

EXPLORING THE INTERPLAY OF AN ENTREPRENEUR'S THINKING, KNOWLEDGE, AND FIRM-LEVEL INNOVATION

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ABSTRACT: *This study investigates entrepreneurs' individual characteristics in terms of knowledge and thinking skills to better understand the role of these traits in innovation. We use interpretative phenomenological analysis (IPA) to attain deeper insights about entrepreneurs' cognitive processes and innovation. We propose that knowledge breadth plays an enhancing role in the relationship between an entrepreneur's knowledge depth and firm innovation. In return, innovation at a firm level is shown to be affected by an entrepreneur's integrative thinking ability. Implications for practice and future research are discussed.*

Keywords: *knowledge breadth, knowledge depth, integrative thinking, innovation, SMEs*

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INTRODUCTION

The more extensive a man's knowledge of what has been done, the greater will be his power of knowing what to do. Benjamin Disraeli (1804–1881, British Prime Minister)

This quote by Benjamin Disraeli indicates the important role of knowledge, experiences, and accumulated skills in dealing with unknown situations. Its meaning can be easily reflected in entrepreneurship, where entrepreneurs tackle problems they have never experienced before with their own knowledge base and methods in order to provide an innovative solution. The impact of knowledge (Dakhli & De Clercq, 2004; Davidsson & Honig, 2003) and an entrepreneur's thinking (Baron, 1998; Krueger, 2007) on different entrepreneurship outcomes has been widely explored in prior literature. The significant impacts of these characteristics in entrepreneurship, such as creativity (Shalley & Gilson, 2004), firm performance (DeCarolis & Deeds, 1999), and innovativeness (Marcati et al., 2008), have long been delineated. However, we still do not have a good understanding of how aspects of an entrepreneur's cognition interact in influencing firm-level innovation. Correspondingly, we are interested in an individual's narrative about innovation.

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An individual's knowledge serves as a prerequisite base for discovering and exploiting opportunities (Gupta & Govindarajan, 2000; Wiklund & Shepherd, 2003) and represents a foundation on which innovation can be built (Nonaka et al., 2000). Authors such as Price et al. (2013) suggest a positive relationship between knowledge and innovation, and recognize knowledge as a vital part of innovative activity (Cohen & Levinthal, 1990; Martín-de-Castro et al., 2008). Scholars distinguish between different types of knowledge. Rather than studying a firm's accumulated knowledge, this research focuses particularly on knowledge at the individual level of an entrepreneur, specifically its breadth and depth, and the effect these domains have on firm innovation. The first refers to the range of different areas in which a firm has expertise, whereas the latter indicates the amount of within-field knowledge (Prabhu et al., 2005). Drawing from existing literature, our particular interest concerns exploration of individual as well as interactive effects of both dimensions – depth and breadth – on innovation.

In addition to an entrepreneur's knowledge, we also aim to explore entrepreneurs' thinking patterns to reveal components that lead to innovativeness. We base our research on a theory by Martin (2007b), who claims that successful entrepreneurs are competent integrative thinkers, and explore the contribution of such a thinking style to innovation. Martin defines integrative thinking as “the ability to face constructively the tension of opposing ideas and, instead of choosing one at the expense of the other, generate a creative resolution of the tension in the form of a new idea that contains elements of the opposing ideas but is superior to each” (Martin, 2007b, p. 15).

We seek to verify empirically the importance of an entrepreneur's integrative thinking for innovation. The concept derives from observation, and we begin by exploring entrepreneur attributes that characterize innovativeness. By identifying the emerging themes that delineate thinking that fosters innovation, we reveal the resemblance to the theory of integrative thinking. In response to the limited studies in the field, we utilize qualitative research methods to develop a deeper understanding and rich descriptives of entrepreneurs' perceptions and behaviour in relation to firm-level innovation (Patton, 2002). A novel interpretative phenomenological analysis (IPA) is used to explore how entrepreneurs perceive different situations they are facing in the innovation process, how they make sense of the surrounding factors, and what meaning they attribute to underlying cognitive attributes (Smith et al., 1997).

In this study we focus on small and medium-sized enterprises (SMEs) entrepreneurs. We demonstrate that SMEs' innovation can be attributed largely to the knowledge and thinking of the entrepreneurs who run them, rather than being a cumulative effect of all employees. Generally speaking, SMEs provide an interesting field of research because they are essential to the economy (Drilhon & Estime, 1993) and have become a driving force for technological progress, economic growth, and overall competitive development (Lin, 1998; Thornburg, 1993).

1 LITERATURE REVIEW

1.1 Knowledge breadth and knowledge depth

This research focuses on two dimensions of personal knowledge: depth and breadth. In the literature, knowledge depth is described as the degree of expertise one possesses, whereas knowledge breadth refers to a broad understanding of other disciplines (Brown & Katz, 2009). To date, the knowledge dimensions of depth and breadth have been studied only at a firm level. Authors have looked at the problem from various perspectives. Marvel and Lumpkin (2007) proved the positive effect of experience depth on innovation radicalness, whereas Prabhu et al. (2005) show that firms with a deeper knowledge are more innovative in terms of patent numbers. Similarly, a recent study by Carlo et al. (2012) examined a knowledge-based model of radical innovation in the field of IT. It shows an important role of knowledge depth and knowledge diversity of a firm in the level of radical innovation. However, more studies are needed to explore in detail the interplay between entrepreneur knowledge depth and breadth and the overall contribution of these domains to firm innovation.

Interestingly, the effect of knowledge depth is not self-evident. There is evidence of both negative and positive influences on innovation. Nowadays, narrow specialization tends not to be sufficient – emphasizing one specific area of expertise and lacking the adaptive ability to advance in different fields might cause firms problems handling different situations which require diversified knowledge, through the institutionalizing of core rigidities resulting in inhibition of innovative activity (Leonard-Barton, 1995). Specifically, experts typically possess many experiences and skills and much knowledge in their areas of expertise. Their focus becomes a specialized niche. Therefore they suffer from an “expert syndrome”, which inhibits their creativity (Dean, 1999). It describes the experts’ usual negligence of other domains outside their specialization. Evidently, there exists the unconditional need for knowledge diversity and, consequently, knowledge breadth. Scholars (e.g., Bierly & Chakrabarti, 1996; Cohen & Levinthal, 1990) stress the importance of knowledge diversity for creativity and innovation, which also represents a basis for strategic advantage, and of the ability to integrate knowledge across different scientific knowledge bases outside and inside the firm’s main scope, for better performance and innovation (Henderson & Cockburn, 1994; Pisano, 1994).

Boosting knowledge breadth and depth in a complementary rather than a substitutive way might be crucial for a firm’s success. Along with this assumption, Dewar and Dutton (1986) stress the importance of knowledge depth and diversity for innovation. So an entrepreneur must possess the highest level of both knowledge domains. Prabhu et al. (2005) also suggest that breadth of knowledge increases the possibility for “happy accidents”, which may originate as a result of concept application from one field across different disciplines. Likewise, van Wijk et al. (2012) indicate the necessity of balanced knowledge for enhanced innovation performance – knowledge depth is shown to contribute to exploitative and exploratory innovations, whereas knowledge breadth impacts solely exploratory innovations.

It is evident that companies that generate knowledge from a vast foundation are more productive (Henderson, 1994). Bierly and Chakrabarti (1996) emphasize the role of knowledge breadth, because such a knowledge base provides more options to transform related technologies in new, unexpected ways, which eventually increases the sustainability of competitive advantage (Reed & DeFillippi, 1990). Many researchers provide explanations of the positive role of the integration of different fields of expertise (Henderson & Cockburn, 1994), especially in technical industries. They mention that deep expertise in one field and integration of a wide range of disciplines increases the competitive edge of a firm. In order to stay in the market within a certain discipline, firms have to broaden their areas of specialization. Prabhu et al. (2005) show that greater breadth of knowledge leads to increased innovation. Similarly, Cohen and Levinthal (1989) recommend a greater number of fields of knowledge in order for a firm to be more innovative.

Building on such theories as that human capital positively affects firm innovation (Dakhli & De Clercq, 2004; Popadiuk & Choo, 2006) and that depth of technical experience and education is positively related to innovation radicalness (Marvel & Lumpkin, 2007), we can assume also that entrepreneur knowledge – specifically, its breadth and depth – positively affects innovative activity of a firm. Deriving from the previous discussion, we can postulate that human capital in SMEs is largely represented by the entrepreneurs who run them, so their knowledge may have a positive effect on innovation. In other words, the knowledge set of an entrepreneur may provide a foundation on which a firm is able to innovate (Nonaka et al., 2000).

We build our research questions on the assumption of the prevailing role of entrepreneurs in the decision-making processes of SMEs (Lin, 1998; Torres & Julien, 2005). We use this role to create a parallel between the connection between firm-level knowledge and innovation and the connection between a manager's/entrepreneur's knowledge and firm innovation. The focus on the relationship between an entrepreneur's individual-level characteristics and firm-level innovation output is of a particular importance in the context of SMEs, because it has been shown that entrepreneurs are vital drivers of firm innovation (Marcati et al., 2008). Amabile et al. (1996) suggest that innovation begins with creative ideas by individuals and teams within an organization. Whereas large firms are managed by professionals, SMEs usually are owned and run by founders (Lu & Beamish, 2006; Shuman & Seeger, 1986). The latter are less comprehensive in their decision behaviour, and thus should possess more diversified knowledge (Smith et al., 1988), because their behaviour otherwise might have negative consequences for the enterprise's performance (Lu & Beamish, 2006). Moreover, firm performance, development, growth, and innovation are said to be a reflection of an entrepreneur's characteristics, actions, effectiveness, and behaviour (Baron, 2013; Hmieleski et al., 2015; Lin, 1998). North and Smallbone (2000) show the central role of an entrepreneur in the initiation and development of innovation. In their study, an entrepreneur was often also the only person involved in the innovation process of a firm.

Building on prior literature, we define the scope of our research by posing the following questions:

How does an entrepreneur's knowledge affect innovation?

How do knowledge breadth and knowledge depth influence each other?

How does the combination of knowledge breadth and knowledge depth impact firm innovation?

1.2 Entrepreneurs' integrative thinking

Another important attribute successful entrepreneurs have been shown to exhibit is integrative thinking (Martin, 2007b). Integrative thinking illustrates a manner in which entrepreneurs solve problems. Effective use of such thinking brings their firms to a higher level of performance and innovation.

According to Martin (2007b) the process of integrative thinking consists of four steps. These stages do not differ tremendously from conventional business thinking; rather, it is the way in which integrative thinkers approach them that makes a difference. In determining salience, an integrative thinker, in contrast to a conventional thinker, searches for less obvious but potentially relevant factors. When analysing causality, not only linear relationships between variables are considered but also multidirectional and nonlinear relationships. A third step, employment of a holistic approach to the problem, is crucial. Resolution is later achieved by resolving tensions between opposing models.

In the following paragraphs we review the steps of the process in depth and examine their individual contributions to innovation. For the purposes of innovation it is crucial to determine real market needs, develop a deep understanding of the consumer, and then to comprehend all the fragments that compose a problem (Brown & Wyatt, 2010; Nussbaum, 2004; Sakkab, 2007). Integrative thinkers exhibit an ability to see all the salient aspects of the problem and seek less obvious but relevant factors (Brown, 2008, p. 87; Martin, 2007a, p. 66, 2007b, p. 47). This advantage might have a parallel in an organizational construct of absorptive capacity. In order for firms to be innovative, they require an ability to recognize new and useful external information, assimilate it, and then use it for commercial purposes (Cohen & Levinthal, 1990). Such characteristics are suggested to have an important effect on innovation (Fabrizio, 2009; Murovec & Prodan, 2009; Tsai, 2006), because more-relevant information can be gathered externally and used appropriately in problem solving. Because our focus is on SMEs, where an entrepreneur's decisions usually also represent the firm's decisions (Carrier, 1994; Torres & Julien, 2005), we postulate that the same features also apply to entrepreneurs.

Entrepreneurs further differ in mechanisms for analysing causality. To make a good decision later on, a proper analysis of the salient features and how they relate to each other must first be made. Conventionally, entrepreneurs seek an easy way out and are happy with simple linear relationships. On the other hand, integrative thinkers consider all relationships between variables. This step is grounded in generative reasoning, which helps to provide a foundation for creative resolutions. To put it differently, it is the process of using abductive logic, which successfully operates with novel and interesting data

(Ambrose & Harris, 2009, p. 43). When solving difficult problems, integrative thinkers need to look at everything, because a potentially omitted part could lead them to solution. Abductive logic is a tool for discerning a pattern out of the mystery (Martin, 2007b, 2009, p. 74). After an observation of an unpredicted phenomenon is made, abduction is used to find answers because it is perfect for managing incomplete information (Arrighi & Ferrario, 2008; Hintikka, 1998). In addition, an important feature of generative reasoning is also a trial-and-error concept, which is shown to foster innovation (Cannon & Edmondson, 2005; Thomke, 2003). In summary, abductive thinking, by generating new hypotheses and new outcomes, fosters creativity and innovation (Gonzalez & Haselager, 2005; Ross, 2010).

After causal relationships between salient features have been established, a decision needs to be made. Entrepreneurs usually lose sight of a problem, which results in mediocre results. Integrative thinkers, on the other hand, keep the whole problem architecture in mind to see how different parts fit together and how decisions will affect one another. A third differentiation from conventional thinking is the use of a holistic approach.

Integrative thinkers create a holistic architecture in a search for creativity (Ambrose & Harris, 2009; Martin, 2007b, p. 82). They avoid conventional thinking by using segmented analyses, and by keeping the entire problem in mind while working on its parts they are able to examine the mutual effects of single parts (Brown & Katz, 2009; Martin, 2007a, pp. 65-67). Holistic thinking enhances understanding of the relationships between parts within the context of the system. This style creates the foundation for a greater innovativeness and innovation, because problem defragmenting is not optimal for solving tough problems – Martin (2007b, p. 79) argues that there exist only business decisions, not finance, marketing, and other decisions. A problem must be seen as a whole, and segmented specialists (e.g., R&D, marketing, human resources) do not have much knowledge in other fields and therefore frequently reject decisions other than their own. Other divisions then have to try their best within limits. Many other scholars (e.g., Cooper & Edgett, 2008; Desbarats, 2005) agree that a holistic approach has become a new imperative for better innovation processes and therefore for achieving a competitive edge.

In achieving resolution, entrepreneurs too often accept unpleasant trade-offs and settle for the best alternative. The reason lies in their tendency to simplify, which causes ignorance of possible opportunities, which emerge when examining problem features in the previous stages. By contrast, should there exist tensions between opposing ideas, integrative thinkers are prepared to solve them and generate innovative outcomes (Martin, 2007a). It is no problem for them to examine everything again at the end of the process and find a way to integrate all features in a nonconventional, superb, innovative outcome.

Prior literature suggests that the steps that form the integrative thinking process have a positive effect on innovation individually. Building on prior knowledge suggesting a strong linkage of entrepreneur behaviour in fostering SMEs' innovation (Marcati et al., 2008), we expect that entrepreneur thinking enhances firm innovation. This study explores factors that determine how their thinking leads to innovation, determines how successful entrepreneurs act, and examines a possible linkage of these attributes

with the characteristics of integrative thinking. The aim is to reveal prevailing factors of entrepreneur thinking skills that affect innovation and verify whether these factors actually characterize integrative thinkers, which are said to be the new imperative in business. To set the context of our research we pose the following questions:

What are the key determinants of an entrepreneur's thinking that enhance his/her problem-solving skills?

How does an integrative-thinking entrepreneur differentiate from other entrepreneurs?

How does an integrative-thinking entrepreneur affect firm innovation?

2 RESEARCH DESIGN

This article develops a deep understanding of how an entrepreneur's knowledge dimensions and integrative thinking interact to impact firm innovation. Because there exists a paucity of studies that qualitatively examine entrepreneurs' stories about the mechanisms we study and their impact on innovation, the qualitative methodological approach was used to examine entrepreneurs' feelings, attitudes, and perceptions (Patton, 2002). Existing empirical studies suggest a positive independent effect of our investigating variables, but we do not yet know enough about their interplay and overall impact on firm innovation.

Interpretative phenomenological analysis (IPA) was found to be the most appropriate method for exploring the personal experiences and perceptions of entrepreneurs (Cope, 2011; Smith et al., 1997; Thompson et al., 1989). IPA attempts to explore real-life motives, largely leans on personal experience, and draws on individuals' perceptions, rather than producing an objective statement (Pietkiewicz & Smith, 2014). Using this method, we may be able to better understand relationships between knowledge breadth, knowledge depth, an entrepreneur's integrative thinking skills, and the overall effect of these factors on firm innovation. Our aim is thus to explore in detail our area of concern and identify essential components of entrepreneur knowledge and integrative thinking in relation to innovation which make them unique, rather than to test predetermined hypotheses.

The study draws on the indicative guidelines for IPA by Smith (2014; 1997). The research questions were designed very broadly with an open inductive approach to understand how entrepreneurs experience our particular phenomena. No predetermined propositions were formed prior to our research.

2.1 Sampling

IPA aims to produce a detailed examination of phenomena rather than to generate a generalizing theory. Nevertheless, the investigation may bring insights into universal mechanisms (Pietkiewicz & Smith, 2014). The method relies on the use of purposeful sampling within a fairly homogenous group, because it involves finding a group of information-rich participants who share significance and relevance for a particular

research problem (Greening et al., 1996). Purposeful sampling is constructed to serve our specific need to include entrepreneurs with similar demographic/economic-status profiles, closely related to experiences in innovation, in order to enable a profound examination of our research questions.

IPA studies use small sample sizes because a detailed analysis is time-consuming—the aim is not to generalize but to determine the in-depth perceptions of the participants (Smith, 2015). In theory, a sample of three is recommended because it allows adequate in-depth individual engagement and still showcases similarities and differences between individuals. A larger sample size could lead to overwhelmingly vast amounts of data being generated, which may inhibit production of a sufficiently incisive analysis. Therefore our sample consists of three Slovenian entrepreneurs whom we identified through our personal network.

2.2 Data Collection

The primary methodology used in IPA research is phenomenological semi-structured interviewing. We followed IPA guidelines (Smith, 2015) to attain a first-hand description of investigated domains of the entrepreneurs' experiences. Such interviews allow enough flexibility to provide solid grounds for further detailed examination of unexpected directions and interesting areas that may arise. The interview protocol was loosely structured in advance and began with an opening question without hidden presumptions about the entrepreneurs' personal stories of determinants that can be attributed to their firm innovation, followed by key questions indicating the topics we wanted to discuss. Initial questions were modified to participants' responses by gentle probing (Smith, 2015). When respondents gave intangible answers, we used more-explicit yet still sufficiently vague prompts to move to our addressing areas. Similarly, we strictly avoided evoking a notion of knowledge breadth, knowledge depth, and integrative thinking until the last part of the interview, when we tried to connect their stories with the mentioned mechanisms. We carefully recorded responses provided by participants and loosely funnelled them to the researched topics with minimal probing by asking them more-specific questions. We recorded the interviews with the agreement of all three participants. Their profiles are located in Table 1.

<i>Name</i>	<i>Profile</i>
<i>Adam</i>	Adam is a serial entrepreneur, manager, and, recently, a well-known Slovenian business angel. He is a partner in many successful companies and has co-founded one of the biggest online stores in the region. His passion is predicting future trends and exploring the impact of new technologies. Recently he has started to mentor young entrepreneurs.
<i>Ben</i>	Ben is an entrepreneur with a diverse background in programming and philosophy, and can be best described as an evangelist of the regional start-up community. He is a co-founder of the first start-up in Slovenia to acquire venture capital financing. His company raised almost 10 million Euros' worth of investment. He is also a member of a Slovenian business angel fund.
<i>David</i>	David was on the board of directors at one the leading company for direct marketing and e-commerce in Central and Eastern Europe, with over 7000 employees and 300+ million customers. In charge of sales and IT, in his last year he had spent 298 days travelling for business. Later he founded his own start-up to create an imaginative centre where new ideas will arise.

2.3 Data Analysis

Smith (2015) suggests that IPA methodology is flexible, individual, and not prescriptive. Following a set of flexible guidelines, which can be adapted to specific purposes, we used a step-by-step approach to the analysis.

First we transcribed all three interviews, each of which lasted between 70 and 80 minutes. We read all three transcripts several times in order to become more familiar with the content and to identify potential new insights. In each stage of reading, we made additional notes and observations about the content, language, and context. The next stage involved transforming these notes into emerging themes, concise phrases that captured the essential context of the notes. We continued with theme clustering by identifying the connections between emerging themes. These clusters then represented the superordinate themes, which fully capture the entrepreneurs' views of our topic.

Each transcript was searched individually for its own theme clusters without any presumptions. Following identification of convergence and divergence between participants' themes, a final table of superordinate themes was constructed for all three topics under investigation. In the process, certain themes were dropped because they did not fit well within the structure.

Three main superordinate themes emerged for entrepreneur knowledge and eight for integrative thinking. In what follows, we describe each theme and provide evidential interview extracts to support our interpretation and to present entrepreneurs' pertinent perspectives.

2.4 Findings

In the next sections, findings from the IPA analysis are described by categories. We start by demonstrating results for entrepreneur knowledge and conclude with findings regarding entrepreneur thinking.

2.4.1 *Entrepreneur knowledge*

Extensive knowledge in one field is said to be no longer sufficient. We expect that the more knowledge a person possesses in terms of breadth and depth separately, the more successful, creative, and innovative he/she can be; narrow specialists tend to neglect other points of view and thus are inflexible and hard to work with. On the other hand, if a person possesses only knowledge breadth, his/her skills are insufficient to be a part of strategic process. Therefore, Brown (2005; 2009) postulates that firms need to search for people with balanced knowledge depth and breadth to remain competitive. These two knowledge dimensions can be represented by a so-called T-shaped structure, where a vertical line depicts depth and a horizontal line depicts breadth. Such a balanced person possesses deep knowledge and deep analytical expert thinking skills in his/her field of specialization along with a broad understanding of other disciplines and broad empathy. In this case, depth represents a skill that allows making tangible contributions to the outcome, whereas breadth depicts the capacity and disposition for collaboration across disciplines. Such individuals are curious, open-minded, always eager to learn, and have experience in areas not necessarily directly needed for their jobs. This structure allows them to combine knowledge, i.e., to connect general knowledge, experiences, skills, and hobbies to a problem in the area of their expertise. It enables new perspectives on how to utilize the expert knowledge in many different aspects of life and thus makes entrepreneurs more creative and, ultimately, innovative (Brown & Katz, 2009).

Grant (1996) assumes that narrow-field knowledge itself is not sufficient by exploring mechanisms for effective specialist knowledge integration. He suggests that specialists do not need to know everything from other expertise domains, but communicating their knowledge to other specialists is of particular importance. For such operations, a common knowledge is crucial, because it enhances sharing different aspects of knowledge. Evidentially, there appears to be a solid relationship between an entrepreneur's knowledge and his/her innovativeness, which affects a firm's innovation (Jiao et al., 2014; Marcati et al., 2008). An entrepreneur's knowledge base may improve the likelihood of opportunity recognition and is positively related to innovation radicalness through generated breakthrough insights (Marvel & Lumpkin, 2007). In addition, knowledge breadth has been recognized as a catalyst for successful managerial innovation and innovation performance

(Rodan & Galunic, 2004). In the following sections we review how entrepreneurs actually perceive knowledge in real-life situations.

Participants were asked to discuss all of the determinants that enhance and affect the innovation activity of the firm. They started very broadly and soon narrowed to their personal-level characteristics. The first topic that emerged was personal knowledge. The findings uncover three areas that characterize an entrepreneur's knowledge and its effect on innovation: (1) openness to experiences, (2) knowledge breadth and depth, and (3) learnability and curiosity.

Entrepreneurial openness has gained a great deal of attention recently. Scholars such as Slavec (2014), Ciavarella et al. (2004), and Dean (1999) link it with innovation and performance. In terms of an entrepreneur's openness, all three participants highlighted travel, command of foreign languages, and personal hobbies. These three aspects are prerequisite to gaining new insights which enhance innovation. They enhance idea generation, improve the process of problem solving, and grant easier access to information. As participant David suggests, travelling serves as a foundation for spotting new ideas, enhanced communication, better self-confidence, and a greater understanding: "In this way you can see that the world is not a bogey, that others are not so much more capable than you, you get confidence and lose fear." Similarly, participant Ben argues that personal openness, hobbies and experiences gained through travelling are essential for innovativeness: "The breadth of life experiences significantly increases the likelihood that you will find the optimum solution for whatever is a concrete problem. And it is important to have a personal life just so that your brain remains soft and flexible." In his opinion an entrepreneur's brain is constantly on when faced with an ambitious challenge. It is not rare that one can find a solution to a problem when dealing with a completely different situation. Participant Adam, on the other hand, when discussing the innovation factors, puts significant emphasis on command of foreign languages: "You have to speak different languages to recognize the important actual trends and to acquire information easier."

The next theme that emerged during our data analysis is knowledge in terms of its depth and breadth. Knowledge depth creates a foundation on which innovation can be built (Prabhu et al., 2005). Specifically, depth of experiences contributes to innovation radicalness (Marvel & Lumpkin, 2007). David agrees: "Expertise in a certain area is central for strategic thinking and innovation." The vital role of knowledge depth is also summarized by Ben: "An entrepreneur needs a content to start innovating. You have to know it all to exploit opportunities and to find a gap in a certain area, which could be further optimized and turned into a prosperous business opportunity." Interestingly, Adam stresses the importance of different knowledge dimensions: "To keep your product fresh and competitive, you need to build on your existing expertise and dig deeper into technology, user experience, or even marketing. Similarly, when introducing new products, the knowledge depth in your field is still required; however, in order to construct something completely new, you need to expand your knowledge in various domains to produce something really unique." The need for both knowledge dimensions is best described by David: "I need both knowledge depth and breadth. This is the only way that guarantees new perspectives on how my expertise can be creatively used."

Knowledge in different domains for the purposes of greater innovativeness has been highlighted by several scholars (Bierly & Chakrabarti, 1996; Brown & Katz, 2009; Carlo et al., 2012). Participants highlight the important role of knowledge breadth in enhancing innovation, because combining different disciplines helps uncover innovative solutions. Adam sees knowledge breadth as an important generator of hype and curiosity to start something new and consequently fuel innovation: “You need a horizontal knowledge to be innovative. Not that I am a top expert in all domains, but at least I know which industries are prospective and what is to be expected from them.” Ben further outlines the important role of knowledge breadth in innovation: “Knowledge in a certain area may bring an innovative solution to the problem in a completely different area as you try to connect them together. The fact that I taught myself to program in a previous life has a significant impact on my ability to connect different disciplines with programming and search for creative solutions.” David adds, “Many times I remember Mr. Japiec, who said that his cardiology profession helped him in designing innovative ships.”

All three respondents similarly specified knowledge breadth as the most important factor in achieving innovation. Knowledge breadth is vital to understanding what knowledge is missing and how to acquire it. “Breadth helps you to see your lacking skills. And then you go and get this knowledge yourself or find people who have this knowledge,” says David. Ben agrees: “I was surrounded by people from whom I could learn from the beginning. And I needed to teach myself how to proactively involve them in my business as consultants.” It is important to understand what one can and cannot do, what one knows and what one does not. As Adam says, “The decision who you will hire will affect the end product.” Therefore you need to know what you really want to achieve in that particular field in order to develop an innovative product you have in mind. Otherwise the end product may be something completely different from what you had expected. Adam says, “Should we come to an area where I presume someone knows more about it than me, I will be able to let go and participate only as a controller. For that you still have to know something in this field, in order to give the right instructions.”

Knowledge breadth is important for solving multi-faceted problems. Ben argues that knowledge breadth enhances communication with employees and offers more-effective control over them to allow for a better and faster innovation process: “Knowledge breadth is important, as you never know what kind of problems you will encounter. It happens that I know how to talk with designers, although I have never worked in this field professionally. But my knowledge in this field helps me hire a better designer and to control his outcomes more effectively, since we speak a common language.”

The last theme that emerged is learnability, which is suggested to play a central role in innovation and performance (Cope, 2005; Martin, 2007b; Mi Dahlgaard-Park & Dahlgaard, 2010). In order to be innovative, one needs to constantly learn and nurture one’s own curiosity. This is how one broadens and deepens his/her knowledge base, which serves as a foundation on which innovation can be built. Knowledge gained through regular education is never enough. Adam argues that an “entrepreneur needs more and more knowledge each year in order to stay competitive and produce innovative products”. Ben adds that “curiosity is a must.

You need to start solving problems not only because they need to be solved, but also because they are interesting. This is how you broaden your horizons.” Furthermore, entrepreneurs need to learn how to listen to other people and to recognize things they don’t know. Ben claims that “you have to know what and how to absorb and reuse when it matters the most – when searching for an innovative solution”. David agrees: “You build your innovative knowledge base with previous experiences, obedience and mistakes along the way”

This deep insight into the entrepreneurs’ knowledge builds on the existing theories regarding its role by focusing on three major attributes that seem to be of great essence in practice. It indicates the highly important role knowledge has for entrepreneurs and for their firms. Despite the significance of an entrepreneur’s expertise, interviews reveal that it is knowledge breadth that stimulates the problem-solving process and accounts for more-innovative solutions. A firm can be more innovative when an entrepreneur integrates different areas with their own expertise and identifies solutions that are not yet seen. In addition, learnability, openness, and curiosity also are crucial because one’s knowledge has to be constantly upgraded and expanded. So in order for a firm to be more innovative, its entrepreneur has to always strive for new experiences. In summary, these comments and themes are suggestive of the strong relationship that knowledge breadth has with knowledge depth and their joint enhanced impact on firm innovation. All things considered, we construct the following proposition:

P1: Breadth of an entrepreneur’s knowledge, in terms of general knowledge, experiences, and skills, enhances the effect that the entrepreneur’s deep knowledge has on firm innovation.

2.4.2 Entrepreneurs’ integrative thinking

The literature describes integrative thinkers as entrepreneurs who do not rely on analytical processes and particularly refuse to accept trade-offs in the form of either/or choices. These entrepreneurs possess the ability to widen the scope of their approach and to see all of the salient aspects of a problem and try to find a way past them by favouring “both/and” thinking in order to create novel solutions (Brown, 2008, p. 87; Brown & Katz, 2009, p. 85). In contrast to Fitzgerald’s definition (1945), which in fact creates the foundation for further development of the concept, the new understanding is much more generalized and not exclusive to geniuses (Chamberlin, 1931; Martin, 2007b). Even though there exist leaders who can strengthen their integrative capability through practice and exercise, great integrative thinkers are still rare, mostly due to the anxiety that it causes and to the fact that many leaders choose simplicity and clarity over complexity and ambiguity, which are considered to take much more time and effort (Martin, 2007a). The following paragraphs will serve as an insight into those thinking determinants which entrepreneurs find crucial for being innovative. As it turns out, all of the emerging factors characterize the integrative-thinking process.

The findings of our phenomenological interviewing indicate eight major themes grounded in personal decision-making and thinking processes that affect innovation of the firm: (1)

fast decision-making, (2) 80/20 rule, (3) holistic approach, (4) embracing complexity, (5) comprehensiveness, (6) risk perception, (7) inclusion of others, and (8) future stance.

The interviewees agree that fast decisions in problem solving are crucial for firm innovation. Similarly, the literature tries to understand how to make quality decisions quickly for better performance (Dane & Pratt, 2007; Eisenhardt, 1989; Perlow et al., 2002). It is better to start acting than to try to think of a perfect solution first. Such probing will allow for more-innovative solutions as one deals with the unknowns and puts the elements together in novel ways. David says, "When we opened new markets, we did not make any substantial research of them, no Porter analysis and so on.... We just did it. If we had known all the indexes, then we would have opened half less markets. Sometimes you just need to try." Similarly, Adam agrees, "I make quick decisions and don't waste time with contemplating. As long as you picture your goal in your mind, it doesn't matter which option you will choose. The world will still be spinning and people won't mind." Likewise, it is better to make a mistake than to search for an ideal solution. According to David, "I think it is better to make a mistake on Monday, so you can fix it on Friday, than accept the right decision in two weeks." This is how one becomes involved in the market early enough to learn through mistakes and improve the solution over time.

The second theme to emerge was the 80/20 rule (Koch, 2011; Martin, 2007b). Although the theory of integrative thinking argues that it is worthwhile to put in an additional 80% of effort to reach a solution that is only 20% better, our respondents somewhat objected. All three respondents agreed that the value of time is priceless. "I think it is a waste of time to put 80% more effort in search for only 20% better outcome. I rather use this time to make another product" (David). Indeed, with more time one increases the number of problems one may solve. Ben says, "Today, 60% of the perfect solution can already be enough to be innovative." In his experience, "The problem must only be solved to the point where the next step, whether it is worth to dig in deeper, is confirmed." Correspondingly, one should not focus solely on one solution when one has to get to market as quickly as possible: "Someone else will surely come, who will see a completely different story, and make a better solution with far less effort than I would do" (Adam).

Holistic thinking is another important aspect in achieving innovation (Ambrose & Harris, 2009; Desbarats, 2005). In the participants' experiences, an individual cannot be innovative unless he/she approaches a problem in a rounded fashion. This is the only way in which partial aspects of the problem will not blur the higher meaning and divert the activities. David says, "You have to break a complex problem into pieces, otherwise you won't find the solution. But while working on each piece separately, you still have to think of the whole situation all the time. That enhances innovation for sure, otherwise you just get lost."

Furthermore, complexity evolves an entrepreneur's ability to think innovatively, identify more opportunities, and deal with problems creatively. Indeed, complexity seems important in business (Baggen et al., 2015; Hsieh et al., 2007). Problems are "supposed to be taken as personal challenges. This is how you build up the capacity to innovate," says Ben. Dealing with complex problems should not impose any stress. The search for

a creative solution should be a great motivation for entrepreneurs. David says, "You can learn a lot and experience many unconventional solutions. Complex problems give many useful insights that can be used when searching for creative solutions of all the problems to come."

Our respondents strongly emphasized an integrative approach to any problem solving (Ambrose & Harris, 2009; Martin, 2007a). They see it as a path to identifying features of a problem others may miss, and in this way to build an innovative solution. All three entrepreneurs have in common a capacity to search for all the salient data available. That is to say that innovative entrepreneurs have this predisposition. David confirms, "I have many experiences, which help me find the components that may seem hidden. I use these components to make a better decision and ultimately build a better product." When facing a problem, entrepreneurs should first closely examine all its parts from near and far to find something that may be essential for a more-innovative solution and then connect these findings in a non-conventional, non-linear way in order to achieve a greater innovativeness. Adam says, "When I face a certain problem, I try to look at it from different perspectives to find something that is missing and identify all crucial components that may lead to different solutions that are usually overlooked. I also include insights from different people. Then I try to connect these findings in a new, innovative way. This is how firm innovation works." Similarly, Ben says, "First you need to understand the whole story, gather ideas from your co-workers, without any prior established presumption that would inhibit the detection of new facts. Then you connect all the dots and start experimenting. Usually this results in an innovative solution." In addition, in order to get innovative results, Ben mentions the need for "a fast and comprehensive analysis", which in his opinion is extremely rare.

Another important aspect that adds to a more innovative entrepreneur's thinking process is risk perception (Hyrsky & Tuunanen, 1999; Palich & Bagby, 1995). Innovative entrepreneurs are supposed to perceive risk in a different way. According to the participants, there is no such thing as risk and it does not affect their decision-making process. Adam argues, "If you know things well enough, there is no risk involved." Ben adds, "With a great intuition, the risk diminishes." However, they agree that courage is a must and should not be mistaken for risk-taking. David explains, "To find an innovative solution, you do need to go out of the box and have courage into diving into less known areas. Only thus you dare to try new things and grow your creativity and innovativeness by mixing them with accumulated experiences. However, I don't perceive such act as an act of risk-taking."

Entrepreneurs need to have passion for their work. Otherwise, as David states, "they won't find satisfactory and innovative solutions". They need to include other people in their thinking process and search for challenges in discussions with others (Byrne et al., 2009; De Jong & Den Hartog, 2007). That is how a firm can be more innovative as different views are merged together into a solution. According to the interviewees, not many entrepreneurs are open to other people's opinions. That is a true virtue and a distinctive competence. Adam argues, "Entrepreneurs need to have an ear for their employees, friends, and others. Listening to their stories and their insights might give

them a completely different view of a certain matter. And then you just need to integrate everything in an innovative solution.” In David’s words, it is sometimes “difficult to admit you were wrong and others were right, but as soon as you realize that this is the way to a greater innovativeness of a firm, you are on the right path”. Moreover, the communication should go in both directions. An innovative and successful entrepreneur will have a passion for sharing his knowledge and for mentoring others. According to Ben, that is one of “the main drivers of entrepreneurship”. In other words, giving back to employees gives you more confidence and better recognition. This is how employees will have no fear sharing ideas with an entrepreneur, which “will result in better firm innovation”.

A salient topic that emerged is an ultimate orientation towards the future. Greater attention to the future leads to a more effective uncovering of new technologies and an enhanced innovativeness (Martin, 2007b; Yadav et al., 2007). The world has to be seen as full of challenges and changes for the better. This competence is best described by Adam: “To be more innovative, you need to always be in the future with your mind. You need to think how your current solution will affect the future and how you can help build it. You try to do unthinkable, yet necessary in order to be more innovative. You try to predict the future by imagining your product in it and see how well it fits.”

Phenomenological interviews offered us deep insight into entrepreneurs’ thinking processes. We identified several themes that characterize problem-solving skills important for innovation. These emerging themes also echo important practices of integrative thinking as described by Martin (2007a): consideration of more salient features, multidirectional consideration of causality, visualisation of the whole problem, and refusal to accept unpleasant trade-offs. Because the process has not been investigated thoroughly in the literature, we wanted to gain a close understanding of how an entrepreneur’s thinking skills provide more creative and innovative solutions. It turns out that an entrepreneur’s thinking is central to problem solving. Different methods and skills of an entrepreneur might result in completely different solutions. In our participants’ opinions, these are the characteristics that will grant a higher innovativeness to entrepreneurs and, consequently, better performance and innovativeness to their firms.

We found that the essential characteristics of an entrepreneur’s thinking process that enhance problem solving and innovation are also the ones that differentiate an integrative thinker from a conventional thinker: the ability to accept fast decisions, not striving for absolutes, the ability to develop an integrative approach to a problem and keep it in mind while searching for solutions, openness to complex problems, the ability to identify all the invisible components of the problem, constant use of others’ opinions, and a different perception of risk-taking and future stance. All these characteristics, according to our observations and our participants’ opinions, have a strong impact on their personal innovativeness as well as on overall firm innovation. Consequently, we assert the following proposition:

P2: By using integrative thinking in problem solving, entrepreneurs improve creativity and enhance firm innovation.

3 DISCUSSION AND IMPLICATIONS

This research was intended to improve our understanding of the underlying factors of entrepreneurs' cognitive attributes, to explore how these attributes are related to each other, and to reveal the prevailing personal factors that have a strong effect on firm-level innovation. We used qualitative research methods to understand the feelings, emotions, perceptions, and personality characteristics of entrepreneurs. Specifically, we utilized IPA to explore entrepreneurs' personal experiences about their knowledge and thinking and drew on the individuals' own perceptions. The findings expand the existing view of entrepreneurs' cognitive assets (e.g., Dakhli & De Clercq, 2004; Martin, 2007b) in relation to innovation in order to emphasize a strong link between entrepreneurs and firm-level output.

While supporting the vital role of entrepreneurs in firm innovation, this research supplements the existing theories on knowledge and thinking by suggesting the importance of knowledge breadth for innovation processes. A diversity of experiences acquired by entrepreneurs has been shown to play a vital role in opportunity recognition and firm innovation. These experiences develop an entrepreneur's knowledge breadth, which allows for new perspectives on how to use his/her expertise in different ways. Combining different areas of knowledge makes entrepreneurs more creative and innovative.

Furthermore, innovation is largely dependent on the thinking processes of entrepreneurs. Evidently, in order to achieve innovation and to be better at it, certain thinking patterns emerged which all could be linked to integrative thinking theory (Martin, 2007a). These themes facilitate the innovativeness of an entrepreneur and positively affect overall firm innovation: fast decisions, non-perfectionism, holistic approach, inclination towards complexity, comprehensiveness, collaboration, and future stance.

Our research contributes to the areas of entrepreneurs' characteristics and behaviour and the innovation of SMEs. In sum, our findings correspond to observations in the literature that suggest firm performance and innovation are a reflection of entrepreneur characteristics and behaviours (Baron, 2013; Hmieleski et al., 2015). We provide clearer evidence of the impact entrepreneurs have on their firms by connecting their activities to firm-level outcomes. We analyse and identify the most relevant personal characteristics that contribute to firm-level innovation. This study is among the first to examine knowledge depth and breadth at an entrepreneurial level. So far, the literature encompasses studies of knowledge dimensions mostly at a firm level (e.g., Marvel & Lumpkin, 2007). Using IPA methodology and bridging entrepreneurs' decisions with their SMEs' decisions, we seek to understand entrepreneurs' knowledge dimensions, the mutual interaction of these dimensions, and how they help SMEs to be more innovative. Our findings support previous arguments about the importance of knowledge in innovation (e.g., Farace & Mazzotta, 2015) and complement the understanding of the interplay between its dimensions at the personal level of the entrepreneur. In addition, our results emphasize an important enhancing role that is played by knowledge breadth in terms of general knowledge, experiences, and skills in the relationship between entrepreneur expertise and firm innovation.

Similarly, entrepreneurs' thinking skills that contribute to innovation are explored in detail and linked to the theory of integrative thinking proposed by Martin (2007b). It seems that there exists a certain mindset – attributes of entrepreneurs' thinking processes – that facilitates entrepreneurs' success as well as innovation. In the first stage of this innovative process, the entrepreneur has the capacity to spot less obvious but relevant and salient features of the problem. In the next step, he/she seeks to explore multidirectional and nonlinear relationships between different parts of the problem. In the third step, the entrepreneur creates the relationship model depicting variables from previous steps by using a holistic approach. Finally, the entrepreneur generates an innovative outcome by embracing complexity, considering all parts of the problem, and resolving tensions among opposing ideas.

We have several practical implications for entrepreneurs to facilitate innovation in SMEs. First, the study highlights that entrepreneurs in SMEs have a vital role in fostering innovation because they often play the central decisive role. Based on the interviews, entrepreneur characteristics have a strong impact on firm-level outcomes. Therefore, in order for a firm to perform better or be more innovative, entrepreneurs themselves are a key element of change. Next, our interviews illustrate that entrepreneurs should constantly expand their horizons with travelling, learning foreign languages, and hobbies, because these are prerequisites for easier information acquisition, which can be used in innovative activity. An entrepreneur's openness therefore enhances the innovative idea-generation process and helps gain new insights into the problem area. An innovative entrepreneur should be curious and eager to learn in order to stay competitive and produce innovative solutions. Furthermore, knowledge breadth has been suggested as the vital and most important dimension of knowledge, which entrepreneurs tend to neglect. Entrepreneurs' knowledge breadth increases personal innovativeness and ability to execute and control several activities effectively. Indeed, knowledge breadth is an essential factor in firm innovation because it facilitates an interdisciplinary approach in finding creative solutions. On the other hand, it also reveals gaps in an entrepreneur's knowledge. It helps in human-resource-based decisions, because it grants the capacity to select the right employees for a certain activity and promotes more-effective controlling and monitoring. In addition, entrepreneurs should constantly deepen their expertise to enhance exploitative innovation and identify opportunities in their domains.

Similarly, an entrepreneur's thinking has been shown to largely influence his/her innovative activity and enhance firm innovation. All the themes that emerged in this analysis are strongly connected to the concept of integrative thinking, which is said to enhance a person's innovativeness and ultimately lead to better firm innovation. Evidently, in order to achieve better innovation outputs, an entrepreneur has to possess an ability to make quick decisions. It is better not to invest all the time in searching for a perfect solution to a problem, because this allows more time for experimentation. Moreover, entrepreneurs who utilize integrative thinking have a capability to identify certain components of the problem that many others many not see, which allows them to connect ideas in a way that will boost firm-level innovation. Correspondingly, entrepreneurs who want their firms to be more innovative consider other people's opinions, because these might offer them

novel tools to understand different insights and merge them in an innovative solution. Finally, it is important to think about the future. Mentally transferring current problems and possible solutions to the future helps entrepreneurs spot the missing link and identify the right direction, and ultimately leads to more-innovative outcomes for a firm.

4 LIMITATIONS AND FUTURE RESEARCH

There are several limitations to this study. We use qualitative research methods, which typically raise concerns such as subjectivity, sampling, validity, reliability, and statistical generalization (Neergaard & Ulfhøi, 2007; Stritar & Drnovšek, 2015). In general, with the use of qualitative research our findings cannot be extended to wider populations with the same degree of certainty that quantitative analyses can be (Atieno, 2009). In addition, the generalization is also affected due to the small number of cases used in the study. However, the aim of IPA is to gain rich descriptions of the studied phenomenon, identify its essential components, and explore individuals' perceived insights into different situations, rather than making more-general claims (Pietkiewicz & Smith, 2014). Furthermore, use of small sample sizes and purposeful sampling to find a fairly homogenous sample are suggested in order to attain theoretical generalizability (Smith et al., 1997). Without sufficient experiences in the field of innovation, it would be much more difficult to determine the components that facilitate innovation at an entrepreneurial level. Therefore the individuals analysed in the research were selected on the basis of their own success stories. Such a method would normally lead to a sample selection bias (Heckman, 1977), but the aim of this study is to gain rich insights by understanding a sense of the participants' experience and to compose propositions for further research. Hence future research should focus on additional examination and verification of entrepreneurs' cognitive aspects and their effect on firm innovation. To make results statistically significant, quantitative research methods can be used to test propositions on a large sample without the interference of the researcher's presence that can affect subjects' responses.

Second, IPA suggests using open-ended questions without any hidden presumptions in order for an interview to go into novel areas. As the interview schedule is only suggestive, there is an issue of attained objectivity. Furthermore, probes are allowed to guide a participant and investigation into a certain area of interest. Different techniques may have been used for each individual participant in order to achieve this. In addition, prompts followed from participants' answers may unintentionally affect their subsequent answers. There is a need to conduct such research on a larger scale and to use as uniform an interview schedule as possible.

Third, learning from experience may result in the issue of hindsight bias, which affects individuals' inability to recall their experiences and circumstances accurately (Henriksen & Kaplan, 2003). This simplification of past events describes the tendency for people to overestimate the likelihood of past event occurrences and see them as more predictable (Arkes et al., 1988; Roese & Olson, 1996), and is suggested to be strongly linked to entrepreneurs' recollections of their entrepreneurial experiences (Cassar & Craig, 2009).

Therefore in our analysis we may have overlooked some of the more complex determinants of knowledge and thinking effect on innovation. Further research should be undertaken with a focus on factors of entrepreneur knowledge and thinking which may be affected by hindsight bias.

Fourth, this study does not address an interplay between knowledge dimensions, integrative thinking, and innovation in full detail. There exists a question of their reciprocal effect as well as the strength of their individual effect on innovation. Further studies are needed to identify components that are more essential for innovation than others. To understand this, a measure of integrative thinking and personal knowledge should be constructed. Because integrative thinking is a fresh concept, deriving from experience and observation, the measure would allow for its verification on a large sample of entrepreneurs and explore its significant contribution. Moreover, existing measures of knowledge are based on prior work experience (years in business) and education (education level). In our opinion, these measures do not represent personal knowledge correctly. Rather, a measure should be constructed that would allow the capture of personal level of knowledge according to different fields of expertise.

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