

**The Formation of Opportunity Beliefs among University Entrepreneurs:
An Empirical Study of Research- and Non-research-driven Venture Ideas**

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Abstract

Opportunity beliefs, in other words the beliefs of a potential entrepreneur about the feasibility and market fit of a venture idea, are considered as a key driver of entrepreneurial action. The entrepreneur's existing knowledge plays an important role in reducing the uncertainty surrounding a venture idea, thereby contributing to the formation of strong opportunity beliefs. We develop and test a model which incorporates different types of knowledge that can be considered relevant for the formation of opportunity beliefs. Following a screening of 5955 students at 12 German universities, we identify a sample of 292 aspiring entrepreneurs who evaluate their own venture ideas. We analyze the determinants of opportunity beliefs and entrepreneurial action using structural equation modeling. Empirical evidence suggests that different types of knowledge are relevant depending on the venture idea pursued. Research-driven venture ideas benefit from industry experience, whereas general human capital is important for other types of ideas. We also find divergent relationships between opportunity beliefs and entrepreneurial action. The results contribute to our understanding of how opportunity beliefs are formed and how they relate to entrepreneurial action under different conditions of uncertainty. Our study has practical implications for entrepreneurship education and the support of university start-ups.

Keywords: Opportunity beliefs; Nascent entrepreneurs; Uncertainty; University entrepreneurship; Research-driven venture ideas, Global University Entrepreneurial Spirit Students' Survey (GUESSS)

JEL codes: L26, M13, D8, O3

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1 Introduction

Opportunity beliefs are becoming increasingly recognized as fundamental to understanding the entrepreneurial process (Davidsson, 2015; Dimov, 2010; Edelman & Yli-Renko, 2010; Shepherd, McMullen, & Jennings, 2007). They are formed through a cognitive process when people assess the qualities of a venture idea. Opportunity beliefs can be defined as a potential entrepreneur's certainty that a venture idea is economically feasible and meets the demands of the market (Grégoire, Shepherd, & Lambert, 2010). These beliefs are important because they guide the decision whether or not to become entrepreneurially active. They lead to greater initiative and a higher likelihood of firm emergence (Dimov, 2010).

Opportunity beliefs are formed in situations of uncertainty (Knight, 1921; McMullen & Shepherd, 2006). Specific knowledge related to the perceived opportunity can help to reduce this uncertainty because it “sheds light on the degree to which the opportunity exists and can realistically be pursued” (Wood, McKelvie, & Haynie, 2014, p. 257). Thus, previous literature has stressed the importance of the relatedness of the entrepreneur's existing knowledge and skills to the perceived opportunity for the formation of opportunity beliefs (Haynie, Shepherd, & McMullen, 2009; Wood et al., 2014). People relate their specific knowledge to a perceived potential opportunity, which has been described as ‘opportunity individuation’ (Wood et al., 2014). Previous studies have especially dealt with technology-related venture ideas which are characterized by a high degree of uncertainty (Grégoire et al., 2010; Haynie et al., 2009; Wood et al., 2014). Specifically, uncertainty about how and in what markets a new technology might be applied and what a viable business model might look like is present in such a context (Mosey & Wright, 2007).

However, given the importance that uncertainty plays in the formation of opportunity beliefs, it is surprising that existing research has not considered the different degree of uncertainty that venture ideas itself have depending on their origin and research-intensity. While high-tech

start-ups involving a high degree of uncertainty might be the archetype of new entrepreneurial firms, there is increasing evidence that non-technology-driven ventures are also of great importance. For example, in a recent survey of studies on high-growth firms, Henrekson & Johansson (2009) do not find evidence for an overrepresentation of such gazelles in high-technology industries; gazelles are also widely prevalent in services. Audretsch (2014, p. 320) argues that the goal of the university “is not just to promote technology transfer and increase the number of startups but to ensure that people thrive in the emerging entrepreneurial society”. Thus, previous studies on opportunity beliefs might not be representative of the broad spectrum of early-stage entrepreneurial decision making where different degrees of uncertainty prevail (Samuelsson & Davidsson, 2009; Smith, Matthews, & Schenkel, 2009).

Also, previous studies are largely based on experimental study designs where people are expected to form beliefs concerning predefined opportunity scenarios. Yet, individuals and the ideas they are pursuing are intertwined (Dew, Velamuri, & Venkataraman, 2004). We need to better understand the determinants of opportunity beliefs concerning venture ideas that people are actually pursuing. Because of their study design, experimental studies are not able to examine the relationship between opportunity beliefs and entrepreneurial action. Overall, there is an increasing need to complement the results of experimental studies with results from representative surveys of real entrepreneurs who are currently in the process of evaluating their own, more or less uncertain venture idea (Dimov, 2007; Grégoire et al., 2010).

The aim of this paper is, first, to analyze how aspiring entrepreneurs form opportunity beliefs under different conditions of uncertainty and, secondly, how these beliefs relate to entrepreneurial action. Entrepreneurial opportunities are commonly conceptualized as new means-ends relationships (Shane & Venkataraman, 2000). We develop a model which incorporates two important types of knowledge that can be considered relevant for the formation of opportunity beliefs in this means-ends framework: formal knowledge about entrepreneurship and relevant pro-

fessional experience. We distinguish between two different types of venture ideas: research-driven venture ideas which emerge from a research project and/or involve R&D spending and which are likely to be characterized by a high degree of uncertainty, on the one hand, and non-research-driven ideas, on the other hand.

In the empirical part of this contribution we analyze opportunity beliefs of people who are currently in the process of evaluating a business idea for themselves. Following a screening of 5955 students at 12 German universities we identify a sample of 292 aspiring entrepreneurs. Using structural equation modeling, we investigate the determinants of their opportunity beliefs by applying an adapted version of the opportunity beliefs measure proposed and validated by Grégoire et al. (2010). Our analysis suggests that professional experience is important for the formation of opportunity beliefs, as already indicated by previous literature. However, we are able to show that this relationship only holds for research-driven venture ideas where a high degree of uncertainty is present and, presumably, completely new means-ends relationships have to be identified. For non-research-driven business ideas, which are likely to target established markets, general human capital in the form of university education is important for developing strong opportunity beliefs. We also find different relationships between opportunity beliefs and entrepreneurial action. There is a positive relationship for non-research-driven venture ideas where it is relatively easy to identify and conduct the activities required to start a business. Overall, our results suggest that opportunity beliefs depend on different antecedents and lead to different outcomes depending on the type of the venture idea. Our results contribute to our understanding of how opportunity beliefs are formed and how they relate to entrepreneurial action under different conditions of uncertainty.

2 The Nature and Determinants of Opportunity Beliefs

Despite being a central concept in entrepreneurship research, the nature of entrepreneurial opportunities is still subject of an ongoing debate (Hansen, Shrader, & Monllor, 2011; Venkataraman,

Sarasvathy, Dew, & Forster, 2012). Entrepreneurial opportunities require the discovery of new means-ends relationships (Shane & Venkataraman, 2000). For some time, scholars have discussed whether such opportunities are objective or subjective (Alvarez & Barney, 2007), i.e. whether they exist in some form in the market and have to be recognized by an individual with the necessary skills and information (Kirzner, 1979; Shane, 2000) or, in contrast, whether they do not exist per se but have to be enacted and created by purposeful actions of individuals (Gartner, Carter, & Hills, 2003; Schumpeter, 1934). However, this ontological debate neglects that entrepreneurial opportunities are novel and uncertain and their true value cannot be determined in advance (Crossan, Lane, & White, 1999). Whether a situation can be termed an opportunity only becomes clear after people have tried to take advantage of a perceived opportunity and have taken action in the hope of individual, firm, and social betterment (Grégoire et al., 2010, p. 117). Thus, we cannot truly speak of opportunity recognition but only of individual's beliefs about the desirability and feasibility of a venture idea (Davidsson, 2015; Grégoire et al., 2010).

Opportunity beliefs can be described as an individual's degree of 'certainty that a 'venture idea' represents an opportunity' (Grégoire et al., 2010, p. 118). This concept is similar to what Shepherd, McMullen, and Jennings (2007) also describe as 'opportunity beliefs', Dimov (2010) as 'opportunity feasibility belief', Davidsson (2015) as 'opportunity confidence' and Edelman and Yli-Renko (2010) as 'perceived market opportunity'. Grégoire et al. (2010) show that opportunity beliefs are articulated in terms of two dimensions: perceived feasibility and perceived fit. Perceptions of feasibility are concerned with "whether an opportunity is seen as reasonably possible to achieve within a foreseeable future" (p. 122) and the perceived fit captures whether the intended business solution is perceived to match the needs and requirements of the targeted market (Grégoire et al., 2010).

Opportunity beliefs are different from the intention or decision to act on a perceived opportunity. McMullen and Shepherd (2006) conceptualize opportunity recognition as a two-stage

process: Initially, a person forms a subjective belief that an opportunity exists for somebody with the relevant qualities and means. Once a person perceives such a so-called ‘third-person opportunity’, he or she forms beliefs regarding this opportunity and on whether to exploit it or not, i.e. whether this is an opportunity for the actor (‘first-person opportunity’) and should be acted upon (McMullen & Shepherd, 2006, p. 141). Shepherd et al. (2007, p. 78ff) argue that a prospective entrepreneur will develop a first-person opportunity if he or she has evaluated the risk, uncertainty, and ambiguity of the perceived third-person opportunity in relation to his or her own knowledge and motivation. Coherence between the entrepreneur’s knowledge and value structure and the perceived opportunity are likely to contribute to forming first-person opportunity beliefs. Results from conjoint analyses and other experimental studies support this conjecture: the transition from a third-person to a first-person opportunity is facilitated by the relatedness or complementarity of an entrepreneur’s existing knowledge to the focal opportunity (Grégoire & Shepherd, 2012; Haynie et al., 2009; Wood et al., 2014).

In general, human capital, represented by acquired knowledge, skills and abilities, increases the productivity of people in the workplace (G. S. Becker, 1964; Schultz, 1959). What is important for the formation of opportunity beliefs is specific human capital related to starting a business rather than general human capital (Fiet, 1996, 2007; Marvel, 2013; Shane, 2000). Human capital can be obtained by formal learning and informally as a result of experience. In the context of aspiring entrepreneurs who aim at discovering new means-ends relationships, two types of human capital can be considered particularly important: First, previous professional experience may assist in identifying customer needs and potential markets in which to apply a new means of supply. Existing literature has largely focused on this type of knowledge for the formation of opportunity beliefs (Grégoire & Shepherd, 2012; Haynie et al., 2009; Wood et al., 2014). Second, knowledge about entrepreneurship may assist in assembling the resources to be able to serve the market identified. While studies usually investigate or control for the effect of

professional experience (Dimov, 2010; Grégoire & Shepherd, 2012; Haynie et al., 2009), formal entrepreneurial learning might be more important in the context of young aspiring entrepreneurs at universities (Guerrero & Urbano, 2012; Souitaris, Zerbinati, & Al-Laham, 2007). However, existing research on opportunity beliefs has not adequately looked at this relationship. Therefore, we investigate the effect of formal entrepreneurship learning on opportunity beliefs.

Uncertainty plays an important role in the development of opportunity beliefs. Knowledge is widely dispersed in society (Hayek, 1945). Even if people had the same knowledge, their beliefs, attitudes and personality characteristics would lead to different perceptions concerning a potential entrepreneurial opportunity. The dispersion of knowledge in society is associated with genuine uncertainty which is associated with heterogeneous expectations concerning perceived opportunities. These specific expectations lead to a “nexus of the enterprising individual and the opportunity to discover, create, and exploit new markets” (Dew et al., 2004, p. 661). A person’s cognitive resources determine how far potential business ideas are perceived as more or less attractive. In other words, impressions of external situations or information are filtered through the lens of person-specific factors, they are ‘individuated’ (Wood et al., 2014, p. 255).

However, individuals might experience different types of uncertainty depending on the type of business idea they are pursuing. Milliken (1987) distinguishes between state, effect, and response uncertainty. While state uncertainty refers to the uncertainty that originates from not fully understanding or being able to predict the relevant environment of a person or organization, effect uncertainty relates to the inability to predict what impact environmental changes have on the organization. The third type of uncertainty, response uncertainty, describes what response options are available and what the outcome of each might be (Milliken, 1987, p. 136f). For research-driven ventures, this third type of uncertainty is likely to be strongly present because these types of ventures are based on a new technology or a new invention, i.e. a new means, whose application to a specific market is frequently unclear. Thus, completely new means-ends relation-

ships still have to be discovered. For other, non-research-driven venture ideas, response uncertainty is likely to be less important because these venture ideas are less innovative and have been applied before (Samuelsson & Davidsson, 2009).

On the basis of this overall framework we will now derive hypotheses on the determinants of opportunity beliefs of aspiring entrepreneurs and on the relationship between opportunity beliefs and entrepreneurial action.

3 Hypotheses

3.1 Formal Entrepreneurship Learning

Formal learning may assist in the accumulation of explicit knowledge about entrepreneurship, as the first type of human capital mentioned above. Universities and other educational institutions are increasingly trying to equip their students with the necessary knowledge and skills for starting a business. The aim of these endeavors is to support the foundation of different types of research- and knowledge-based ventures, thereby contributing to regional job creation and growth. In the past two decades there has been a dramatic increase in the number of entrepreneurship related courses in the U.S. and in other countries, including Germany, where the empirical study of this contribution is set (European Commission, 2006; Klandt, 2004; Kuratko, 2005; Schmude, Welter, & Heumann, 2008). By offering entrepreneurship courses, training, and extra-curricular support, universities aim at enhancing students' motivation and capability for starting a business (Mwasalwiba, 2010; Solomon, 2007; Walter, Parboteeah, & Walter, 2013). Furthermore, universities have established technology transfer offices with the aim of transferring new knowledge and technologies to an application in the market (Thursby, Jensen, & Thursby, 2001). However, these offices can be considered more relevant for start-ups of researchers and faculty than for student entrepreneurship (Åstebro, Bazzazian, & Braguinsky, 2012; Siegel & Wright, 2015).

Although entrepreneurship is high on the agenda of a growing number of universities around the world, the empirical evidence concerning the effects of entrepreneurship education and training is surprisingly weak (Martin, McNally, & Kay, 2013). Frequently, relevant studies focus on entrepreneurial intentions rather than activities, are not able to investigate long term effects, and have methodological limitations (von Graevenitz, Harhoff, & Weber, 2010). By and large, the existing empirical evidence suggests that entrepreneurship education enhances students' propensity or intentionality for entrepreneurship (Peterman & Kennedy, 2003; Pittaway & Cope, 2007). Still, Pittaway and Cope (2007, p. 498) identify a significant gap in the evidence-base: "What is not known, however, is whether this propensity or intentionality is turned into 'entrepreneurial behavior' either in its broader sense or when focused narrowly on venture creation." Martin et al. (2013) provide the first quantitative review of the effects of entrepreneurship education and training. Their analysis of the literature suggests that entrepreneurship education and training has a significant impact on human capital assets, such as knowledge and skills, as well as entrepreneurship outcomes, such as starting a firm. Yet, on average the effect sizes are only small. Thus, a number of other factors are likely to play a role as well (Martin et al., 2013, p. 10).

Despite the fact that opportunity recognition has been described as a core competence of entrepreneurs (Morris, Webb, Fu, & Singhal, 2013) and as an important topic of entrepreneurship textbooks (Edelman, Manolova, & Brush, 2008) and entrepreneurship courses (Potter, 2008; Solomon, 2007), there is only scant evidence on the influence of formal learning about entrepreneurship on opportunity recognition or – specifically – opportunity beliefs. Fiet (2002) argues and presents experimental evidence that entrepreneurial competencies needed to make discoveries can be taught. He presents a theory-based activity approach that relies on specific decision rules and systematic search activities. Muñoz, Mosey, and Binks (2011) argue that mental frames, developed over time, may explain why entrepreneurs are capable of identifying opportunities.

Teaching can foster the capability of identifying opportunities by changing the way people perceive external stimuli and by using what they already know. Souitaris, Zerbinati, and Allaham (2007) suggest that specific knowledge about entrepreneurship learned during a program improves the participants' opportunity-identification ability. However, they do not test this assumption empirically. DeTienne and Chandler (2004) investigate a training program that uses specific idea-enhancing exercises. Based on an experimental study design they are able to show that entrepreneurship education has a positive effect on individual's ability to identify opportunities. Saks and Gaglio (2002) analyze how educators from entrepreneurship programs in the U.S. conceptualize and teach the opportunity identification process. They reveal that opportunity evaluation seems to be the central focus of coursework while educators feel less confident to teach students how to discover and create business concepts. Assuming that the same holds for Europe, entrepreneurship learning should still increase the capability to evaluate one's venture idea. Overall, it seems reasonable to assume that formal learning about entrepreneurship has a positive effect on opportunity beliefs of people who are currently trying to start a business. Students who have acquired formal knowledge about entrepreneurship should be better positioned to evaluate their own business idea and gain confidence that it represents an opportunity.

It is also reasonable to assume that formal knowledge about entrepreneurship has a direct effect on entrepreneurial action. As students acquire knowledge of the actions somebody has to take in order to start a business and enhance their respective practical management skills, they should be better positioned to take action concerning their own venture idea (Souitaris et al., 2007).

Hypothesis 1a: Formal learning about entrepreneurship relates positively to opportunity beliefs of aspiring entrepreneurs.

Hypothesis 1b: Formal learning about entrepreneurship relates positively to entrepreneurial action of aspiring entrepreneurs.

3.2 Professional Experience

Professional experience is another source of human capital that is likely to be important for the formation of opportunity beliefs and entrepreneurial action. Proponents of Austrian economics (Hayek, 1945) and of the discovery theory of opportunity identification (Shane, 2000; Venkataraman, 1997) argue that differences in prior knowledge and experience are a main reason why some individuals are able to perceive an opportunity while others are not. Knowledge about customer problems is an important reason for entrepreneurs to start a new business (Von Hippel, 1988). This is because changes in technology, markets, or framework conditions do not generate obvious entrepreneurial opportunities. Without a certain degree of domain-specific knowledge, i.e. industry knowledge or understanding of customer needs, one may not recognize the possibility for action (McMullen & Shepherd, 2006; Shane, 2000). Industry experience is associated with contextual knowledge that makes nascent entrepreneurs better positioned to gather relevant information and adapt their business idea to a feasible, operable state, thus, increasing the perceived confidence in the venture idea (Dimov, 2010; Fiet, 1996).

Besides knowledge about customer needs there are other, cognitive mechanisms by which professional experience can contribute to opportunity beliefs. For example, Baron (2006) argues that entrepreneurs use cognitive frameworks they have acquired through experience to perceive connections between seemingly unrelated events or trends in the external world, i.e. they are able to “connect the dots” between changes in technology, demographics, markets, government policies, and other factors.

Empirical studies support the importance of professional experience for opportunity recognition: Case study research shows that academic entrepreneurs with direct experience in manufacturing, in addition to having a strong scientific research profile, are particularly capable

of perceiving business opportunities and acting upon them (Shane, 2000). Based on an experimental study design, Shepherd & DeTienne (2005) show that the level of an individual's prior knowledge of customer problems increases the number of opportunities identified and the innovativeness of those opportunities. Wennberg, Wiklund, and Wright (2011) find that university spin-offs benefit more from the number of years of industry experience of the founders than corporate spin-offs. Thus, previous industry experience is of considerable importance for university spin-offs. Overall, we argue that professional work experience has a positive effect on opportunity beliefs.

Professional experience can also be assumed to have a positive effect on entrepreneurial action, since aspiring entrepreneurs with relevant work experience are more likely to know what action to take and whom to contact when trying to start a new business in an industry they know (Mosey & Wright, 2007). Previous research found conflicting results concerning the effect of professional or industry experience on entrepreneurial action. While Reynolds & Curtin (2011) report that previous business experience in the market or sector where the new firm will compete has a positive effect on business emergence, Samuelsson & Davidsson (2009, p. 246) do not find such an effect for innovative or imitative new ventures and they conclude that deep experience from a particular industry might be both an asset and a liability in a new venturing context. However, overall we still hypothesize that such a relationship exists.

Hypothesis 2a: Relevant professional experience relates positively to opportunity beliefs of aspiring entrepreneurs.

Hypothesis 2b: Relevant professional experience relates positively to entrepreneurial action of aspiring entrepreneurs.

3.3 The Moderating Role of the Research Intensity of Venture Ideas

Venture ideas differ in their degree of uncertainty involved. Research conducted at universities serves as source of knowledge that creates new entrepreneurial opportunities which can lead to the formation of innovative new firms (Wennberg et al., 2011). However, new knowledge or a new technology do not in themselves constitute an entrepreneurial opportunity but only a new means of supply (Grégoire et al., 2010). Frequently in academic entrepreneurship, nascent entrepreneurs start with an invention or new technology and find it difficult to match it to a market need (Mosey & Wright, 2007). While research-based venture ideas might have the potential for innovations and commercial success, they are also likely to be technology-driven rather than driven by the perception of a specific market demand. An important cognitive challenge for identifying opportunities is that of perceiving similarity matches and mismatches between new means of supply and market contexts where to apply these new means of supply. In the specific context of technological inventions, an entrepreneurial opportunity thus consists of applying a new technology in a particular market (Grégoire & Shepherd, 2012). In the case of research-driven venture ideas it is likely to be more difficult to identify a match between the new technologies or new knowledge and a market need because completely new means-ends relationships have to be discovered. Relevant industry experience may help to reduce the uncertainty surrounding research-driven venture ideas whereas other venture ideas are likely to profit less from industry experience because more codified information is already available (Smith et al., 2009).

In an experimental study, the willingness to launch a new venture has been found to be most strongly influenced by entrepreneur's assessment of the uncertainty related to the outcome of one's own action, i.e. response uncertainty (McKelvie, Haynie, & Gustavsson, 2011). Such a response uncertainty is likely to be greatest for innovative business ideas because, by definition, there is no or only little information available as to what market to target and what customer de-

mands are. Overall, this leads us to hypothesize that the process of forming opportunity beliefs and its outcomes are different for different types of venture ideas.

Hypothesis 3: The determinants of opportunity beliefs and entrepreneurial action are different for research-driven compared to non-research-driven venture ideas. Specifically, industry experience is more important for research-driven compared to non-research-driven venture ideas.

3.4 Opportunity Beliefs and Entrepreneurial Action

As argued above, entrepreneurial action can be conceptualized as a two-stage process. First, people develop a third-person opportunity belief which might then be translated into a first-person opportunity belief. The perception that a situation might constitute a business opportunity for someone with the necessary skills and knowledge “triggers a decision-making process in which the prospective entrepreneur must evaluate whether this third- person opportunity constitutes a first-person opportunity.” (McMullen & Shepherd, 2006, p. 141) If the doubt concerning a perceived third-person opportunity can be reduced, this is likely to lead to the decision to exploit this opportunity, i.e. a first-person opportunity (McMullen & Shepherd, 2006). Thus, strong third-person opportunity beliefs should be related to entrepreneurial action.

We know of only one study that empirically investigates the relationship between opportunity beliefs and entrepreneurial action. Using longitudinal data, Dimov (2010) shows that opportunity confidence positively affects venture emergence. Yet, Dimov measures opportunity confidence as the average of the nascent entrepreneur’s opportunity feasibility belief and start-up self-efficacy, thereby combining two theoretically distinct constructs. Overall, we argue that strong third-person opportunity beliefs are likely to lead to first-person opportunity beliefs, i.e. entrepreneurial action.

Hypothesis 4: Opportunity beliefs of aspiring entrepreneurs are positively related to entrepreneurial action.

The complete hypotheses model is shown in Figure 1.

***** Insert Figure 1 here *****

4 Data and Methods

4.1 Measuring Opportunity Beliefs

Our measure of opportunity beliefs is based on Gregoire et al. (2010) who provide – to our knowledge - the first validated measure of this concept. They are able to provide evidence that opportunity beliefs are captured by indicators pertaining to two perceptual dimensions: (a) the degree of alignment between an opportunity's specific means of supply and a target market (*degree of alignment*) and (b) the general feasibility of introducing this new/improved supply-demand combination (*general feasibility*). We slightly reformulated the items of their scale to adapt them to our survey format (see Table 1). People were asked to indicate their opportunity beliefs concerning the business idea they are currently pursuing. Thus, we investigate opportunity beliefs when they are formed rather than ex post (Cassar & Craig, 2009).

***** Insert Table 1 here *****

4.2 Data

The list of items was included in the German version of the 2011 Global University Entrepreneurial Spirit Students' Survey (GUESSS). GUESSS is an international research project that investigates and compares entrepreneurial intentions and activities of students in 26 countries in the world. Data is gathered by means of an online survey.¹ Previous research based on GUESSS data has e.g. looked at career choice intentions of students (Laspita, Breugst, Heblich, & Patzelt, 2012;

¹ More information about the project can be found at: <http://www.guesssurvey.org/>

Zellweger, Sieger, & Halter, 2011) and the influence of the organizational and regional context on entrepreneurial activities (Bergmann, Hundt, & Sternberg, 2014).

In Germany, 37 universities participated in the GUESSS project in 2011. The students of these universities received an email with a neutrally worded invitation to participate in a study on their ‘future occupational choice’ and a link to the online survey. As an incentive to participate a lottery with five tablet-computers was conducted. The email policy of most participating universities did not allow us to send a reminder email. At some universities, only students from some departments could be contacted; at others, the response rate was rather low. Thus, in order to avoid a sample selection bias (Heckman, 1979), we only used data from those 12 universities where all students could be contacted by email and where the response rate was above 5 percent.² Overall, the response rate for these 12 universities was 6.9 percent, which is comparable to other online-surveys among students (Porter & Whitcomb, 2003). To have a more homogeneous sample, we only consider students of German nationality at Bachelor’s and Master’s level. We exclude students of medicine and law because, in Germany, these subjects of study are geared towards becoming a professional in these fields and opportunity recognition can be assumed to be different from other subjects. Applying these selection criteria, the sample size was reduced to 5955. Although there are no indications for a non-response bias³, we cannot claim representative-

² The following 12 universities are included in the analysis: Universität Bayreuth, Fachhochschule Coburg, Universität Düsseldorf, Hochschule Esslingen, Zeppelin University Friedrichshafen, Universität Göttingen, Fachhochschule Hannover, Universität Hannover, Hochschule Konstanz, Universität Siegen, Universität Witten/Herdecke, Westsächsische Hochschule Zwickau. This selection of universities includes large public universities, public universities of applied sciences as well as two small private universities.

³ We controlled for non-response bias by distinguishing between three groups: early, middle, and late respondents, the assumption being that non-respondents are more similar to late-respondents than to early-respondents (Oppenheim, 1966). We compare early and late respondents using t-tests for equality of means and find no statistically significant differences concerning age, subject of study, start-up propensity, start-up experience, and number of visited entrepreneurship courses between the two groups. There is a significant difference concerning gender, with late respondents being more likely to be female. However, our interpretation of this finding is that because male students spend more time per day using the internet (Kleimann, Özkilic, and Göcks, 2008) they are more likely to be early respondents. Overall, the share of female respondents is even slightly higher than at Ger-

ness for the twelve universities or Germany as a whole. However, as pointed out by Davidsson (2008, p. 171), exact representation of the population of interest might not be the most relevant issue for many research questions but the usefulness from a theoretical point of view. For the present study this calls for a sample of individuals who have formed beliefs about a business idea they are currently considering, avoiding problems of hindsight bias. This demand can be met by using the following selection mechanism.

4.3 Identifying Aspiring Entrepreneurs

As explained above, our measure of opportunity beliefs requires people to express their beliefs about a specific opportunity that they are evaluating or have recently begun to exploit (Gregoire et al., 2010, p. 118). A central question in the GUESSS questionnaire is, ‘Please indicate if and how seriously you have been thinking about founding an own company.’ which acts as a filter question for the following in depth questions about entrepreneurial activities. We select those respondents who stated that they ‘*have made an explicit decision to found a company*’, ‘*have a concrete time plan when to take the different steps for founding the company*’ or have ‘*already started putting their plan into action*’. Thus, we only select people who are currently in the process of evaluating a specific venture idea. We call these people *aspiring entrepreneurs*. We do not select people who are only weakly considering starting a new business and we also do not select people who are already self-employed⁴. All these aspiring entrepreneurs received the questions on opportunity beliefs. Aspiring entrepreneurs account for 5.6 percent of all German students at the 12 selected universities. Astebro et al. (2012) estimate that 6.4 percent of all graduates of U.S. universities start a business within three years after graduation. For graduates from

man universities in general, which is contrary to the assumption that women are more likely to be non-respondents. Thus, overall our results suggest that a non-response bias is not present.

⁴ People who have only thought ‘repeatedly’ about founding a firm were not investigated because, in a pre-test, they could frequently not answer all items concerning opportunity beliefs. Also, people who have ‘never’ or only ‘sketchily’ thought about starting a business were not included.

German universities this share is about 5.5 percent (Holtkamp & Imsande, 2001). Thus, the share of aspiring entrepreneurs seems reasonably high. Based on these selection criteria, we get a sample of 292 aspiring entrepreneurs which form the basis of the following analyses.⁵ In our sample, aspiring entrepreneurs are on average 25 years old; 32 percent are female.

4.4 Assessing the Opportunity-Beliefs Measure

Because the opportunity beliefs scale taken from Gregoire et al. (2010) has not been used in survey research before we conduct a confirmatory factor analysis to check its dimensionality (Gerbing & Anderson, 1988; Hinkin, 1998). We conduct a confirmatory factor analyses with two competing models: In the first model, a one-dimensional structure is assumed for all five opportunity-beliefs items. In the second model, we assume a two-dimensional structure with 'degree of alignment' (3 items) and 'general feasibility' (2 items) as separate constructs.

To assess the appropriateness of the structural model, the following fit measures are used: *Chi-square/df* measuring absolute fit, Comparative Fit Index (*CFI*) measuring incremental fit; and Root Mean Square Error of Approximation (*RMSEA*) measuring absolute 'badness' of fit (Hair, Black, Babin, Anderson, & Tatham, 2006). What constitutes an acceptable model fit and what the best ways are to assess model fit are still being debated in the literature (Lance, Butts, & Michels, 2006). Most fit indicators depend on the complexity of the model and the number of observations (Hair et al., 2006). However, the following cut-off values are frequently used for indicating well-fitting structural equation models: *Chi-square/df*: 3.0 or less; *CFI*: .90 or more; *RMSEA*: .08 or less (Gefen, Straub, & Boudreau, 2000; Hair et al., 2006). As can be seen from Table 2, Model 2 clearly has the better model fit. This result suggests that opportunity beliefs should be viewed as a two-dimensional construct with 'degree of alignment' and 'general feasi-

⁵ We exclude all respondents who gave the same response to all five items of the opportunity beliefs scale because this is likely to be the result of careless response behavior. (Johnson, 2005)

bility' as related but distinct dimensions. The following analysis takes account of this two-dimensional structure of opportunity beliefs.

***** Insert Table 2 here *****

4.5 Measurement of Entrepreneurial Activity

In line with Samuelsson and Davidsson (2009) we measure entrepreneurial activity by calculating the logarithm of the number of conducted gestation activities. This value is calculated on the basis of a question about which steps the respondents have already undertaken to found their company. As suggested by Bird & Schjoedt (2009) we only count concrete activities (Formulated a business plan; Purchased equipment; Worked on product development; Discussed with potential customers; Asked financial institutions for funding) and do not count less tangible or merely cognitive activities. All these activities were 0/1-coded. We calculate the logarithm of the number of conducted gestation activities to account for a non-linear, decreasing effect⁶.

4.6 Measurement of Independent Variables

We use the following measures for the exogenous variables:

We measure formal learning about entrepreneurship by using a 5-item scale proposed by Souitaris et al. (2007). The scale was slightly adapted to capture learning about entrepreneurship from attended university courses in general rather than from one specific course, which is similar to how Zhao et al. (2005) measure formal learning about entrepreneurship (See Table 3). The students were asked five questions and had to answer on a 7-point Likert scale (1=strongly disagree, 7=strongly agree), e.g. '*The University offerings I attended increased my understanding of the actions someone has to take in order to start a business*'. For our research design, such a perceptual measure is more appropriate than a measure about attended entrepreneurship courses be-

⁶ Because some people have not conducted any gestation activity yet and the logarithm can only be calculated for values greater than 0 we added 1 before making the logarithmic transformation.

cause it captures human capital assets (as outcomes of education) rather than human capital investments (Martin et al., 2013). Cronbach's Alpha of this five-item scale is .88.

***** Insert Table 3 here *****

In line with previous research (Davidsson & Honig, 2003; Marvel & Lumpkin, 2007) we measure the extent of previous work experience by the number of months people have already undertaken professional work experience that is relevant for the intended business. We calculate the logarithm of this value to account for a non-linear, decreasing effect.⁷

We measure the research intensity of venture ideas on the basis of a formative index. The respondents were asked to answer the following three questions concerning their planned business: “*Does spending on research and development have a major priority for your business?*”; “*Has an application for a patent, copyright, or trademark relevant to this new business been submitted?*”; and “*Did your business emerge from a research project?*”. The first two items were adapted from Samuelsson & Davidsson (2009). The last item was designed to capture the specific context of university start-ups. For all three items, answer options were “yes” (counting as 2 in our formative index), “partly true” (counting as 1), and “no” (counting as 0). We add up the values for all three questions and treat all ventures with an index value of 2 or more, i.e. where at least one of the three questions was answered in the affirmative or where at least two questions were answered with “partly true”, as being research-driven and all other ventures as non-research-driven. Overall, 106 ventures (36 percent) count as research-driven and 186 (64 percent) as non-research-driven.⁸ To assess the stability of our results we do a second analysis with a stricter definition: We only treat venture ideas with an index value of 3 or more as being re-

⁷ Because some people do not have any professional experience yet and the logarithm can only be calculated for values greater than 0 we added 1 before making the logarithmic transformation.

⁸ To show that these two groups are indeed different and that research-driven venture ideas are more innovative and act in a context of higher uncertainty we conducted the following test: Respondents were asked to evaluate whether there are other businesses offering the same products or services to their (potential) customers. The average level of agreement is lower for research-driven venture ideas with the difference between research-driven and non-research-driven venture ideas being statistically significant (2-tailed t-test; $t = 2.414$, sign: 0.016).

search-driven and venture ideas with an index value of zero as non-research-driven, thus, leaving out all the venture ideas with a value of 1 or 2. Using this classification, 97 research ideas count as non-research driven and 57 as research driven.

4.7 Control Variables

We include gender and general human capital, measured in terms of total years of university study, as control variables in all our models because they have been shown to be relevant determinants of opportunity beliefs and entrepreneurial activity (Autio, Dahlander, & Frederiksen, 2013; Brush, Manolova, & Edelman, 2008; Oehler, Höfer, & Schalkowski, 2014).

The descriptives and correlations of the variables used are given in Table 4. As expected, the two dimensions of opportunity beliefs are positively correlated. Research-driven venture ideas are perceived as having a lower degree of feasibility and alignment which shows the different character of these ideas compared to others. Years of university study and professional experience are positively related.

***** Insert Table 4 here *****

4.8 Method and Measurement Model

We use structural equation modeling (SEM) (AMOS 21, maximum likelihood estimating technique) to estimate the path coefficients of the proposed hypothesis model (Figure 1). SEM has been described as the best multivariate procedure for testing the relationships among a set of concepts represented by multiple observed variables. It is able to examine multiple dependence relationships simultaneously while taking account of the measurement error of individual items (Hair et al., 2006, p. 703ff). In our analysis, the extent of opportunity beliefs and the number of gestation activities (ln) act as endogenous (i.e. dependent) constructs. We analyze the determinants of opportunity beliefs among aspiring entrepreneurs as outlined in Figure 1. The model takes account of the two-dimensional structure of opportunity beliefs. The two control variables gender

and general human capital (measured in terms of years of university studies) have a structural path to all endogenous and exogenous variables, except for the measurement part of the model.⁹ To assess the appropriateness of the structural model we use the fit measures described above.

Hypothesis 3 postulates an interaction effect. To test this effect we conduct two-group comparisons (Jöreskog, 1998) and specify cross-group equality constraints, as described by Kline (2005, p. 289f). Specifically, we force the model to derive equal unstandardized estimates for the path coefficient ‘professional experience -> opportunity belief’ within the two groups. The fit of the constrained model can then be compared with that of the unrestricted model without equality constraints by using the chi-square difference statistic. If the fit of the restricted model is significantly worse than that of the unrestricted model, we can conclude that the parameters are likely not to be equal in the underlying populations (Kline, 2005, p. 290).

The results of this study are based on cross-sectional data which bears the risk of common method variance. As it was not possible to measure the exogenous and endogenous variables from different sources, we took some other precautions to reduce the risk of this potential bias, as suggested by Podsakoff, MacKenzie, Lee, and Podsakoff (2003). First, we separated the measurement of the exogenous and the endogenous variables by placing them in completely different contexts in the questionnaire. Second, we guaranteed response anonymity which is likely to be credible in an online survey. Third, we used items with different scale anchors. Additionally, we conduct the following post hoc statistical tests to control for the presence of common method bias. First, we conduct Harman’s one-factor test. This test is conservative in detecting biases and is likely to detect major common method biases (Malhotra, Kim, and Patil, 2006; Podsakoff et al., 2003). In our case, all 14 indicators used in this analysis were included in one exploratory factor analysis. This exploratory factor analysis delivers four factors with eigenvalues greater than one, which explain 65 percent of the total variance. The first factor (rotated) explains only

⁹ It should be noted that although gender is a binary variable, it is possible to include it in the model under certain conditions (IBM, 2013).

24 percent of the total variance. Thus, no single factor accounts for the majority of the variance, suggesting that a severe common method bias is not present. Next, we conducted a confirmatory factor analysis and compared the fit of a one-factor structure with that of a seven-factor structure, comprising all variables included in the SEM. The fit of the one-factor model is significantly worse than that of the seven-factor structure. This indicates that our constructs are not only theoretically but also empirically distinct. Overall, the results of these different tests suggest that common method bias is not a major issue in our analysis.

There is some disagreement in the literature whether control variables should be included in structural equation models or not (T. E. Becker, 2005; Mueller & Hancock, 2010). We report the results with control variables because they also contribute to our understanding of the determinants of opportunity beliefs. To test the stability of the results we also ran the models without the two control variables and obtained almost identical results.

5 Results

The results of different structural equation models are presented in Table 5. Model 1 is based on the full sample of 292 aspiring entrepreneurs. The other two models are based on sub-samples, specifically, research-driven venture ideas (Model 2) and non-research-driven venture ideas (Model 3). For all models the fit indices meet the guidelines concerning model fit described above, thus, indicating a good model fit (Gefen et al., 2000; Hair et al., 2006).

***** Insert TABLE 5 here *****

The results of the first model can be used for testing Hypotheses 1a, 1b, 2a, 2b, and 4. Hypothesis 1a assumes a direct positive effect of formal learning about entrepreneurship on opportunity beliefs. This hypothesis has to be rejected because the path coefficient is not significant. However, there is a significant positive relationship between formal entrepreneurship learning and entrepreneurial action, supporting Hypothesis 1b.

Relevant professional experience is significantly positively associated with opportunity beliefs, supporting Hypothesis 2a. There is no significant relationship between professional experience and entrepreneurial action. Thus, we have to reject Hypothesis 2b.

Hypothesis 3 postulates an interaction effect. To test this effect we compare the results of the same path model with two different samples, as described above (Jöreskog, 1998). Model 2 describes the result for research-driven venture ideas and Model 3 for non-research-driven ones. In Model 2 we find a significant positive influence of professional experience on opportunity beliefs which is not present in Model 3. A comparison of a constrained model (where the path estimate *prof. experience* -> *opportunity beliefs* is forced to be the same for both groups) and an unrestricted model show a statistically highly significant chi-square difference (Chi-square: 7.275; df: 1; p: .007), suggesting that professional experience has a different effect depending on the research intensity of the venture idea. To assess the stability of our results we conducted the same two-group comparison with a more narrow definition of what constitutes a research-driven and a non-research-driven venture idea, as explained above. Again, we obtained a statistically significant difference between the two groups.¹⁰

There is a positive relationship between opportunity beliefs and entrepreneurial action. Thus, people with strong opportunity beliefs are more likely to have taken action on a perceived opportunity, supporting Hypothesis 4. On closer inspection this relationship only holds for non-research-driven venture ideas. For research-driven venture ideas, opportunity beliefs are not related to entrepreneurial action. Here, only general human capital in the form of years of university studies plays a role.

Overall, we find support for Hypotheses 1b, 2a, 3 and 4. We have to reject Hypotheses 1a and 2b.

¹⁰ Chi-square: 4.249; df: 1; p: .039. Presumably, the difference between the two groups is only significant on the 5 percent-level because of the smaller sample sizes of the two groups.

6 Discussion

Uncertainty plays an important role in the formation of opportunity beliefs. As described by previous research, opportunity beliefs are formed in relation to the perceived uncertainty about the feasibility and fit of a venture idea (Grégoire et al., 2010; McMullen & Shepherd, 2006). Consistent with our hypothesis we find professional experience to have a positive effect on opportunity beliefs, presumably by reducing the uncertainty that surrounds a venture idea. Aspiring entrepreneurs with relevant industry experience are more convinced that their business idea is feasible and meets the demands of the market. Hence, in this sample, the evidence indicates that industry experience helps aspiring entrepreneurs develop opportunity beliefs, stressing the importance of specific human capital. However, on closer inspection this relationship only holds for research-driven venture ideas and not for others. Apparently, professional experience is especially useful for venture ideas characterized by a high degree of uncertainty because it can help to identify new means-ends relationships that would otherwise remain unidentified (Gruber, MacMillan, & Thompson, 2012). In the case of non-research-driven venture ideas, there is a lower need to reduce uncertainty because, presumably, such venture ideas are less novel and have been applied before. Here, aspiring entrepreneurs are likely to start new ventures closely linked to their subject of study, for example in the liberal professions. In line with this explanation, we find general human capital – in the form of university education – to be important for this type of venture ideas, suggesting that opportunity recognition can be learned. Overall, our results indicate that opportunity individuation takes different forms depending on the level of uncertainty involved. While professional experience is important for feeling more certain about research-driven venture ideas, general human capital is relevant for perceiving non-research-driven business opportunities.

We do not find evidence for a relationship between professional experience and entrepreneurial action. Having industry experience does not make people conduct more gestation activi-

ties. This finding is consistent with Samuelsson & Davidsson (2009) who likewise did not find an effect of industry experience on progress in the entrepreneurial process. The reason for this might be that industry experience leads to a more diverse set of business ideas (Gruber et al., 2012) which might, however, be more difficult to achieve. Thus, there is growing evidence that professional experience is important for opportunity beliefs but does not directly facilitate action.

Contrary to our hypothesis, formal learning about entrepreneurship has no direct effect on opportunity beliefs. This is an important non-result because it suggests that having acquired knowledge about entrepreneurship and starting a business does not help people in reducing the uncertainty about the feasibility and fit of a specific business idea. However, there is a direct effect of formal learning on entrepreneurial action. Presumably, formal entrepreneurship learning has increased peoples' intention to become entrepreneurially active and their understanding of the actions they have to take in order to start a business (Souitaris et al., 2007), resulting in a higher number of conducted gestation activities. This relationship can only be found for non-research-driven venture ideas where, presumably, the actions required to start a business are more easily identified and conducted than in the case of research-driven ideas.

Opportunity beliefs are considered as an important driver of entrepreneurial action. Overall, our results confirm this relationship. Strong third-person opportunity beliefs are positively related to the number of conducted gestation activities. This results supports previous research that reducing uncertainty, especially response uncertainty and uncertainty about customers demand for one's product or service, is a central factor in regulating entrepreneurial action (Autio et al., 2013; McKelvie et al., 2011). However, there are again indications that this relationship does not hold for all types of venture ideas. While we do find a significant relationship for non-research-driven venture ideas, there is none for research-driven ones. Despite feeling relatively certain about the feasibility and fit of a venture idea, aspiring entrepreneurs who aim at pursuing an innovative, research-driven venture idea do not necessarily conduct more gestation activities.

There are two possible explanations for this. The first is that there might still be a certain degree of response uncertainty that prohibits action despite perceiving strong opportunity beliefs. Possible courses of action might be more difficult to identify which might delay or defer entrepreneurial activities. The second explanation is that the venture gestation process might simply require a different sequence or timing of activities. Previous research has shown that the venture gestation process is different for innovative compared to imitative ventures (Samuelsson & Davidsson, 2009) and that technology-based ventures take longer to get established (Liao, Welsch, and Tan, 2005). Strong opportunity beliefs might motivate aspiring entrepreneurs to stick to their research-driven venture idea, which might, however, require a longer period of product development before more concrete entrepreneurial activities can be conducted.

7 Contribution to the Literature

To our knowledge, this is the first study of opportunity beliefs among aspiring entrepreneurs in a survey setting using a validated scale of opportunity beliefs. This study has two main contributions. First, we are able to contribute to our understanding of the formation of opportunity beliefs under different conditions of uncertainty. Our study suggests that different types of knowledge relatedness are important for research-driven and non-research-driven venture ideas. Whereas relevant professional experience and, thus, tacit knowledge is important for research-driven ideas, non-research-driven ideas benefit from general human capital, specifically, codified knowledge obtained during university studies. Opportunity beliefs relate to entrepreneurial action. However, we find such a relationship only for non-research-driven venture ideas and not for others suggesting that different types of uncertainty are prevalent in the two cases. Research on opportunity recognition has frequently used experiments or advocates their use. (Dimov, 2011; Grégoire et al., 2010; Haynie et al., 2009; Wood et al., 2014). Research of this kind is typically characterized by high internal validity and a low or unknown external validity. To ensure its generalizability in a broader context, even proponents of experimental research acknowledge that this line of re-

search should be complemented with studies using other research designs (Dimov, 2007; Grégoire et al., 2010; Shadish, Cook, and Campbell, 2002). While our study confirms some of the results of previous research, we also find novel and unexpected results. Overall, our results suggest that venture ideas are characterized by a different degree of uncertainty, which affects the determinants and outcomes of opportunity beliefs.

As a second contribution, we add to our understanding of the measurement of opportunity beliefs. This analysis applies an adapted measure of opportunity beliefs proposed by Grégoire et al. (2010) in a large-scale survey of aspiring entrepreneurs. Our results support the view that opportunity beliefs are not a uni-dimensional concept but consist of two related but somehow distinct constructs: the general feasibility of the business solution and the degree of alignment between the intended business solution and market demand. Thus, we are able to confirm the finding of Grégoire et al. (2010) for a comprehensive sample of aspiring entrepreneurs who are currently evaluating their own venture ideas.

8 Limitations and Future Research

This study has some limitations. First, this study was set in the context of aspiring student entrepreneurs in Germany and our results might not hold in other contexts. We are aware that *'entrepreneurial research on student subjects does not generalize to real world entrepreneurs'* (Robinson, Huefner, and Hunt, 1991). However, the focus in this study is on aspiring student entrepreneurs only, i.e. people who are studying and trying to start their business at the same time. The relevance of this type of entrepreneurship has recently been shown (Åstebro et al., 2012). Still, a fruitful extension of our study would be to replicate it for academic entrepreneurs.

Second, concerning the analysis of the effect of formal learning about entrepreneurship on opportunity beliefs, this study has not been able to follow a pre-test/post-test/control-group study design which can be regarded as best-practice approach in entrepreneurship education research (von Graevenitz et al., 2010). However, our study did not aim at measuring the impact of one

specific course but at measuring opportunity beliefs among a broad sample of aspiring entrepreneurs. People in this phase of the entrepreneurial process are rare and difficult to capture in real time (Davidsson & Honig, 2003, p. 304). Using a large-scale cross-sectional survey we were able to identify an adequate sample of aspiring entrepreneurs. It was beyond the scope of this study to first identify a suitable number of aspiring entrepreneurs and then follow them over time in pre-test / post-test study design. Future research is encouraged to proceed in that direction. Also, we did not analyze whether different types of entrepreneurship courses have a different effect on entrepreneurial learning.

Third, we have only included limited information about the venture idea in our analysis, except for research intensity. Future studies are encouraged to investigate additional characteristics of venture ideas and their relationship to opportunity beliefs.

Finally, some exogenous variables in our analysis have been measured using single-item measures. Presumably, the use of multi-item measures would further improve the model fit of the structural equation models and is thus advised for future studies. Also, our measure of entrepreneurial activity could only take into account a limited number of gestation activities.

9 Implications for Practice

This research contributes to our understanding of the formation of opportunity beliefs among aspiring entrepreneurs, specifically, in the university context. Thus, our results are important for the study of university spin-offs as well as for teaching entrepreneurship.

In general, our results suggest that different approaches are required to support different types of venture ideas. For the majority of non-research-driven start-ups, entrepreneurship courses and general human capital obtained at university seem to be able to facilitate entrepreneurial action. For research-driven venture ideas, the significance of professional experience and the non-significance of formal entrepreneurship learning stresses the importance of own work experience rather than ‘research and plan writing’, as already indicated by Edelman, Manolova, and

Brush (2008, p. 646). For these innovative business ideas, it is probably not enough just to get entrepreneurs into the classroom and present their stories in order to 'bridge the gap' between academia and business (Kuratko, 2005). Aspiring entrepreneurs must have gained practical experience themselves. Thus, entrepreneurship courses should encourage students to develop business concepts based on their own work experience, mirroring Fiet's (2007) recommendation that people can increase their search effectiveness by systematically restricting it to known domains. However, it might not always be possible to gain practical experience in the area in which one is doing research. For these ventures, Grégoire & Shepherd (2012) provide some guidance as to how potentially valuable new technology-market combinations might be identified.

Compliance with Ethical Standards

In preparing this document, the author followed accepted principles of ethical and professional conduct, as outlined in the 'Instructions for authors' of the Journal of Technology Transfer.

Conflict of Interest: The author declares that he has no conflict of interest.

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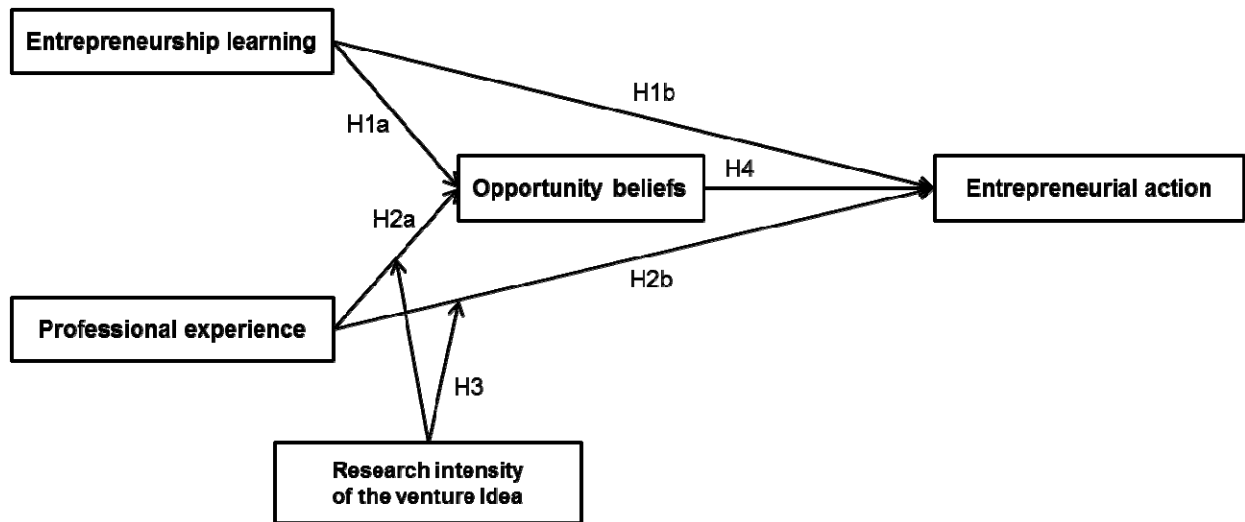
Figure 1: Hypotheses Model

Table 1: Items of the Opportunity Beliefs Measure

No.	Item	Source
<i>General feasibility of the opportunity</i>		
1a	The conceived, intended or carried out business concept is sufficiently developed to be implemented in the targeted market.	Adapted from Grégoire et al. (2010), item 2a
1b	The implementation of the business concept in the targeted market is feasible and attractive.	Adapted from Grégoire et al. (2010), item 2b
<i>Degree of alignment between focal means of supply and target market</i>		
2a	The business concept has the capabilities to satisfy the needs of the targeted market.	Adapted from Grégoire et al. (2010), item 1b
2b	There is a match between what the business concept does and what the targeted market demands.	Adapted from Grégoire et al. (2010), item 1c
2c	The business concept can be used to solve problems of the targeted market.	Adapted from Grégoire et al. (2010), item 1a

Note: All aspiring entrepreneurs were asked to indicate their level of agreement on a 7-point scale “concerning the business concept they are currently pursuing”. They were also given the following explanations: “The term ‘business concept’ describes the way in which you want to create and distribute a product or service. The term ‘market’ relates to the customers of your product or service”.

Table 2: Model fit of two different confirmatory factor analyses

Model	<i>Cmin/df</i>	<i>IFI</i>	<i>CFI</i>	<i>RMSEA</i>
CFA with opportunity beliefs as a one-dimensional construct	2.787	.955	.954	.078
CFA with opportunity beliefs as a two-dimensional construct	2.193	.972	.971	.064
<i>Common guidelines for good model fit</i> (Gefen et al., 2000; Hair et al., 2006)	< 3.000	> .900	> .900	< .080

Table 3: Items of the Entrepreneurial Learning Measure

No.	Item
	The University offerings I attended ...
1	... increased my understanding of the attitudes, values, and motivations of entrepreneurs.
2	... increased my understanding of the actions someone has to take in order to start a business.
3	... enhanced my practical management skills in order to start a business.
4	... enhanced my ability to develop networks.
5	... enhanced my ability to identify an opportunity.

Note: People were asked to indicate their level of agreement on a 7-point scale (1=strongly disagree, 7=strongly agree). All items are adapted from Souitaris et al. (2007).

Table 4: Descriptives and Correlations

	Descriptive statistics		Correlations							
	Mean	Std. Dev.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) # gestation activities (ln)	0.45	0.54	1							
(2) Opportunity beliefs: general feasibility	5.19	1.30	.222**	1						
(3) Opportunity beliefs: degree of alignment	5.75	1.01	.133*	.570**	1					
(4) Entrepreneurship learning (index)	4.07	1.49	.195**	.061	.054	1				
(5) # months prof. experience (ln)	1.70	1.74	.116*	.244**	.157**	.035	1			
(6) Research-driven (0/1)	0.36	0.48	-.018	-.156**	-.134*	-.061	.016	1		
(7) Years of university study	3.34	2.37	.148*	.170**	.160**	.084	.202**	.015	1	
(8) Gender (1=female)	0.32	0.47	-.140*	.088	.077	-.151*	.038	-.088	.005	1

** . Correlation is significant at the 0.01 level (2-tailed)

* . Correlation is significant at the 0.05 level (2-tailed).

Table 5: Findings on Hypotheses Testing (Results from structural equation models)

			Model 1 All (n=292)			Model 2 Research-driven (n=106)			Model 3 Non-research-driven (n=186)		
		Hypothesis	path coeff.	stand. path coeff.	path coeff.	stand. path coeff.	path coeff.	stand. path coeff.			
Main effects:											
Entrep. learning	-->	Opportunity beliefs	H1a	0.036	0.048	0.031	0.041	0.025	0.034		
Entrep. learning	-->	Entrep. Action	H1b	0.072 **	0.181	0.061	0.149	0.076 *	0.195		
Prof. experience	-->	Opportunity beliefs	H2a	0.122 **	0.207	0.282 **	0.455	0.053	0.095		
Prof. experience	-->	Entrep. Action	H2b	0.018	0.059	0.011	0.035	0.016	0.053		
Opportunity beliefs	-->	Entrep. Action	H4	0.069 *	0.131	0.042	0.079	0.099 *	0.185		
Controls:											
Gender (female)	-->	Entrep. learning		-0.436 *	-0.150	-0.147	-0.046	-0.609 **	-0.218		
Gender (female)	-->	Prof. experience		0.136	0.037	-0.122	-0.031	0.206	0.057		
Gender (female)	-->	Opportunity beliefs		0.273 *	0.124	0.462 +	0.189	0.145	0.071		
Gender (female)	-->	Entrep. Action		-0.153 *	-0.132	-0.213 +	-0.165	-0.142 +	-0.129		
Years of study	-->	Entrep. learning		-0.043	-0.075	-0.025	-0.047	-0.065	-0.107		
Years of study	-->	Prof. experience		0.148 **	0.202	0.249 **	0.376	0.072	0.092		
Years of study	-->	Opportunity beliefs		0.059 *	0.137	-0.013	-0.031	0.091 *	0.206		
Years of study	-->	Entrep. Action		0.029 *	0.128	0.067 **	0.307	0.000	0.001		
Model fit:											
<i>Cmin</i>				124.849		83.354		97.084			
<i>df</i>				65		65		65			
<i>p</i>				.000		.062		.006			
<i>Cmin/df</i>				1.921		1.282		1.494			
<i>IFI</i>				.959		.966		.965			
<i>CFI</i>				.957		.963		.964			
<i>RMSEA</i>				.056		.052		.052			

Notes: Significance level: ** $p < .01$ * $p < .05$ + $p < .10$

The unstandardized path coefficients are reported for the comparison of the same paths in different models whereas the standardized path coefficients should only be used for the comparison of different paths within the same model.