisition of formal qualifications, for example, certifications.

phenomenon dominates existing angel learning literature. Inexperienced BAs need to find ways to compensate for the challenges of learning from experience when there has been no experience to learn from (Glaser & Weber, 2007; Harrison et al., 2015; Smith et al., 2010).

To avoid knowledge asymmetries, Bonnet and Wirtz (2012) stress the need to bring investors' mindsets closer to the entrepreneurial knowledge base. By externalizing the entrepreneurs' knowledge, together they can create a shared understanding of potential growth opportunities. In turn, mutual learning can occur (Bonnet & Wirtz, 2012). But, externalizing knowledge can be difficult due to its tacit nature (Nonaka et al., 2001). It can be faster and thus cheaper if the initial cognitive gap between the entrepreneurs and the investors is smaller (Bonnet & Wirtz, 2012), in that it depends on investors' initial skills and knowledge. Only when they successfully externalize their knowledge and both parties are willing and able to learn can conflicts from knowledge asymmetries be resolved. However, a certain degree of cognitive heterogeneity among entrepreneurs and investors opens up to new perspectives and allows to sustain an ongoing process of learning and innovation, enhancing the value created in a start-up together (Cohen & Wirtz, 2022; Forbes, 1999).

BAs play an active role in the entrepreneurial process and participate hands-on in the creation of entrepreneurial successes, considering their investment and involvement as an extension of their own entrepreneurship (Politis & Landström, 2002). Hence, the entrepreneurial learning literature is utilized to underpin the empirics of this study. Kolb's experiential learning theory (Kolb, 1984) dominates the field (Wang & Chugh, 2014). This theory sees learning as the process of grasping experience and transforming it to action (Kolb et al., 2001) by continuous reflection and conceptualization (Kayes, 2002). To transform prior experience into entrepreneurial knowledge for opportunity recognition something must be done with it (Kolb, 1984), leading to strategies that either aim at exploring, that is, choosing new actions that are distinct from the ones that they have taken, or exploiting, that is, choosing actions that replicate or are closely related to the ones they have already taken (March, 1991). The latter option is limited in the green context's new markets. It occurs action-based through learning by doing, from past experience, from positive or negative experiences, and vicariously from the experience of others (Cope, 2003; Lévesque et al., 2009; Minniti & Bygrave, 2001).

Several of the entrepreneurial learning concepts are adopted from organizational learning theory (Dutta & Crossan, 2005). Like in entrepreneurial learning, experiential learning created through "learning by doing" (Arrow, 1962) dominates. Pisano's (1994) framework shows the dynamic interplay of existing knowledge with the generation of new knowledge through trial and error, resulting in the development of knowledge. If prior scientific and practical knowledge exist – even if they are informal and tacit – they can provide predictive models that enable learning before doing. Examples for such

exploitation approaches in entrepreneurship are due diligence before and monitoring routines after investing (Wirtz, 2011). If, in contrast, prior theoretical knowledge is weak, experience is limited, and several crucial variables are unknown, experimental learning by doing becomes necessary. Such trial and error approaches are time-intensive and thus costly (Pisano, 1994). A central concept is the learning curve. Argote et al. (1990) add the aspect of depreciation also due to technology development and technology obsolescence. This can lead to learning that is not cumulative nor linear. In this context, Barney et al. (1996) highlight the role of feedback and active reflection for individuals to determine how they advance in applying new knowledge. According to them, this is an important part of the feedback loop commonly associated with learning by doing or the learning curve (Argote et al., 1990; Pisano, 1994) – similar to what the entrepreneurial learning literature describes.

Synthesized, the existing angel learning literature suggests a variety of mostly experiential informal and individual learning strategies, focusing on decision-making and becoming an angel in the first place. The learning strategies applied to develop context-specific knowledge for post-investment involvement and their interconnectedness are not explained by the literature. The strategy behind this paper is to use the specificity of green start-ups as a window into the broader phenomenon of the creation of knowledge for angel involvement.

Methodology

Given the present stage of the literature, an exploratory qualitative study was chosen to answer the research question (RQ). For this, an abductive approach was followed (Sætre & Van de Ven, 2021). Having observed an anomaly – BAs offering sustainability value-adding activities without a background in sustainability – a multiple case study of five BAs was conducted, based on three rounds of interviews with each case. This enabled the exploration of the phenomenon by collecting rich contextual insights while also upholding a holistic perspective (Yin, 2009). Comparing the individual cases studied encouraged a deeper understanding of the underlying dimensions and dynamics of learning antecedents, learning strategies, and learning outcomes, thus contributing to developing the literature on angel learning and green angels (Eisenhardt & Graebner, 2007).

Cases were selected based on their theoretical appropriateness (Eisenhardt & Graebner, 2007), following Patton's (2002) purposeful sampling for cases that have great revelatory potential. Based on the data collection from a previous study on green angels, unique cases (Yin, 2003) of five BAs were identified that offer sustainability value-adding activities without having had previous sustainability experience. The cases are also

revelatory, because of the unique access that enables the researchers to study previously unaddressed aspects (Yin, 2003). Summarized, BAs were selected who:

- Have invested as BAs without being related to the founders,
- Are actively involved in their investments,
- Are situated in Germany or the Nordics,
- Have at least one green start-up in their investment portfolio, and
- Offer sustainability value-adding activities but have no or only limited sustainability knowledge from previous experience.

The interviewed BAs have started investing in green start-ups recently, one to four years prior to the first round of interviews. Some have started as green angels; others were active as conventional BAs before. They all have extensive previous career experience of at least 10 years, some have founding experience, others have a more general managerial and industry-specific background. [Table 1](#) provides an overview of the five cases. They come from Germany or Sweden. To ensure the participants' anonymity, the individual nationalities were redacted.

The primary data source for this study are interviews with the five cases. To observe possible developments over time, the interviews were conducted during three time periods over 1.5 years (see [Table 2](#)), adding up to 15 interviews in total. The interviews followed guides designed by the author for the respective rounds, adjusted as necessary before each interview to incorporate any secondary data relevant to the case. The subjects were encouraged to use their own terms when talking about their journey. The interviewer asked concrete follow-up questions to focus on facts and concrete events thus avoiding cognitive biases and impression management (Fisher & Geiselman, 1992). The data collection ended when issues raised by the RQ reached the point of saturation (Strauss & Corbin, 1998). The interview data was supplemented with information from other sources (Creswell & Poth, 2016), for example, secondary data from LinkedIn biographies, news articles, and websites.

In the first interview round, the participants were asked to talk about their involvement as green angels with minimal interruption by the interviewer, to obtain an in-depth understanding of how the knowledge necessary to offer sustainability value-adding activities was developed during each individuals' journey. The second interview round was designed to go deeper into questions addressed in the previous round and to observe changes in the answers. The questions were open-ended and sought to capture the BAs' approach to increase their sustainability knowledge. In the third round of interviews, a preliminary model was presented based on the initial findings from the first two interview

Table 1. Case characteristics.

Case	BA Since	Green BA Since	Portfolio Composition	Selected Examples of Sustainability Value-Adding Activities	Revelatory Potential
1	2016	2017	Impact start-ups; e.g. foodtech, edtech, and healthtech	<ul style="list-style-type: none"> • Forward green industry trends • Connect the start-ups with sustainability experts • Focus on growing the business 	15 years of entrepreneurial career in traditional industries but has recently shifted their focus on green and impact startups, actively working learning more, driven by curiosity.
2	2019	2019	Research-intensive greentech, sharing platform, foodtech	<ul style="list-style-type: none"> • Develop a clear sustainability strategy and value proposition • Require clear sustainability indicators • Provide access to sustainability-focused network 	After more than a decade as a strategy consultant in sectors like oil and gas, construction, and telecommunication, they became a BA and consultant on sustainability topics, mentors in an accelerator and social projects, and is a speaker in panel talks and discussions.
3	2020	2020	Foodtech, agritech, sustainable fashion	<ul style="list-style-type: none"> • Develop a clear sustainability strategy and value proposition • Focus on growing the business • Request quantifiable indicators that lay the groundwork for the later reporting 	Generalist, with a background in marketing and political science. Has co-founded various start-ups, one of them a green start-up. After some years as a VC investor, they are rather new to impact-motivated angel investing.
4	2014	2018	Mixed portfolio, focusing on energy, software, and food; approx. 30% green	<ul style="list-style-type: none"> • Prepare for future sustainability focused financing • Challenge the entrepreneurs' mindset • Connect the portfolio start-ups to create synergies 	Co-founder of an energy cleantech start-up and has several decades of energy-industry-specific experience, giving him access to insider information. After a long career as a traditional BA, they have recently developed the aim to actively support their start-ups' sustainability performance.
5	2017	2017	Greentech and foodtech	<ul style="list-style-type: none"> • Develop a clear sustainability strategy and value proposition • Require clear sustainability indicators • Challenge the entrepreneurs' mindset 	Over a decade of experience as a consultant advising Fortune500 corporations, SMEs, and start-ups on sustainability and innovation topics, investor, speaker, and mentor. They rally for "new visions, values, and ventures to redesign our systems, products, and services for the better." They mostly work with technology-heavy sustainability topics and aims to understand their projects in-depth to ensure having an impact with their involvement.

Table 2. Overview of the data collected.

Interview Round	Point In Time	Average Duration	Word Count
1	December 2021 to February 2022	60 min	29,921 words
2	July 2022	80 min	29,968 words
3	April 2023	35 min	18,387 words
Total			78,276 words

rounds. This way, the cases could validate findings and fill remaining gaps in the data.

The audio recordings were transcribed by the author as part of the data analysis process. The coding in NVivo was inspired by Gioia et al. (2013) to facilitate the emergence of novel knowledge while analyzing the data. An abductive approach was chosen to be open in bringing the concept of green angel learning to life. Abductive research is characterized by a nonlinear, iterative process of systematic combinations and inference that matches theory with reality (Dubois & Gadde, 2002). As suggested by Eisenhardt (1989), the data analysis iterated between the existing literature and the empirical data throughout the data collection, analysis, composition and revision of the article. During the coding process, new codes were added, compared, grouped, and regrouped with the initial codes, guided by the RQ (Saldaña, 2021). The result of this iterative approach were 40 first-order concepts. A search for links among these first-order concepts bore 17 second-order themes. These were then distilled into four aggregate dimensions, encompassing the antecedents and outcomes as well as the two overarching learning strategies (see Figure 2).

This study has limitations. Several researchers have noted the methodological challenges posed by the BA population (Avdeitchikova et al., 2008; Landström & Mason, 2016). Because of their informal organization, low-key profile, and dispersion, identifying BAs engaging in green ventures can be difficult. The purposeful sampling helped overcome this challenge (Patton, 2002). For this study, the chosen research design was not fit to study tacit learning. Instead, this study focuses on making an initial investigation of the different learning approaches of BAs toward becoming green angels. The validity and robustness of the findings were ensured by the research design. In addition, the participants were assured anonymity to address potential key informant bias. The multiple case study approach supported the mitigation of the negative effects of observer bias. This study was limited to BAs from Germany and Sweden. The countries portray similar maturity levels of green venture development and stimulation. Thus, this allows for comparisons.

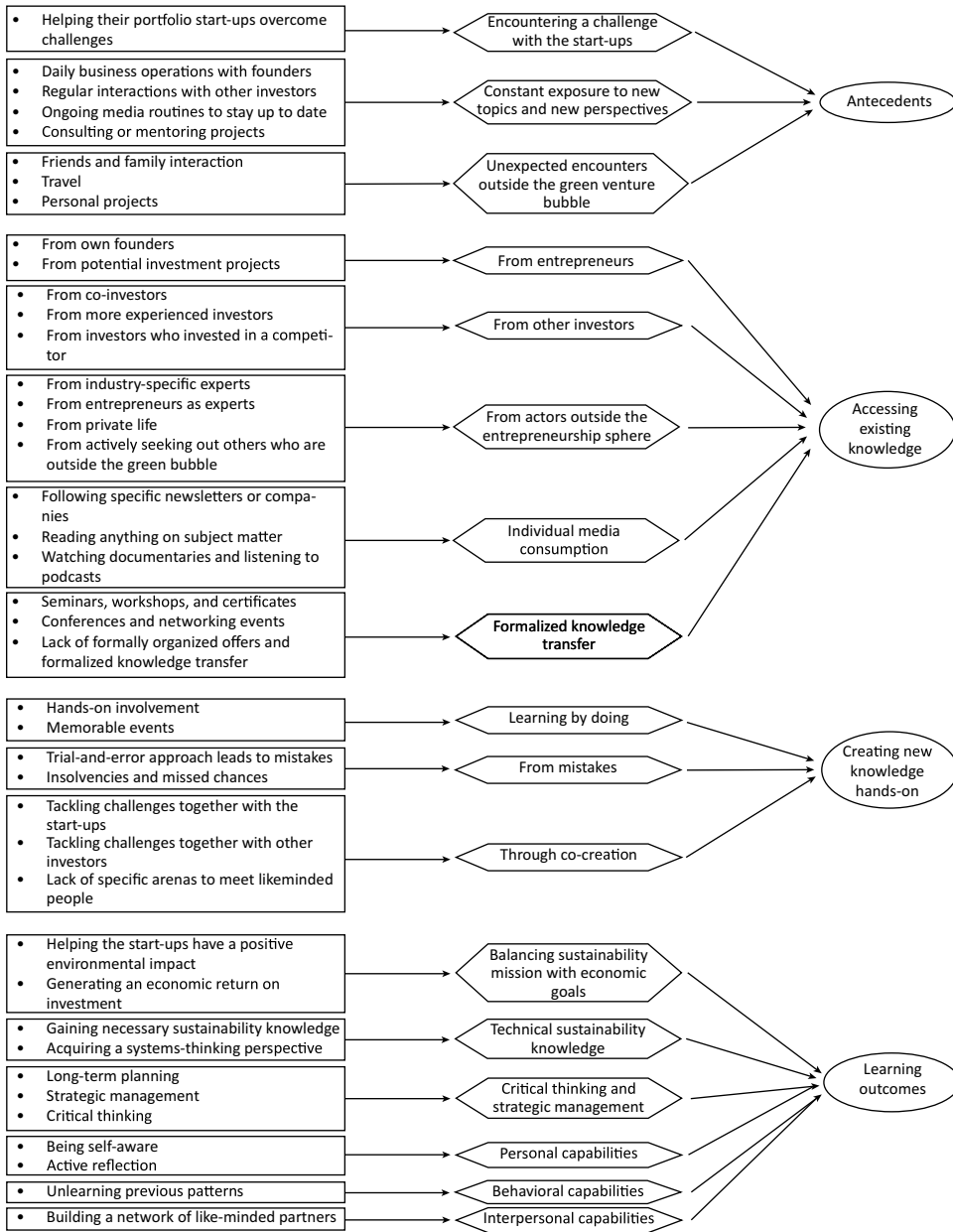


Figure 2. Data structure.

Findings and analysis

Antecedents

The interviewed BAs' development of knowledge necessary to offer sustainability value-adding activities is ignited by different antecedents.

Encountering a specific challenge with their start-ups

The interviewed BAs realize the need to apply a learning strategy when they meet the limits of their own knowledge. Such challenges often arise during pre-investment due diligence, when information is distributed asymmetrical. In addition, the interviewed BAs support their start-ups in the post-investment stage to overcome challenges together.

There are always challenges, for example when we have to figure out what the go to market approach is. We have hypotheses. How can we test them quickly and cheaply to understand what works? Such topics come up regularly. (Individual 5)

Constant exposure to new topics and new perspectives

The daily business of BAs constantly precedes learning. The interviewed BAs are exposed to new business models, new industries, new markets, and new people on a regular basis. They are curious and have regular routines including media consumption, conferences, and networking events to stay up-to-date on general market and technology developments, and to be exposed to new topics and people. Every interviewee highlights the learning impulses from talking to their own founders and potential investment projects. With their businesses, founders – both current investees as well as potential ones – continuously bring up new topics. These often are topics, questions, and perspectives that the BAs would not have considered on their own.

The [topics] are driven by the start-ups. It would be presumptuous to say that I have already dealt with this in advance. (Individual 4)

The BAs are also in touch with other investors. BA networks, groups, and syndicates are arenas to meet like-minded people to get new impulses from. Conferences and events expose the BAs to topics that they would not have actively dealt with otherwise.

Being active in different roles outside of angel investing exposes them to new sustainability-related knowledge, for example, consulting or teaching. Many of the interviewed BAs are also consultants. Some focus on conventional topics like pitching or business plan development, others advise on sustainability-specific topics. This urges them to learn in a targeted way to provide a service to their clients.

Unexpected encounters outside the green venture bubble

Encounters outside the green venture bubble environment can ignite unexpected moments of learning. They can occur outside the interactions with founders, investors, or other actors within the ecosystem, for example, in the private life, through friends, travels, real estate projects, or their own children.

Learning strategies

Accessing existing knowledge

When meeting the limits of their own knowledge, the interviewed BAs first investigate opportunities to retrieve the missing information by accessing existing knowledge.

From entrepreneurs. Founders are one of the central sources for insights and knowledge. Even though the BAs aim to support with their human, social, and financial capital, the entrepreneurs themselves can offer new insights as well. Of course, one aim is to overcome unevenly distributed information about the start-up. Furthermore, most of the founders of green start-ups can offer industry-specific knowledge, often on sustainability topics. Thus, BAs seek out their expertise. These expert entrepreneurs can be from portfolio companies, or from competing ventures or the BAs' network.

[The founders] are on the move in the market and try out things. (Individual 5)

From other investors. The interviewed BAs also learn from other, more experienced investors. Before deciding to invest in a start-up, they seek out more experienced BAs' advice. Once the investment is realized, working together with co-investors gives the BAs access to others' knowledge. Exchanging information with investors from competing ventures helps understanding what does not work and what does, from another perspective. This way, the interviewed BAs learn from others' mistakes and successes.

From actors outside the entrepreneurship sphere. Learning from experts is relevant when the knowledge of the BAs and their network reaches its limits. These are usually industry-specific experts from outside the entrepreneurship sphere. Several of the interviewed BAs acknowledge that it helps to seek the insights of someone who is more isolated in a specific topic. External actors can provide valuable insights and explain complex matters. Individual 1 regularly meets with industry experts to gain more insights into a new technology or a new market. Due to the value of the network, the BAs invest significant time into building their network.

From individual media consumption. Learning from others does not necessarily involve social interaction. Regular media routines help the BAs to stay informed about trends and technology news, but also to learn about regulatory, reporting and impact measurement topics. Most of the interviewed BAs follow specific newsletters or companies on LinkedIn. In addition, several of them state to dedicate a significant amount of time to reading books. Even if the books do not have a direct relation to the daily investment business, the BAs read up on sustainability topics, aware of the relevance of a holistic knowledge base. Watching documentaries and listening to podcasts supplements information obtained from other sources.

Through formal formats. In addition to the informal vicarious learning strategies presented so far, the interviews reveal that formal sources of knowledge are valued. Formal learning formats organized by a trustworthy facilitator promise the transfer of high-quality knowledge. This can occur through seminars, workshops, and trainings for BAs investing or wanting to invest in green start-ups. This often entails certification and can provide access to additional tools. Individual 2 noticed that their start-ups need guidance in reporting their impact. They then obtained the official certification for the Global Reporting Initiative standards.

The interviewed BAs note a slow change and maturation of the ecosystem, but criticize the lack of specific green angel educational formats, for example, specialized seminars or formal green angel networks.

The really deep-tech sustainability companies are struggling to find initial investments because it requires knowledgeable angels. I wish there was an education for all BAs.
(Individual 1)

Interlinkages between the strategies. When targeting new topics, the interviewed BAs first aim to exploit the existing knowledge through informal strategies. None of the interviewed BAs choose to jump in at the deep end, learning by doing without any previous investigation. Several of the interviewed BAs describe themselves as social learners, preferring to talk to others rather than read a book or take a course.

When investing in a new vertical, I start talking to people and look for experts who can support me on the way. But not on an educational structured level, not workshops, not courses, nothing like that. I value personal contact and exploring at my own pace.
(Individual 3)

Other BAs prefer a more asocial learning for targeting new topics, conducting desk research first. Their first step is to google a new topic and read up on it. Afterward, they ask experts follow-up questions to get deeper into a topic.

I'm always someone who wants to look for themself first. Afterwards, you can always call the person, but I find it a bit stupid when I call someone with something that I can operate myself easier. (Individual 2)

The BAs realize the limits of their own knowledge and of the information accessible through initial learning strategies. When desk research is not reliable, the network cannot help to acquire insights, and the information is not publicly accessible, insider information is needed. For this, the interviewed BAs turn to formal formats to professionalize with structured knowledge, expanding the initially built knowledge base. Formal learning is not for everyone, and some BAs skip this stage.

Creating new knowledge hands-on

When the limits of accessible knowledge are reached, the BAs need to create new knowledge through active involvement.

Learning by doing. Much learning happens through hands-on involvement and memorable experiences. The BAs mention surprises due to naïvete regarding capital intensity and time horizons of green venture investments. Also, the lack of established best practice approaches necessitates experimentation. Individual 5 mentions building own work-arounds for missing suitable tools. Because the green ventures' markets are often immature and dynamic, learning by doing is often equivalent with "figuring it out on the go" and realizing that most people active in the field do the same.

From mistakes. When BAs are involved in the daily business, learning by doing, things can go awry. Results are trial and error experiences. Individual 5 is convinced that routines and approaches can only be developed further by daring to experiment and see whether a completely different approach also works. The BAs clearly state: "I learn best from my own mistakes." BAs that experience a start-up's insolvency can derive valuable learnings for future involvement, for example, intervening sooner. They also recall situations where they rejected a start-up prematurely, regretting a missed-out opportunity in hindsight.

Through cocreation. This experiential learning seldomly occurs to one BA alone. The collective learning aspect is fundamental in a complex context. Bringing together the BAs' own expertise and the one of their founders or co-investors to solve challenges extends the BAs' knowledge, especially on sustainability-specific topics.

Another form of cocreating hands-on learning are collaborative moments of success. Individual 4 shares a memory of how a founder of one of the start-ups they had invested in organized a fruit tree planting event. The experience of planting ancient fruit trees on an extremely cold day. They recall that "being in

this together with the founder showed me what we are doing this for.” Also, learning together with other BAs is mentioned. Since there are only a few experienced green angels to learn from, the interviewees learned about green start-ups together with other BAs. While conferences, BA networks, groups, and syndicates are seen as good arenas to meet like-minded people to learn from and with, the lack of dedicated spaces for meeting other green angels is criticized.

Learning outcomes

As a result of these various learning strategies, the interviewed BAs develop the knowledge necessary to offer sustainability value-adding activities, enabling them to overcome knowledge gaps.

Balancing sustainability mission with entrepreneurial goals

The interviewed BAs want to have a positive environmental impact with their investments, but also stress that they expect an economic return in addition to the impact created.

We are not philanthropist. We really want to support impactful start-ups but we also need to see the business relevance of it. (Individual 3)

Technical sustainability knowledge

The interviewed BAs aim to understand the start-ups’ business model – some want to gain an in-depth understanding, others are content with a surface level knowledge enough to pitch their start-ups’ ideas to others. A better technical understanding of sustainability topics relevant for their start-ups enables BAs to give valuable advice and to ask critical questions that challenge the start-ups, for example, regarding supply chains, materials, impact measurement, or life cycle assessments.

One reoccurring topic is that problems and their solutions are more complex than anticipated. The BAs strike the importance of a systems-thinking perspective, understanding the interconnectedness of sustainability issues to achieve the mission. This is especially crucial when it comes to hardware innovations. Due to the fast-paced dynamics and the variety of issues, every new start-up brings up new technical sustainability themes, necessitating a continuous learning from the angel side.

Critical thinking and strategic management

This complexity requires long-term strategizing and critical thinking. The BAs describe that they challenge their start-ups by questioning again and again the concrete impact of the business idea to ensure achieving the initial mission, building on the technical sustainability knowledge. Here, patience and long-term strategizing play a role. The interviewed BAs develop competencies

aimed at ensuring follow-on financing by other sustainability-oriented investors. For example, they install an impact reporting routine early on.

The interviewed BAs note the abundance of green investment opportunities. One challenge that is often mentioned in this context is greenwashing. Every interviewee recalls a teachable, memorable event where they assessed an investment opportunity and were surprised to learn that the presented sustainability impact is more marketing than real commitment for an environmental impact. They learn to apply critical thinking and challenge the entrepreneurs' claims, also after investing.

Personal capabilities

Developing the personal capabilities to navigate the duality of green entrepreneurship is mentioned by several BAs. Individual 5 decides against investing in that business idea when they do not understand a topic and does not find anyone who can help him understand. This self-awareness is essential. Many of the interviewed BAs realize in the retrospective that they were naïve and/or underestimated the time-, knowledge-, and capital-intensity of green startups.

The more you get into the space, you realize that you need to educate better.
(Individual 1)

Behavioral capabilities

The interviewed BAs have a background in traditional, nonsustainability-oriented entrepreneurship, management and/or consulting. The BAs acknowledge that relearning and unlearning old patterns plays and beliefs a large role in becoming green angels.

It was quite a change. (...) It is a re-learning and unlearning. At university, you are taught aspects that don't work at all in the context of the circular economy. In my business career, I learned things that unfortunately worked then, but don't work anymore. (Individual 5)

The interviewed BAs highlight that even after some years of experience in green venture investing, they continue to learn. They want to become more professional in their sustainability value-adding activities, for example, by having a clear set of sustainability selection criteria. The data collected over 1.5 years showed that the interviewed BAs changed their behavior: in the first interview, Individual 4 stated that they did not ask their portfolio companies for any sustainability-related KPIs. In the third interview, they stated to now query which SDGs the business model contributes to.

To have this experiential learning effect over time, active reflection is key. Individual 5 has reflected on what they have learned from the first couple of investment and due diligence rounds, and from the feedback loop when

something did not work out. Especially with the immaturity of green venture markets, keeping track of market developments is important, following similar start-ups that entered the market, understanding why some succeed, and others do not.

Interpersonal capabilities

To achieve an intentional, measurable impact, the interviewed BAs collaborate and co-invest with others. They acknowledge that green venture investments are a trend topic and building a network of genuine, like-minded partners is central to achieve the bigger mission, making the captable decisive. Hence, interpersonal capabilities are essential.

You cannot do impact alone. (Individual 4)

Discussion

The empirical findings connect the antecedents igniting this knowledge development, subsequent learning strategies, and resulting learning outcomes constituting different aspects of knowledge needed to offer sustainability value-adding activities (see Figure 3).

Embarking on the journey of becoming green

The “why” in entrepreneurial learning is largely understudied (Toutain et al., 2017). The presented empirical findings show that by investing in green start-ups and being involved in the green start-up sphere, green angels are constantly exposed to topics where their own knowledge is limited. This study underlines that the motivation to develop deeper sustainability-specific knowledge often lies in the intention to recognize and develop opportunities (Penrose, 1959; Wirtz, 2011), especially those opportunities that unite purpose and profit. Positioning themselves as green angels also exposes BAs to

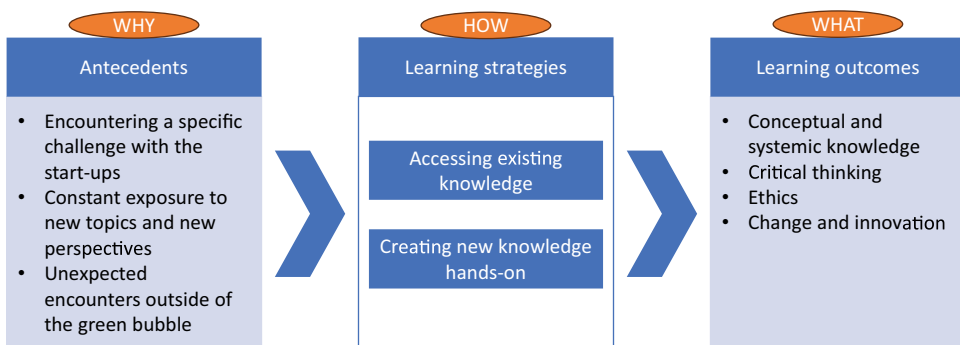


Figure 3. Developing the knowledge necessary to offer sustainability value-adding activities.

coincidental, unintentional opportunities of learning, which the learner typically becomes aware of “after the experience, and only through reflection” (Botelho, Harrison, et al., 2023, p. 6). BAs do not only learn to make better pre- and post-investment decisions in a new, dynamic green context, but also out of curiosity and fun which has often motivated the initial green investment decision (Botelho, Mason, et al., 2023). Finally, a driving force to develop knowledge that aids with offering sustainability value-adding activities is the associated competitive advantage over other BAs during the selection process as well as for the portfolio company once the BA has invested (Barney, 1991; Siefkes et al., 2023). Overall, being a green angel becomes a learning vehicle in itself.

While Politis and Landström (2002) propose a step-wise BA learning journey where the BAs first develop the knowledge and then begin to invest, other studies suggest that active angels recognize the need to improve their investment-related skills once they are involved in the investment. The results of this study support the latter and add important perspectives. Unlike in Harrison et al. (2015), the findings imply that BAs often become green after having invested in non-green ventures or being active in traditional industries. Upon their first green investments, BAs offer value-adding activities based on their initial knowledge foundation. Soon they realize that they are reaching the limits of their own knowledge which ignites the different strategies presented in this study, as understanding is key to achieve a competitive advantage (Barney, 1991). When becoming green, they change their investment philosophy rather than their level of involvement.

Employing various learning strategies

Previous literature investigates angel learning strategies separately, neglecting their interconnectedness. This study’s findings contextualize acknowledged yet underdeveloped vicarious, formal, and collective learning strategies together with the informal and individual experiential strategies accentuated by the scarce existing literature. In a complex context, BAs exploit others’ existing knowledge (March, 1991). Depending on personal preferences, social or individual approaches are pursued. The empirical findings support previous studies on the decision-making process: other investors are a key source of vicarious learning (Bonnet & Wirtz, 2012; Harrison et al., 2015; Smith et al., 2010), for example, as advisors or co-investors. Neglected by the existing literature, this study further emphasizes the importance of learning from the founders themselves (De Clercq & Sapienza, 2005): especially in the early phase of becoming green, BAs learn a lot from their portfolio start-ups, overcoming information asymmetries. To verify and bundle the knowledge, BAs turn to formal learning formats. The interviewed BAs agree that angel groups and trainings are safe spaces for BA learning and support (Harrison et al.,

2015; San José et al., 2005), where they can meet like-minded investors, to learn from and with each other, and facilitate larger investment rounds (Botelho et al., 2021; Mason et al., 2019), especially in the green context. Yet, the offer for green angel learning formats is limited, highlighting a pronounced need for more formal educational formats and meeting arenas.

Reaching the limits of available knowledge, BAs pursue exploratory learning strategies. In line with the entrepreneurial learning literature (Cope, 2003; Kolb, 1984; Lévesque et al., 2009; Minniti & Bygrave, 2001), much of the green angel learning is facilitated through active involvement. Trial and error approaches and reflecting on the outcomes enable BAs to create new knowledge (J. B. Barney et al., 1996; Pisano, 1994), reducing the uncertainty associated with the immaturity of green markets. Our findings also emphasize the mutual aspect noted by few previous studies (Bonnet & Wirtz, 2012; Cohen & Wirtz, 2022): collective learning² matters more than investigated so far, that is, BAs learning not only from, but also with others. This cocreation occurs when overcoming challenges together with other investors and together with the entrepreneurs or more generally, by working together with other actors to create a supportive environment for green angel investments (Qin et al., 2021; Toutain et al., 2017).

On knowledge and sustainability value-adding activities

The result of these learning strategies is the development of entrepreneurial knowledge (Politis & Gabrielsson, 2015) and mindsets (Penrose, 1959) in a sustainability-specific context, which includes several dimensions. Conceptual and systemic sustainability knowledge includes learning about sustainability (Ploum et al., 2018). To be able to offer sustainability strategy advice, BAs need technical sustainability knowledge to understand the subject matter (Bergset, 2015, 2018; de Lange, 2019). Also for sustainability supervision, technical sustainability knowledge is key, for example, how to assess the (potential) sustainability performance of early-stage start-ups (Kuckertz et al., 2019). Systems thinking and long-term planning are required for all roles.

Critical thinking encompasses skills in strategic management and interdisciplinarity (Laasch et al., 2022). They are needed for BAs to identify opportunities as sustainability strategy advisors, for example, on uniting economic success and environmental impact. For sustainability advice and mentoring, critical thinking and asking difficult questions are central. This dimension is about sustainable opportunity recognition, that is, opportunities that sustain the natural and/or communal environment as well as provide development gain for others (Patzelt & Shepherd, 2011). For this, knowledge about the

²Collective learning relies on a social element: an effective combination of knowing what and knowing *how* as well as knowing *who*, that is, contacts and networks that provide access to knowing what and knowing how (Gibb, 1997).

environment is central, linking the two dimensions of conceptual sustainability knowledge and critical thinking.

Most research on angel learning uses financial proxies to assess angel learning during decision-making. This study emphasizes the cognitive aspects of angel learning, building on Penrose's (1959) context-specific mindsets. The findings reveal an ethical dimension, reflecting personal capabilities and learning to care (Ploum et al., 2018). Self-awareness regarding one's own bias, the limits of one's knowledge and the ability to reflect on own actions and learnings are needed to become green angels. Active reflection requires a certain level of proactiveness (Pisano, 1994) and experience as this consciousness arises over time (Barney et al., 1996), an aspect that is understudied in the experiential learning literature. This study's results on unlearning old patterns as discussed by Argote et al. (1990) support the importance of reprioritization and an evolving attitude toward being an investor as argued by Harrison et al. (2015), especially in a green context where knowledge and mindset are of unique importance.

Change and innovation abilities require learning to make change happen (Ploum et al., 2018). Previous studies highlight the need to circumvent the dangers of greenwashing in VC investments (Kuckertz et al., 2019). This study confirms this for angel investments: green angels want to support with more than merely superficial sustainability advice: they want to become change agents. This also requires interpersonal capabilities (Ploum et al., 2018). Fili and Grünberg (2016) mention the significance of the social dimension of the investor-estee relationship. Immature markets require more signaling, legitimacy, and trust. To make change happen, BAs need social capital: a robust network of like-minded partners and the capacity to build meaningful, long-term alliances with the right partners. A trustworthy and knowledgeable reputation in the green investment sphere enables BAs to support their start-ups' sustainability resource acquisition as legitimate actors (de Lange, 2019), funneling more capital into impactful ventures and closing in on creating a positive environmental impact through their investments.

Sustainability value-added is not one concrete outcome but a process of hands-on involvement. Green angels take on several of the sustainability value-adding roles which can overlap similar to conventional roles (Fili & Grünberg, 2016). The competences and dimensions themselves also overlap and cannot be fully translated into separate activities. Politis (2008) distinguishes between value-adding roles requiring human capital for the strategy advice and monitoring roles, and social capital for the resource acquisition and mentoring roles. Contrasting, the empirical results in this presented study show that more than a trustworthy and competent reputation is necessary for resource acquisition and mentoring: Context-specificity requires human capital also here. Only with a sustainability knowledge base and aligned mind-sets can green angels provide these social-capital-affiliated value-adding activities.

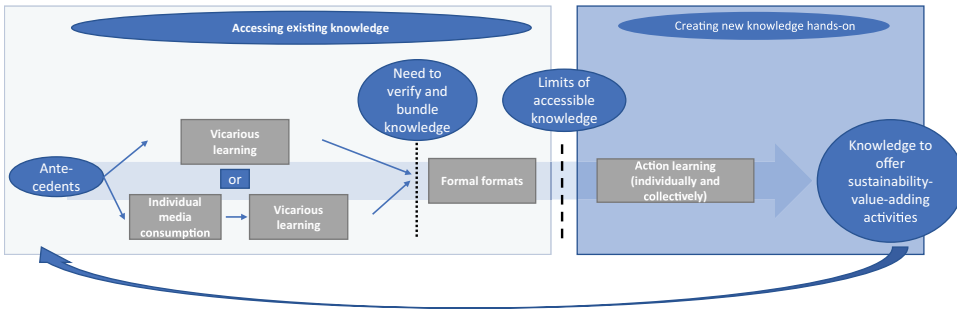


Figure 4. The hybrid and continuous learning trajectory of bas becoming green.

Continuously applying hybrid learning strategies

Contributing to the angel learning literature by bringing together empirical findings with the existing literature on learning, angel learning and sustainability competences results in a model depicting the hybrid, continuous trajectory through which BAs develop the knowledge necessary to offer sustainability value-adding activities (see Figure 4). The introduced model shows that knowledge about sustainability in entrepreneurship travels between actors not only through a learning curve, but also a loop which emphasizes the ongoing learning (Argote et al., 1990; Pisano, 1994), which is especially important in the emergent, dynamic, and complex green context.

The existing literature discusses angel learning in an isolated way, focusing on individual strategies rather than their interaction (Botelho et al., 2021; Harrison et al., 2015). The fast-paced environment and dynamics of the green markets require investors to be adaptable in their learning strategies, rendering it impossible to establish a routine or patterns, underlining Argote et al.'s (1990) insights on the dynamics of learning. The findings presented in this study show that when BAs' previous knowledge, skills, and experience are not sufficient to contribute with relevant social and/or human capital. Instead, they combine traditional learning strategies into hybrid strategies. Depending on the knowledge availability and the BAs' experience, the strategies applied by an individual can change over time. When a new knowledge gap emerges, BAs go through another cycle of learning.

The findings further underline the continuous, dynamic elements postulated by Argote et al. (1990) and Pisano (1994) also during the journey of BAs becoming green. This also applies for BAs with previous investor experience in other industries. It is not a linear process that ends when the BA develops knowledge necessary to offer sustainability value-adding activities but has an ongoing trajectory. Unlike assumed by previous research, this learning continues after the initial investments. The phases of corporate career, entrepreneurial learning, and integrated investor career described by Politis and Landström (2002) become more fluid. Instead of a linear process of developing managerial competence first, then entrepreneurial competence, and then bringing both together, the development of

knowledge to offer sustainability value-adding activities incorporates learning loops where there is a constant need to learn, including unlearning old patterns.

Conclusion

The strategy in this study has been to use green start-up investments as a vehicle to explore the broader phenomenon of angel learning, investigating how BAs develop the knowledge necessary to offer sustainability value-adding activities. By building on angel learning and sustainability competence literature, it was explored how BAs become green angels. The introduced model shows that knowledge about sustainability in entrepreneurship travels through hybrid strategies, which can be continuous throughout the green angel career due to the complexity of the context.

This study's findings go beyond what the existing literature considered to encompass BA journeys and post-investment involvement, connecting the literature streams on angel learning, learning, and sustainability competences. The literature on BA learning focusses on experiential informal and individual learning (Botelho et al., 2021; Harrison et al., 2015; Politis & Landström, 2002; Smith et al., 2010), omitting vicarious, collective, and formal strategies. The introduced model illuminates that they are central when BAs develop knowledge to offer sustainability-value-adding activities. Previous studies have researched angel learning strategies in an isolated way. The findings provide empirical support for the interconnectedness of the different strategies. BAs realize that their previous knowledge, skills, and experience are not sufficient to contribute to their green start-ups, so they combine learning strategies into hybrid approaches. Furthermore, the continuity aspect of angel learning has been neglected by previous studies. The findings introduce more nuanced perspectives on how investor experience is shaped and developed.

Moreover, this article contributes to the emerging literature on the specificity of green angels (Botelho, Mason, et al., 2023; Siefkes et al., 2023). Understanding how green angels learn to become green is central to placing green angels more prominently in the green venture ecosystem where they contribute to economic, environmental, and social aspects (Avdeitchikova & Landström, 2022). This study conceptualizes BAs' sustainability value-adding activities further, giving insights into the entrepreneurial knowledge (Politis & Gabrielsson, 2015) and mindset (Penrose, 1959) required in a sustainability-specific context. On a methodological level, the calls for more case studies on BA value-adding activities through a contextual lens are addressed (Politis, 2016).

This study has practical implications. It reveals strategies for BAs investing in green start-ups to overcome information asymmetries and uncertainties that usually hinder BAs investing in immature markets, challenging the prevalent mismatch between the requirements of a green

entrepreneur and the skill set of the typical investor who lacks an understanding of sustainability-specific aspects (Bergset, 2018; Harrer & Owen, 2022). By applying the hybrid learning strategies presented, BAs can get closer to their goal of becoming change agents for sustainability through their investments and ongoing involvement (Bergset, 2015; de Lange, 2019; Ploum et al., 2018). More policy incentives and governmental support offers are needed to encourage green angel investments and learning (Botelho, Mason, et al., 2023). The study highlights a pronounced need for angels' support organizations to provide angels with more formal training formats in green angel investing.

Furthermore, the phenomenon of BAs learning to navigate these contexts, that is, develop knowledge to offer smart, relevant capital is applicable beyond the context of green ventures. Other buzzword-heavy fields like AI or deep-tech start-ups can profit from investors specialized in the sector or technology field they invest in (Berger & Udell, 1998). Here, too, information asymmetries exist, leading to higher risks for the investor and a complex investor-investee relationship (Carpenter & Petersen, 2002). The insights presented in this study might also be transferrable to other contexts with knowledge-intensive emergent markets.

This study opens several future research avenues. Longitudinal studies are needed to further investigate the role of experiential learning, for example, including real-life approaches to challenges. Also, the cocreation aspect opens up potential for future research: How does BA collaboration, for example, through syndication, affect BA learning? In addition, the mutual learning between BAs and their founders needs to be explored further. Further research is needed on how the green start-up ecosystem can meet the illuminated need for more formalized green angel learning formats, for example, through specialized seminars offered by BA networks. Also, the ethical aspect of becoming a green angel is relevant for future research. The transferability of the insights presented in this study to other contexts with knowledge-intensive emerging markets is another promising avenue for future research.

Acknowledgments

The work presented in this paper is a result of research supported by NTRANS Norwegian Centre for Energy Transition Strategies. The project has received funding from the Research Council of Norway (grant number 296205). I am particularly grateful the participating business angels who agreed to participate in this research project. Furthermore, I thank Diamanto Politis for the valuable feedback provided along the way.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author acknowledges funding from FME NTRANS, grant number 296205, supported by the Research Council of Norway.

ORCID

Meike Siefkes  <http://orcid.org/0000-0003-1428-4692>

References

- Argote, L., Beckman, S. L., & Epple, D. (1990). The persistence and transfer of learning in industrial settings. *Management Science*, 36(2), 140–154. <https://doi.org/10.1287/mnsc.36.2.140>
- Arrow, K. J. (1962). The economic learning implications of by doing. *The Review of Economic Studies*, 29(3), 155–173. <https://doi.org/10.2307/2295952>
- Audretsch, D., Fiedler, A., Belitski, M., & Meurer, M. (2023). Values and entrepreneurship in the sustainable society. *Small Business Economics*. <https://link.springer.com/journal/11187/updates/25186956>
- Avdeitchikova, S., & Landström, H. (2022). The role of business angels in the new financial landscape. In D. Lingelbach (Ed.), *De Gruyter handbook of entrepreneurial finance* (pp. 223–244). De Gruyter.
- Avdeitchikova, S., Landström, H., & Månsson, N. (2008). What do we mean when we talk about business angels? Some reflections on definitions and sampling. *Venture Capital*, 10(4), 371–394. <https://doi.org/10.1080/13691060802351214>
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. <https://doi.org/10.1177/014920639101700108>
- Barney, J. B. (1986). Strategic factor markets: Expectations, luck, and Business strategy. *Management Science*, 32(10), 1231–1241. <https://doi.org/10.1287/mnsc.32.10.1231>
- Barney, J. B., Busenitz, L. W., Fiet, J. O., & Moesel, D. D. (1996). New venture teams' assessment of learning assistance from venture capital firms. *Journal of Business Venturing*, 11(4), 257–272. [https://doi.org/10.1016/0883-9026\(95\)00011-9](https://doi.org/10.1016/0883-9026(95)00011-9)
- Berger, A., & Udell, G. (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking & Finance*, 22(6), 613–673. [https://doi.org/10.1016/S0378-4266\(98\)00038-7](https://doi.org/10.1016/S0378-4266(98)00038-7)
- Bergset, L. (2015). The rationality and irrationality of financing green start-ups. *Administrative Sciences*, 5(4), Article 4. <https://doi.org/10.3390/admsci5040260>
- Bergset, L. (2018). Green start-up finance—where do particular challenges lie? *International Journal of Entrepreneurial Behavior & Research*, 24(2), 451–575. <https://doi.org/10.1108/IJEBR-11-2015-0260>
- Björgum, Ø., & Sørheim, R. (2015). The funding of new technology firms in a pre-commercial industry – The role of smart capital. *Technology Analysis & Strategic Management*, 27(3), 249–266. <https://doi.org/10.1080/09537325.2014.971002>
- Bonnet, C., & Wirtz, P. (2012). Raising capital for rapid growth in young technology ventures: When business angels and venture capitalists coinvest. *Venture Capital*, 14(2–3), 91–110. <https://doi.org/10.1080/13691066.2012.654603>
- Botelho, T., Harrison, R., & Mason, C. (2021). Business angel investment as an informal learning process: Does experience matter? *British Journal of Management*, 34(1), 321–342. <https://doi.org/10.1111/1467-8551.12583>

- Botelho, T., Harrison, R., & Mason, C. (2023). Business angel investment as an informal learning process: Does experience matter? *British Journal of Management*, 34(1), 321–342. <https://doi.org/10.1111/1467-8551.12583>
- Botelho, T., Mason, C., & Chalvatzis, K. (2023). 50 shades of green—angel investing in green businesses. *IEEE Transactions on Engineering Management*, 70(3), 950–962. <https://doi.org/10.1109/TEM.2022.3167282>
- Carpenter, R. E., & Petersen, B. C. (2002). Capital market imperfections, high-tech investment, and new equity financing. *The Economic Journal*, 112(477), F54–F72. <https://doi.org/10.1111/1468-0297.00683>
- Cohen, B., & Winn, M. I. (2007). Market imperfections, opportunity and sustainable entrepreneurship. *Journal of Business Venturing*, 22(1), 29–49. <https://doi.org/10.1016/j.jbusvent.2004.12.001>
- Cohen, L., & Wirtz, P. (2022). Decision-making style in entrepreneurial finance and growth. *Small Business Economics*, 59(1), 183–210. <https://doi.org/10.1007/s11187-021-00528-y>
- Collewaert, V., & Manigart, S. (2016). Valuation of angel-backed companies: The role of investor human capital. *Journal of Small Business Management*, 54(1), 356–372. <https://doi.org/10.1111/jsbm.12150>
- Cope, J. (2003). Entrepreneurial learning and critical reflection: Discontinuous events as triggers for ‘higher-level’ learning. *Management Learning*, 34(4), 429–450. <https://doi.org/10.1177/1350507603039067>
- Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage Publications.
- Croce, A., Guerini, M., & Ughetto, E. (2018). Angel financing and the performance of high-tech start-ups. *Journal of Small Business Management*, 56(2), 208–228. <https://doi.org/10.1111/jsbm.12250>
- Croce, A., Ughetto, E., Bonini, S., & Capizzi, V. (2021). Gazelles, ponies, and the impact of business angels’ characteristics on firm growth. *Journal of Small Business Management*, 59(2), 223–248. <https://doi.org/10.1080/00472778.2020.1844489>
- Croce, A., Ughetto, E., Scellato, G., & Fontana, F. (2021). Social impact venture capital investing: An explorative study. *Venture Capital*, 23(4), 345–369. <https://doi.org/10.1080/13691066.2021.1982069>
- De Clercq, D., & Fried, V. H. (2005). Executive forum: How entrepreneurial company performance can be improved through venture capitalists’ communication and commitment. *Venture Capital*, 7(3), 285–294. <https://doi.org/10.1080/13691060500258943>
- De Clercq, D., & Sapienza, H. J. (2005). When do venture capital firms learn from their portfolio companies? *Entrepreneurship Theory and Practice*, 29(4), 517–535. <https://doi.org/10.1111/j.1540-6520.2005.00096.x>
- de Lange, D., & Valliere, D. (2020). Sustainable firms and legitimacy: Corporate venture capital as an effective endorsement. *Journal of Small Business Management*, 58(6), 1187–1220. <https://doi.org/10.1080/00472778.2019.1681880>
- de Lange, D. E. (2017). Start-up sustainability: An insurmountable cost or a life-giving investment? *Journal of Cleaner Production*, 156, 838–854. <https://doi.org/10.1016/j.jclepro.2017.04.108>
- de Lange, D. E. (2019). A paradox of embedded agency: Sustainable investors boundary bridging to emerging fields. *Journal of Cleaner Production*, 226, 50–63. <https://doi.org/10.1016/j.jclepro.2019.04.007>
- Dean, T. J., & McMullen, J. S. (2007). Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. *Journal of Business Venturing*, 22(1), 50–76. <https://doi.org/10.1016/j.jbusvent.2005.09.003>

- Dubois, A., & Gadde, L.-E. (2002). Systematic combining: An abductive approach to case research. *Journal of Business Research*, 55(7), 553–560. [https://doi.org/10.1016/S0148-2963\(00\)00195-8](https://doi.org/10.1016/S0148-2963(00)00195-8)
- Dutta, D. K., & Crossan, M. M. (2005). The nature of entrepreneurial opportunities: Understanding the process using the 4I organizational learning framework. *Entrepreneurship Theory and Practice*, 29(4), 425–449. <https://doi.org/10.1111/j.1540-6520.2005.00092.x>
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1), 25–32. <https://doi.org/10.5465/amj.2007.24160888>
- Fili, A., & Grünberg, J. (2016). Business angel post-investment activities: A multi-level review. *Journal of Management & Governance*, 20(1), 89–114. <https://doi.org/10.1007/s10997-014-9296-7>
- Fisher, R. P., & Geiselman, R. E. (1992). *Memory enhancing techniques for investigative interviewing: The cognitive interview*. Charles C Thomas Publisher.
- Forbes, D. P. (1999). Cognitive approaches to new venture creation. *International Journal of Management Reviews*, 1(4), 415–439. <https://doi.org/10.1111/1468-2370.00021>
- Fransman, M. (1994). Information, knowledge vision and theories of the firm*. *Industrial and Corporate Change*, 3(3), 713–757. <https://doi.org/10.1093/icc/3.3.713>
- Gaddy, B. E., Sivaram, V., Jones, T. B., & Wayman, L. (2017). Venture capital and cleantech: The wrong model for energy innovation. *Energy Policy*, 102, 385–395. <https://doi.org/10.1016/j.enpol.2016.12.035>
- Ghosh, S., & Nanda, R. (2010). Venture capital Investment in the clean energy sector. *SSRN Scholarly Paper ID 1669445*. Social Science Research Network. <https://doi.org/10.2139/ssrn.1669445>
- Gibb, A. A. (1997). Small firms' training and competitiveness. Building upon the small business as a learning organisation. *International Small Business Journal*, 15(3), 13–29. <https://doi.org/10.1177/0266242697153001>
- Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the gioia methodology. *Organizational Research Methods*, 16(1), 15–31. <https://doi.org/10.1177/1094428112452151>
- Glaser, M., & Weber, M. (2007). Why inexperienced investors do not learn: They do not know their past portfolio performance. *Finance Research Letters*, 4(4), 203–216. <https://doi.org/10.1016/j.frl.2007.10.001>
- Hall, B. H., & Lerner, J. (2010). Chapter 14—The financing of R&D and innovation. In B. H. Hall & N. Rosenberg (Eds.), *Handbook of the economics of innovation* (Vol. 1, pp. 609–639). [https://doi.org/10.1016/S0169-7218\(10\)01014-2](https://doi.org/10.1016/S0169-7218(10)01014-2)
- Harrer, T., & Owen, R. (2022). Reducing early-stage cleantech funding gaps: An exploration of the role of environmental performance indicators. *International Journal of Entrepreneurial Behavior & Research*, 28(9), 268–288. <https://doi.org/10.1108/IJEBR-10-2021-0849>
- Harrison, R. T., Mason, C., & Smith, D. (2015). Heuristics, learning and the business angel investment decision-making process. *Entrepreneurship & Regional Development*, 27(9–10), 527–554. <https://doi.org/10.1080/08985626.2015.1066875>
- Hoyos-Iruarrizaga, J., Fernández-Sainz, A., & Saiz-Santos, M. (2017). High value-added business angels at post-investment stages: Key predictors. *International Small Business Journal: Researching Entrepreneurship*, 35(8), 949–968. <https://doi.org/10.1177/0266242616686401>

- Kayes, D. C. (2002). Experiential learning and its critics: Preserving the role of experience in management learning and education. *Academy of Management Learning & Education*, 1(2), 137–149.
- Kelly, P. (2007). Business angel research: The road traveled and the journey ahead. In H. Landström (Ed.), *Handbook of research on venture capital* (1st ed., pp. 315).
- Kolb, D. A. (1984). *The experiential learning theory of development*. Prentice Hall Englewood Cliffs.
- Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (2001). Experiential learning theory: Previous research and new directions. *Perspectives on Cognitive, Learning, and Thinking Styles*, 1, 227–247.
- Kuckertz, A., Berger, E. S. C., & Gaudig, A. (2019). Responding to the greatest challenges? Value creation in ecological startups. *Journal of Cleaner Production*, 230, 1138–1147. <https://doi.org/10.1016/j.jclepro.2019.05.149>
- Laasch, O., Moosmayer, D. C., & Antonacopoulou, E. P. (2022). The interdisciplinary responsible management competence framework: An integrative review of ethics, responsibility, and sustainability competences. *Journal of Business Ethics*, 187(4), 733–757. <https://doi.org/10.1007/s10551-022-05261-4>
- Landström, H., & Mason, C. (2016). Business angels as a research field. In C. Mason & H. Landström (Eds.), *Handbook of research on business angels*. Edward Elgar Publishing.
- Lévesque, M., Minniti, M., & Shepherd, D. (2009). Entrepreneurs' decisions on timing of entry: Learning from participation and from the experiences of others. *Entrepreneurship Theory and Practice*, 33(2), 547–570. <https://doi.org/10.1111/j.1540-6520.2009.00303.x>
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71–87. <https://doi.org/10.1287/orsc.2.1.71>
- Mason, C., & Botelho, T. (2018). Early sources of funding (2): Business angels. In L. Alemany & J. J. Andreoli (Eds.), *Entrepreneurial finance: The art and science of growing ventures* (pp. 60–96). Cambridge University Press.
- Mason, C., Botelho, T., & Harrison, R. (2016). The transformation of the business angel market: Empirical evidence and research implications. *Venture Capital*, 18(4), 321–344. <https://doi.org/10.1080/13691066.2016.1229470>
- Mason, C., Botelho, T., & Harrison, R. (2019). The changing nature of angel investing: Some research implications. *Venture Capital*, 21(2–3), 177–194. <https://doi.org/10.1080/13691066.2019.1612921>
- Mason, C. M. (2006). Informal sources of venture finance. In S. Parker (Ed.), *The life cycle of entrepreneurial ventures* (pp. 259–299). Springer US. https://doi.org/10.1007/978-0-387-32313-8_10
- Minniti, M., & Bygrave, W. (2001). A dynamic model of entrepreneurial learning. *Entrepreneurship Theory and Practice*, 25(3), 5–16. <https://doi.org/10.1177/104225870102500301>
- Nonaka, I., Toyama, R., & Byosièrè, P. (2001). A theory of organizational knowledge creation: Understanding the dynamic process of creating knowledge. In M. Dierkes, A. Berthoin-Antal, J. Child, & I. Nonaka (Eds.), *Handbook of organizational learning and knowledge* (pp. 491–517). Oxford University Press.
- O'Neil, I., & Ucbasaran, D. (2016). Balancing “what matters to me” with “what matters to them”: Exploring the legitimation process of environmental entrepreneurs. *Journal of Business Venturing*, 31(2), 133–152. <https://doi.org/10.1016/j.jbusvent.2015.12.001>
- Owen, R., & Mason, C. (2017). The role of government co-investment funds in the supply of entrepreneurial finance: An assessment of the early operation of the UK angel co-investment fund. *Environment & Planning C Politics & Space*, 35(3), 434–456. <https://doi.org/10.1177/0263774X16667072>

- Patton, M. Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative Social Work*, 1(3), 261–283. <https://doi.org/10.1177/1473325002001003636>
- Patzelt, H., & Shepherd, D. A. (2011). Recognizing opportunities for sustainable development. *Entrepreneurship Theory and Practice*, 35(4), 631–652. <https://doi.org/10.1111/j.1540-6520.2010.00386.x>
- Penrose, E. T. (1959). *The theory of the growth of the firm*. Oxford university press.
- Pisano, G. P. (1994). Knowledge, integration, and the locus of learning: An empirical analysis of process development. *Strategic Management Journal*, 15(S1), 85–100. <https://doi.org/10.1002/smj.4250150907>
- Ploum, L., Blok, V., Lans, T., & Omta, O. (2018). Toward a validated competence framework for sustainable entrepreneurship. *Organization & Environment*, 31(2), 113–132. <https://doi.org/10.1177/1086026617697039>
- Politis, D. (2008). Business angels and value added: What do we know and where do we go? *Venture Capital*, 10(2), 127–147. <https://doi.org/10.1080/13691060801946147>
- Politis, D. (2016). Business angels as smart investors: A systematic review of the evidence. *Handbook of research on business angels*. <https://www.elgaronline.com/view/edcoll/9781783471713/9781783471713.00013.xml>
- Politis, D., & Gabriëlsson, J. (2015). Modes of learning and entrepreneurial knowledge. *International Journal of Innovation and Learning*, 18(1), 101. <https://doi.org/10.1504/IJIL.2015.070241>
- Politis, D., & Landström, H. (2002). Informal investors as entrepreneurs—The development of an entrepreneurial career. *Venture Capital*, 4(2), 78–101. <https://doi.org/10.1080/13691060210816>
- Qin, F., Mickiewicz, T., & Estrin, S. (2021). Homophily and peer influence in early-stage new venture informal investment. *Small Business Economics*, 59(1), 93–116. <https://doi.org/10.1007/s11187-021-00523-3>
- Randjelovic, J., O'Rourke, A. R., & Orsato, R. J. (2003). The emergence of green venture capital. *Business Strategy and the Environment*, 12(4), 240–253. <https://doi.org/10.1002/bse.361>
- Sætre, A. (2003). Entrepreneurial perspectives on informal venture capital. *Venture Capital*, 5(1), 71–94. <https://doi.org/10.1080/1369106032000062731>
- Sætre, A. S., & Van de Ven, A. (2021). Generating theory by abduction. *Academy of Management Review*, 46(4), 684–701. <https://doi.org/10.5465/amr.2019.0233>
- Saldaña, J. (2021). *The coding manual for qualitative researchers* (4th ed.). Sage Publications Ltd.
- San José, A., Roure, J., & Aernoudt, R. (2005). Business angel academies: Unleashing the potential for business angel investment. *Venture Capital*, 7(2), 149–165. <https://doi.org/10.1080/13691060500063392>
- Siefkes, M., Bjørgum, Ø., & Sørheim, R. (2023). Business angels investing in green ventures: How do they add value to their start-ups? *Venture Capital*, 1–30. <https://doi.org/10.1080/13691066.2023.2260101>
- Smith, D. J., Harrison, R. T., & Mason, C. M. (2010). Experience, heuristics and learning: The angel investment process.
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research techniques*. Citeseer.
- Toutain, O., Fayolle, A., Pittaway, L., & Politis, D. (2017). Role and impact of the environment on entrepreneurial learning. *Entrepreneurship & Regional Development*, 29(9–10), 869–888. <https://doi.org/10.1080/08985626.2017.1376517>
- Wals, A. E. (2015). *Beyond unreasonable doubt. Education and learning for socio-ecological sustainability in the anthropocene*. Wageningen University.

- Wang, C. L., & Chugh, H. (2014). Entrepreneurial learning: Past research and future challenges. *International Journal of Management Reviews*, 16(1), 24–61. <https://doi.org/10.1111/ijmr.12007>
- Wirtz, P. (2011). Beyond agency theory: Value creation and the role of cognition in the relationship between entrepreneurs and venture capitalists. In R. Yazdipour (Ed.), *Advances in entrepreneurial finance: With applications from behavioral finance and economics* (pp. 31–43). Springer. https://doi.org/10.1007/978-1-4419-7527-0_3
- Yin, R. K. (2003). *Design and methods* (5th ed.). SAGE.
- Yin, R. K. (2009). How to do better case studies. *The SAGE Handbook of Applied Social Research Methods*, 2, 254–282.