SYSTEMIZING ENTREPRENEURIAL METACOGNITION: THINKING ABOUT THE PAST AND FUTURE

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This accepted paper is the authors' version.

Please cite as: Bastian, B., Hjelle, M., & Shepherd, D. (2025). Systemizing Entrepreneurial Metacognition: Thinking About the Past and Future. *Entrepreneurship Theory and Practice*, *50*(1), 231-274.

Abstract
This review of the entrepreneurial metacognition literature systematizes the existing literature. Metacognition is vital for entrepreneurs to sense, act, and mobilize cognitive resources under uncertainty. Despite the rapidly growing stream of metacognitive research in entrepreneurship, indicating that the topic is promising and emerging, these bits of knowledge still need to be brought together to provide a big picture of where we have been to explore where we can go. Our review addresses this need by analyzing the literature on entrepreneurial metacognition. We define entrepreneurial metacognition as the mental activities of generating self-awareness and monitoring and controlling one's cognition about identifying potential opportunities, creating a new venture, and/or managing a new venture. The inductive results reveal five attributes that reflect the essence of entrepreneurial metacognition: (1) adaptive cognition, (2) metaheuristics, (3) self-regulated cognition, (4) cultural adaptation, and (5) metacompetencies. We address definitional issues and empirical patterns, synthesize the attributes of entrepreneurial metacognition and present a model that links entrepreneurial metacognition's antecedents and outcomes to advance future research.

Keywords
Metacognition; decision-making; entrepreneurship; review; self-regulation; thinking

INTRODUCTION

Cognition describes the mental processes involved in acquiring knowledge and awareness (Thagard, 2005) and is crucial for explaining how and why entrepreneurs take action (e.g., Daspit et al., 2021; Mitchell et al., 2002; Zhang & Cueto, 2017) in the face of uncertainty, ambiguity, time pressure, and emotional stress (Armstrong et al., 2012; Dew et al., 2015; Forbes, 1999). Reviewing, evaluating, and grounding entrepreneurial cognition are critical for the entrepreneurship field as doing so helps us understand why individuals become entrepreneurs (Mitchell et al., 2007) and how they perceive risk and build resilience (Ahmed et al., 2022; Fang et al., 2018), identify potential opportunities (Grégoire et al., 2010; Shepherd et al., 2017), and frame the meaning of their market solutions (Snihur et al., 2022). Thus, research on cognition has contributed a great deal to our knowledge of entrepreneurship (for reviews, see Grégoire et al., 2011; 2015; Shepherd et al., 2015; Zhang & Cueto, 2017).

Research on entrepreneurial cognition has increasingly acknowledged the importance of an entrepreneur's metacognition (e.g., Kuratko et al., 2021; Michaelis et al., 2021). Metacognition is thinking about how one thinks (Flavell, 1979). Therefore, we define *entrepreneurial metacognition* as the mental activities of generating self-awareness and monitoring and controlling one's cognition about identifying potential opportunities, creating a new venture, and/or managing a new venture. For example, an entrepreneur engages their metacognition when they deliberately seek information that disconfirms their opportunity conjecture, disengage their ego to process negative feedback about a prototype from potential customers, and use new information to generate a range of corrective courses of action from which they choose the "best" option.

Insights into metacognition can help us understand why some entrepreneurs credit "thinking differently" to their success (e.g., Mitchell et al., 2007). Metacognition involves self-awareness (Hägg, 2021) and "multiple, alternative decision frameworks focused on

interpreting, planning, and implementing goals," which enable entrepreneurs to understand what changes they need to make (if any) and how to enact those needed changes (Haynie & Shepherd, 2009, p. 697; Krueger, 2007). Therefore, metacognition enables entrepreneurs to sense, act, and mobilize resources under uncertainty (Haynie et al., 2010) for better task performance (Baron & Henry, 2010), for example, by stimulating opportunity recognition (Lorenz et al., 2017), cultural learning (Mosakowski et al., 2013; Yu and Mills, 2021), and resource acquisition (Baron & Henry, 2010).

Although most entrepreneurial studies have emphasized cognitive adaptability as the essence of metacognition (e.g., Haynie & Shepherd, 2009) and the entrepreneurial mindset needed to be metacognitive (Haynie et al., 2012), studies have used various terms to refer to the same concept, reflecting a lack of definitional consensus and thus differences in its operationalization. We propose that this variation in the conceptualization of metacognition in the entrepreneurship literature risks fragmenting this emerging stream of research and thereby hindering theory-building efforts (Bacharach, 1989; Suddaby, 2010). Thus, we need to review the entrepreneurship literature on metacognition to offer insights that can change our perspectives in this critical research area (for the benefits of reviews, see Alvesson & Sandberg, 2020; Rauch, 2020; Tranfield et al., 2003). We need to be metacognitive about our metacognitive research.

In this review, we adopt an active, critical reflective stance to organize the literature, from which we develop a framework on entrepreneurial metacognition and offer future research suggestions (consistent with Fitz-Koch et al., 2018; Stephan, 2018). Our literature review reveals that more than 35% of the articles in the final sample related to entrepreneurial metacognition were published from 2020 onward, indicating that the area is promising and emerging. However, to date, no efforts have been made to organize, question, and reconcile this broad but fragmented body of literature. Given the recent rapid growth of entrepreneurial

metacognition research, we argue that now is an ideal moment to pause, reflect, take stock, and think about productive future research directions. Therefore, this article aims to answer the following questions: how is entrepreneurial metacognition conceptualized; what are the drivers and outcomes of entrepreneurial metacognition; and what challenges need to be addressed to theoretically, empirically, and practically move this research stream forward? This paper offers a comprehensive review of 64 studies to provide some answers to the above questions.

Our review proceeds as follows. First, we identify and organize the literature on entrepreneurial metacognition. Second, we analyze the research on entrepreneurial metacognition to highlight the attributes considered at its essence. Third, we propose a model that clarifies the critical relationships of entrepreneurial metacognition, including their primary antecedents and outcomes. Finally, we map out a future research agenda for advancing our knowledge of this critical topic.

METACOGNITION AS A PSYCHOLOGICAL CONSTRUCT

Metacognition differs from cognition as it is a higher-order construct for understanding how to approach tasks, whereas cognition is a lower-order construct for fulfilling or performing tasks (Akturk & Sahin, 2011; Flavell, 1979). Research on metacognition initially developed in the educational psychology literature (e.g., to explain reading comprehension development) advanced toward explaining how individuals can use metacognition to improve their teaching performance (Panadero, 2017) and students' learning (Veenman, 2011). From these educational beginnings, metacognition now has a lengthy, rich history in developmental, personal, social, cognitive, and clinical psychology (Norman et al., 2019). These rich research streams indicate that metacognition is essential for explaining how individuals engage in cognitive activities, such as thinking, articulating, debating, and problem-solving.

While metacognition is generally considered to involve thinking about one's thinking, it has two distinct but intertwined functions (Efklides, 2008; Flavell, 1979): it involves (1) monitoring cognitive activities, such as estimating confidence in one's ability to succeed at a task (Dunlosky & Metcalfe, 2008; Flavell, 1978), and (2) controlling cognitive activities, such as adopting a new approach when encountering difficulties in solving a problem (Dunlosky & Metcalfe, 2009). However, researchers have still not settled on a standard definition (Hurst, 2019). Nevertheless, we are progressing in understanding the essence of metacognition in the entrepreneurial context.

In an introduction of metacognition to the entrepreneurship domain, Baron (2007) defined metacognition as an increased awareness of one's cognitive strengths and limitations (based on Kanfer, 1990; Zimmerman, 1990), including self-regulation to monitor, regulate, and enhance performance.[1] Next, Haynie and Shepherd (2009, p. 696) defined metacognition as a process that incorporates self-regulation to inform "the development and generation of new sensemaking structures (heuristics) as a function of a changing environment" (based on Flavell, 1987; Nelson, 1996). Indeed, Haynie and Shepherd (2009) highlighted the importance of metacognition for entrepreneurs to make sense of their environments and adapt to uncertain situations. Haynie and colleagues (2010) extended this work by explaining how metacognition facilitates discovering and exploiting opportunities. They theorized that an entrepreneur's metacognition is stimulated by the interaction of their environment (outside the entrepreneur's mind) and motivation (i.e., primarily the entrepreneur's goals for their venture). From this perspective, environmental clues shape an entrepreneur's motivation, and the entrepreneur's motivation shapes how they perceive their environment (Griffin & Ross, 1991; Wyer & Srull, 1989) as they navigate the entrepreneurial journey as a motivated tactician.

[1] Baron and Henry (2010: 52) defined metacognition as "individuals' knowledge and understanding of their cognition and performance."

However, despite solid foundations for conceptualizing metacognition, definitions are often vague, arbitrary, and multifaced (Brown, 1987; Mitchell et al., 2011; Reder, 1996; Weinert, 1987). For example, although Flavell (1979) defined metacognition as knowledge and cognition about cognitive phenomena, metacognition has also been used to describe how ineffective strategies can be abandoned and how reframing thoughts can lead to a cognitive restructuring process. It has also been defined as rules about approaches to actions and as a strategic mindset (e.g., Ball & Christensen, 2019; Gilbert-Saad et al., 2023; Kaffka et al., 2021; Michaelis et al., 2021). Based on the above, we offer the following definition, which we used as the basis to construct boundaries for our search of papers that can reasonably be considered on or about entrepreneurial metacognition[2]:

> **Entrepreneurial metacognition** *refers to the mental activities of generating self-awareness and monitoring and controlling one's cognition about identifying potential opportunities, creating a new venture, and/or managing a new venture.*

Over and above the contributions to the entrepreneurship literature from taking stock and offering a big picture of where we have been to gain a deeper understanding of where we should go with future research, our review also contributes beyond entrepreneurship. Increasing our understanding of entrepreneurial metacognition has the potential for additional theory elaborations in psychology, education, and other neighboring fields.

METHOD

Guided by best practice (Transfield et al., 2003), we took a comprehensive review approach to organize studies on metacognition in entrepreneurship. We performed three steps for this process: data collection, data analysis, and reporting of the results (e.g., Crossan and Apaydin, 2010; Moe et al., 2015; Mol, Khapova, & Elfring, 2015). To gain a complete

[2] This definition encapsulates previous discussions of the concept. Discussions of self-regulation (Baron, 2007) are captured by the awareness, monitoring, and controlling stated in the above definition. Furthermore, discussions of making sense of one's environment to adapt (Haynie & Shepherd, 2009; Haynie et al., 2010) are encapsulated by the mental activities as well as the awareness of cognition related to entrepreneurial "change" activities (i.e., identifying potential opportunities as well as creating and managing new ventures).

overview of all articles published about metacognition in the entrepreneurship domain, we decided not to put any "earliest publication" limit on our review. Accordingly, we searched for articles published up to May 2024. Then, we established the conceptual boundaries for our search. Boundaries for a literature search are essential as they enable readers to precisely determine the scope of a review (Denyer & Tranfield, 2009).

Specifically, we wanted to establish conceptual boundaries for the term metacognition because this concept has been argued to be arbitrary and "not without controversy" (Mitchell et al., 2011, p. 685). First, metacognition is more of a higher-order construct than cognition (e.g., Akturk & Sahin, 2011; Flavell, 1979; Georghiades, 2004; Jacobs & Paris, 1987; Nelson, 1996; Schraw, 1994). Therefore, we included studies on higher-order processes within the boundaries of our review and excluded studies focusing exclusively on lower-order cognition constructs. Second, the entrepreneurial context can be extreme (and thus distinct from other contexts like employment) due to its high uncertainty, emotionality, consequentiality, stress, and time pressure (McMullen & Shepherd, 2006; Townsend et al., 2018). Therefore, we excluded studies on metacognition that were not situated in the entrepreneurial context (at least as specified by the aim or design of the study). Finally, metacognition is not restricted to the individual per se as it can emerge as a collective (Hogan, 2001), social (Goos et al., 2002), and shared process (Iiskala et al., 2011). Therefore, we did not exclude papers on entrepreneurial metacognition based on their level of analysis.

Consistent with the above boundaries for the review, we used the search terms metaco* AND entrepreneur* and additional synonyms for "entrepreneur" by including OR founder*, OR startup*, and OR venture* as well. We set the search criteria to peer-reviewed academic journals and book chapters on Scopus. Following best practices, we excluded studies not published in English (Zhang & Cueto, 2017) and those that were not peer reviewed (Antin-Yates et al., 2023). To include articles that did not emerge in this initial

search, we extended our search to the Web of Science (WoS) (e.g., Ahmed et al., 2022; see Figure 1 for details about the article flowchart). Furthermore, we limited our search to articles within the fields of business/management and economics. Still, we included psychology and decision sciences to ensure we found influential metacognition articles in multidisciplinary journals. After adjusting for the overlap between Scopus and WoS, our initial search yielded 2,666 articles.

---Insert Figure 1 about here---

Two authors independently read the abstracts of these articles. We used a coding system (Altman et al., 2022) whereby a paper was coded red if the judge determined the paper definitely did not fit within the boundaries of the review, green if the paper definitely fit within the boundaries of the review, and orange if the judge was unsure. Papers were coded red if they did not use the term metacognition in the main theoretical framework, as a measurement, and/or as a critical implication. For example, Ferreira and colleagues (2017), Ramsgaard and colleagues (2021), and Trevelyan (2011) introduced the application of metacognition but did not investigate metacognition in the theory, methodology, contributions, or implications.

The judges also coded papers red if they did not use an entrepreneurship-related term (e.g., entrepreneur, founder, new venture, and so on) in the main theoretical framework, as a measurement, and/or as a critical implication. For example, Zeni and colleagues (2016) and Kudesia (2019) wrote impactful papers but only tangentially referred to entrepreneurs' cognitive processes. The judges discussed papers with a single or double orange code and agreed to code each red or green (Blagoev et al., 2024). There were no absolute disagreements (i.e., a paper coded as red by one and green by another) and only a few (16%) minor differences (i.e., a paper was coded green or red by one coder and orange by the other).

To reduce the risk of excluding relevant articles (Type 1 error), we examined the selected articles' reference lists to identify additional work that might not have been identified in our search. This process helped us explore the "grey literature," which might be more challenging to find but allows for a more comprehensive review of a topic. Specifically, we found and added an early conference paper (Mitchell et al., 2005) to the final sample. Next, we showed our list of papers to three scholarly experts in the area, and they suggested three additional articles. We also conducted an independent Google Scholar search for unpublished works and conference papers, such as those in the *Academy of Management Proceedings*. This search produced three papers.

After all these steps, the final sample contains 64 publications on entrepreneurial metacognition. Figure 2 illustrates the final sample based on the number of articles published annually to highlight the emergence of entrepreneurial metacognition research. Notably, more than 70% of the articles were published from 2015 onward.

---Insert Figure 2 about here---

In the following analysis stage, we thoroughly and independently reread the selected papers. We inductively analyzed the conceptualizations of and empirical findings related to entrepreneurial metacognition to extract concepts and themes through the original researchers' interpretations—that is, using each paper's claims (for similar methods, see Altman et al., 2022; Antin-Yates et al., 2023; Bradley et al., 2024; Tabor et al., 2018).

We used a three-step coding process to identify the essential attributes of entrepreneurial metacognition (Gioia et al., 2013). First, we read each article independently and used open coding to identify codes from the theoretical foundations, independent and dependent variables, methods, research purposes, and findings. We then compared and contrasted primary codes to identify similarities, differences, and contradictions and put them into emergent second-order themes (Strauss & Corbin, 1994). As a result, a broad

representation of second-order themes emerged in a qualitative scheme (Antin-Yates et al., 2023; Wood & McKelvie, 2015). We found this manual process crucial to organizing the literature as the articles showed that metacognition constitutes a wide range of perspectives within entrepreneurship. Specifically, through this process, we identified 12 second-order themes: the entrepreneurial mindset, flexible cognition, recognition-primed decision-making, social metacognition, entrepreneurship education, cognitive monitoring, metacognitive heuristics, entrepreneurial expertise schemes, personality, international entrepreneurship, entrepreneurial intentions, and self-awareness.

Second, we individually analyzed the themes from the previous step and ultimately refined these into five aggregate categories representing the essential attributes of entrepreneurial metacognition as represented in the literature: entrepreneurs' adaptive cognition, metaheuristics, self-regulated cognition, cultural adaptation, and metacompetencies. Specifically, we combined the entrepreneurial mindset, flexible cognition, and self-awareness into *adaptive cognition*; recognition-primed decision-making, social metacognition, and metacognitive heuristics into *metaheuristics*; cognitive monitoring and entrepreneurial expertise schemes into *self-regulated cognition*; international entrepreneurship and entrepreneurial intentions into *cultural adaptation*; and entrepreneurship education and personality into *metacompetencies*.

Finally, as a last step to ensure the reliability of the process, we conducted an interrater reliability comparison of these five attributes (Gwet, 2010). Two judges from the author team compared their independent judgments on the five aggregate attributes and found an initial agreement of 86% (Buengeler et al., 2021). We then calculated Cohen's kappa for each attribute and followed Landis and Koch's (1977) classification of scores: 0.41–0.60 = moderate, 0.61–0.80 = substantial, and 0.81–1 = almost perfect. We found substantial agreement for adaptive cognition (k = .76), metaheuristics (k = .64), self-regulated cognition

(k = .75), and cultural adaptation (k = .75) and moderate but close to substantial agreement for metacompetencies (k = .60). The few differences between the researchers were resolved through discussions (Schwens et al., 2018).

---Insert Table 1 and Figure 3 about here---

RESULTS

Figure 3 illustrates the structure of our review of entrepreneurial metacognition. In the middle of the figure is entrepreneurial metacognition. On the left side of the figure are its antecedents, and on the right side are its outcomes. We start with entrepreneurial metacognition's antecedents; then highlight the various attributes of metacognition; and, finally, highlight its outcomes.

Antecedents of Entrepreneurial Metacognition

Our analysis reveals that the antecedents of entrepreneurial metacognition revolve around three main factors: (1) emotional and cognitive drivers, (2) personality traits, and (3) external triggers.

The **emotional drivers** of entrepreneurial metacognition *arise from an entrepreneur experiencing affect that stimulates their metacognition*. For example, when an entrepreneur experiences negative affect from facing obstacles when performing an entrepreneurial task, it can stimulate their metacognition to facilitate their decision-making process (Bastian & Zucchella, 2022) as well as emotional experiences to notice and interpret sensory experiences (Chen & Xu, 2022). Indeed, Shepherd and colleagues (2023) proposed that linguistic and social experiences accompany sensory experiences and stimulate metacognition for thinking abstractly about business models. The **cognitive drivers** of entrepreneurial metacognition *arise from an entrepreneur noticing or interpreting information that stimulates their metacognition*. These cognitive drivers can engage alternative thinking pathways to face uncertainty and assess one's thinking style (Dimov & Pistrui, 2023). For example, receiving

unsettling feedback or an unanticipated rejection activates individuals' metacognitive thinking to break down and reframe their existing assumptions (Kaffka et al., 2021). Similarly, engaging in specific practices (e.g., meditation, self-reflection, or writing memories [Engel et al., 2021; Yu & Mills, 2021]) leads to a metacognitive process that enables individuals to evaluate their ideas more objectively (Jankowski & Holas, 2014; Kelly & Dorian, 2017). Furthermore, identifying with multiple cultures increases individuals' awareness of their cognitions and behaviors in different cultural contexts (Dheer and Lenartowicz, 2016).

An entrepreneur's personality traits can impact their entrepreneurial metacognition. **Personality traits** *represents entrepreneurs' abilities, motives, and attitudes to exhibit a metacognitive response* (Caprana & Cervone, 2000) (Brandstätter, 2011; Kerr et al., 2018; Rauch & Frese, 2007). For example, individuals high in extroversion are less able to self-regulate their emotions and thus tend to be less cognitively adaptive (Bajwa et al., 2017; Graziano et al., 1985). Further, Moore et al. (2021) suggested that attention-deficit/hyperactivity disorder (ADHD) helps entrepreneurs increase their knowledge monitoring. This relationship is mediated by entrepreneurs' tendency to acquire, develop, and protect their resources (Lanivich et al., 2024).

The **external triggers** *represent environmental changes that can stimulate entrepreneurial metacognition*. Indeed, a novel situational context prompts entrepreneurs to reflect upon and reconsider their cognitive strategies (Haynie et al., 2010). Learning contexts can also promote entrepreneurial metacognition. For example, entrepreneurship and cross-cultural training courses can increase an individual's cognitive awareness (Kurczewska et al., 2018; Ling & Venesaar, 2015; Venesaar et al., 2011). Indeed, in entrepreneurial cross-cultural settings (e.g., venture creation programs and bootcamps), expressing a need for help triggers metacognitive deliberation regarding the specific nature of assistance required and the appropriate manner to seek it (Hjelle & Bastian, 2024; Mosakowski et al., 2013). Contextual

factors include collectively developed positive experiences from household members entrepreneurs trust and believe (Cogan & Pret, 2023).

Attributes of Entrepreneurial Metacognition

Table 1 details the five inductively generated essential attributes of entrepreneurial metacognition (explored in the entrepreneurship literature): (1) adaptive cognition, (2) metaheuristics, (3) self-regulated cognition, (4) cultural adaptation, and (5) metacompetencies. We describe these attributes of entrepreneurial metacognition before highlighting their outcomes.

An entrepreneur's **adaptive cognition** *is their capability to change their cognitive approach to achieve desirable outcomes in a dynamic business environment*. An example of adaptive cognition is when an entrepreneur notices changes in their external environment, reflects on their current strategic approach, considers others' approaches, and changes how they approach the "new" situation. Therefore, based on social cognition theory (Fiske & Taylor, 1991), adaptive cognition describes the ability to be "dynamic, flexible, and self-regulating in one's cognition given dynamic and uncertain task environments" (Haynie et al., 2010, p. 218). Specifically, adaptive cognition is central to the entrepreneurial mindset, whereby a combination of goals and environmental influences activate an entrepreneur's awareness about their cognition on an entrepreneurial task (e.g., Lynch & Corbett, 2023). This awareness allows the entrepreneur to evaluate multiple alternatives to make more conscious decisions (Chen & Xu, 2022; Haynie et al., 2012; Mattingly et al., 2016) in the face of uncertainty and risk (Bastian & Zucchella, 2022; Cho & Jung, 2014; Wang et al., 2020).

An entrepreneur's **metaheuristics** *are the mental shortcuts they apply to design, develop, and effectively use their expert schemas and intuition to make sense of their current tasks or situations.* For example, an entrepreneur can have a simple rule that within 24 hours after pitching their venture to investors, their entrepreneurial team meets for a debrief—a

reflection, postmortem, and a (re)evaluation of the path forward. Indeed, this attribute of entrepreneurial metacognition involves shortcut solutions that enable simple and quick decisions (heuristics) to adapt entrepreneurial schemas and intuition to make sense of new experiences (Blume & Covin, 2011). Such metaheuristics are vital for decision-makers in dynamic environments because they provide decision rules to facilitate adaptation to environmental changes (Bandura, 2001; Gilbert-Saad et al., 2023).

An entrepreneur's **self-regulated cognition** *is their capability to control their thoughts and emotions to maintain or improve functioning.* While some studies have considered self-regulation within the broader consideration of entrepreneurial metacognition as adaptive cognition, others have focused almost exclusively on entrepreneurs' self-regulated cognition. For instance, entrepreneurs who ask themselves, "How is this situation different for me from situations I faced in the past?" can reflect on what worked and did not work well previously to stop themselves from automatically enacting an approach consistent with the status quo. Indeed, well-developed self-regulatory processes play a crucial role in entrepreneurs' selection of the most suitable strategies or courses of action based on their goals and available resources (Nambisan & Baron, 2013).

An entrepreneur's **cultural adaptation** *refers to the cognitive strategies they implement to learn, understand, and respond to cultural signals* (Mosakowski et al., 2013). For example, entrepreneurs culturally adapt when they realize that the approaches needed to successfully negotiate with potential investors in their home contexts differ from those of their current contexts and when they adopt negotiation strategies consistent with the cultures in which they are currently embedded. Therefore, cultural adaptation reflects the capability to change one's thoughts and behaviors in response to unfamiliar cultural situations (Earley & Ang, 2003; Ott & Michailova, 2018).

An entrepreneur's **metacompetencies** *denote their capability to judge their personal knowledge, skills, and experiences that can be deployed given their current task or situation*. For example, when faced with a challenge, an entrepreneur may assess their own competencies, such as their problem-solving abilities, and then adjust their approach to the challenge based on this self-assessment. Indeed, metacompetencies support individuals' responses to changes through learning, self-reflecting, and assimilating what is learned into their existing knowledge structures (Briscoe & Hall, 1999; Dries & Pepermans, 2007). The primary metacompetencies are metaknowledge and meta-affection. Metaknowledge refers to knowledge about what is known, how, and by whom (Evans & Foster, 2011; Graesser et al., 2009)—for example, the extent to which individuals know the capabilities of the firms they manage (Foss & Jensen, 2019). Meta-affection constitutes emotional awareness to monitor, regulate, and evaluate affect, such as mood and temperament, to enable individuals to feel empowered and persist (Ruohotie & Koiranen, 2000; Snow et al., 1996).

Outcomes of Metacognition in Entrepreneurship

Most entrepreneurship research has focused on the outcomes of metacognition. This research can be divided into five primary outcomes: (1) new venture formation factors, (2) individual decision-making factors, (4) team-based factors, (3) entrepreneurial learning factors, and (5) individual performance factors.

The **new venture formation outcomes of metacognition** *relate to the creation of a new venture.* For example, metacognition can influence new venture formation by facilitating the generation of entrepreneurial intentions (Linan & Chen, 2009; Schlaegel & Koenig, 2014) to start a new venture (Dheer & Castrogiovanni, 2023; Haynie et al., 2010). Indeed, metacognition increases entrepreneurs' ability to become aware of and evaluate opportunities in new environments (Kelly & Dorian, 2017; Lorenz et al., 2017). When entrepreneurs reflect

on their actions, they better understand what has influenced their performance and what resources are still needed (Baron & Henry, 2010).

The **individual decision-making outcomes of metacognition** *relate to an entrepreneur's decisions*. Metacognition supports heuristic decision-making through intuition and reliance on experience (Gigerenzer & Goldstein, 1999; Gilbert-Saad et al., 2021). Another line of reasoning (e.g., a more conscious understanding of what entrepreneurs know and do not know [Nambisan & Baron, 2013]) has found that metacognition shapes entrepreneurs' decisions to persist with an underperforming venture by modifying the impact of outcome probabilities related to potential alternatives (Mattingly et al., 2016). Indeed, entrepreneurial metacognition appears to impact expert entrepreneurial schemas (Blume & Covin, 2011) and synergize causal and effectual logic (Chen & Xu, 2022).

The **entrepreneurial team outcomes of metacognition** *relate to an entrepreneurial team's decisions and/or activities*. For example, metacognition can help reduce blind spots, which helps entrepreneurs identify the necessary resources to enhance their entrepreneurial teams (Bruegst & Patzelt, 2014) and facilitate a more balanced collective decision-making approach (Bastian & Zucchella, 2022; West, 2007). Metacognition may also encourage entrepreneurs to better grasp the resources required to adapt to technological changes and/or align such changes with existing internal R&D efforts. Consequently, such familiarization with technological shifts increases entrepreneurs' comprehension of the respective impact on their firms and likely increases adaptation by other ecosystem participants (Nambisan & Baron, 2013). Metacognition additionally helps individuals recognize and address positive inner aspects, such as inner strength and openness, and negative inner aspects, such as pressure, frustration, and attachment, which may enhance and/or induce collective value-creation processes (Schaefer et al., 2020). In particular, collaborative metacognition enables teams to monitor their adaptation to changing uncertainty in team activities. It ensures the

selection of strategies through coordination and negotiation, which leads to increased team-based creativity (Richardson et al., 2023). Furthermore, organizations can foster collective adaptability in entrepreneurial contexts by sharing self-reflective guiding rules in the form of metacognitive heuristics that enable swift responses to changes and facilitate organizational transformation (Gilbert-Saad et al., 2023). In this way, metacognition assists individuals in comprehending abstract concepts and collaboratively interpreting their significance for business model coherence with others (Shepherd et al., 2023).

The **entrepreneurial learning outcomes of metacognition** *relate to entrepreneurs gaining new knowledge, competences, and skills.* For instance, entrepreneurs who engage in metacognitive processing transform business failures into meaningful learning experiences (Byrne & Shepherd, 2015). Furthermore, self-regulated cognition leads to more effective learning outcomes due to reduced cognitive biases (Fust et al., 2017). When entrepreneurs use metacognition as knowledge to understand how their cognitive strategies should be used, they strategically learn to use reflection practices and consult with experts to complement their knowledge (O'Shea & Buckley, 2010). These learning strategies can positively impact individuals' metacognitive awareness. For instance, metacognition triggered by reflective diaries contributes to higher self-awareness in the learning process (Hägg, 2021). However, some scholars have stressed the importance of students' ability to manage all three parts of metacompetencies (i.e., metacognition, meta-affection, and metaknowledge) for learning outcomes (Kyro et al., 2011). The interplay among these metacognitive factors is crucial for students to understand how to perform entrepreneurial tasks and what those tasks entail (Kurczeweska et al., 2017). Metacognition is also vital for transforming learning experiences into expertise (Winkler et al., 2021).

The **individual performance outcomes of metacognition** *relate to an entrepreneur's performance on critical tasks.* For example, higher levels of metacognition, in combination

with entrepreneurial orientation, lead to increased firm performance (Cho & Jung, 2014). Likewise, in the face of entrepreneurial tasks, metacognition helps entrepreneurs use feedback more effectively, contributing to better task performance (Haynie et al., 2012). Furthermore, entrepreneurs with higher levels of metacognition engage in more innovative behavior and start-up efforts (Michaelis et al., 2021). Innovative behavior is stimulated through metacognition as self-awareness can set off a chain of thought processes, creating ideas for novel products and services (Christensen, 2024; Dyer et al., 2008; Kemboi & Taurus, 2021). Interestingly, metacognitive cultural intelligence positively influences entrepreneurs' self-creativity when they possess higher emotionality. This finding suggests that metacognition has particular affective components that stimulate creativity (Altinay et al., 2021). Finally, metacognition leads to better adaptation to uncertainty and regulation of affect as more metacognitively aware entrepreneurs have an increased understanding of their cognitive strengths and limitations (Baron, 2007).

Synthesis of Entrepreneurial Metacognition Attributes

While we offer a definition of entrepreneurial metacognition that is broadly consistent across the studies in our review, these studies have varied in the attributes they emphasize in their investigations of entrepreneurial metacognition (see Table 2 for the conceptual themes, definitions, and illustrative examples of content).[3] However, upon reflection, these differences may not be substantial. Indeed, two attributes of entrepreneurial metacognition—adaptive cognition and self-regulated cognition—are highly prevalent in the reviewed papers. Similarly, another prevalent theme—cultural adaptation—represents a contextualized attribute of the previous two (i.e., entrepreneurs' adaptive cognition and self-regulated cognition to

[3] We propose that entrepreneurial metacognition is a unidimensional construct such that its various attributes reflect the same latent construct. In the language of measurement, we propose that entrepreneurial metacognition is best empirically investigated with a reflective measurement approach. However, we note that "constructs themselves are neither inherently formative nor reflective in nature" (Covin & Wales, 2012: 678; see also Wilcox, Howell, & Breivik, 2008).

address a task in one culture vis-à-vis a different culture). Specifically, the normative significance of entrepreneurial challenges and scenarios can strongly motivate entrepreneurs to process what they understand metacognitively and do not understand (e.g., self-regulate) about their context to adapt to these challenges (e.g., adaptive cognition).

---Insert Table 2 about here---

Moreover, the last theme—metacompetencies—appears to be an individual-level reflective attribute of entrepreneurial metacognition. On the one hand, metacompetencies can be considered antecedents of entrepreneurial metacognition. On the other hand, metacompetencies can be considered part of the inner workings of entrepreneurial metacognition (like the cogs and wheels of a watch—they drive the timekeeping but are still integral to the watch). Like metacompetencies, metaheuristics could be considered antecedents of entrepreneurial metacognition or critical mechanisms by which entrepreneurial metacognition operates. Indeed, an entrepreneur's metaheuristics could be considered a subset of their metacompetencies. Likewise, metaheuristics can be antecedents when entrepreneurs clarify the abstract concepts of their business models to provide meaning so that it encourages metacognitive processes (Shepherd et al., 2023). Given the relatedness of these different attributes considered by various studies as the essence of entrepreneurial metacognition, it is unsurprising that some studies have used multiple attributes in combination as a blended notion (consistent with multiple items capturing a variable). With the foundation of a synthesis of metacognition laid, in the next section, we critique the key relationships revealed in the findings of entrepreneurial metacognition research with the aim to challenge our understanding of the field.

Critiques of Key Relationships in Entrepreneurial Metacognition Research

Our results also highlight several issues that we now critique. First, early studies on metacognition have been concerned with developing scales to measure adaptive cognition in

the context of entrepreneurship (goal orientation, metacognitive knowledge, metacognitive experience, metacognitive choice, and monitoring [see Haynie & Shepherd, 2009]) and to evaluate entrepreneurship education (Ling et al., 2013; Venesaar et al., 2011). Although these scales have been successfully validated, some studies in our sample have only applied parts of these adaptive cognition scales. For example, Kemboi and Tarus (2021) and Mattingly et al. (2016) measured only some metacognitive scales. This practice raises an essential question for entrepreneurship theorizing: to what extent can researchers conclude that entrepreneurs engage in metacognition when metacognition represents the *aggregate* of these five theoretical scales? On the other hand, perhaps it is appropriate to theorize and empirically test aspects of the metacognition construct (Cox, 2016).

Second, our analysis shows a significant increase in hybrid metacognition studies. These studies have used novel conceptualizations of metacognition and/or some blend of adaptive cognition, metaheuristics, self-regulated cognition, cultural adaptation, and/or metacompetencies. Although these studies have been exploratorily crucial to opening new research fronts, they have not necessarily increased clarity in our understanding of metacognition due to the variety of theoretical backgrounds. For example, sensemaking, heuristics, recognized-primed decision-making, strategic decision-making, and design thinking are all associated with metacognition, yet their theoretical backgrounds differ substantially. Therefore, on the one hand, we gain a different perspective on the metacognition phenomenon from these various literatures. On the other hand, we face greater challenges integrating these different perspectives to see the big picture of metacognition.

Finally, our review indicates a lack of knowledge about whether metacognition is mainly a slower deliberate analytic framework (System 2) or a faster intuitive framework (System 1) or a combination of both types of reasoning (Kahneman, 2011, as indicated by Shepherd et al., 2023). For example, while self-regulated cognition mainly suggests

entrepreneurs use a System 2 process to monitor and regulate their performance through increased awareness of their cognitive strengths and limitations (Baron, 2007), adaptive cognition crucially includes affective-based metacognitive activities "through which previous memories, intuitions, and emotions may be employed as resources given the process of making sense of a given task" (Haynie et al., 2010, p. 222), thereby reflecting System 1. Alternatively, the literature on metacompetencies has proposed interactions among self-reflection on learning, self-awareness about motivation, and emotional awareness to monitor, regulate, and evaluate affective activities—a possible combination of Systems 1 and 2.

OPPORTUNITIES FOR FUTURE RESEARCH ON ENTREPRENEURIAL METACOGNITION

In this review, we sought to answer the following questions: how is entrepreneurial metacognition conceptualized; what are the drivers and outcomes of entrepreneurial metacognition; and what challenges need to be addressed to theoretically, empirically, and practically move this research stream forward? The first two questions are addressed above and are shown in Figure 3 as a big picture of what we know about entrepreneurial metacognition. This big picture of entrepreneurial metacognition also reveals aspects of the phenomenon that we have not yet investigated and thus research questions that are important to address. To answer our final question, we propose future research avenues to help resolve the tensions highlighted in the literature and enhance our comprehension of metacognition in entrepreneurship (see Table 3). We focus on research opportunities to contribute new knowledge to our understanding of entrepreneurial metacognition's antecedents, outcomes, and processes.

---Insert Table 3 about here---

Future Research on Entrepreneurial Metacognition's Antecedents

We propose future research that can make important contributions to our understanding of the antecedents of entrepreneurial metacognition by exploring (1) metacognition at the collective level and how (2) emotions, (3) culture, (4) neurodiversity, and (5) uncertainty impact entrepreneurial metacognition.

Collectives and Entrepreneurial Metacognition. Establishing new ventures through collaborative founding teams rather than individual efforts significantly impacts venture outcomes (Forbes et al., 2006; Kamm et al., 1990; Kamm & Nurick, 1993). For example, members of an entrepreneurial founding team influence their venture by engaging in problem-solving activities, sharing perspectives, allocating resources, and assessing potential actions, all of which are cognitively caused and may lead to more informed decisions and ultimately improved venture performance (de Mol et al., 2015; Eisenhardt 2013; Foss et al., 2008). As an extension of this research, we see significant opportunities to explore the influence of the interacting relationships between metacognition and other units of analysis. Recent entrepreneurship studies exploring metacognition have argued that metacognition represents the self and others, thus urging for a collective perspective (Shepherd et al., 2023). In the same way that cognitive exchanges can be shared between individuals to coordinate action (West, 2007), metacognitive exchanges can also create collective adaptability in the context of entrepreneurial value-creating efforts (Bastian & Zucchella, 2022). This consideration is vital to understanding that metacognition represents knowledge of and awareness about the self and others as part of a social or collective (Frith, 2012) entrepreneurial process.

However, research on entrepreneurial team metacognition is still scarce, as is that on collective metacognition outside entrepreneurial teams (e.g., engagement processes with stakeholders [see, e.g., Burns et al., 2016]). For example, while we already know that individual factors influencing metacognition may be caused by unsettling feedback (Kaffka et al., 2021) and by self-awareness practices through meditation (Schaefer et al., 2020), we do

not currently understand if these factors differ when entrepreneurs are embedded in team processes that essentially involve shared content-related knowledge. Perhaps the metacognitive adoption of a reflexive stance is crucial to prevent friction between entrepreneurs and stakeholders.

Emotions and Entrepreneurial Metacognition. Future research can explore the emotional antecedents of metacognition. For example, emotional states, such as worry, influence metacognition, making individuals' decisions more accurate (Massoni, 2014). Still, it remains unclear whether emotions contribute to entrepreneurial metacognition. Future research could explore how negative emotions and entrepreneurial metacognition interact and how this bundle might lead to a deeper understanding of how entrepreneurs respond to their journeys' emotional ups and downs. For instance, could metacognition be an advantage for entrepreneurs learning from failure? Knowing this might also have practical relevance for nascent entrepreneurs and entrepreneurship education regarding how we can teach and prepare entrepreneurs for their journeys.

Furthermore, while positive emotions, such as happiness or hope, may cause optimistic assessments (Cardon et al., 2012; Foo, 2011), they may simultaneously lower the effectiveness of entrepreneurial metacognition for identifying potential opportunities or unexpected threats. Future research can explore which emotional experiences contribute to more useful entrepreneurial metacognition to, for example, appreciate the value of external inputs; which emotions have an opposite effect; and whether these differences are significant at the collective level (Borghi et al., 2017; Shepherd et al., 2023).

Mindfulness and Entrepreneurial Metacognition. It has also been shown that mindfulness represents a metacognitive practice (Kudesia, 2019) and can stimulate

entrepreneurial metacognition.[4] Mindfulness is increasingly popular in entrepreneurship as it leads to positive emotional, cognitive, and behavioral effects (e.g., Murnieks et al., 2019; van Gelderen et al., 2019), but we know relatively less about its relationship with metacognition (Jankowski & Holas, 2014). For example, metacognition can be enhanced through mindfulness training to significantly reduce an individual's risk of depression through their information processing (Teasdale et al., 2002; Wells, 2002). Thus, future research could investigate how mindfulness training in entrepreneurship courses impacts aspiring entrepreneurs' metacognition. This research could additionally lead to fruitful insights into cognitive flexibility and alertness in entrepreneurial contexts as these factors increase with improved mindfulness (Good et al., 2016). As we gain a deeper understanding of mindfulness in stimulating entrepreneurial metacognition, we can consider how individuals can add mindfulness as a tool to be selected as part of an entrepreneurial metacognitive process.

Culture and Entrepreneurial Metacognition. Understanding metacognition in different contexts is crucial, such as within different cultures (Mosakowski et al., 2013; Yu & Mills, 2021), industries (Dimov & Pistroi, 2023), educational settings (Ustav & Venesaar, 2018), and entrepreneurial families and family firms (e.g., Riar et al., 2022; Steier et at., 2004), yet we know little about the role of specific contexts in metacognition research. We see promising research insights evolving from more contextual metacognitive research. With greater contextual variation, we can better understand when and how different entrepreneurial cognition practices are deployed and to what effect (Mosakowski et al., 2013). Future research can explore whether and how entrepreneurial metacognition differs across national cultures (Mitchell et al., 2002). For example, cultural identification with multiple contexts heightens metacognitive awareness of cognitive processes and behaviors, influences

[4] Mindfulness is the metacognitive process through which people adjust their mode of information processing based on the situation at hand (Kudesia, 2019).

entrepreneurial intentions (Dheer & Lenartowicz, 2016), and enhances cross-cultural training (Kurczewska et al., 2018). However, entrepreneurship research in these contexts remains scarce (Liu et al., 2021). New interesting contextual insights may additionally emerge from research on entrepreneurial families and family firms (Eddleston et al., 2010; Kotlar et al., 2018; Miller et al., 2016). For example, research could investigate how metacognition influences the preservation of socioeconomic wealth in family firms and whether metacognitively handling crises may hinder and/or facilitate exploiting new opportunities.

Neurodiversity and Entrepreneurial Metacognition. Moore and colleagues (2021) opened the door to exploring metacognition and neurodiversity, showing that people with ADHD are more likely to use metacognition. Research on neurodiversity can explain how entrepreneurs think differently (Wiklund et al., 2017). However, the metacognitive mechanisms through which neurodiversity, such as ADHD, affects entrepreneurship are still underexplored (Lanivich et al., 2024). For example, future research could examine which executive control functions restrict or reinforce attention to metacognitive processes. Perhaps impulsivity, on the one hand, allows entrepreneurs to metacognitively seize a valuable opportunity, while, on the other hand, it may lead to disastrous, reckless action (Winstanley et al., 2006).

Uncertainty and Entrepreneurial Metacognition. Implementing completely novel strategies, venturing for radical innovation, and adapting to shocks (e.g., volatility from market shocks, war conditions, and pandemics) are more vital to entrepreneurship than ever. However, these activities are subject to radical uncertainty (Kurdoglu et al., 2023). This uncertainty brings new metacognitive challenges for entrepreneurs as “thinking about thinking” becomes increasingly demanding with more unknown unknowns (Ehrig & Foss, 2022). Thus, future research can investigate how entrepreneurs’ metacognition is affected by

higher uncertainty. Perhaps "thinking about thinking" when uncertainty is exceptionally high causes doubt in an entrepreneur's mind and reinforces inaction.

Future Research on Entrepreneurial Metacognition and Processes

Future research can expand our understanding of entrepreneurial metacognition and its processes by taking different perspectives to understand the phenomenon, including a (1) developmental perspective, (2) a resilience perspective, (3) an international business perspective, and (4) a neurodiversity perspective.

A Developmental Perspective of Entrepreneurial Metacognition. Future research can explore how metacognition develops over time. The historical research on metacognition in developmental psychology (Flavell, 1979) investigated how metacognition develops in children. However, how metacognition develops (or changes) throughout an individual's entrepreneurial journey is unclear. Thus, future research can focus on how metacognition develops among entrepreneurs given that metacognition supposedly declines with age (Palmer et al., 2014), how entrepreneurs engage different aspects of the metacognitive process, and why and when entrepreneurs engage and disengage their metacognition. Similarly, future researchers can explore how entrepreneurship educators can improve metacognition in students and how this development can be measured.

A Resilience Perspective of Entrepreneurial Metacognition. Our literature review reveals metacompetencies to be a vital attribute of entrepreneurial metacognition as they represent entrepreneurs' capacity to respond to changes by learning, introspecting, and otherwise acquiring knowledge to foster resilience (Briscoe & Hall, 1999; Dries & Pepermans, 2007). Importantly, these competencies go side-by-side with conscious motivational control and the ability to oversee, adjust, and assess emotional activities, but we need to learn more about this interplay. As stressful situations can result in different resilience strategies, future research can explore if and how metacognition develops while using these

coping strategies (Ahmed et al., 2022; Pangallo et al., 2015). Perhaps metacognition has a distinct function in how entrepreneurs learn from their experiences and develop resilience after a negative experience. Future entrepreneurship research can also explore how cognitive, motivational, and affective components interact on a metalevel to formulate entrepreneurs' learning strategies, how metacognition influences the use of different strategies of design tasks when those decision-makers perceive different degrees of uncertainty over time, and how this impacts the design of meaningful problems (see Ball & Christensen, 2019).

An International Business Perspective of Entrepreneurial Metacognition. Cultural adaption is a vital attribute of entrepreneurial metacognition and a critical resource for entrepreneurs in international settings. Entrepreneurship often involves the movement of goods, services, and capital across international borders, including by "born globals" (Oviatt & McDougall, 1994). Nevertheless, despite the importance of international business for entrepreneurs, we still need to learn more about entrepreneurial metacognition and how it operates in different cultural contexts. This need is exemplified by the cultural adaptation attribute of metacognition, which helps entrepreneurs successfully understand and adapt to new cultures they are unfamiliar with. However, metacognitive research on international entrepreneurship is scarce. Future research could explore how metacognition helps new ventures with their internationalization decisions. Perhaps metacognition research can provide insights into how entrepreneurs overcome their unfamiliarity as market actors (e.g., liability of foreignness and outsidership [Johanson & Vahlne, 2009]) and shorten their adjustment periods in new foreign markets (Reuber, 2016).

A Neuro-Entrepreneurship Perspective of Entrepreneurial Metacognition. Different disciplines, such as neuroscience, indicate promising insights into metacognition's impact on decision-making accuracy and decision debiasing in advanced experimental settings (Fleming et al., 2012; Fleming, 2021). Neuro-entrepreneurship cognition research could thus contribute

new knowledge (Ooms et al., 2023). For example, several neurobehavioral studies have indicated that the prefrontal cortex is one of the brain regions that plays a central role in the top-down control of information processing (Fernandez-Duque et al., 2000; Fleming & Dolan, 2014; Fleming, 2021; Shimamura, 2000). Although the prefrontal cortex is a large and multifaceted brain region that serves various functions, substantial empirical evidence points to its vital direct connection to the metacognitive process (Pannu & Kaszniak, 2005). However, experimental studies on entrepreneurial metacognition are still scarce. Future research can thus explain how entrepreneurs adapt and/or refine their decision-making processes through neuroscientific metacognition interventions.

Future Research on Entrepreneurial Metacognition's Outcomes

We propose future research that can make important contributions to our understanding of the outcomes of entrepreneurial metacognition, including (1) collective outcomes, (2) corporate entrepreneurship outcomes, (3) and well-being outcomes.

Entrepreneurial Metacognition and Collective Outcomes. While metacognition typically involves individual entrepreneurs, investigating new ventures through collaborative founding teams and other stakeholder groups may also open up promising future research directions on the collective outcomes of entrepreneurial metacognition (Burns et al., 2016; Forbes et al., 2006). For example, research from a collective perspective on metacognition, which includes the understanding and awareness of others from a group perspective, has recently shown that metacognitive rules can specify approaches to options or actions that create the collective adaptability required to implement organizational change (Gilbert-Saad et al., 2023). However, we still know relatively little about this perspective. Perhaps entrepreneurs can improve their evaluations of decisions and mitigate their cognitive biases if their decision-making processes are made through a collective process of metacognition (Brodbeck et al., 2007) as such a process leads to reevaluations of one's own and others'

knowledge (Frith, 2012). Future research can also explore the relationship between metacognition and emotional intelligence (Zhang et al., 2023) as cultivating metacognitive abilities can increase individuals' awareness of emotions and their ability to understand others' emotions (Kallio et al., 2018).

Entrepreneurial Metacognition and Family Business Outcomes. Furthermore, metacognition as collective cognition is also worth exploring as an outcome in the context of different units of analysis. For example, social capital—which is crucial for structural, cognitive, and relational dimensions within family firms (e.g., Chrisman et al., 2021) and entrepreneurial teams—may provide an interesting future research direction from a metacognitive standpoint (Discua Cruz et al., 2013). Indeed, social capital emerging from metacognitive processes increases the ability to learn from others, stimulates the recognition of feedback, and encourages engagement with others (Bastian & Zucchella, 2022). Family business researchers can also explore what role social metacognition has (Shepherd et al., 2023) in establishing goal diversity in family firms and whether such social metacognition creates collective commitment to adopt family-centered goals (Chrisman et al., 2005; Kotlar & De Massis, 2013)

Entrepreneurial Metacognition and Corporate Entrepreneurship Outcomes. Research on corporate entrepreneurship could also provide new insights into metacognition (Shepherd & Krueger, 2002) as organizational adaptation to change is crucial for firm performance, especially for those in dynamic environments. For example, self-reflective guiding rules (e.g., metacognitive heuristics) that are shared in a group (Bandura, 2001; Gilbert-Saad et al., 2023) may represent guidelines that foster the collective flexibility necessary to implement organizational transformation, but more research is needed to broaden this perspective. For example, how does top managers' metacognition impact the formation of corporate entrepreneurship strategies (Ireland et al., 2009); the structure and rewards for

autonomous teams within organizations (Burgelman, 1983); and the creation, advancement, and termination of ventures (Bakker & Shepherd, 2017; McGrath, 1999)?

Entrepreneurial Metacognition and Well-Being Outcomes. Entrepreneurial well-being (Stephan, 2018; Wiklund, 2019) is an outcome of metacognition worthy of exploration. For example, can metacognition help entrepreneurs cope with work-related stress to enhance well-being? Some research has pointed to the critical role of metacognition as a mindfulness practice. Still, more research is needed to understand how such metacognitive mindfulness can facilitate entrepreneurs' innovation or decision-making processes (Altinay et al., 2021; Kudesia, 2019; Chan & Parhankangas, 2017). Furthermore, the entrepreneurship literature has implicitly assumed that metacognition is inherently beneficial. However, within psychology, metacognition has also been shown to lead to more stress and anxiety (Spada et al., 2008), thereby diminishing well-being. Perhaps entrepreneurs who overthink and believe that negative thoughts must be controlled engage in maladaptive coping strategies. At the same time, future experimental research needs to explore if metacognition can help improving entrepreneurial decision-making by means of debiasing (e.g. Croskerry et al., 2013), when this leads to beneficial outcomes, and when and how it leads to detrimental outcomes for entrepreneurs.

Conclusion

With this literature review, we aimed to analyze entrepreneurial metacognition to help organize and understand existing knowledge on the topic by addressing definitional issues and highlighting empirical patterns and attributes. Subsequently, we showed the critical relationships between the identified attributes of entrepreneurial metacognition. These relationships demonstrate that the entrepreneurship literature has examined metacognition using various definitions and operationalizations. Although this broad spectrum of constructs has established metacognition in entrepreneurship as a vital mechanism to sense, act, and

mobilize cognitive resources under uncertain conditions, it has also increasingly led to concepts that are not clearly defined and/or tested and rely on different theories. We then provided a research agenda to hopefully inspire and guide future entrepreneurship research on metacognition.

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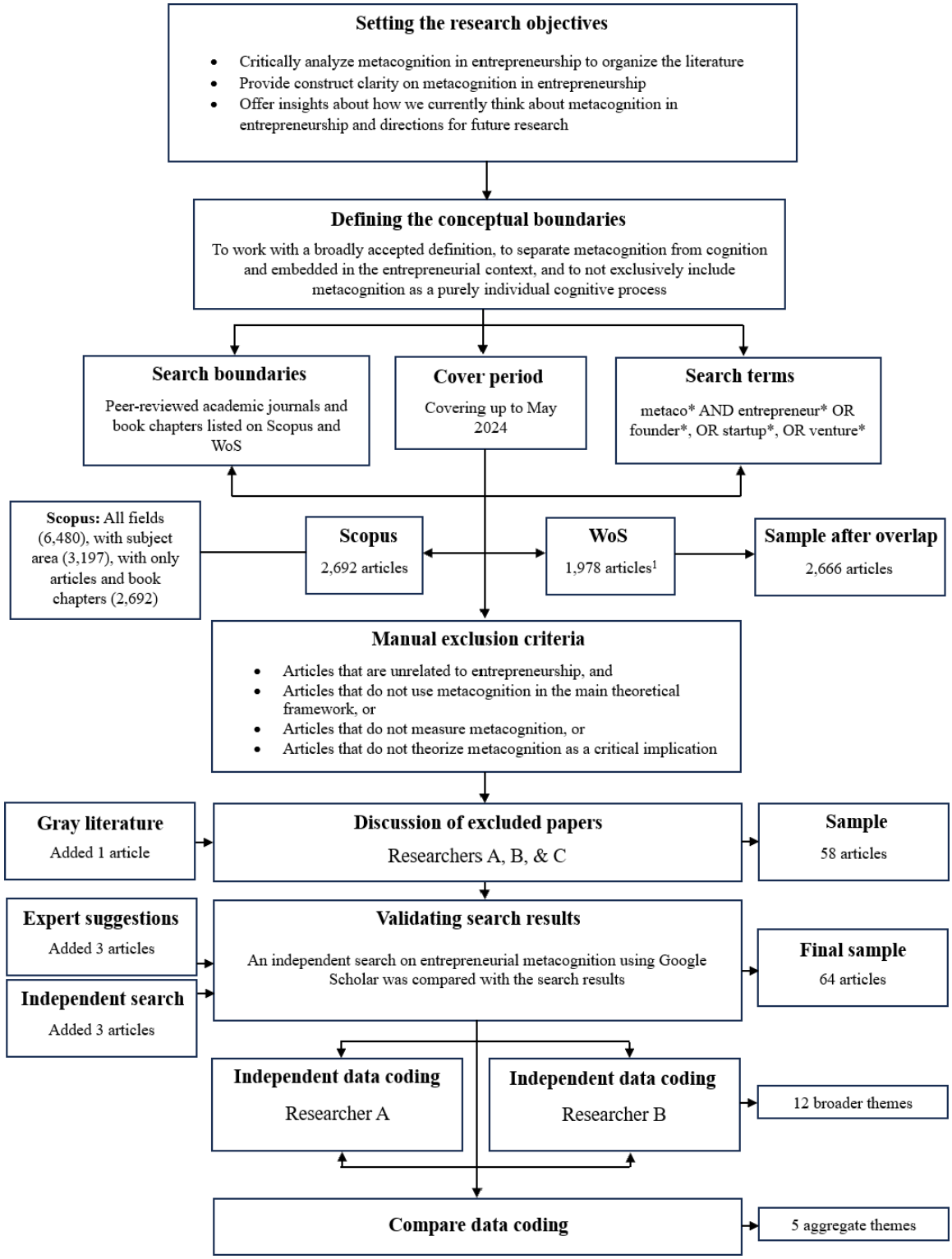
Figure 1: Flowchart of the Article-Selection Process[5]



[5] For our search on WoS, we started with the same keywords as we did on Scopus but additionally searched for adaptive cogniti* (205), self-awar* (291), and self-regulat* (1,482) as we realized while scanning through the Scopus results that metacognition is often described as the ability to be aware of and regulate one's own cognition. Thus, this process ensured we did not miss influential papers that implicitly conceptualized metacognition.

Figure 2: Number of Entrepreneurship-Related Metacognition Studies Published per Year

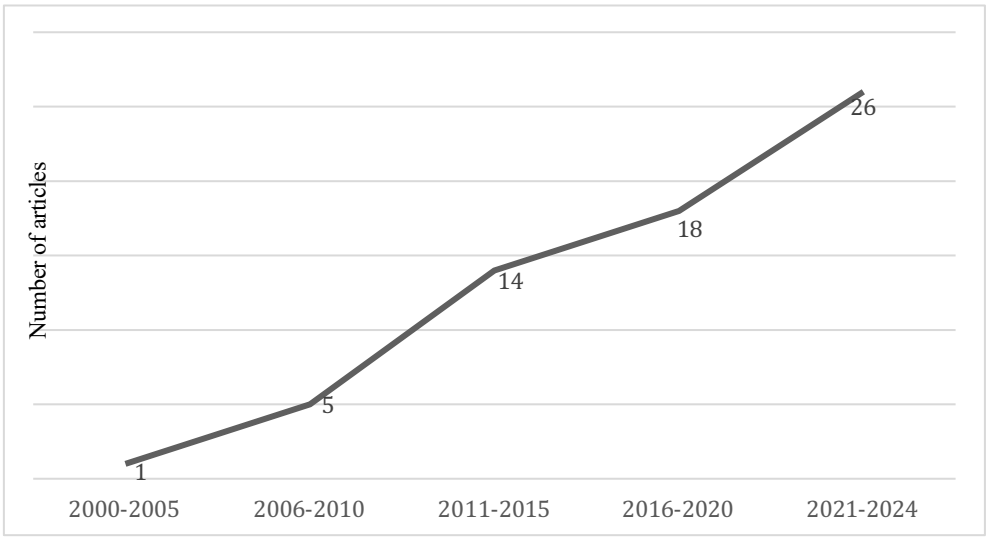


Figure 3: Critical Relationships of Entrepreneurial Metacognition

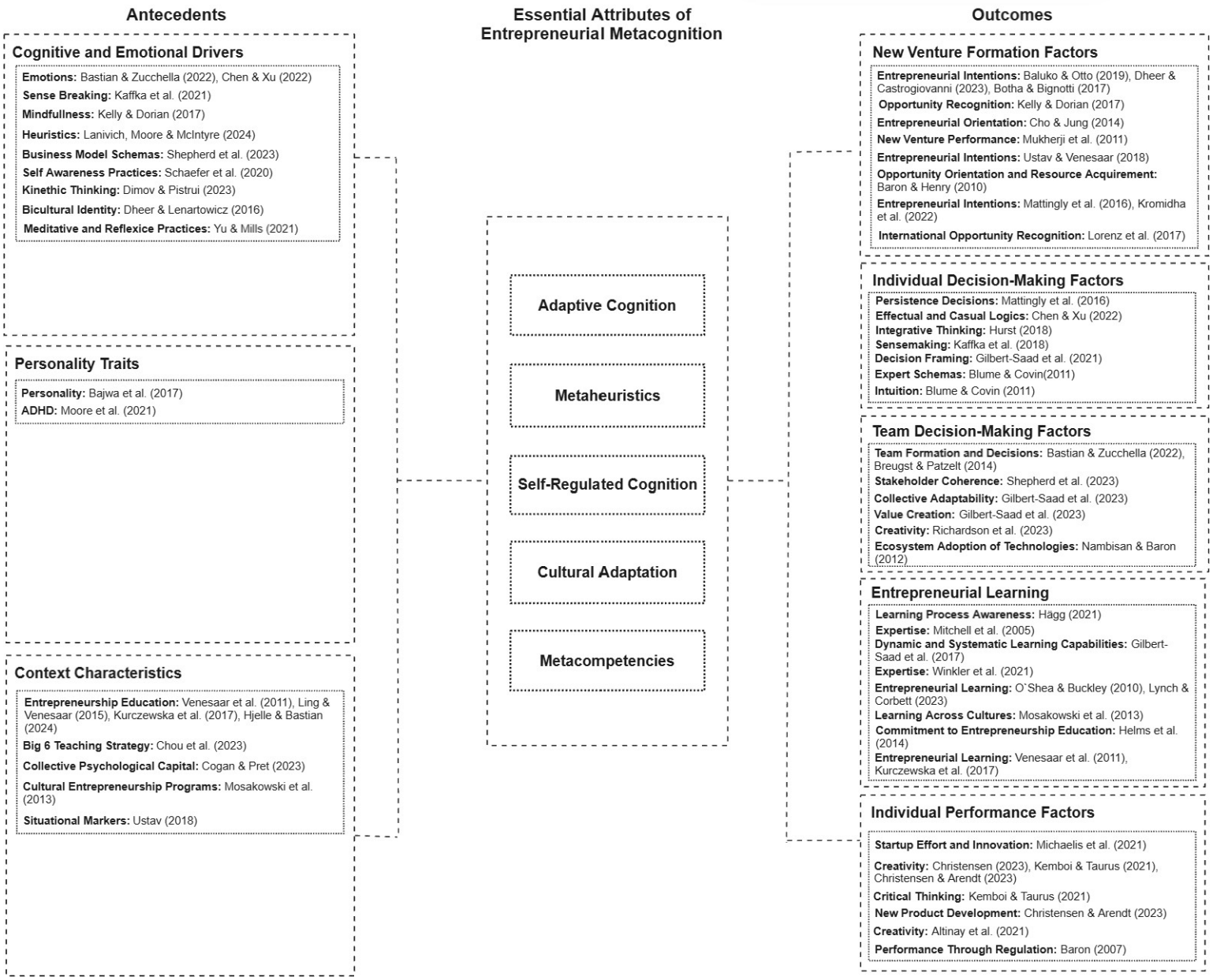


Figure 3.1: Antecedents and Outcomes of Adaptive Cognition

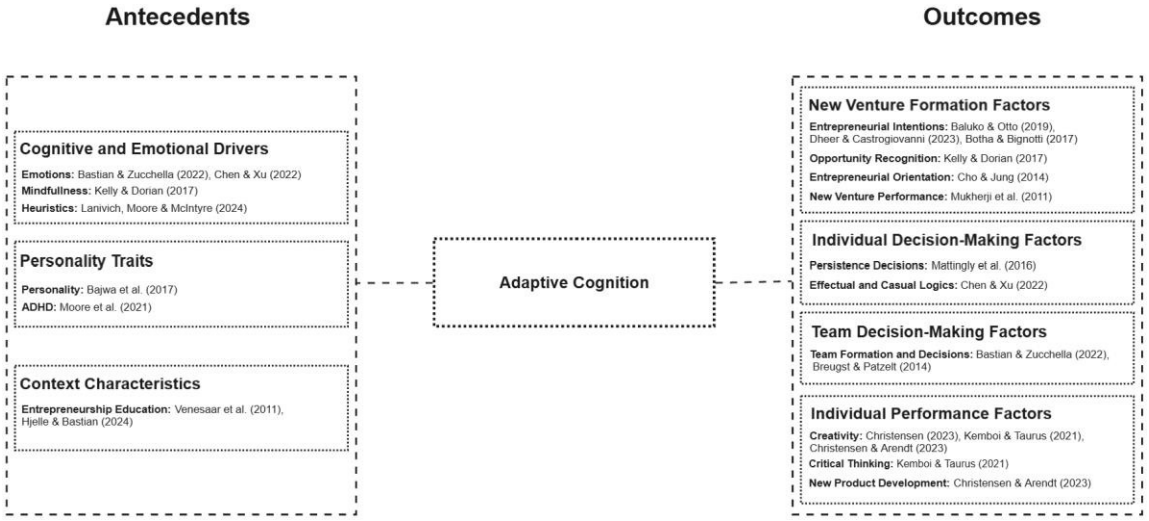


Figure 3.2: Antecedents and Outcomes of Metaheuristics

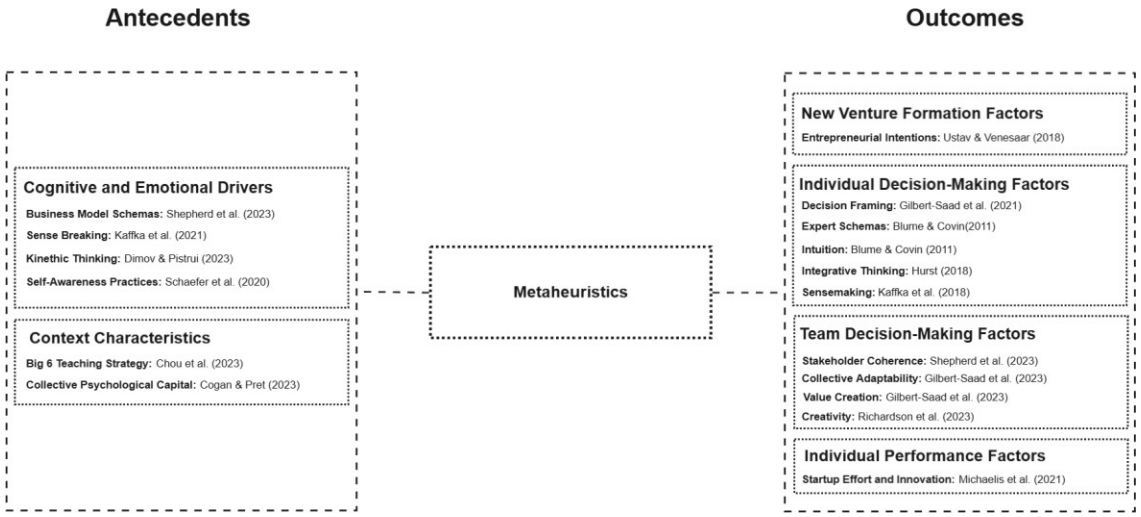


Figure 3.3: Outcomes of Self-regulated Cognition

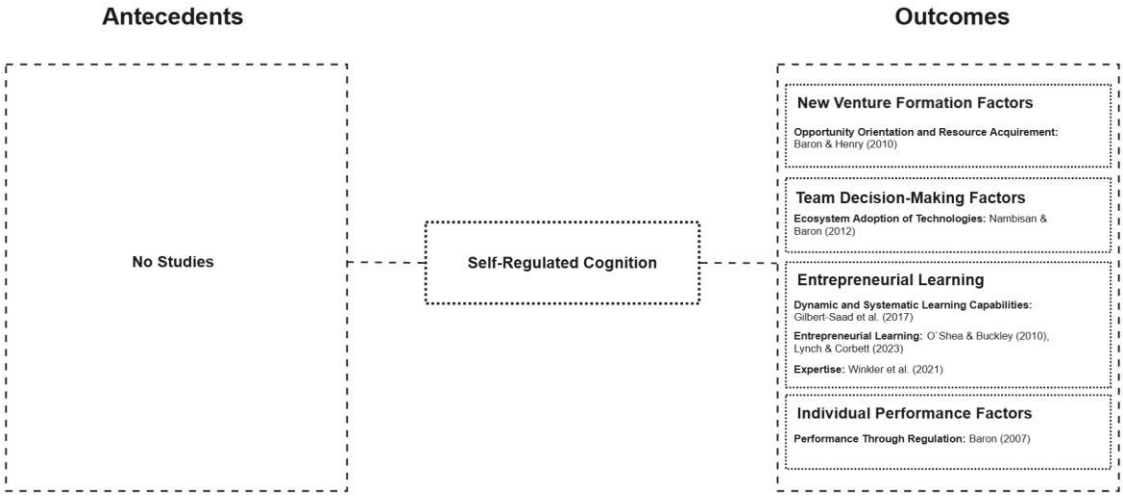


Figure 3.4: Antecedents and Outcomes of Cultural Adaptation

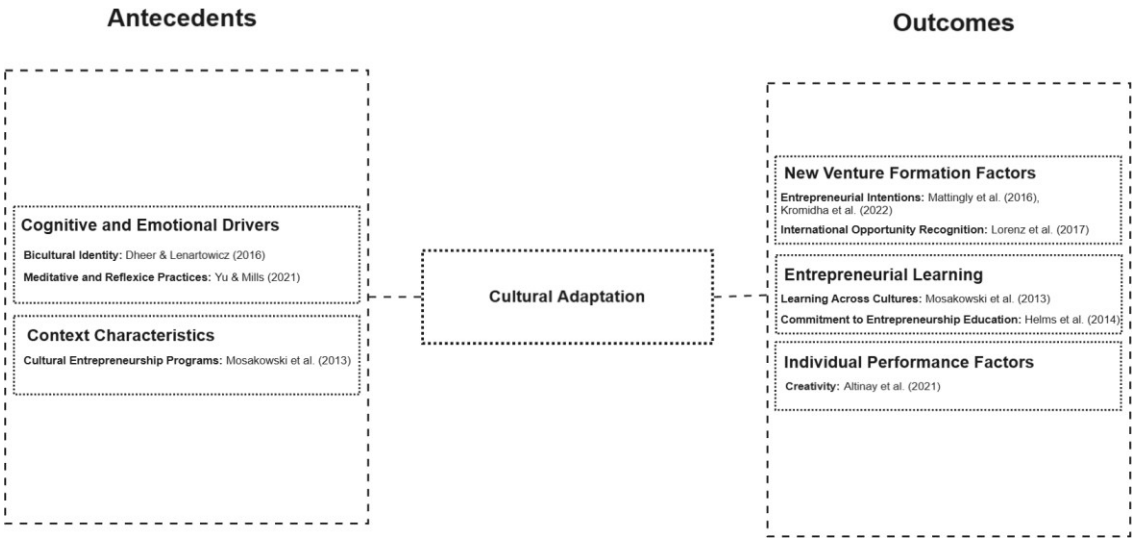


Figure 3.5: Antecedents and Outcomes of Metacompetencies

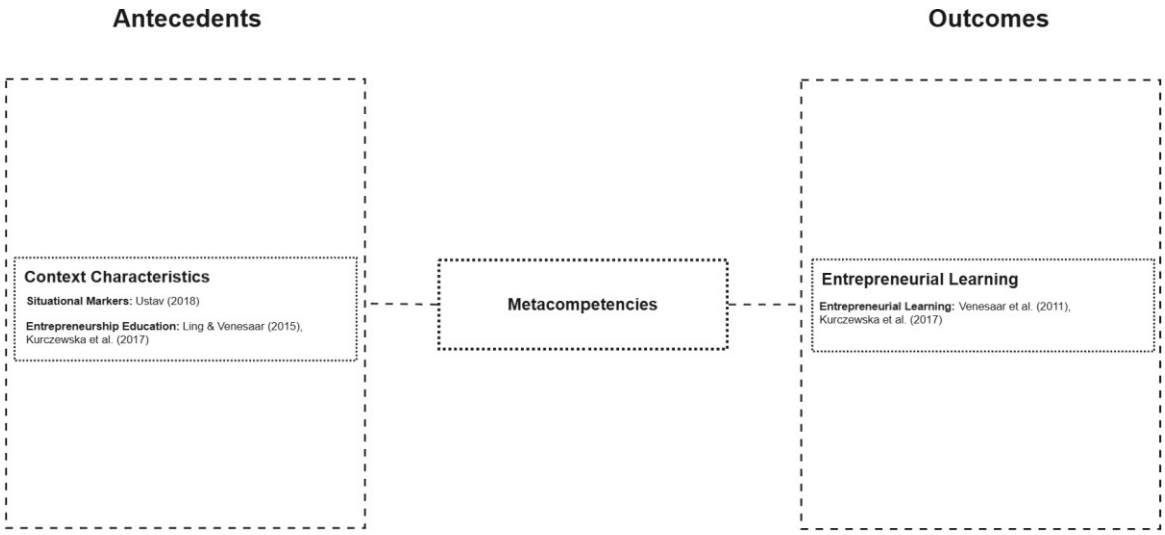


Table 1: Included Articles with Conceptual Theme Coding

	Year	Author(s)	Journal	Method	Conceptual Themes				
					Adaptive Cognition	Meta Heuristics	Self-Regulation Cognition	Cultural Adaptation	Meta Competencies
1	2005	Mitchell et al.	BAB	Quantitative		✓			
2	2007	Baron	SEJ	Conceptual			✓		
3	2009	Haynie & Shepherd	ETP	Quantitative	✓				
4	2010	Baron & Henry	SEJ	Conceptual			✓		
5	2010	Haynie et al.	JBV	Conceptual	✓				
6	2010	O`Shea & Buckley	IEMJ	Qualitative			✓		
7	2011	Blume & Covin	JBV	Conceptual		✓			
8	2011	Kyrö et al.	BC	Qualitative					✓
9	2011	Mukherji et al.	AMPROC	Quantitative	✓				
10	2011	Venesaar et al.	AE	Quantitative	✓				
11	2012	Haynie et al.	ETP	Quantitative	✓				
12	2013	Ling et al.	BC	Quantitative	✓				
13	2013	Mosakowski et al.	ALE	Qualitative				✓	
14	2013	Nambisan & Baron	ETP	Conceptual			✓		
15	2014	Breugst & Patzelt	AMPROC	Quantitative	✓				
16	2014	Cho & Jung	AEJ	Quantitative	✓				
17	2014	Helms et al.	IJESB	Quantitative				✓	
18	2015	Baron et al.	JBV	Quantitative			✓		
19	2015	Byrne & Shepherd	ETP	Qualitative		✓			
20	2015	Ling & Venesaar	EE	Quantitative					✓
21	2016	Cox	Dissertation	Quantitative	✓				
22	2016	Dheer & Lenartowicz	ETP	Quantitative				✓	
23	2016	Mattingly et al.	IEMJ	Quantitative	✓				
24	2017	Bajwa et al.	JMM	Quantitative	✓				
25	2017	Botha & Bignotti	IEMJ	Quantitative	✓				
26	2017	Fust et al.	ERJ	Conceptual			✓		
27	2017	Kelly & Dorian	NEJE	Conceptual	✓				
28	2017	Lorenz et al.	JWB	Mixed method				✓	
29	2017	O`Shea et al.	OPR	Conceptual			✓		
30	2018	Kurczewska et al.	ET	Qualitative					✓
31	2018	Ustav & Venesaar	ET	Mixed method		✓			
32	2018	Ustav	JEC	Mixed method					✓
33	2019	Baluku & Otto	IJESB	Quantitative	✓				
34	2019	De Winnaar & Scholtz	MD	Conceptual		✓			
35	2019	Ball & Christensen	DS	Conceptual		✓			
36	2019	Hurst	IJEBR	Quantitative					✓
37	2020	Schaefer et al.	JSE	Qualitative		✓			
38	2020	Wang et al.	IMDS	Quantitative	✓				
39	2021	Altinay et al.	JBR	Quantitative				✓	
40	2021	Gilbert-Saad et al.	MD	Qualitative		✓			
41	2021	Hägg	IJEBR	Conceptual		✓			
42	2021	Kaffka et al.	JSBM	Qualitative		✓			
43	2021	Kemboi & Tarus	IJEV	Quantitative	✓				
44	2021	Liu et al.	JHTM	Quantitative				✓	
45	2021	Lianage et al.	AEJ	Quantitative	✓				
46	2021	Michaelis et al.	JBVI	Quantitative		✓			
47	2021	Moore et al.	ETP	Quantitative	✓				
48	2021	Winkler et al.	JSBM	Conceptual			✓		
49	2021	Yu & Mills	JMH	Qualitative				✓	
50	2022	Bastian & Zucchella	IEMJ	Qualitative	✓				
51	2022	Chen & Xu	FIP	Quantitative	✓				
52	2022	Kromidha et al.	IJEBR	Quantitative				✓	
53	2023	Cogan & Pret	AMPROC	Qualitative		✓			
54	2023	Chou et al.	TSC	Quantitative		✓			
55	2023	Christensen	BC	Conceptual	✓				
56	2023	Christensen et al.	DS	Quantitative	✓				
57	2023	Dheer & Castrogiovanni	JBR	Quantitative	✓				
58	2023	Dimov & Pistrui	JBVD	Quantitative		✓			
59	2023	Gilbert-Saad et al.	TFSC	Qualitative		✓			
60	2023	Lynch & Corbett	JSBM	Conceptual	✓				
61	2023	Richardson et al.	BC	Conceptual		✓			
62	2023	Shepherd et al.	AMR	Conceptual		✓			
63	2024	Hjelle & Bastian	BC	Conceptual	✓				
64	2024	Lanivich et al.	IJEBR	Quantitative	✓				

Table 2: The Conceptual Themes of Entrepreneurial Metacognition

Conceptual Theme	**Definition**	**Illustrative Content**
Adaptive Cognition	An entrepreneur's capability to change their cognitive approach to achieve desirable outcomes in a dynamic business environment.	• When entrepreneurs notice changes in their external environment and think about what to do next. • When entrepreneurs, based on these changes, reflect on their strategic approaches and consider others' approaches. • When entrepreneurs adapt their approaches to potential novel situations.
Metaheuristics	An entrepreneur's mental shortcuts to design, develop, and effectively use their expert schemas and intuition to make sense of their current tasks or situations.	• When entrepreneurs set rules about meeting within 24 hours after pitching their ventures to investors. • When entrepreneurs use such rules to reflect on their situations with their teams. • When entrepreneurs use such rules to evaluate and reevaluate a way forward with their teams.
Self-Regulated Cognition	An entrepreneur's capability to control their thoughts and emotions to maintain or improve functioning.	• When entrepreneurs ask themselves, "How is this situation different for me from situations I faced in the past?" • When entrepreneurs use such reflection to understand what worked for them and what did not work for them. • When entrepreneurs use such reflection to avoid automatically enacting an approach consistent with what comes to mind first.
Cultural Adaptation	An entrepreneur's cognitive strategies to help them learn, understand, and respond to cultural signals.	• When entrepreneurs realize that their current approaches to convince investors differ from the approaches they take in their home contexts. • When entrepreneurs use this understanding to adopt negotiation strategies consistent with the cultures that they are facing. • When entrepreneurs use this understanding to be able to change their thoughts in response to unfamiliar cultural situations.
Metacompetencies	An entrepreneur's capability to judge their personal knowledge, skills, and experiences that can be deployed given their current task or situation.	• When entrepreneurs face challenges and assess their own competencies. • When entrepreneurs use this assessment to improve their problem-solving abilities. • When entrepreneurs use this understanding of their problem-solving abilities and adjust their approaches to challenges.

Table 3: Summary of Future Research Opportunities in Entrepreneurial Metacognition

	Research Directions	Future Research Questions
Entrepreneurial Metacognition's Antecedents	Collectives and Entrepreneurial Metacognition	How does heterogeneity in metacognition within an entrepreneurial team impact the new venture's decisions? How can entrepreneurial teams increase their metacognition for better team performance? How does team metacognition enhance the success of entrepreneurial ventures, and why are some more effective at using their metacognition than others?
	Emotions and Entrepreneurial Metacognition	Which emotions stimulate metacognition to help entrepreneurs overcome obstacles, and what impact does this have on decision-making and innovation within entrepreneurial ventures? What is the effect of negative emotions on metacognition for family firms and their decisions? How and why is the regulation of emotions critical for enhancing metacognitive awareness and performance in entrepreneurs, and how does this relationship affect entrepreneurial success?
	Mindfulness and Entrepreneurial Metacognition	How does mindfulness training impact entrepreneurial metacognition and entrepreneurs' well-being? How does enhancing one's metacognition through mindfulness reduce the risk of depression? Why does mindfulness enhance metacognition more in some entrepreneurs than others?
	Culture and Entrepreneurial Metacognition	How does metacognition shape identification with a new culture and influence entrepreneurial action? How do different cultures impact the relationship between metacognition and venture performance? Are entrepreneurs from some cultures more metacognitive than others, and why?
	Neurodiversity and Entrepreneurial Metacognition	Which executive control functions restrict and/or reinforce metacognitive processes? How does metacognition impact the decision-making and activities of impulsive entrepreneurs? How and why does neurodiversity influence metacognitive strategies in entrepreneurs and vice versa?
	Uncertainty and Entrepreneurial Metacognition	How does uncertainty trigger entrepreneurial metacognition, and can metacognition reveal previously "unknown" uncertainties? Can metacognition be detrimental to entrepreneurs making decisions and taking action under uncertainty, and if yes, why? How does metacognition shape the trial-by-error learning of entrepreneurs as they try to make sense of their uncertainty-shrouded opportunities? Can entrepreneurs "outsource" metacognition to artificial intelligence?
Entrepreneurial Metacognition and Processes	A Developmental Perspective of Entrepreneurial Metacognition	How does metacognition develop over time for entrepreneurs? When does metacognition decline for entrepreneurs, how does this decline impact the entrepreneurial process, why does this metacognitive decline happen, and is there anything that can be done to slow or reverse this decline?

	A Resilience Perspective of Entrepreneurial Metacognition	How and why do cognitive, motivational, and affective processes influence entrepreneurial metacognition, and how do they interact on a metalevel? Why are some entrepreneurs more effective at acquiring and/or deploying their entrepreneurial metacognition and at overseeing, adjusting, and assessing their emotional activities than others? How does metacognition develop during stressful situations to enable entrepreneurs to develop different resilience strategies?
	An International Business Perspective of Entrepreneurial Metacognition	How does metacognition influence entrepreneurial decision-making, action, and performance in unfamiliar foreign markets? Why does entry into different (e.g., in psychological distance) international markets enhance an entrepreneur's metacognition, and how does metacognition influence one's awareness of exploring different international markets?
	A Neuro-Entrepreneurship Perspective of Entrepreneurial Metacognition	How do different regions of the brain impact entrepreneurs' development and engagement of metacognition, and how is metacognitive feedback interpreted and stored in the brain? How can neuroscientific techniques and interventions, such as neuroimaging and brain stimulation, help (nascent) entrepreneurs develop and/or refine their metacognition? Can neuro-entrepreneurship insights about metacognition help entrepreneurs and stakeholders mitigate cognitive biases, and to what effect?
Entrepreneurial Metacognition's Outcomes	Entrepreneurial Metacognition and Collective Outcomes	Does collective metacognition improve the evaluation of entrepreneurial ideas? Why are some entrepreneurial teams more effective at developing and deploying their collective cognition than other entrepreneurial teams? How does collective metacognition influence the decision-making, action, and performance of new ventures?
	Entrepreneurial Metacognition and Family Business Outcomes	How does metacognition influence or help with managing goal diversity in family firms? How does entrepreneurial metacognition influence decision-making processes and strategic planning in family-owned businesses, and what impact does this have on business performance and growth? How can metacognition shape a family business's commitment to family-centered goals? Does metacognition promote socioemotional wealth and vice versa?
	Entrepreneurial Metacognition and Corporate Entrepreneurship Outcomes	How does metacognition influence the creation of internal corporate ventures as well as their strategic decision-making, pivoting, and terminating? Why are some organizations more metacognitive about their corporate entrepreneurship efforts than others? How and why can metacognitive strategies employed by corporate entrepreneurs drive successful intrapreneurial initiatives and contribute to the long-term sustainability of their organizations?
	Entrepreneurial Metacognition and Well-being Outcomes	How and why can metacognition help entrepreneurs cope with work-related stress, and vice versa, how does an entrepreneur's well-being influence their development and deployment of metacognition? Can metacognition negatively impact well-being and vice versa, and if yes, why? What role does the development of metacognitive debiasing strategies play in managing decision-making, entrepreneurial stress and preventing burnout, and how does this contribute to entrepreneurial well-being?