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ENTREPRENEURSHIP AND REGIONAL KNOWLEDGE DYNAMICS

EMPIRICAL EVIDENCE FROM GERMANY

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Jessica Birkholz

FIRST EXAMINER:

Prof. Dr. Jutta Günther

University of Bremen

SECOND EXAMINER:

PD Dr. Holger Graf

Friedrich-Schiller-University Jena

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List of Abbreviations

ANCOVA	Analysis of Covariance
B2C	Business-to-Consumer
BBSR	Federal Institute for Research on Building, Urban Affairs, and Spatial Development
EE	Entrepreneurial Ecosystem
EU	European Union
GEM	Global Entrepreneurship Monitor
IPC	International Patent Classification
ITI	Intermediate Technology Initiative
KSTE	Knowledge Spillover Theory of Entrepreneurship
NACE	Nomenclature générale des Activités économiques dans les Communautés Européennes
NUTS	Nomenclature des unités territoriales statistiques
OECD	Organisation for Economic Co-operation and Development
PACAP	Potential Absorptive Capacity
R&D	Research and Development
RACAP	Realised Absorptive Capacity
REDI	Regional Entrepreneurship and Development Index
S3	Smart Specialisation Strategy
SBIR	Small Business Innovation Research
TEA	Total early-stage Entrepreneurial Activity
USA	United States of America

Chapter 1

Entrepreneurship as Vehicle for Regional Knowledge Transformation: the Relation between the Entrepreneurial Process and Regional Knowledge Dynamics

Jessica Birkholz

Abstract

With accelerating globalisation and the shift from traditional inputs to knowledge for economic advantages, regional policies increasingly aim at the stimulation and development of knowledge. In this vein, entrepreneurs are viewed as agents that convert regional knowledge to innovations, thereby increasing competition, and gain the attention of scientific and political actors. However, the rapid implementation of policies that follow the rationale to stimulate entrepreneurial activities to foster regional economic development encounter many unresolved questions. The core question this dissertation contributes to is how the entrepreneurial process and regional knowledge dynamics are intertwined with each other. The results provide empirical insights into this relationship on different stages of the entrepreneurial process – regional business opportunity perception, transformation of a business idea to a new venture, the diffusion of explicit knowledge generated by entrepreneurs and the impact of crises on the type of entrepreneurial activities that are evaluated as valuable. Implications for the design of regional innovation policies are deduced that take the complex interactions between knowledge, innovations, entrepreneurship and regional economic development into account.

Keywords: Regional innovation system; Knowledge; Entrepreneurship

JEL classifications: D83; M13; O31; O32; R11; R58

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1 Introduction

One fundamental question in social sciences is why some regions thrive while others lack the ability to grow economically (Feldman, 2014). This issue is raised already by Adam Smith in his seminal book 'An Inquiry into the Nature and Causes of the Wealth of Nations' (Smith, 1863) and did not lose its relevance until today (Feldman, 2014). This topic of regional development was strongly associated with economically lagging regions and the combat of poverty for a long time. However, as the economic development is increasingly global in nature and thus faster-paced, advanced economies are confronted with the challenge of continuously restructuring themselves as well (Feldman, 2014). In the 1990s knowledge and entrepreneurship emerged to be a policy priority to foster economic growth, acknowledging that entrepreneurship is a key factor for regional development and structural change (Audretsch, 2018; Stuetzer et al., 2018).

Policies centred on entrepreneurial activities to foster regional economic development are often based on the belief that entrepreneurship in the form of new ventures is a magic bullet that turns lagging regions into prospering ones by generating innovations and ultimately economic growth (Shane, 2009). However, contrary to the conventional perspective that highlights the quantity of entrepreneurial activities, recent developments in this field suggest that only a small proportion of new ventures are conducive to economic growth (Acs et al., 2016; Mueller, 2007; Stam, 2015; Szerb et al., 2019). This also corresponds to findings showing that policies aiming to increase the amount of entrepreneurial activities are ineffective (Acs et al., 2016; Arshed et al., 2014; Pugh et al., 2021). This observation can also be made for Germany as the 'Total early-stage Entrepreneurial Activity' (TEA), as measured by the Global Entrepreneurship Monitor, is ranked lower when compared internationally (Sternberg et al., 2021; 2020; 2019; 2017). Thus, entrepreneurship requires a differentiated reflection in policies, otherwise resource allocations may result in being inefficient (Hurst & Pugsley, 2011; Shane, 2009).

When aiming at regional economic development, innovative and knowledge-intensive ventures show a much more pronounced impact than entrepreneurial activities in general (Szerb et al., 2019; Wong et al., 2005). Based upon this observation, the interest in the interplay of region, innovation and entrepreneurship has risen in recent decades and structural change and diversification are prominently discussed in scientific and political debates (Fernandes et al., 2021; Grillitsch, 2019). However, the uneven spatial distribution of knowledge and entrepreneurship and the dynamics causing these are still not fully explored (Fritsch &

Kublina, 2019; Malecki, 2010). These research gaps result in the undesirable outcome that the rapid implementation of regional innovation policies that base themselves on the interplay of region, knowledge and entrepreneurship act prematurely to scientific research (Foray, 2015; Varga et al., 2020).

To disentangle the relationship between new ventures, innovations and regional growth, which empirical research to date does not find a well-specified relation for (Fritsch, 2007), a wide range of data sources, interdisciplinary research and a variety of methodological approaches are required (Belitski et al., 2021; Henning & McKelvey, 2020). Furthermore, the multi-dimensionality of entrepreneurship with a multitude of antecedents and impacts needs to be acknowledged (Goel & Saunoris, 2017). The currently dominant approach in the measurement of entrepreneurial activities at spatial level is restricted to the 'organisational view' of entrepreneurship that focusses on the establishment of ventures and their operating status (Audretsch et al., 2015; Stuetzer et al., 2018). However, this approach alone delivers only limited insights into what actually constitutes entrepreneurship (Stuetzer et al., 2018). Thus, a complementation by other approaches, data sources and methods is inevitable to gain deeper understanding of the interplay of region, knowledge and entrepreneurship.

Thus, answering the questions how regional knowledge bases can be improved, what the role of knowledge is in stimulating entrepreneurial activities and regional development, and how entrepreneurship and regional knowledge are interrelated is of high relevance to the design of impactful regional innovation policies (Fritsch & Wyrwich, 2018; Henning & McKelvey, 2020). Therefore, this dissertation states the following overarching research question:

RQ: How is entrepreneurship related to regional knowledge dynamics?

The present dissertation makes use of three theoretical perspectives that offer starting points for investigation. First, literature in the tradition of Schumpeterian and neo-Schumpeterian view provides the theoretical lenses for examining innovative entrepreneurship and is widely applied in doing so (Henning & McKelvey, 2020). The present dissertation contributes to this tradition by linking knowledge and entrepreneurship in an explicit way by examining the interdependence structure of tacit and explicit knowledge and its transformation in relation to entrepreneurship (Henning & McKelvey, 2020). Second, the theoretical elaboration on regional innovation systems contributes to the dissertation by providing the framework of regional innovative entrepreneurship. The literature in this vein profits from the findings in this dissertation that answer the call of former research to enhance the knowledge about the interrelation of entrepreneurship and regional innovation systems and acknowledges the

context-dependency of entrepreneurial activities (Rypestol & Aarstad, 2018). Third, evolutionary economics provide the theoretical lenses to investigate the process of entrepreneurship and its relation to regional knowledge dynamics. Studies in this dissertation link entrepreneurship and evolutionary economics by analysing different stages of the entrepreneurial process – pre-foundation, foundation of new ventures and diffusion of entrepreneurially generated knowledge (McKelvey et al., 2020; Winter, 2016). The combination of these three approaches – Schumpeterian tradition, regional innovation systems, and evolutionary economics – to study entrepreneurship in the regional context, refers to the call of former research that pleads for a fully dynamic framework of entrepreneurship that covers micro, meso and macro units (Audretsch, 2018; Iammarino, 2005; Malerba & McKelvey, 2020).

2 The knowledge-based economy and innovation policy rationales

2.1 The rise of the knowledge-based economy

Physical capital was considered to be the driving force of economic performance for a long time (Audretsch, 2018). Based on this assumption, the influential work of Karl Marx 'Das Kapital' (1867, as cited in Audretsch, 2018) and the seminal works of Solow (1956, 1957) highlight the importance of physical capital in economic development (Audretsch, 2018). However, in the 1980s and 1990s mounting empirical evidence showed that economic performance was shifting from depending on physical capital to depending on knowledge (Audretsch, 2018). Responding to this change in narrative, new endogenous growth models appeared that replaced physical capital with knowledge as the key factor in enabling economic development (Audretsch, 2018; Lucas, 1988; Romer, 1986, 1990, 1994). This shift marked the beginning of the era of the 'knowledge-based economy' which emphasises knowledge, the structural aspects in which knowledge is conveyed and development trajectories (Cooke & Leydesdorff, 2006). By focussing on knowledge as an independent input factor for economic development, this concept differentiates itself from the older term 'knowledge economy' which interprets knowledge as embodied in the composition of the labour force (Cooke & Leydesdorff, 2006).

The newly emerged paradigm of the 'knowledge-based economy' relies on three pillars. First, knowledge is the essential input factor economic development is based upon (Audretsch, 2018; Cooke & Leydesdorff, 2006). Knowledge is distinct from other economic goods because it is characterised by a high degree of uncertainty, asymmetry, and high costs of transactions (Arrow, 1962; Audretsch, 2018). Second, connected to the first pillar, knowledge spillovers and

learning are central features of this paradigm (Bishop, 2019). Third, innovations resulting from knowledge and provoking market instability and technological change are a key concept of the 'knowledge-based economy' because these are argued to lead to economic growth (David & Foray, 2002; Gonzalez-Pernia et al., 2012; MacNeill & Jeannerat, 2016; Schumpter, 1934). The concept of 'knowledge-based economies' relying on these three pillars became central to economic policy in advanced economies that aim at creating and incorporating knowledge (David & Foray, 2002; MacNeill & Jeannerat, 2016). The mission of the Organisation for Economic Co-operation and Development (OECD) is related to this paradigm as its goal is to coordinate science and technology policies of the member states (Cooke & Leydesdorff, 2006).

The rise of the 'knowledge-based economy' falls in a similar time span as the development of the internet and accelerating globalisation. In this period 'The Economist' published a special issue with the claim 'The Death of Distance' (1995, as cited in Audretsch, 2018), followed by similar expectations formulated by the World Bank (1999, as cited in Morone & Taylor, 2010), stating that the intangible character of knowledge enables it to be easily shared globally (Audretsch, 2018; Morone & Taylor, 2010). Friedman (2005, as cited in Audretsch, 2018) argued in this book 'The World is Flat' that the rise of modern information and communication technologies reduces the transaction cost of knowledge to zero and thus renders the regional environment irrelevant for economic development. This line of argument is based on the assumption that modern information and communication technologies enable the transfer of knowledge which formerly was only available in geographical proximity (MacNeill & Jeannerat, 2016). This reasoning also impacted growth theory which assumed that knowledge and learning are spatially unbounded and are accessible for commercialisation around the globe which corresponded to the mostly predicted development at that time (Audretsch, 2018; Grossman & Helpman, 1994; Morone & Taylor, 2010). However, this prediction was not in line with scholars that predicted an increasing instead of a decreasing importance of location (Morone & Taylor, 2010). This opposite expectation is based on the argument that the transfer of valuable knowledge requires experience and direct interactions because a significant share of knowledge is hard to codify (Morone & Taylor, 2010). Moreover, knowledge acquired in the past is setting the frame for knowledge that can be learned and thus provides opportunities but also imposes limits (Atkinson & Stiglitz, 1969; Boschma et al., 2014). Following from this, actors differing to a large degree in their experiences and cumulated knowledge, which is partially dependend on the regional environment, are less likely to understand each other and be able to make use of their knowledge (Boschma et al., 2014; Cohen & Levinthal, 1989, 1990). Based on these considerations, modern innovation policies aim at strengthening the

innovation capabilities of regions and their actors, acknowledging the localised pattern of knowledge (Fernandes et al., 2021).

Innovative capabilities are central to these policies because innovations are one of the most important factors for economic growth in the 'knowledge-based economy' (Edquist, 1997; Stough, 2003). Innovations are defined as new combinations of goods and production processes (Schumpeter, 1934), the adoption of new ideas (Ahluwalia et al., 2017; Damanpour & Evan, 1984), the generation and adoption of improved products or processes (Röd, 2016), or the process by which new products and processes are implemented (Nelson & Rosenberg, 1993, as cited in Morone & Taylor, 2010). Innovations and their emergence are, despite a large corpus of research, still not fully understood (Ferreira Moutinho, 2016). However, the fact that innovation involves a multitude of factors is indisputable which causes the complexity of knowledge processes that may lead to the lack of understanding (Furman et al., 2002; Leydesdorff & Fritsch, 2006). Moreover, it is scientific consens that the basis is knowledge that makes up the essence of innovations (Gherardi, 2012; Howells, 2002). However, the commercialisation of knowledge and its incorporation into innovations is not warranted (Michelacci, 2003; Qian, 2017). One mechanism for the transformation of knowledge into innovations is entrepreneurship (Audretsch, 2018; Braunerhjelm et al., 2010; Schumpeter, 1934). Based on these considerations, the Bayh-Dole Act and the Small Business Innovation Research (SBIR) program that were issued by the United States Congress were among the first policies that were clearly designed to foster economic growth by making use of the intersection of knowledge and entrepreneurship (Audretsch, 2018; Link & Link, 2009). The rationale of this reasoning is summarised in Figure 2.1. Knowledge is embedded into the regional framework and is transferred by the means of entrepreneurial activities into innovations that give rise to economic development by introducing competition and structural change.

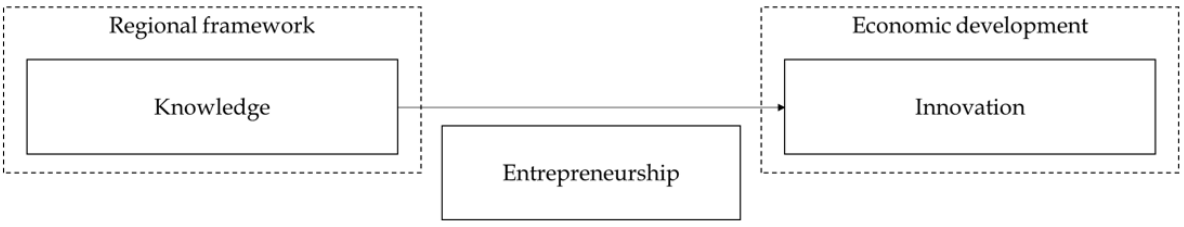


Figure 2.1: Rationale of regional innovation policies
Source: Own illustration

However, the phenomenon that some regions are able to efficiently turn knowledge into economic development while others cannot is far from being fully understood (Caiazza et al.,

2015). To gain more insights into this, the concept of knowledge and how it is intertwined with the regional sphere and entrepreneurship needs to be analysed more thoroughly.

2.1.1 Knowledge as a multi-faceted concept

To contribute to solving the puzzle of regional economic development, it is not sufficient to view knowledge as a homogenous and one-dimensional construct. The most fundamental differentiation in this regard is between knowledge and information (Audretsch, 2018). Although the concepts of information and knowledge are interlinked with each other, these are not interchangeable (Audretsch, 2018; Audretsch & Feldman, 1996; Dosi, 1988; Morone & Taylor, 2010). Information can be defined as codified facts; different contexts do not change their interpretation (Audretsch, 2018). In contrast, knowledge can be seen as a complex system into which information can be incorporated (Morone & Taylor, 2010). Therefore, learning cannot be equated with the accumulation of information, but involves cognition and integration processes (Ancori, 2000; Morone & Taylor, 2010). However, this distinction between information and knowledge has been repeatedly ignored by neoclassical economic approaches. This view has been criticised because it does not allow for studying cognition and learning (Ancori, 2000; Cooke & Leydesdorff, 2006; Morone & Taylor, 2010). This restricted perspective may have also contributed to a one-sided evaluation of knowledge types. For example, practical and applied knowledge, which is derived from manual labour, is less valued and in European Union innovation policies, in which Research and Development (R&D) knowledge claims the main role (Havas, 2015; Shearmur & Doloreux, 2021). However, to arrive at a fine-grained understanding of regional economic development processes a differentiated perspective is required and the view of knowledge as a discrete entity and learning as the exchange of information chunks needs to be abandoned (Rigg et al., 2021).

Although knowledge is always partially dependent on its regional context because it provides the framework to interpret it, this dependence increases the more the knowledge is tacit in nature (MacNeill & Jeannerat, 2016; Morone & Taylor, 2010; Pugh et al., 2021). Tacit knowledge is defined as being inherent in a person without the person being fully aware of all details of this knowledge (Morgan, 2004; Morone & Taylor, 2010; Nelson & Winter, 1982; Polanyi, 1962). Because of these characteristics, tacit knowledge is facilitated by a common understanding and shared cognitive frameworks that tend to be geographically clustered (Morone & Taylor, 2010; Pinch et al., 2003). It is further argued that collectively shared tacit knowledge influences individual and organisational learning processes. Thus, it can be hypothesised that tacit knowledge is central to the geographical concentration of innovative activities and economic

performance (Hassink & Klaerding, 2012; MacNeill & Jeannerat, 2016; Morone & Taylor, 2010; Pugh et al., 2021).

Therefore, the distinction between tacit and its counterpart explicit knowledge which can be transferred easily in form of technologies, documents, and new products (de Almeida et al., 2021; Morone & Taylor, 2010), is of crucial relevance as these flow in very different ways (Morone & Taylor, 2010). It is even argued that this lack of distinction and the underrepresentation of tacit knowledge in the scientific literature is one of the missing pieces to thoroughly understand geographical innovation patterns (Morone & Taylor, 2010). However, these two types of knowledge – tacit and explicit – do not exist independently from each other but rather represent knowledge at different maturity stages. All knowledge is created in the first place as purely tacit (Cowan & Foray, 1997). When an initial idea matures, it becomes more codified by cognitive processes (Cowan & Foray, 1997; Morone & Taylor, 2010). However, not all tacit knowledge is converted into more codified forms which provides an explanation for why the majority of knowledge can be classified as tacit (de Almeida et al., 2021; Polanyi, 1962).

Economic development in this vein can be understood as learning from knowledge that is available and to further enhance this knowledge. This acquisition of knowledge is a cognitive process that integrates new information into a system of other information (Morone & Taylor, 2010). Hence, this process of knowledge generation cannot be disentangled from its context and knowledge can be interpreted as socially constructed (Alvesson, 1993; Bruffee, 1986; Rayner, 2012; Rigg et al., 2021; Shearmur & Doloreux, 2021). Because of this dependency of knowledge on context, it can be stated that knowledge development in regions follows a path-dependent pattern with the knowledge base being only accessible for actors in the same regional context (Boschma et al., 2014; Neffke et al., 2018). This calls for place-based policies rather than a 'one-size-fits-all' approach (Glückler, 2020; Hassink & Klaerding, 2012; Iammarino et al., 2019).

2.1.2 Rationale of regional innovation policies

As the 'knowledge-based economy' and thus the relevance of knowledge as a factor for economic growth have increased, regional policies are acknowledged as an important driving force for stimulating regional learning processes. These policies foster regional economic development that goes beyond the interests of single actors (OECD, 2001). The regional level is especially suitable to study and support learning processes and innovation for two reasons (Gonzalez-Pernia et al., 2012; Teirlinck & Spithoven, 2019). First, the geographical clustering

of innovative activities makes regions self-containing systems (Asheim & Gertler, 2006), and, second, the sharing of tacit knowledge enhances the efficiency of localised learning processes (Asheim & Isaksen, 2002; Teirlinck & Spithoven, 2019). Hence, territorial competitiveness is likely to arise from the regional framework (Gonzalez-Pernia et al., 2012; Porter, 2003; Scott & Storper, 2003).

The role of stimulation of knowledge production and absorption within regional development policies correspond to the underlying conceptualisation of economic advantages regions can aim for. The theoretical contributions about absolute advantages as defined by Smith (1863)[1] and comparative advantages as proposed by Ricardo (1817)[2] can be interpreted as the origins of the discussion about regional differences in economic performance and their causes. A newer approach to this phenomenon is the concept of competitive advantages which incorporates context sensitive factors that lead to an economic advantage over other regions. This view acknowledges the importance of the role of domestic markets and supply chains (Cooke & Leydesdorff, 2006; Porter, 1998). The perspective of constructed advantages extents this view by accepting the relevance of knowledge infrastructures, community and culture besides economic and governmental conditions, thus broadening the concept by systemic aspects (Cooke & Leydesdorff, 2006). The constant re-definition of what constitutes an economic advantage hints at the multiplicity of approaches for regional development depending on which perspective these build upon.

One can argue that cluster policies base themselves on the concept of competitive advantages by referring to the work of Porter (1998) in which a cluster is defined as a geographical concentration of companies, suppliers and institutions that compete and collaborate with each other resulting in economic growth (Bishop, 2019; Saha et al., 2018). The transfer of specialised skills is emphasised in this approach and thus highlights the relevance of knowledge about capabilities and resources other actors have that can be contacted in achieving economic advantages following the Schumpeterian tradition of combining knowledge to produce innovations (Morone & Taylor, 2010; Schumpeter, 1934). In the late 1990s and 2000s cluster policies were acknowledged to be the main driving force for increasing competitiveness (Bishop, 2019; Swords, 2013). However, these policies often led to highly specialised geographical areas which are highly vulnerable to external shocks and crises (Bishop, 2019).

[1] Absolute advantages are evident whenever a region can produce a good in a more cost efficient manner than another regions.

[2] The concept of comparative advantages assumes that regions specialise in the production of goods that have the highest efficiency ratio within one regional economy.

Another, more general, concept addressing learning processes in regions is the 'learning region' which was launched in the mid-1990s (Hassink & Klaerding, 2012). The 'learning region' is defined as a region that facilitates individual and organisational learning by means of flexible networks of economic and political actors that co-ordinate learning processes that are embedded into a framework of regional institutions (OECD, 2001). However, this concept is criticised for its spatial fetishism, meaning that the regions themselves tend to be perceived as actors and regional actors actually performing the learning processes are neglected (Hassink & Klaerding, 2012; Morgan, 2004). This criticism calls for a re-conceptualisation of this concept that acknowledges the geographical proximity as complementary to other forms of relations in which knowledge is exchanged (Morone & Taylor, 2010). Thus, the regional environment should be interpreted as a field of opportunities which are only accessible for actors embedded in the regional framework, therefore, this concept can be labelled as 'learning in space' (Hassink & Klaerding, 2012; Shearmur, 2011). This re-conceptualisation and the increasing acceptance of the concept of constructed advantages may be reasons for the development that modern regional innovation policies, such as the smart specialisation strategies (S3), aim at a more holistic perspective with taking structural elements into consideration (Cooke & Leydesdorff, 2006).

Related and un-related variety (Frenken et al., 2007), local path dependencies (Martin & Sunley, 2006) and the smart specialisation strategy (Foray, 2015) are some of the most influential policy-related concepts that appeared in recent years (Pyka et al., 2019). All of these concepts emphasise the systemic nature of innovation and focus on knowledge and learning processes as fundamental in economic development especially highlighting structural properties of regional economies (Lundvall, 2012; Pyka et al., 2019). The underlying concept for these approaches is the 'innovation system' concept that focusses more strongly on providing optimal conditions for learning in the regional framework (Pyka et al., 2019; Vermeulen & Pyka, 2018). This view centres on factors that impact the generation, diffusion, and application of new economic knowledge (Edquist, 1997; Fernandes et al., 2021; Lundvall, 2012). The first type of innovation systems that were examined are 'national innovation systems' (Malerba & McKelvey, 2020). This original concept is adapted to analyse the interactive learning processes in more homogenous and specific contexts (Cooke et al., 1997; Fernandez-Serrano et al., 2019). One of these more specific concepts of innovation systems is the 'regional innovation system' that concentrates on local firms, clusters and especially informal institutions (Asheim & Isaksen, 2002; Boschma & Martin, 2010; Cooke et al., 1997; Grillitsch, 2019; Malerba & McKelvey, 2020). It contributes significantly to a better

understanding of innovation and development on regional level (Asheim et al., 2011; Doloreux & Porto Gomez, 2017; Fernandez-Serrano et al., 2019; Rypestol & Aarstad, 2018). In this vein, innovation is understood as an evolutionary and interactive social learning process (Rondé & Hussler, 2005, as cited in Fernandes et al., 2021). As this definition already suggests, regional innovation systems posit contextual differences in how knowledge and information are transferred (Cantner & Graf, 2008).

Although the presented approaches differ slightly in their reasoning about how regions convert regional knowledge into economic growth, they have in common that knowledge spillovers are a key ingredient. Knowledge spillovers are defined as unintentional knowledge exchanges via formal or informal channels without monetary compensation between different actors which may be firms, individuals or regions (de Almeida et al., 2021). Because of the tacit nature of knowledge spillovers, they tend to be geographically localised and are hypothesised to generate economic growth (Audretsch, 2018; Cerver-Romero et al., 2020; Jaffe et al., 1993). Moreover, spillovers can have different qualities depending on the similarity of the knowledge that spills over and the knowledge the surroundings have. While the Marshall-Arrow-Romer model assumes that regional specialisation enables more efficient usage of knowledge spillovers (Glaeser et al., 1992; Teirlinck & Spithoven, 2019), the Jacobs model suggests that regional diversification allows for knowledge to be re-combined in novel ways and thus enables innovation (Beaudry & Schiffauerova, 2009; Teirlinck & Spithoven, 2019). Frenken et al. (2007) build on the notion of the Jacobs model and introduce the idea that the relatedness of knowledge plays a role in this process. The authors state that knowledge pieces are easier to re-combine when they are related to each other than in the case of unrelated knowledge pieces (Boschma et al., 2014; Content et al., 2019; Frenken et al., 2007). Thus, regional capabilities and knowledge enables the use of some knowledge spillovers (related ones) while constraining diversification into new industries by unrelated spillovers (Neffke, 2009). Empirical observations suggest that specialisation has increased significantly in Europe since the early 1980s (Kogler et al., 2017). This phenomenon is also found at a sub-national level (Midelfart-Knarvik et al., 2002). This development is hypothesised to be caused by the emergence of a European market for technological solutions accompanied by a division of labour and R&D (Kogler et al., 2017). Knowledge spillovers are not only emerging in a localised manner, the benefits of knowledge spilllovers tend to be geographically bounded as well (Audretsch, 2018). However, when left unexploited, knowledge spillovers may be beneficial for surrounding areas and hamper the original region´s knowledge development which is especially true in times of ever increasing globalisation (Caragliu & Nijkamp, 2012).

2.1.3 Relevance of entrepreneurship in innovation policies

In the neo-Schumpeterian school of thought the concept of complex adaptive systems, as which one can classify regional innovation systems, is especially evident (Hanusch & Pyka, 2006). 'Complex' in this context refers to decentralized decision processes and 'adaptive' corresponds to the evolution of systems via learning (Pyka et al., 2019). In this type of systems, aggregated differences in economic performances are caused by individual experiences and actions (Huggins & Thompson, 2020). Because the rationality which is laying the foundation of human agency is spatially bounded (Huggins & Thompson, 2019, 2020; Pike et al., 2016), an uneven regional pattern of knowledge, innovation, and development is resulting (Huggins & Thompson, 2020).

One type of human agency in this vein is entrepreneurship which is argued to play an important role in converting knowledge into economic development (Audretsch et al., 2021; Audretsch & Belitski, 2017; Audretsch & Lehmann, 2005). Thus, entrepreneurs can be interpreted as essential micro-agents in regional innovation systems that drive the process of creation and diffusion of innovations (Fernandez-Serrano et al., 2019; Schumpeter, 1934; Uyarra, 2010). However, the relationship between entrepreneurship and regional innovation systems is not uni-, but bi-directional. The regional environment provides conditions for learning processes and resources entrepreneurs can build upon and thus influence the effectiveness of the entrepreneurial function (Malerba & McKelvey, 2020). Like innovation and knowledge, entrepreneurship is unevenly distributed across regions and is described as a regional event (Armington & Acs, 2002; Florida et al., 2017; Sternberg, 2009). There is empirical evidence for the correlation between the emergence of entrepreneurial activities and regionally unevenly distributed individual characteristics, like personality traits (Del Monte & Pennacchio, 2020). Moreover, it is widely acknowledged that the understanding of entrepreneurship and its uneven regional pattern requires reference to its context and historical roots (Aparicio et al., 2016; Feldman, 2001; Ferreira et al., 2017; Nayak & Maclean, 2013; Veciana & Urbano, 2008). Nevertheless, there are still open issues that the former President of the European Commission, Romano Prodi, urged scientists and politicians to close (Audretsch, 2018). To address this call, entrepreneurship and regional innovation systems and the associated innovation activities and interactive learning processes need to be linked closely together (Cooke, 2001).

Based on these considerations, the advisory group to the European Commissioner for Research and Innovation introduced the concept of smart specialisation strategies (S3) in a policy brief in 2007 (Uyarra, 2019; Varga et al., 2020). Later, this concept was transferred from the sectoral

level to the regional one and was incorporated into the European Union Cohesion Policy from 2014 until 2020 (McCann & Ortega-Argilés, 2015; Uyarra, 2019; Varga et al., 2020). The S3 approach turned into a major novelty in regional policies by offering a solution to the widening productivity gap between the United States of America (USA) and the European Union (EU) that is argued to be caused by a lack or duplication of specialisation (Foray, 2015, 2018; Kogler et al., 2017). The main rationale of the S3 approach is to diversify into related capabilities a region already inhibits (Uyarra, 2019). Apart from the focus on productivity and innovation as well as the emphasis on regional embeddedness, which are also shared by cluster policies (Saha et al., 2018), the S3 approach has two key novelties. First, the S3 follows a bottom-up perspective in which 'entrepreneurial discovery' is central. This 'entrepreneurial discovery' describes the process in which actors of the regional innovation system identify the domains to diversify into because these actors have superior knowledge compared to policy makers which capabilities are available in the region (D'Adda et al., 2019; Foray, 2015; Hausmann & Rodrik, 2003; Uyarra, 2019). Second, the specialisation domains are defined by the technological background and not based on industries (Asheim & Grillitsch, 2015; D'Adda et al., 2019). Thus, the smart specialisation approach can be described as an innovation-based regional economic development policy that focusses on 'entrepreneurial discovery' and 'structural change' via transformative activities as key concepts (Varga et al., 2020). However, the efficiency of smart specialisation strategies crucially depend on the starting conditions of the regional innovation system (Varga et al., 2020). As the S3 approach emphasises entrepreneurship as an initiator for structural change, the regional level of entrepreneurship impacts the outcome of these policies as suggested by empirical findings showing that lagging regions are not in the position to profit from this type of policy (McCann & Ortega-Argilés, 2016b; Varga et al., 2020). Therefore, it is of crucial relevance to gain fine-grained insights into the relation between regional innovation systems and entrepreneurial activities, because the more experimental a policy is, the more contextual knowledge is needed for a successful implementation (Uyarra, 2019).

The concept of entrepreneurial ecosystems (EE) provides a framework that focusses on entrepreneurial actors in urban or regional environments which makes it possible to add contextual information to regional innovation policies such as the smart specialisation strategies (Acs et al., 2017; Pugh et al., 2021; Spigel, 2017). In this view, entrepreneurs are conceptualised to be organic parts of the system and new ventures are the output of this system that are released into the economy (Acs et al., 2017). This multidimensional approach comprises commonalities in research interests from the field of entrepreneurship, economic

geography, and urban economics (Pugh et al., 2021; Spigel, 2017). Entrepreneurial ecosystems are, in this vein, defined as a combination of social, political, economic, and cultural pillars in a regional framework that supports the emergence of entrepreneurship (Malecki, 2018; Spigel, 2017). Based on this approach, the Regional Entrepreneurship and Development Index (REDI) has been introduced as a measurement of the quality of entrepreneurial ecosystems (Varga et al., 2020). It consists of three sub-indices that describe entrepreneurial abilities, entrepreneurial attitudes, and entrepreneurial aspirations (Varga et al., 2020). A balance of these indices is evaluated as desirable (Varga et al., 2020). These theoretical considerations and the measurement approach emphasise that the same entrepreneurial activity can have distinct impacts depending on the regional environment and are a valuable extension for the design of regional policies (Fernandez-Serrano et al., 2019).

An additional source of heterogeneous territorial entrepreneurship outcomes is the type of entrepreneurial activities (Szerb et al., 2019), which relates to the notion that entrepreneurial ecosystems can be understood as the combination of regional and individual attributes (Pugh et al., 2021; Stam, 2014). Because different types of entrepreneurship yield distinct outcomes in terms of the innovation capacity and economic growth, the overall regional composition of these entrepreneurial types relates to the territorial effect of it (Cerver-Romero et al., 2020; Szerb et al., 2019; Vivarelli, 2013). Further, entrepreneurial ecosystems of different quality have varying capabilities to materialize effects of business formations (Szerb et al., 2019) and stimulate entrepreneurial activities based on opportunities and economic returns (Huggins & Thompson, 2020). Hence, stronger ecosystems are able to profit from entrepreneurial activities of all sorts, whereas weaker ecosystems rely more strongly on innovative entrepreneurship (Szerb et al., 2019). These interrelated levels of attributes on regional and individual/firm level lead one to question the validity of policy programs aiming at non-selective stimulation of entrepreneurial activities (Acs et al., 2016; Shane, 2009; Szerb et al., 2019; Vivarelli, 2013). Rather, these considerations suggest that it is essential to have a differentiated perspective on entrepreneurship in regional contexts (Hayton & Cacciotti, 2013).

The most relevant distinction of entrepreneurial activities to guide selective programs is based on the following two traditions: The first goes in line with the definition initially proposed by Kirzner (1973) and the second follows the Schumpeterian tradition (Schumpeter, 1934). Kirzner (1973) argues that entrepreneurs impact the economy by mobilising resources and contribute by exploiting opportunities (Szerb et al., 2019). Thus, these pursued activities lead to an increased balance in markets which is interpreted as being essential for the competitiveness of economies (Chiles et al., 2010; Ferreira et al., 2017; Korsgaard, 2011;

Rypestol & Aarstad, 2018). Hence, the entrepreneurial function does not necessarily include innovations generated by entrepreneurs but can rely on imitative strategies (Rypestol & Aarstad, 2018). The concept of entrepreneurship as outlined by Schumpeter (1934) contrasts this perspective. In this vein, the entrepreneurial function is fulfilled when entrepreneurs introduce dynamism into an economy by means of innovative activities (Malerba & McKelvey, 2020; Rypestol & Aarstad, 2018; Szerb et al., 2019). By doing so, entrepreneurial activities challenge incumbent firms through the process of 'creative destruction', meaning the entrepreneurially introduced innovations render established products and/or processes obsolete and therefore increase competition (Carlsson et al., 2013; Ferreira et al., 2017; Malerba & McKelvey, 2020). Due to these different understandings of the entrepreneurial function, there have been conceptual debates about the characteristics of entrepreneurs (Cantner et al., 2017), the nature of opportunities (created or discovered) (Ardichvili et al., 2003; Carlsson et al., 2013), the impact of entrepreneurs on incumbents and their power to transform economic systems via innovations (Winter, 1984, 2016). However, what remains unchallenged by both views, although potentially different in its conception, is the relevance of entrepreneurship for regional development (Audretsch, 2018; Caiazza et al., 2015; Cerver-Romero et al., 2020), and the relevance of knowledge in the entrepreneurial process (Cooke & Leydesdorff, 2006; Rypestol & Aarstad, 2018). One can argue that both types of entrepreneurship impact regional development by reinforcing existing structures and capabilities (Kirzner conception) or by breaking with regional traditions and opening up new development paths (Schumpeter conception) (Rypestol & Aarstad, 2018). Because of the centrality of knowledge in both definitions, it is not surprising that in a view that suggests economic development by physical capital, the field of entrepreneurship played a small role only (Audretsch, 2018). However, in times of the 'knowledge-based economy', it leaves one wondering why the concept of learning is not considered extensively in the entrepreneurial ecosystem literature (Pugh et al., 2021).

The Knowledge Spillover Theory of Entrepreneurship (KSTE), proposed by Acs et al. (2009; 2013), addresses this issue by explicitly linking regionally available knowledge and new firm formation (Colombelli et al., 2021). By stating that regional knowledge spillovers are recognised by entrepreneurs and that they turn this unexploited resource into an opportunity (Acs et al., 2009, 2013; Content et al., 2019), this approach addresses critique of endogenous growth theories that do not provide the link between knowledge and economic growth (Colombelli et al., 2021). The cause of knowledge spilling over is, in this vein, reasoned by the 'knowledge filter'. This concept of the 'knowledge filter', as first proposed by Arrow (1962), describes the phenomenon that knowledge is not marketed caused by the inability of

incumbents to exploit the full returns of investments in new knowledge (Attour & Lazaric, 2020; Caiazza et al., 2020; Cerver-Romero et al., 2020; Content et al., 2019). This inability can be related to formal or informal institutional filters that prevent behaviours that would allow an exploitation of the generated knowledge (Caiazza et al., 2015). Entrepreneurs are hypothesised, in this view, to penetrate the 'knowledge filter' (Acs & Plummer, 2005; Caiazza et al., 2020; Carlsson et al., 2009; Qian & Jung, 2017). Through this mechanism, entrepreneurial activities are expected to promote employment growth (Acs & Armington, 2004; Content et al., 2019; Fritsch & Mueller, 2004). However, this entrepreneurial function crucially depends on the underlying regional knowledge base as a larger base offers more opportunities (Acs et al., 2013).

2.1.4 Interdependence of knowledge, regions and entrepreneurship in political agendas

As a next step, it is investigated how these developments in the scientific and political discourse are reflected in regional policies in Germany. Therefore, the interconnectedness and definitions of the three main concepts introduced – regions, knowledge, and entrepreneurship – in the political agenda are of interest. For this purpose, political programs at federal state level in Germany in the time period from 1975 until 2017 are retrieved from the polidoc.net data base (Benoit et al., 2009; Gross & Debus, 2018).[3] The text documents include election programs of parties active in the federal state for each year of elections. A five-stepped procedure was applied to prepare the data for analysis. First, bigrams are identified that appear in the political documents. Second, bigrams that included a stop word according to the ISO list of German stop words were removed from the data set. Third, to filter out the relations between the three main concepts of interest – regions, knowledge, and entrepreneurship – words that can be associated with one of these concepts were aligned.[4] Fourth, the bigrams were lemmatized, which transforms the words into their standard form, to enable the

[3] This time frame is determined by the available data in the data base.

[4] The German words 'Region/Regionen', 'Kommune/Kommunen', 'Gemeinde/Gemeinden', 'Metropole/Metropolen', 'Bundesland/Bundesländer', and 'Stadt/Städte' were aligned to the term 'region'. The German words 'Innovation/Innovationen', 'Invention/Inventionen', 'Wissen', 'Fähigkeit/Fähigkeiten', 'Erfindung/Erfindungen', 'Expertise', and 'Kompetenz/Kompetenzen' were aligned to the term 'knowledge'. The German words 'Entrepreneurship', 'Entrepreneur/Entrepreneure', 'Neugründung/Neugründungen', 'Existenzgründung/ Existenzgründungen', 'Startup/Startups', and 'Ausgründung/Ausgründungen' were aligned to the term 'entrepreneurship'. This summary of terms to the concepts is executed to enable the analysis of the interrelatedness of the concepts rather than single bigram relations. However, these terms are not understood as a conclusive list of synonyms, but rather highlight the most important nouns in each category. To avoid misattributions of nouns that change their meaning in different contexts (e.g. 'Selbstständigkeit' can be interpreted as being self-employed or it could be used in the context of independence of regions), only words were selected that have an unambiguous meaning.

summary of words with the same meaning. For the purpose of clarity in the graphs that are based on this data, only nouns and adjectives were kept in the data set. Fifth, the data set was divided according to the year of publication of the political documents into the decades 1970s, 1980s, 1990s, 2000s, and 2010s. Figure 2.2 shows the network graphs that result from the bigram structure in each decade.[5]

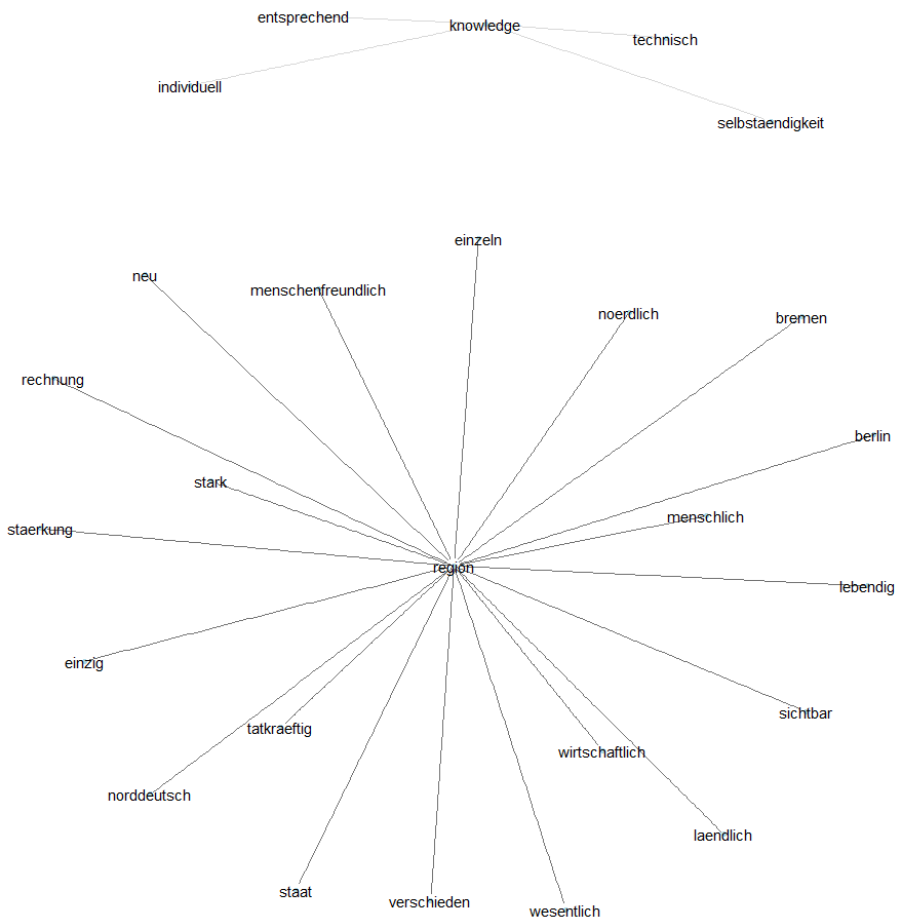
In all networks, the concept of 'region' is the most prominent one, because it has the largest number of words associated with it. Moreover, the words related to the concept do not change significantly over time. These words describe either specific regions (specific nations or sub-national regions) or characteristics these regions have (e.g. attractive, independent, liberal). These findings confirm that this concept of 'region' is with the longest tradition influencing political actions compared to knowledge and entrepreneurship. Further, the definition of the concept is not directly impacted by the scientific discourse.

The second concept 'knowledge' is apparent in all networks as well. However, this concept develops over time from a disconnected and one-sided concept to a concept with many facets and strong interconnectedness with the regional context. The connectedness of 'knowledge' and 'region' is especially evident in the decades 1990s, 2000s, and 2010s. This finding reflects the scientific discourse about the relevance of regions in the era of knowledge as the main component of competitive advantages. Furthermore, the words related to the concept of 'knowledge' have increased quantitatively over the decades. This hints at the increasing relative importance of this concept and that it is discussed in the political documents diversely. A qualitative assessment of the associated words confirms this impression. During the 1970s, the concept was mainly related to technical knowledge, which was extended in the 1980s by acknowledging different types of knowledge as technical/creative and theoretical/practical. In the 1990s, political relevance of knowledge and research as a way to create it, were respected. During the 2000s and 2010s, the definition of the 'knowledge' concept incorporated its origins (e.g. cognition, research), its variety of types (e.g. technological, practical) and its effects on regional and economic development (e.g. growth-enhancing, employment). These findings reflect the scientific discourse of knowledge from a concept that is associated with the work-force to the conceptualisation of the knowledge-based economy and smart specialisation strategies.

[5] For clarity reasons and to avoid misinterpretation of the networks by bigrams that have a single occurrence, only those bigrams that appear at least two times, are displayed.

The third concept of interest – 'entrepreneurship' – is only appearing in the political documents in the 1980s as a disconnected and marginally defined construct. In the following decades, entrepreneurship is connected to the concept of 'region' and, in the 2000s, also to the concept of 'knowledge'. However, it remains comparably separated from these concepts and is stable in its definition as inhibiting competences and as being modern and innovative. Furthermore, the concept of 'entrepreneurship' is related to quantity, importance and necessity, which hints at the dominance of the aim to increase the number of entrepreneurial activities. Because the definition of entrepreneurship highlights innovativeness as main feature and the scientific discourse that points at the relevance of entrepreneurial activities for economic development, it is surprising that this concept remains relatively disconnected from the others.

Overall, these findings show that the role of entrepreneurs in German regions is not very well defined and remains abstract, which may also correspond to the lack of deep understanding how entrepreneurship and the transformation of regional knowledge relate to each other. This present dissertation aims to contribute to addressing this issue. Moreover, the studies in this dissertation contribute to enabling a targeted policy approach that has the power to unfold the full potential of regional entrepreneurial activities.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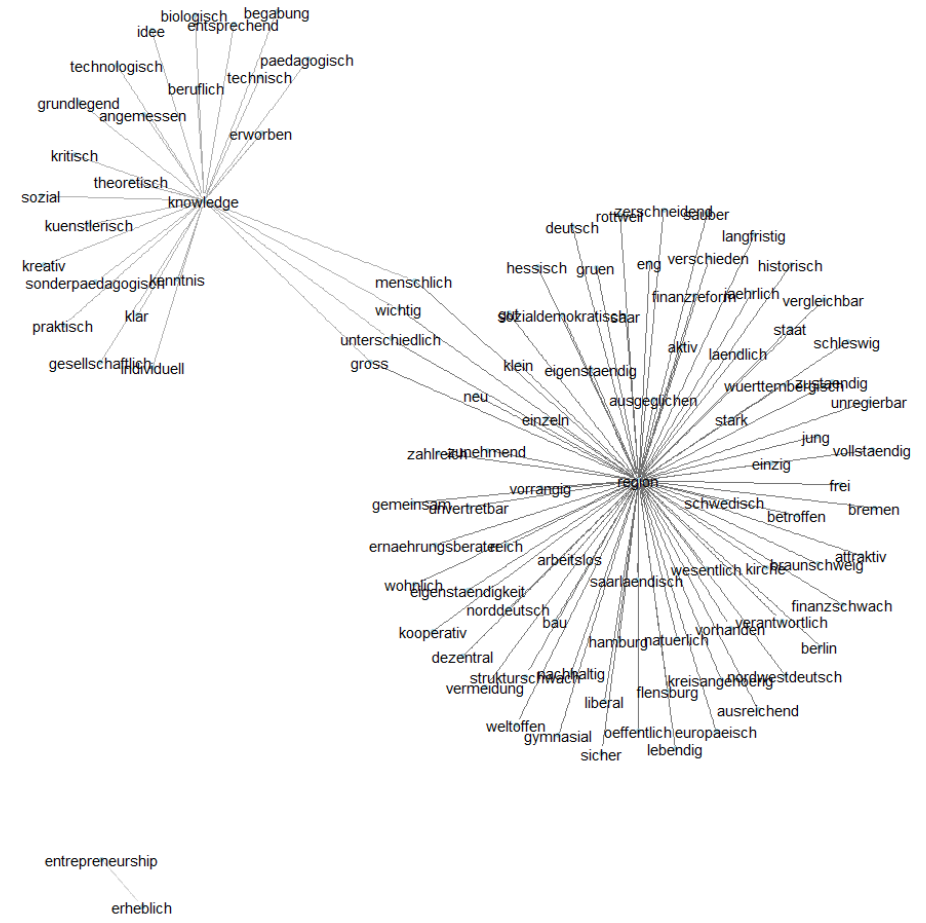
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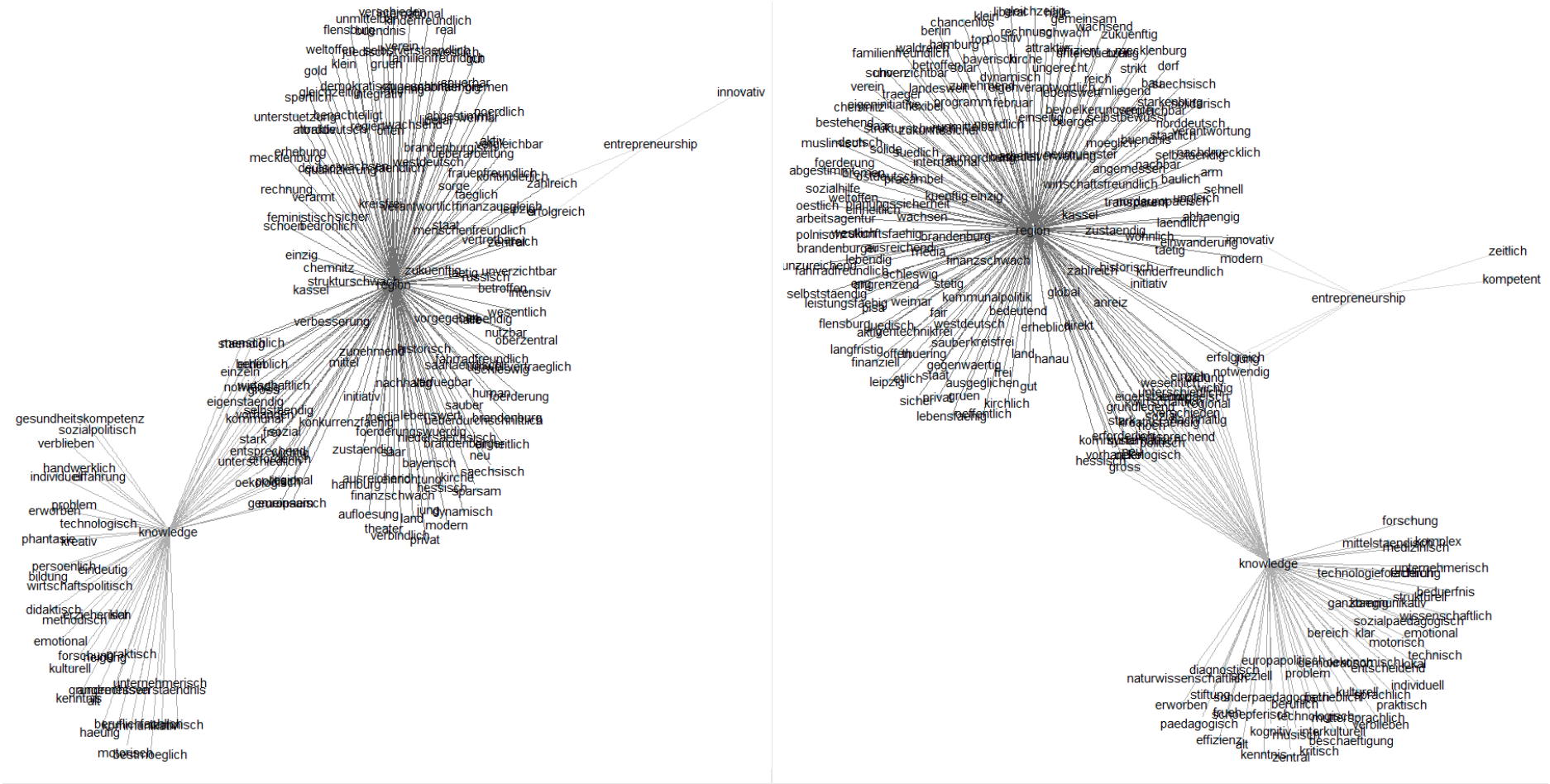
1990s
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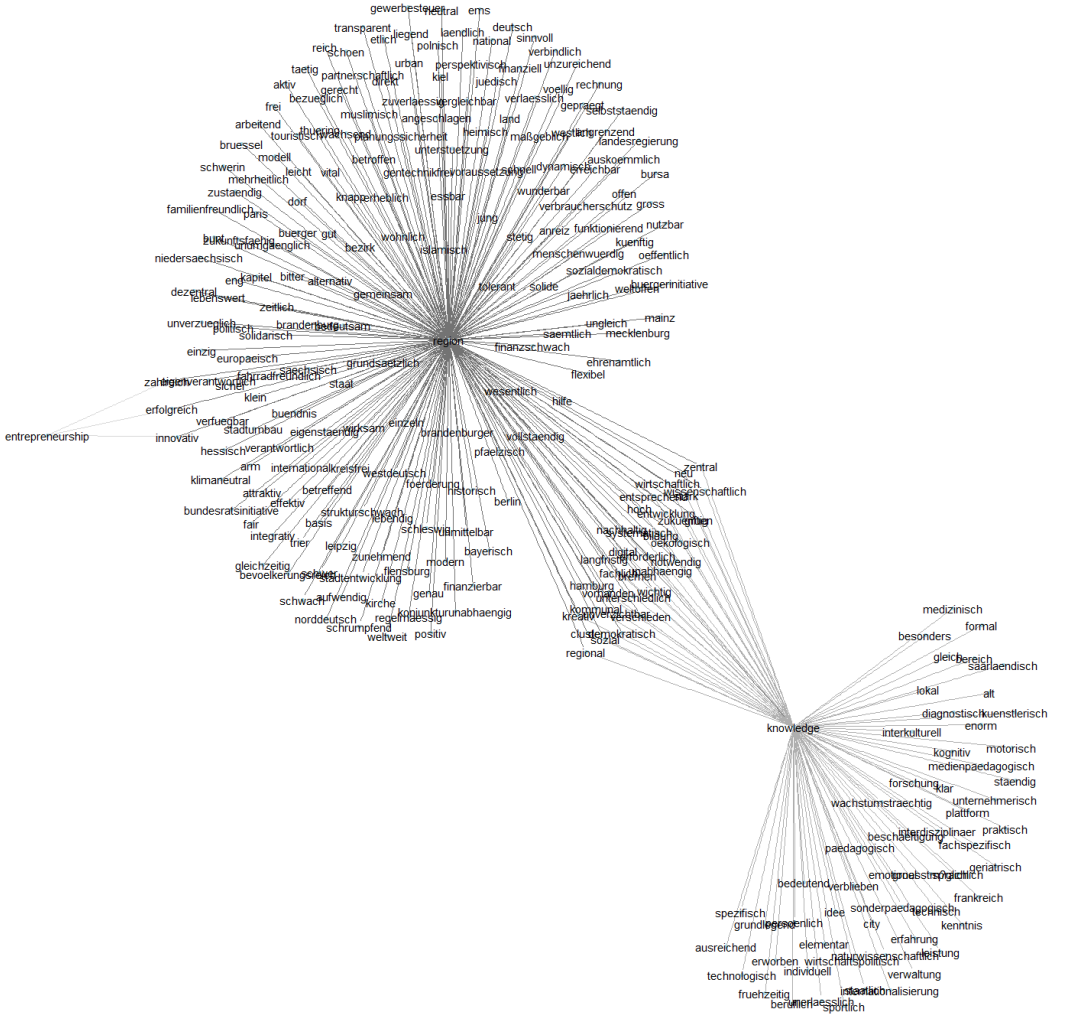

Figure 2.2: Bigram networks based on political documents in the decades 1970s until 2010s
Source: Own construction based on data retrieved from polidoc.net

3 Entrepreneurship as a process

The considerations from the former sections lead to the conclusion that entrepreneurship is linked with the regional environment, innovative activities, networks and interactive learning (Feldman, 2014; Qian et al., 2013). Moreover, these factors have distinct impacts on various stages of the entrepreneurial process which can be defined as identification, evaluation and exploitation of entrepreneurial opportunities and often involve the creation of a new venture (Caiazza et al., 2020; Ferrero & Bessiere, 2016; Shane & Venkataraman, 2000). Opportunity recognition is in this vein acknowledged to be the centre of the entrepreneurial process because it is its starting point (Riquelme, 2013; Shane & Venkataraman, 2000; Venkataraman, 1997). However, without diffusion of the products or processes generated by entrepreneurial activities, the impact of entrepreneurship on the economy remains limited (Caiazza et al., 2020). The conceptualisation of entrepreneurship as a process affected by regional innovation systems, calls for taking on a disequilibrium approach that does not assume that entrepreneurship is solely driven by individual characteristics of entrepreneurs (Shane & Venkataraman, 2000).

The first stage of the entrepreneurial process is based on the perception of opportunities (Riquelme, 2013; Shane & Venkataraman, 2000). In the 'knowledge-based economy', this recognition is closely connected to regional knowledge and ideas that have been generated but are not applied in economic action (Colombelli, 2016). The role of entrepreneurship is to channel this knowledge through re-combination and experimentation to the economy (Fritsch & Kublina, 2018; Kerr et al., 2014; Weitzman, 1998). Thus, the creation of new ventures can be interpreted as an endogenous response to the regional knowledge base enabling entrepreneurial activities in the first place (Acs et al., 2009, 2013; Cerver-Romero et al., 2020; Colombelli, 2016; Malerba & McKelvey, 2020). However, investments in new knowledge do not automatically transform themselves into new ventures and economic growth (Cerver-Romero et al., 2020), but depend on the ability of potential entrepreneurs in the region to perceive the opportunity to commercialise this unexploited knowledge (Qian & Acs, 2013). Insights into the regional tacit knowledge, about specifics of the market and businesses, are of crucial importance for the ability to absorb knowledge spillovers and turn these into new ventures (Qian & Acs, 2013). Although this first step in the entrepreneurial process might be labelled as central, it is not sufficient for entrepreneurship to fulfil its entrepreneurial function in economic systems (Shane & Venkataraman, 2000). The next step includes the development and refinement of business ideas that build on the perceived opportunity, which can be

referred to as the transition from unrealised to latent entrepreneurship (Caiazza et al., 2020; Klofsten, 2005). In this step, the tacit idea is converted into an explicit one. The third step in the entrepreneurial process can be described as the emergence of new ventures on the regional market (Caiazza et al., 2020). By providing new products or services, these new ventures contribute to regional development by initiating their entrepreneurial function, which may result in a reinforcement of the regional development trajectory, or by breaking with these (Caiazza et al., 2020; Grillitsch, 2019; Rypestol & Aarstad, 2018). However, the efficiency of the entrepreneurial function depends also on the incumbents' ability to exploit this new external knowledge and their capabilities to develop new products and processes based on this (Cohen & Levinthal, 1990; Lindholm-Dahlstrand et al., 2019). If no established venture absorbs the entrepreneurially generated knowledge and further develops it, the impact of the entrepreneurial knowledge remains limited. In contrast, if many established ventures absorb and develop this knowledge, the regional development is propelled by entrepreneurial experimentation. This entrepreneurial process might be challenged by changing environmental conditions induced by crises and thereby the efficiency of the entrepreneurial function is impacted (Ferreira et al., 2017). In this case, the diversity of a regional knowledge base is argued to be of main importance for the resilience of economic systems (Bishop, 2019; Colombelli, 2016). This argument is inferred by the proposition that the larger and more diverse the regional knowledge base is, the more diverse entrepreneurial activities in this region can possibly be (Bishop, 2019; Colombelli, 2016). Hence, a more diverse knowledge base can bring forward more diverse entrepreneurial activities which equates to a greater possibility that a subset of these activities can re-orient the regional development to a path of economic success under these new conditions (Bishop, 2019).

The perspective as formulated above allows detailed investigation of the entrepreneurial process and its relation to different types of knowledge and pays attention to the interplay of individual and regional factors. This view addresses three limitations of former considerations. First, as the models of economic growth proposed by Solow (1956, 1957) and Romer (1986, 1990, 1994) suggest that knowledge is either an external component or something that is created by the neighbour, these models do not allow one to deduce meaningful policies on how to foster economic growth via knowledge (Audretsch, 2018). Second, the theoretical considerations made by the KSTE assume that the regional knowledge stock is homogenous in nature and thus lacks a differentiation of types of knowledge (tacit or codified) (Colombelli et al., 2021; Shearmur & Doloreux, 2021). Third, the model of KSTE does not directly pay attention to the interplay of personal and regional factors that impact entrepreneurial

activities, their emergence and the efficiency of their entrepreneurial function (Fritsch & Wyrwich, 2018). The following sections describe the interplay of region, individual and new ventures and their relation to different types of knowledge throughout the entrepreneurial process.

Based on this conceptualisation of the entrepreneurial process and its relatedness to different types of knowledge, this dissertation is composed out of four studies that deliver empirical insights from each stage. Figure 3.1 illustrates the dissertation milestones and their interrelation. Chapter 2 deals with the impact of regional tacit knowledge, Chapter 3 focusses on the codification process of tacit knowledge, Chapter 4 highlights the diffusion of explicit knowledge and Chapter 5 investigates the adaptability of regional tacit knowledge as response to crises. The conceptualisations of the knowledge type investigated in each dissertation milestone are presented in the following sections.

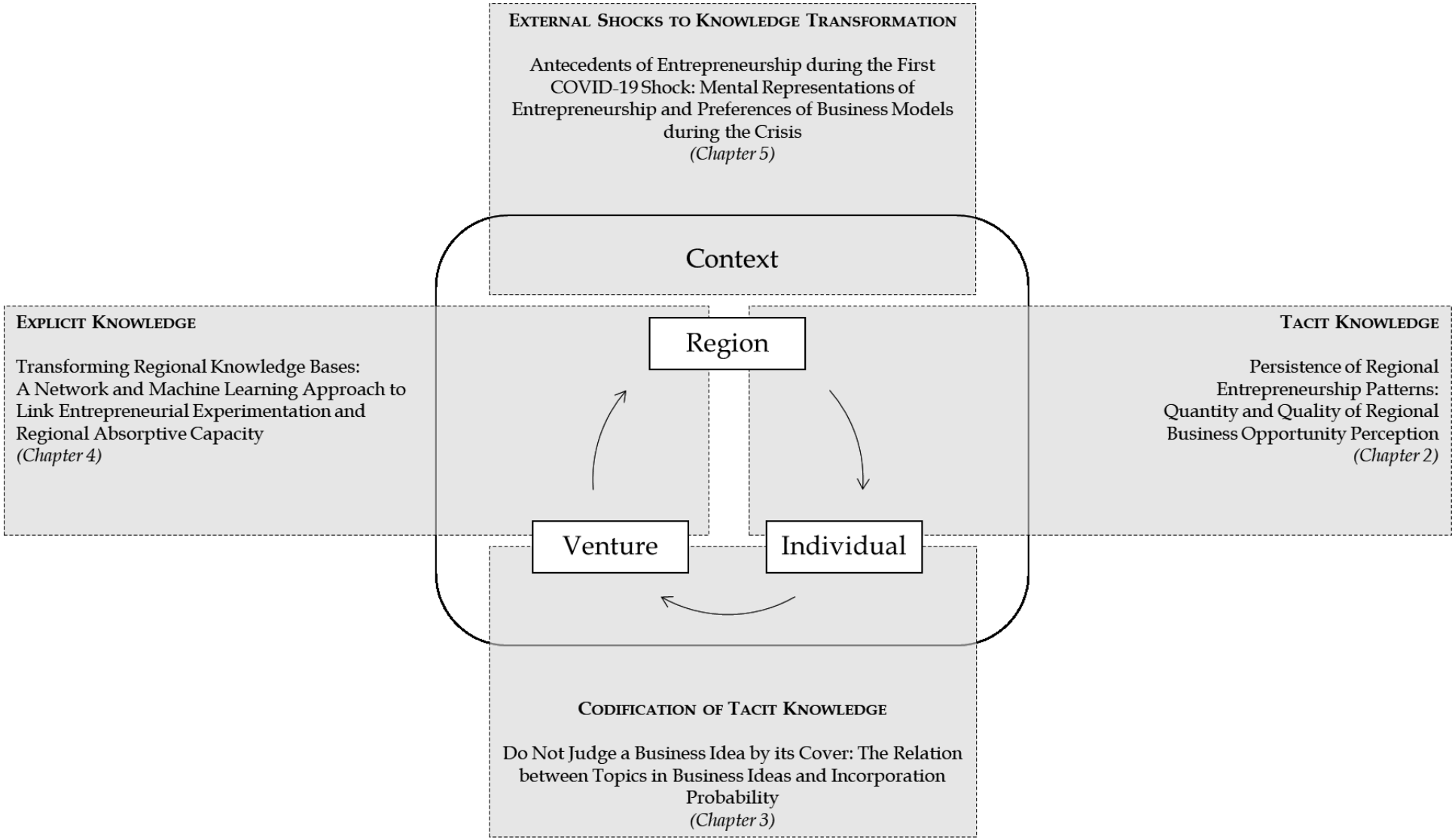

Figure 3.1: Overview of the dissertation chapters
Source: Own illustration

3.1 Regional tacit knowledge as precondition for regional opportunity perception

Opportunity perception as the critical starting point of the entrepreneurial process (Riquelme, 2013; Shane & Venkataraman, 2000) can be defined as generating an idea that is based on beliefs (Venkataraman & Sarasvathy, 2001). This definition already points to the relevance of individual perceptions and cognition (Ferrero & Bessiere, 2016). Three main components shape the perception of opportunities by individuals - 1) personality traits (Gaglio & Katz, 2001), 2) cognition (Baron & Ensley, 2006) and 3) learning (Cohen & Levinthal, 1990; Eisenhardt & Schoonhoven, 1990; Shane & Venkataraman, 2000). In this vein, it is stated that opportunities are only recognised by those that are prepared to perceive them (Krueger & Brazeal, 1994; Strong, 2013). It is argued that perception is not a passive process, but that the perception of every piece of information is compared to former experiences and knowledge an individual has (Hayek, 1952, as cited in Strong, 2013). This mental framework guides the interpretation of new information, changes in technology, markets and other environmental factors (Riquelme, 2013; Valliere, 2013) and evokes a particular response to the perception (Valliere, 2013). Hence, the mental framework steers how an individual interacts with its environment and is the antecedent of individual action (Audretsch & Belitski, 2017; Fernandez-Serrano et al., 2019).

Based on this cognitive perspective of opportunity perception, it is argued that opportunities cannot be understood separately from the entrepreneur (Audretsch & Belitski, 2017; Huggins & Thompson, 2020; Sarason et al., 2010; Wright & Stigliani, 2012). Although this view is often contrasted with the assumption of external opportunities that arise from the economic structure (Malerba & McKelvey, 2020). Both perspectives acknowledge that opportunities are context dependent and require entrepreneurs to perceive these. This process is based on individual mental frameworks (Riquelme, 2013; Shane & Venkataraman, 2000). Although this individual mental framework is of major importance, it is socially constructed and shaped by the regional context of an individual (Kraus et al., 2020). The entrepreneurial ecosystem determines if an individual becomes an entrepreneur, how entrepreneurial activities are influenced and what the efficiency of the entrepreneurial function is (Andersson & Koster, 2011; Audretsch & Belitski, 2017; Autio et al., 2014). The mechanism through which an ecosystem governs entrepreneurship is argued to be partially driven by institutions that lead to persistent regional differences (Garretsen et al., 2019; Gertler, 2010). Institutions are defined in multiple ways (Urbano & Alvarez, 2014), but what all conceptualisations have in common is that institutions can be interpreted as rules, norms and habits that impact social, political and economic interactions and change only slowly (Urbano & Alvarez, 2014). Institutional

frameworks in which individuals are embedded impact individual mental frameworks by providing guidance in which actions are considered as legitimate, desirable, and appropriate (North, 1990, as cited in Langevang et al., 2015). Within the set of regional institutions, entrepreneurship culture is a key factor for steering entrepreneurial activities and, thus, matters significantly for economic growth (Beugelsdijk, 2007; Garretsen et al., 2019). Empirical evidence for the existence of such an entrepreneurial culture in Germany is given by finding a relationship between historical self-employment rates and entrepreneurial-prone personality traits (Fritsch et al., 2019). Such a culture aligns individual mental frameworks and describes the presence of shared values that simultaneously constrains entrepreneurial activities if these do not comply with this cultural attitude and enables entrepreneurial activities that are in line with it (Almeida & Teixeira, 2017; Hodgson, 2006; Hoffman et al., 2002; Langevang et al., 2015; Ogunsade & Obembe, 2016). Therefore, it is expected that the regional entrepreneurship culture influences not only the individual mental frameworks, but also entrepreneurial activities in their quantity and quality (Aparicio et al., 2016; Ferreira et al., 2017; Valdez & Richardson, 2013).

However, institutional frameworks do not impact each individual similarly. Its concrete impact depends on the socialisation process an individual went through as cultural attitudes are transferred via social contacts. This is a mostly unconscious process (Laine, 2016; Ogunsade & Obembe, 2016). The efficiency of this process is also governed by the presence of role models others can learn from, especially in phases prior to starting a new venture, which influence people via unconscious observation as also suggested by the social learning theory as proposed by Bandura (1977, as cited in Zozimo et al., 2017) (Fritsch et al., 2019; Gibson, 2004; Zozimo et al., 2017). Indeed, the presence of role models, defined as accessible, successful individuals that higher the acceptance of entrepreneurial activities, is often related to the efficiency of entrepreneurial ecosystems (Andersson & Koster, 2011; Bosma et al., 2012; Fritsch et al., 2019; Lafuente et al., 2007; Zozimo et al., 2017). Once a regional mindset is embodied, this gives rise to attitudes and expectations, which tames the uncertainty and, thus, allows planning over longer periods of time within this setting (Laine, 2016). However, multiple environmental factors potentially impact this socialisation process (Holcomb et al., 2009; Sardana & Scott-Kemmis, 2010; Zozimo et al., 2017). One of these is identification with the group, as confirmed by the finding that the effect norms and shared values have on entrepreneurial decision-making interact with this identification (Cantner et al., 2017).

Despite these considerations and empirical evidence, the influence of entrepreneurial cultures on entrepreneurial activities is still debated (Almeida & Teixeira, 2017). Moreover, its impact

on heterogeneous entrepreneurial activities, that differ in their antecedents as motivations and required contextual factors as well as in their impact on regional economic development, is far from being fully understood (Hayton & Cacciotti, 2013).

Chapter 2 of this dissertation contributes to this stream of literature. This milestone is entitled 'Persistence of Regional Entrepreneurship Patterns: Quantity and Quality of Regional Business Opportunity Perception'. In this chapter the focus lies on the regional processes that lead to the perception of regional general and innovative opportunities. As the perception of opportunities depends on entrepreneurially prone people being alert to their environment and opportunities within this, the region and its structure are of key importance. The regional environment inhibits a unique composition of actors, networks, economic activities and cultural background, giving rise to region-specific opportunities for new ventures. It can be interpreted that regional tacit knowledge about general and innovative opportunities is transferred to the individual by embeddedness because the regional factors only impact opportunity perception when individuals are embedded into these. This first milestone focusses on channels that transfer regional tacit knowledge to individuals which leads to the recognition of general and innovative business opportunities.

3.2 Transforming tacit ideas into codified plans and the narratives of business ideas

After the initial opportunity perception and the development of a rough draft of a business idea on how to exploit the opportunity, this tacit idea needs to be transformed into an explicit one. This process lowers the information asymmetries between the entrepreneur and potential investors or customers. Especially ideas with a high degree of novelty suffer from this problem of information asymmetries and tend to find balancing of innovative products and the marketing difficult (Fleming, 2004; Proksch et al., 2017; Youtie et al., 2012). Therefore, communication skills are increasingly important to attract external investments, which are often decisive for the success of innovative projects (Rasmussen et al., 2011; Rasmussen & Sorheim, 2012; Youtie et al., 2012).

To persuade investors as well as customers, a story that legitimises the idea and communicates the essence of the business is, especially in the case of novel ideas, of major importance (Cornelissen & Clarke, 2010; Johnson & Bock, 2017; Lounsbury & Glynn, 2001; Martens et al., 2007; McAdam & Marlow, 2011). This narrative of a business idea can also be understood as a mission statement that aligns the organisational strategies (Bart, 1997; Kirk & Nolan, 2010), influences perceptions of stakeholders (Pandey et al., 2017) and motivates specific behaviour patterns of employees (Bart et al., 2001; Ireland & Hirc, 1992; Klemm et al., 1991). Although

there are various definitions of mission statements and compulsory components of such (Fox, 2006; Klemm et al., 1991; Pearce & David, 1987), the common ground is that these statements represent the shared understanding of the essence and imagined future of a venture. In this vein, business plans that concretise the initial business idea and mission statement are often argued to be necessary for a clear narrative and vision as well as its integration into actions (Ashamalla et al., 2008; Hormozi et al., 2002).

Although quantifiable measures of a business idea are used in the first stage of screening processes to select promising ideas for investments or public funding, more subjective characteristics of the idea are central to attract funding (Chen et al., 2009; Drnovsek et al., 2018; McAdam & Marlow, 2011; Rasmussen & Sorheim, 2012). This underlines the outstanding relevance of the narrative of a business idea, because this codifies the tacit idea in such a way that the attractiveness of the business is conveyed easily from entrepreneurs to investors and customers (McAdam & Marlow, 2011; Plomaritou et al., 2011).

However, it remains unclear which narratives are likely to be perceived as novel by investors or experts and which have higher prospects in being successfully incorporated. It is known that investors build on qualitative criteria, e.g. the presentation and communication of the business idea, to base their investment decision on which is highly influenced by subjective judgements (Drnovsek et al., 2018; McAdam & Marlow, 2011). Thus, the fit between entrepreneur and business angel regarding their educational background and previous industry experiences impacts the decision of investment (Drnovsek et al., 2018). This is why there is a call for more objective metrics in the selection process of business ideas that receive support (Gundry et al., 2016; McAdam & Marlow, 2011; Meyskens & Carsrud, 2013; Pandey et al., 2017).

Chapter 3 of this dissertation is dealing with this issue. This milestone is entitled 'Do not Judge a Business Idea by its Cover: The Relation between Topics in Business Ideas and Incorporation Probability'. The main aim of this chapter is to identify the relation between narratives of business ideas and their incorporation success. Business ideas start as purely tacit but by writing the idea down and refining it to address questions about targeted customers and markets, next steps for realisation of the idea and legal requirements, this tacit idea is transformed into an explicit one. This dissertation milestone focusses on this aspect and identifies narratives in novel and non-novel business ideas that are associated with higher and lower incorporation probabilities.

3.3 Codified knowledge as source for regional economic advantage and regional conditions for the entrepreneurial function

For the fulfilment of the entrepreneurial function it is not sufficient to codify a business idea and turn it into a functioning new venture, but regional conditions matter for the impact this business has on the economic development (Autio et al., 2014; Guerrero & Urbano, 2017; Urbano et al., 2019). The regional absorption and advancement of knowledge can be defined as a collective endeavour which relies on coordination mechanisms (Malerba & McKelvey, 2020; Pihlajamaa, 2018). Regional knowledge bases that result from these collective learning processes, which give rise to specific economic activities but at the same time constrain them (Neffke et al., 2018). Based on these considerations, the regional knowledge base, and the coordination mechanisms that are necessary to build it, is the regional conditions that govern the efficiency of the entrepreneurial function.

Of outmost importance for the understanding of what enables entrepreneurship to kick-off system-wide experimentation and collective learning mechanisms, is the interplay of entrepreneurial and established ventures in a regional innovation system (Baumol, 2002; Lindholm-Dahlstrand et al., 2019; Qian & Jung, 2017). The symbiosis between these two types of companies – entrepreneurial and established – is beneficial because these have advantages at different stages of the innovation process (Baumol, 2002).While entrepreneurial ventures are likely to experiment and develop radical innovations and challenge the incumbent firms by doing things differently (Baumol, 2002; Kerr et al., 2014; Lindholm-Dahlstrand et al., 2019), established ventures have the resources, networks and accumulated knowledge about the market environment needed to scale innovations up and bring them to a global scale (Baumol, 2002; Lindholm-Dahlstrand et al., 2019).

For this symbiosis to enable the effectiveness of the entrepreneurial function, established ventures need to incorporate this new knowledge into their knowledge base (Molina-Morales et al., 2019). Identification, assimilation and exploitation of entrepreneurially generated knowledge are necessary components of this learning process that constitutes the absorptive capacity (Cohen & Levinthal, 1989, 1990; Schmidt, 2005). Despite many conceptualisations of absorptive capacity (Lane & Lubatkin, 1998; Schmidt, 2005.; Zahra & George, 2002), the common ground of all definitions is that the concept is a multi-dimensional one that results from a combination of different resources and capabilities (Distel, 2019; Russo-Spena & Di Paola, 2019; Schmidt, 2005). Another shared characteristic of absorptive capacity in all conceptualisations is that the efficiency of the absorption of external knowledge depends on prior knowledge the absorbing unit has and the source that generated the external knowledge

(Choi & Park, 2017; Cohen & Levinthal, 1990; Fritsch & Kublina, 2018; Pihlajamaa, 2018). Hence, absorptive capacity is a path-dependent and context-dependent concept (Pihlajamaa, 2018).

The impact the absorptive capacity of established ventures in a regional innovation system has on regional economic development depends on two factors. First, the ability of a regional system to absorb similar knowledge or knowledge that diverges from the knowledge base, impacts the path-dependency of the regional economic development by either fostering incremental or radical innovations (Choi & Park, 2017; Cohen & Levinthal, 1990; Fritsch & Kublina, 2018; Greve, 2007). Second, the impact of this learning process depends on its efficiency as stated by Zahra and George (2002) who distinguish between potential and realised absorptive capacity to capture the ability of the absorbing entity to advance its own knowledge base by transforming and exploiting external knowledge (Molina-Morales et al., 2019; Solano et al., 2020).

However, it remains unclear how to improve the regional absorptive capacity of entrepreneurial knowledge (Lane et al., 2002; Schmidt, 2005). For this purpose, an analysis of the micro-level processes that govern structural change is of key relevance (Boschma, 2017; Grillitsch, 2019; Uyarra, 2010).

Chapter 4 of this dissertation takes this issue as a starting point. This milestone of this dissertation is entitled 'Transforming Regional Knowledge Bases: A Network and Machine Learning Approach to Link Entrepreneurial Experimentation and Regional Absorptive Capacity'. Regional innovation policies highlight the importance of entrepreneurial experimentation to propel regional development. However, this only succeeds if the generated knowledge diffuses and is absorbed. Diffusion of explicit knowledge is of special interest in this vein because this type of knowledge spills over more easily and can be transferred over large distances. For regions to profit from the knowledge generated by entrepreneurs within the region it is therefore of crucial importance to absorb the knowledge at a fast pace. Otherwise, the generated knowledge may rather contribute to a competitive advantage of other regions than for the region inhibiting the entrepreneurial experimentation. Based on this, the third milestone of the dissertation focusses on the composition of regional absorptive capacities and which components of regional innovation systems impact the absorption of entrepreneurial knowledge the most.

3.4 Changing tacit knowledge during crises and opportunity perception

Events such as the financial crisis in 2008/2009 and the COVID-19 crisis starting in 2020 in Germany qualify themselves as severe crises because the warning time before the event was short, they threaten economic interactions and create uncertainty (Bishop, 2019). Although, this does not mean that these two events are similar in their causes and impacts on the economy (Barbosa-Filho & Izurieta, 2020), the rising uncertainty in both crises is observed to relate to spending that is more oriented towards basic needs and consumer behaviour that is disrupted by affecting daily practices (Kuokkanen et al., 2019; Loxton et al., 2020).

By changing the conditions of everyday actions, severe crises affect not only economic interactions, but also political positions and mental frameworks of individuals (James, 2020). One can interpret crises as events that provoke inconsistencies in expectations and, thus, push individuals to adapt their mental framework to the new situation (Strong, 2013). Therefore, mental frameworks are assumed not to return quickly to the pre-crisis state and, hence, also not shopping habits or other behaviours that are economically relevant (Cepel et al., 2020). This hypothesis is confirmed by findings of Stiglitz et al. (2018) that suggest that even if the economic situation improved objectively, individuals still feel the recession after a crisis and, consequently, the changes in economic behaviour are likely to persist (Fernandez-Urbano & Kulic, 2020). These individual adaptations translate into changed conceptions of entrepreneurship and learning by observing role models. While the relevance of role models increased during the financial crisis, social norms turned out to be significantly negatively related to entrepreneurial activities during the crisis (Santos et al., 2017).

These insights hint at the responsiveness of tacit knowledge about entrepreneurship when the context is disrupted by a crisis. Because of this flexibility, entrepreneurs are key actors for the resilience of regional innovation systems opening new paths for development (Bishop, 2019; Ratten, 2020; Williams & Vorley, 2015). In the case of the region Cambridge, it was empirically proven that local entrepreneurs were of major relevance for the resilience to shocks (Simmie & Martin, 2010). However, crises also challenge entrepreneurs by not only providing opportunities that offer substantial gains when realised, but also by putting pressure on them to adapt to the changing conditions (Klapper & Love, 2011; Kuckertz et al., 2020; Shepherd & Patzelt, 2018). These adverse impacts of crises can also be observed in the earliest stage of entrepreneurial activity. While in some countries entrepreneurial activities in their earliest stage remained stable, in others, among these Germany, this rate significantly dropped between 2006 and 2012 (Vegetti & Adascalitei, 2017). A further finding is that higher unemployment rates pushed people to be necessity-based entrepreneurs (Vegetti &

Adascalitei, 2017). Based on these observations, it can be interpreted that crises and changing context conditions affect, among other things, tacit knowledge about entrepreneurship and, thus, influence entrepreneurial activities from their earliest stages onwards.

The resilience of regional innovation systems is of key importance for sustaining regional economic advantages, and thus, it is not surprising that former research calls for increasing awareness for economic resilience (Radovic & Domazet, 2016, as cited in Filipovic et al., 2018). Specifically, the relationship between uncertainties that accompany a crisis and entrepreneurial activities in their early stages remains unclear (Filipovic et al., 2018; Ratten, 2020; Santos et al., 2017; Vegetti & Adascalitei, 2017).

Chapter 5 of this dissertation contributes empirical insights in this vein. This milestone is entitled 'Antecedents of Entrepreneurship during the First COVID-19 Shock: Mental Representations of Entrepreneurship and Preferences of Business Models during the Crisis'. This dissertation milestone focusses on the impact of changes in the overall economic framework in which the entrepreneurial process is embedded. Shocks can render knowledge obsolete and open up new paths for development. Therefore, it can be hypothesised that the entrepreneurial process and its relation to knowledge dynamics is affected by external shocks. The fourth milestone examines whether this shock also impacts the earliest stage of the entrepreneurial process by affecting the tacit knowledge people have about entrepreneurship. Thus, this chapter investigates the relation between uncertainties that arise in a crisis and the conception of entrepreneurship and preferred business models.

4 Dissertation milestones

To meet the requirements of the proposed dissertation milestones, a wide range of data sources, types and methodological approaches are applied in the present dissertation. This multiplicity of empirical strategies allows the investigation of the overarching research question of how the multidimensional phenomenon of entrepreneurship and regional knowledge dynamics are intertwined with each other. Table 4.1 summarises the purpose, the data set and applied methodologies of each dissertation milestone.

In order to get an overview of the theoretical embeddedness of the single chapters of this dissertation and their overlap, the titles of cited references are analysed by applying text mining. The data preparation followed four steps. First, the titles of the references of each chapter are decomposed into unigrams. Second, stop words were removed from the data set. Third, the remaining unigrams were lemmatised and only nouns and adjectives were

considered for the analysis. Fourth, based on the co-occurrence of words in one chapter of the dissertation, the connections of unigrams were constructed. Figure 4.2 shows the resulting network based on the described data set.

Chapter 2 shows the most relations to distinct words in its references, which speaks to the highest number of references in this chapter as well as a diversified set of studies cited. This chapter contributes to the literature about culture and informal structures and its reflection on cognition and experiences in regional and relational systems that impact opportunity perception and entrepreneurial activities in general. Chapter 3 adds to the literature on entrepreneurial narratives, mission statements and its impact on venture creation and idea generation. In Chapter 4, the contribution to the scientific literature is dominated by the methodological design that applies machine learning techniques and by its strong policy orientation. Chapter 5 advances the literature by generating insights into crises and their impact on economic behaviour. The overlapping core of the theoretical embeddedness of all chapters is defined by entrepreneurship, economic development and how regional and relational contexts influence this interaction. Moreover, all chapters are united by an empirical focus.

The chapters are intertwined with each other in unique ways. Chapter 2 shares the theoretical concept of opportunity perception and enactment with Chapter 3, while connecting to Chapter 4 by addressing the regional context in which entrepreneurial activities take place. Chapter 2 and Chapter 5 show the highest overlap in their contribution to the literature by sharing the cognitive approach and the methodological design associated with this. Further, Chapter 3 is related to Chapter 4 also merely by the application of related methodological procedures in the field of machine learning and more explicitly, decision tree modelling. Chapter 3 connects to Chapter 5 by focussing on individual decision-making processes that take place at different stages of the entrepreneurial process. Lastly, Chapter 4 and Chapter 5 are intertwined with each other by taking the innovation system approach into consideration, however, these two studies have the lowest degree of similarity with each other.

Overall, the dissertation chapters cover distinct literature streams they contribute to but are united by the rationale to study the entrepreneurial process and how it interacts with knowledge transformation and economic development.

In the next subsections, the individual dissertation milestones are summarised by presenting their motivation, purpose and research questions, data and methodological approaches, results and main contribution.

Table 4.1: Summary of the dissertation milestones
Source: Own elaboration

Title	Purpose of the study	Data sources used for dataset creation	Methodological approach
Chapter 2: Persistence of Regional Entrepreneurship Patterns: Quantity and Quality of Regional Business Opportunity Perception	Contribute to the understanding of pre-foundational mechanisms in regional innovation systems	Survey data (primary collection) Representative sample of respondents in three groups of German regions	Binary logistic regression, Association plots
Chapter 3: Do not Judge a Business Idea by its Cover: The Relation between Topics in Business Ideas and Incorporation Probability	Implementation of business idea content for estimation of incorporation probabilities of novel and non-novel business ideas	Business idea descriptions from 2003 until 2019 (Business idea competition organised by BRIDGE)	Structural topic modelling, Classification tree analysis
Chapter 4: Transforming Regional Knowledge Bases: A Network and Machine Learning Approach to Link Entrepreneurial Experimentation and Regional Absorptive Capacity	Broadening the insights into diffusion of entrepreneurial knowledge in regional innovation systems	Patent data, firm level data, and regional data from 1995 until 2015 (applied data bases: Patstat, Orbis, INKAR)	Network analysis, Random forest analyses on basis of conditional inference classification tree analysis
Chapter 5: Antecedents of Entrepreneurship during the First COVID-19 Shock: Mental Representations of Entrepreneurship and Preferences of Business Models during the Crisis	Complement insights into the effects of crises on pre-foundational processes	Survey data (primary collection) Quasi-experimental setting during the first COVID-19 related shutdown in Germany	Binary logistic regression, Association plots

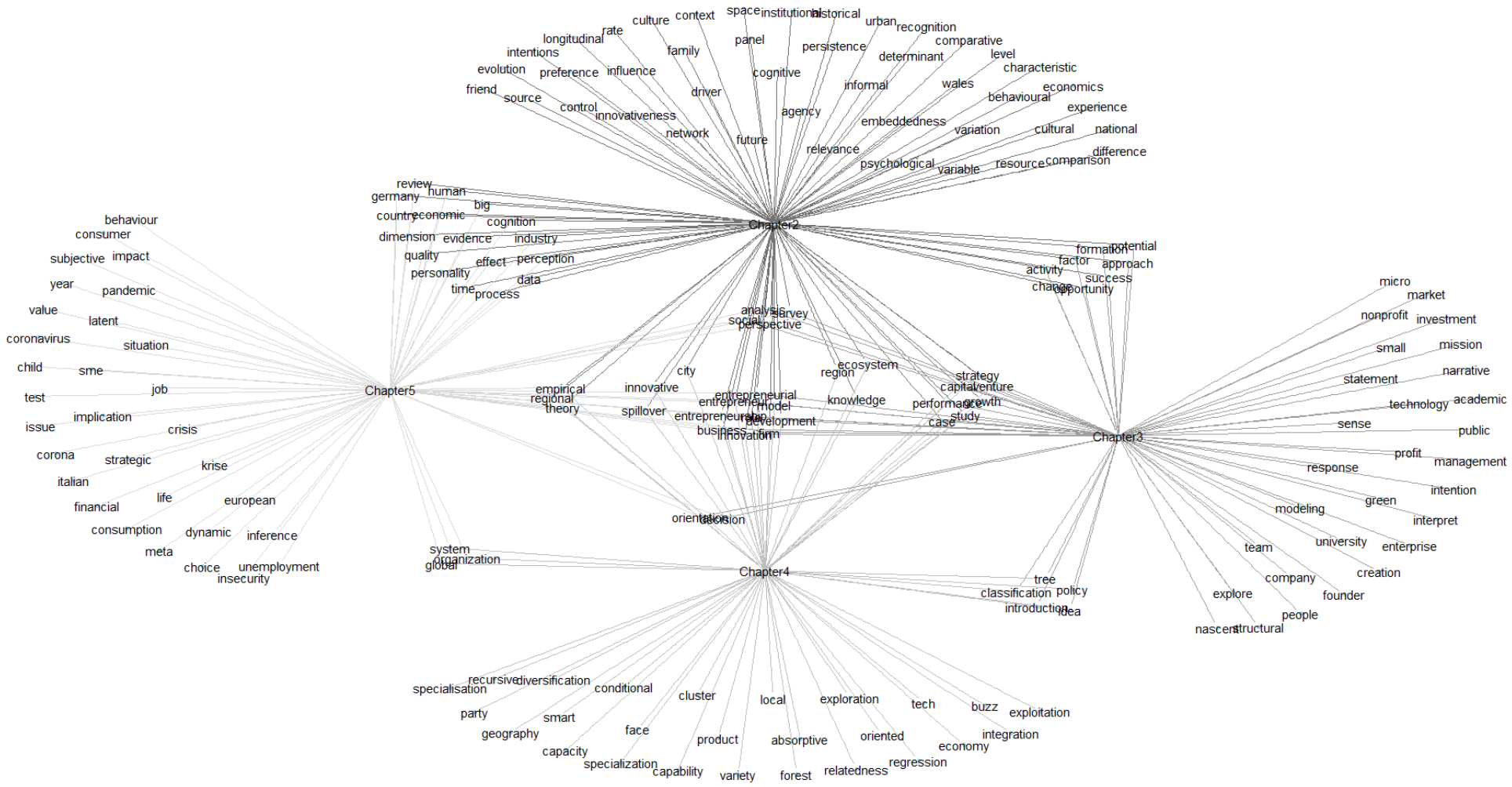

Figure 4.1: Unigram network based on titles of scientific articles
Source: Own construction based on the titles of the references cited in this dissertation

4.1 Persistence of regional entrepreneurship patterns

Motivation – The uneven spatial distribution of entrepreneurial activities appears to be persistent over time, and the reasons for this phenomenon are still not fully understood (Armington & Acs, 2002; Florida et al., 2017; Fritsch et al., 2019; Sternberg, 2009). Perception of a regional business opportunity is the crucial starting point of the entrepreneurial process and, thus, it is of key importance to gain insights into how this perception is regionally determined (Riquelme, 2013; Shane & Venkataraman, 2000; Venkataraman, 1997). Former research finds factors on the actor level (e.g. personality of entrepreneurs, demographic variables) (Hayton & Cacciotti, 2013; Rinne et al., 2012; Shane, 1993; Williams & McGuire, 2010), in social networks (Grillitsch, 2019; Ozgen & Baron, 2007; Riquelme, 2013; Spilling, 2011), in the economic environment (Fernandez-Serrano et al., 2019) and in the regional entrepreneurship culture (Fritsch et al., 2019; Fritsch & Kublina, 2019) to impact the opportunity recognition. Moreover, these factors play out differently for innovative and general opportunity perception. However, all of these variables do not impact opportunity recognition in isolation but are interrelated with the regional context that shapes the process of entrepreneurship fundamentally (Aldrich & Cliff, 2003; Audretsch & Belitski, 2017; Fernandez-Serrano et al., 2019; Ferreira et al., 2017; Goktan & Gunay, 2011; Mason & Brown, 2014; Veciana & Urbano, 2008). Although this is widely acknowledged, an integrated perspective of entrepreneurship in the regional context and the detection of relative impacts of the former stated factors on innovative and general opportunity perception is still a research gap (Garretsen et al., 2019; Szerb et al., 2019).

Purpose & Research Questions – The purpose of this study is to analyse the regional dynamics that lead to the persistence of regional entrepreneurship patterns of German regions in their quantity and quality. Two research questions are stated as follows:

RQ1: How does the regional embeddedness of an individual relate to regional (innovative) business opportunity perception that drives the quantity of perceived opportunities?

RQ2: How does the understanding of (innovative) entrepreneurship, governing the quality of perceived opportunities, differ in distinct regional settings?

Data & Methods – An online survey of three groups of regions in Germany with a representative sample of the overall regional population regarding the distribution of age, gender and educational attainment is conducted. Regional group 1 is characterised by long-standing patterns of high entrepreneurship rates and high proportions of innovative entrepreneurship. Regional group 2 shows low entrepreneurship rates and high proportions of innovative entrepreneurship. Regional group 3 has low entrepreneurship rates and low

proportions of innovative entrepreneurship. Two analysis steps are performed to investigate regional dynamics that influence the quantity and quality of perceived opportunities. Binary logistic regressions estimate the impact of regional embeddedness of individuals on four levels – actor, network, environment, and cultural – on the likelihood of perceiving regional opportunities to start a new venture. Subsequently, implicitly measured mental representations of entrepreneurship are analysed. These mental representations reflect the conceptions of entrepreneurship. These are examined to identify differences between the regional groups with distinct long-standing regional entrepreneurship patterns. Moreover, differences between opportunity-perceivers and non-perceivers are investigated.

Results – The results of this study suggest that regional long-standing entrepreneurship patterns are reinforced by region-individual relations that influence the quantity of perceived business opportunities and by distinct conceptualisations of entrepreneurial activities that impact the quality of perceived business opportunities. However, these dynamics differ between the perception of innovative and general business opportunities. The recognition of innovative business opportunities appears to be less dependent on the regional context than it is the case for general business opportunities. One factor that stimulates the recognition of general regional business opportunities, is the presence of innovative ventures in the region. Therefore, supporting innovative ventures is beneficial short- and long-term. In the short-term these ventures foster business opportunity perception in the region, while in the long-term innovative ventures strengthen the regional entrepreneurship tradition, which also shows a positive impact on the recognition of general business opportunities. Furthermore, the study results reveal that regions that have a lower proportion of innovative businesses are not characterised by a lower quantity of recognised innovative opportunities to found a new venture.

Contribution – This chapter contributes to the literature in three ways. First, the results deliver insights into the relation of regional embeddedness and regional business opportunity perception. Second, by studying multiple layers of regional embeddedness simultaneously, the relative importance of each layer – actor, network, environment, cultural – can be identified. Third, the implicit measurement of mental representations of entrepreneurship offers the possibility to assess cultural attitudes that deliver a piece of the puzzle to help understand the persistent regional entrepreneurship patterns. This cognitive approach enables informed interventions to influence regional entrepreneurship cultures. The results of this study provide insights for the design of holistic policy approaches that aim at stimulating entrepreneurial endeavours in a targeted way from its earliest stage onwards.

4.2 Do not judge a business idea by its cover

Motivation – The support of entrepreneurial activities often follows a non-selective funding scheme that implicitly interprets entrepreneurship as a homogenous phenomenon and distinct dynamics of entrepreneurship types are neglected. However, this assumption is problematic and this practice is not leading to the best outcomes, because not all entrepreneurial activities contribute to economic or social development in the same proportion, which largely depends on their degree of novelty (Shane, 2009). To maximise the impact of distinct types of entrepreneurial activities, a targeted support of these is desirable. However, the main challenge a targeted support is confronted with is the selection of entrepreneurial activities that promise novelty and higher incorporation probabilities (Minola et al., 2017).

Purpose & Research Questions – This chapter focusses on the analysis of the relation between narratives of novel and non-novel business ideas and the probability of a business idea turning into a new venture operating on the market. Two research questions are stated:

RQ1: Are there differences in topic prevalence in novel and non-novel business ideas?

RQ2: How does the composition of topics related to a business idea influence its incorporation probability?

Data & Methods – The data basis for this chapter is business idea descriptions that were handed in to a business idea competition in Bremen, Germany, which took place annually between 2003 and 2019. In addition to this data, the business ideas are followed up and the incorporation of these ideas is recorded. The texts are examined by applying structural topic modelling (Roberts et al., 2014) which reveals latent topic structures in the business idea descriptions and, subsequently, novel and non-novel business ideas are compared with each other to uncover significant differences in topic proportions. As a next step, the relations between the topics are investigated by making use of correlation network analyses. The last analytical component of this study is the employment of classification tree analysis (James et al., 2013; Strobl et al., 2009) for novel and non-novel business ideas separately. These show the relation between the narrative of business ideas and their incorporation probabilities.

Results – The chapter arrives at four main results. First, topics concerning the foundation of the business idea, the products or services, entrepreneurial intentions (serving a social purpose) and entrepreneurial orientation (customer orientation) differ in their proportions in novel and non-novel business ideas. Second, the degree of novelty of business ideas also impacts the interconnectedness of topics. Third, this study confirms the multiplicity of novel entrepreneurial activities by showing distinct narratives in the investigated business ideas,

ranging from technology-based to hybrid forms that combine technology and social purposes. Fourth, the results reject the conventional wisdom that novel business ideas have lower chances of incorporation due to higher risks or challenges. Overall, the chapter arrives at the conclusion that the incorporation probability of business ideas depends to a large extent on their narratives that outweigh traditional indicators (e.g. team size) included in the analysis.

Contribution – Based on the results of this chapter, it is deduced that the narrative of business ideas provides a rich source of information on the degree of novelty and incorporation prospects. The findings of this study can contribute to the design of selective support schemes for entrepreneurial activities and can be of use to early stage investors as well as for managers of accelerators and policy makers.

4.3 Transformation of regional knowledge bases

Motivation – The 'entrepreneurial discovery' is a key element in the increasingly important smart specialisation strategy policy, because entrepreneurship is interpreted as the missing link between regional knowledge and economic growth (Braunerhjelm et al., 2010; D'Adda et al., 2019; Foray et al., 2012). For this 'entrepreneurial discovery' to develop its full potential, a symbiosis of entrepreneurial and incumbents is essential. This symbiosis is conditioned by the structural characteristics of the regional innovation system it takes place in. Despite its crucial relevance, the diffusion of entrepreneurially generated knowledge and in which contexts it is efficient is criticised as being underrepresented in regional policies and scientific research (Lindholm-Dahlstrand et al., 2019; Uyarra, 2019).

Purpose & Research Questions – Purpose of this chapter is the analysis of the impact and importance of regional innovation system characteristics for the regional absorptive capacity of entrepreneurial knowledge. Three research questions are stated:

RQ1: Which regional innovation system characteristics enabling identification, assimilation and exploitation of knowledge are the most important for absorbing entrepreneurial knowledge?

RQ2: Which regional innovation system characteristics enabling higher efficiency in identification, assimilation and exploitation of knowledge are the most important for absorbing entrepreneurial knowledge?

RQ3: Which effect do these important regional innovation system characteristics have on different levels of entrepreneurial knowledge absorption?

Data & Methods – The unit of analysis is German regions between 1995 and 2015. Regionalised patent data which is combined with firm and regional level information builds

the basis for the data set. Three networks are constructed that enable identification, assimilation and exploitation of knowledge: 1) cooperation between incumbents, 2) learning regimes and 3) the technological knowledge base. Characteristics of these networks are assessed by network indicators, describing the size, structure and fragmentation. Random forest analyses based on conditional inference classification trees and correlational analyses filter out the importance and impact of these network indicators on the regional absorption of entrepreneurial knowledge.

Results – The results of this chapter confirm that regional absorptive capacity is a multi-dimensional concept with key factors for the absorption of entrepreneurial knowledge in all three layers - cooperation between incumbents, learning regimes and technological knowledge bases. However, these regional innovation system characteristics have heterogeneous associations to regional absorption rates across different levels of absorption.

Contribution – Besides the deeper understanding of regional absorption mechanisms of entrepreneurial knowledge, this chapter exemplifies the explanatory power of machine learning techniques in innovation system research because it offers the possibility to include highly correlated variables and takes into consideration complex interactions. Thus, this methodological approach enables a holistic analysis of regional innovation systems and their dynamics. Moreover, this chapter can serve as starting point which network characteristics are of main importance to monitor in policy interventions.

4.4 Antecedents of entrepreneurship during the first COVID-19 shock

Motivation – Entrepreneurial activities are widely acknowledged to be agenda setters for future developments, which is even truer during crises because entrepreneurs are fastest to respond to drastically changed demand patterns and changed expectations for their societal role (Hanusch & Pyka, 2006; McCann & Ortega-Argilés, 2016a; Schumpeter, 1934). Fine-grained information about impacts of crises on entrepreneurial activities is of crucial relevance because it enables counteracting undesired effects in future developments and a targeted support of favourable activities. In former crises, entrepreneurial processes are observed to be impacted in early stages (latent and early entrepreneurship) as well as in later stages (e.g. firm registrations) (Klapper & Love, 2011; Vegetti & Adascalitei, 2017). This impact did not only influence the quantity of entrepreneurial endeavours but also the type of new ventures. Thus, entrepreneurial activities are subject to change in explicit as well as in implicit terms.

Purpose & Research Questions – The purpose of this chapter is to examine the relation between expectations formed at the beginning of the COVID-19 crisis and preferred types of

business models as well as the mental representation of entrepreneurship. Two research questions are formulated:

RQ1: How are crisis expectations related to explicit business model preferences?

RQ2: How are crisis expectations related to implicit mental representations of entrepreneurship?

Data & Methods – An online survey was conducted during the first shutdown in Germany in 2020. Expectations formed at the beginning of the crisis with regard to 1) health, 2) income and financial security, 3) security of working places or possibilities in searching for a job and 4) macroeconomic perception of overall economic development were assessed. The study is designed as a quasi-experiment (Reichardt, 2009) which separates the respondents into sub-samples representing four treatments (negative expectations concerning the four crisis dimensions: economic development, work place security, income stability and health). Explicit business model preferences are measured by following the typology proposed by Malone et al. (2006) that relies on observable and measurable characteristics. The mental representation of entrepreneurship is measured implicitly. Binary logistic regressions and the investigation of implicit mental representations are applied to answer the stated research questions.

Results – The results of this chapter confirm the hypothesis that expectations formed at the beginning of the crisis impact entrepreneurial activities from their antecedents onwards. Explicit business model preferences are adapted by the presence of negative expectations regarding the main income source and the role of the entrepreneur. Implicit mental representations of entrepreneurship are also subject to change when negative expectations are evident. The results suggest that, rather than the existence of the crisis per se, the individual crisis expectations in different affected areas (work place security, income stability, health and economic development) are important for entrepreneurial activities. Hence, the study confirms that the cognitive level is highly relevant in structural change.

Contribution – Besides the main contribution of this chapter providing a fine-grained understanding of the dynamics of crises and their relation to antecedents of entrepreneurial activities, the cognitive approach taken in this study offers new ways to monitor adaptations in entrepreneurship cultures. This allows a targeted design that counteracts undesired changes in entrepreneurial activities from its earliest stage onwards.

5 Conclusion and implications

5.1 Main results and avenues for future research

This dissertation aims to contribute to the question of how entrepreneurship and regional knowledge dynamics are intertwined by analysing entrepreneurial activities at different stages in the entrepreneurial process in Germany. As entrepreneurship is a multidimensional phenomenon, this dissertation makes use of multiple empirical approaches to gain insights into different stages of the entrepreneurial process. Methodological approaches applied in this dissertation range from multivariate statistics to machine learning techniques on the basis of numeric and textual data and analysis of implicitly measured attitudes based on a wide range of data sources – patent data, primary survey data collections and business idea descriptions.

The dissertation chapters yielded four main results. First, tacit knowledge in the form of cultural and informal knowledge bound to the regional level and its transmission via regional embeddedness is found to influence regional business opportunity perception (Chapter 2). It is a beneficial avenue for further research to analyse the impact of the qualitative conceptualisations of entrepreneurship on entrepreneurial activities and to make use of a multitude of approaches for this purpose: analysis of textual data (e.g. news articles, social media) and methodologies from cognition sciences. For example the examination of news articles about entrepreneurial and innovative activities over a long time period can offer insights how region-specific conceptualisations change over time and which events trigger these. Second, narratives that entrepreneurs built around their business idea to transform a tacit idea into an explicit one, are of high relevance for the incorporation probability of an idea (Chapter 3). To advance these insights, it might be beneficial to enrich this type of analysis with more variables of interest and to transfer it to later stages of the entrepreneurial process as the survival of new ventures, their impact on the economy and their disruptive power. Third, the diffusion of explicit knowledge that is generated by entrepreneurial agents determines the economic advantage that can be initiated through this, depends on the regional knowledge and information flow structures (Chapter 4). This result opens up the question of which political interventions are promising the highest return of investment which calls for simulation studies. Fourth, regional tacit knowledge, which is evident to impact entrepreneurial behaviour from opportunity perception (Chapter 2), is found to be adapted during crises by influencing the perception of health, work place security, income stability and economic prospects (Chapter 5). This result calls for future research that acknowledges the multiplicity of crises and their impacts on entrepreneurship. A beneficial avenue would be to

analyse the influence of different components of the crisis (individual perceptions in different areas) over the course of crises to identify bottlenecks that can be tackled via political interventions to avoid undesired agendas for future developments initiated by entrepreneurial activities.

However, the dissertation has two major limitations that give rise to further research. First, the dissertation limits itself to the analysis of German regions. Future research could extend the geographical scope of the analyses performed in this dissertation to compare the results across different regional and national settings. Second, the analyses put emphasis on different types of entrepreneurial activities and suggest that entrepreneurship is not homogenous but has multiple causes and impacts. This dissertation can only be a starting point to investigate different types of entrepreneurial activities, hence, future research may build upon the presented results and acknowledge the multiplicity of entrepreneurial endeavours (e.g. social entrepreneurship).

Apart from advancing the understanding of the relation between regional innovation systems and entrepreneurial activities on different stages of the entrepreneurial process, the dissertation contributes to the literature in two more ways. First, it applies a multitude of empirical methods and data sets which open up new paths for research in the field of entrepreneurship and regional innovation systems. The analysis of implicit attitudes and their impact on entrepreneurial behaviour offer the possibility to quantify cultural attitudes in regions. Future research may take this as a starting point for a cognition approach to entrepreneurship. Moreover, the exploration of textual data by the means of text mining and topic modelling offers a great potential to uncover so far hidden drivers and hindrances for entrepreneurial activities. A beneficial avenue for further research is the incorporation of social media data, news article data and marketing material in economic models to explain the success and failure of entrepreneurial endeavours. Furthermore, machine learning techniques as decision tree modelling and associated ensemble methods (e.g. random forest) pave the way for future research by allowing the holistic exploration of numerical data which is not suitable for multivariate statistical models. Thus, these methodological approaches offer ways to examine regional innovation systems and their characteristics more thoroughly. Second, the present dissertation offers insights valuable for the design of political measures to support entrepreneurial activities throughout the entrepreneurial process and thus the regional economic development which will be presented in the next section in more detail.

5.2 Implications for policy makers

Based on the results of this dissertation and former research backing these up, implications for policy makers can be derived. There is consensus about the relevance of entrepreneurship for regional development but not for the type of policies that support the entrepreneurial process the best (Qian, 2017). As an undifferentiated support of entrepreneurial endeavours is criticised (Shane, 2009), the aim of this dissertation was also to provide fine-grained information about specific parts of the entrepreneurial process to enable targeted policies.

Recently holistic approaches to foster entrepreneurship and innovation have become the new trend in European policies (Audretsch & Belitski, 2017; Autio et al., 2014; Stam & Nooteboom, 2011). Central to these approaches is the acknowledgement that entrepreneurial activities are not solely individually driven (Audretsch & Belitski, 2017; Wright & Stigliani, 2012), but are embedded into a multitude of contexts – regional level (Audretsch & Lehmann, 2005), industry level (Qian, 2018), national level (Acs et al., 2017) and international level (Belitski et al., 2021). This multiplicity and complexity of the entrepreneurship concept and its interrelations with various contexts call for a policy mix rather than a single instrument that is able to efficiently support entrepreneurial activities (MacNeill & Jeannerat, 2016; Varga et al., 2020). Moreover, it is warned against restricting the aim of supporting such a complex phenomenon as entrepreneurship in only one direction – namely increasing the number of businesses (Shane, 2009).

Fostering entrepreneurial activities on the regional level requires consideration of the unique configurations of the regional ecosystems because of the contextual nature of entrepreneurship (Audretsch, 2018; Szerb et al., 2019). Policies that take into account regional specifics are proven to have a greater power to impact entrepreneurial activities (Audretsch, 2018; Autio et al., 2014). Hence, policy makers should avoid the replication of successful policies in other contexts and rely on the strengths and weaknesses of the regional context the policy is located in (Audretsch, 2018; Spigel, 2017; Szerb et al., 2019). Otherwise, as happened in the UK, ambitious policy programs such as the Intermediate Technology Initiative (ITI) deliver only limited value (Brown et al., 2016). However, also seemingly well-targeted interventions in regional innovation systems may result in unexpected outcomes because of the complex nature of these systems (Martin, 2016; Pyka et al., 2019). Therefore, the regional specifics should be investigated prior to the design of regional policies to avoid undesired results (Pyka et al., 2019). However, this dissertation provides overarching guidance for entrepreneurship policies at the regional level regarding four aspects:

First, policy measures may target the initial starting point of the entrepreneurial process and foster conducive tacit knowledge about entrepreneurship. These interventions include influencing individual mental frameworks, competences and the broader social context aiming at the provision of an entrepreneurial climate (Cantner et al., 2017; Garretsen et al., 2019; Iammarino et al., 2017). Because informal institutions only change at a slow pace, these measures are long-term, but empirical findings suggest that such interventions could be very beneficial for regional economic performance (Stuetzer et al., 2018). Awareness campaigns, e.g. portraying successful entrepreneurs of the region, contribute to the tacit knowledge about entrepreneurship (Fritsch & Wyrwich, 2018). However, policy makers should be aware of fluctuations in the conceptualisations of entrepreneurship and the need to re-orient awareness campaigns when crises change the context conditions (Santos et al., 2017). Second, the transformation of a tacit business idea to an explicit business plan calls for policies that support entrepreneurial education and strengthening of human capital (Huggins & Thompson, 2020; Qian & Acs, 2013). Individual learning processes, thus, are crucial for sustaining the performance of regional entrepreneurial ecosystems (Pugh et al., 2021). Third, to maximise the efficiency of the entrepreneurial function, regional innovation and entrepreneurship policies should be aligned (Colombelli et al., 2021). As former policies are criticised for taking a one-sided perspective on regional knowledge and learning processes (Uyarra, 2019), the demand side, or in other words, the diffusion of knowledge in regional innovation systems should be paid more attention to. Interventions that aim at improving regional coordination mechanisms and networks are expected to be beneficial (Malerba & McKelvey, 2020). Fourth, to enable a quick adaptation of the economic system to changed conditions caused by a crisis, a diverse regional knowledge base instead of specialised clusters and, thus, diverse conceptualisations of entrepreneurship are favourable (Bishop, 2019; Del Monte & Pennacchio, 2020).

To conclude, entrepreneurial endeavours provide rich resources for fostering regional economic development and helping solve great societal challenges. Thus, the tailored support of these is of crucial importance economically and for human kind. This dissertation offers insights that allow a more targeted design at the regional level of entrepreneurial activities based on their different characteristics, but can only be seen as a starting point. Further research is needed to fulfil the goal to maximise the impact of entrepreneurship.

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Chapter 2

Persistence of Regional Entrepreneurship Patterns: Quantity and Quality of Regional Business Opportunity Perception

Jessica Birkholz

Abstract

The recognition of regional business opportunities is the crucial starting point of the entrepreneurial process that governs the persistence of regional entrepreneurship patterns. This persistence depends on the quantity of perceived opportunities and the quality of opportunities perceived by regional inhabitants. However, it is unclear which region-individual interactions relate to the quantity regional business opportunity perception and how long-standing regional entrepreneurship patterns are reflected in conceptions of entrepreneurship that govern the quality of perceived opportunities. A primary data collection in German regions with distinct long-standing entrepreneurship patterns assessed two main aspects. First, the regional embeddedness of respondents on four levels – actor, network, environmental, and cultural – is set in relation to the likelihood of opportunity perception. Second, an implicit measurement of mental representations of entrepreneurship is examined. The mental representations of entrepreneurship, reflecting the conceptions of entrepreneurship, are investigated to identify differences between the conceptions of entrepreneurship that come along with the long-standing regional entrepreneurship patterns and to detect differences between opportunity-perceivers and non-perceivers. The results suggest that regions reinforce long-standing entrepreneurship patterns with distinct region-individual relations that impact the quantity of perceived regional opportunities and distinct conceptualisations of entrepreneurship that shape the quality of perceived opportunities. The perception of innovative business opportunities differs from the perception of business opportunities in general, showing that innovative opportunity perception is less dependent on the regional context than general opportunity perception.

Keywords: Entrepreneurship; Opportunity perception; Regional innovation system

JEL classifications: D91; L26; O33; R11

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1 Introduction

The phenomenon that entrepreneurial activities are unevenly distributed across regions, with the resulting pattern being persistent over time, is still not fully understood (Armington & Acs, 2002; Florida et al., 2017; Fritsch et al., 2019; Sternberg, 2009). Path-dependent developments, the persistence of regional determinants of entrepreneurial activities and the presence of regional cultures are approaches to explain the time-invariant geographical pattern of entrepreneurial activity (Fritsch et al., 2019; Fritsch & Kublina, 2019). However, these explanations do not provide clear starting points for regional policy makers because the individual level is disregarded and, thus, their impact on holistic regional entrepreneurship and innovation policies, which have increased in importance over the last years, remains limited (Autio et al., 2014). To contribute to these policies, the region-individual interactions and their effect on the quantity and quality of entrepreneurial activities that make up the essence of the persistent entrepreneurship pattern need to be understood in-depth. Therefore, to deliver insights for the design of policies, the role of entrepreneurial agents embedded in regional innovation systems has to be better reflected in research about the determinants of entrepreneurial activities (Acs et al., 2013; Huggins & Thompson, 2020). This also corresponds to the call for further research focusing on an integrated perspective on entrepreneurship combining different approaches (Valliere, 2013) and the interplay of regional context and individual entrepreneurial actions (Garretsen et al., 2019; Szerb et al., 2019).

Because opportunity perception is the first necessary step in conducting entrepreneurial activities and initiates the reinforcement of regional entrepreneurship patterns, factors impacting this step are crucial for entrepreneurship policies to take into account. Former research found determinants of opportunity perception on four different levels. First, the individuals which pursue business opportunities differ in their personality traits and demographic variables from those that do not act upon opportunities (actor level) (Hayton & Cacciotti, 2013; Rinne et al., 2012; Shane, 1993; Williams & McGuire, 2010). Second, social networks of individuals matter in perceiving opportunities (network level) (Grillitsch, 2019; Ozgen & Baron, 2007; Riquelme, 2013; Spilling, 2011). Third, the economic environment of individuals impacts the perception of opportunities (environment level) (Fernandez-Serrano et al., 2019). Lastly, regional entrepreneurship culture is found to influence the opportunity recognition of individuals (culture level) (Fritsch et al., 2019; Fritsch & Kublina, 2019). All these four layers are known to influence the likelihood of perceiving opportunities, which relates to the quantity of perceived opportunities in regions. Moreover, the regional settings, constituted

by these four layers, convey a distinct understanding of entrepreneurship influencing the quality of entrepreneurial activities in the region. The overall regional pattern of entrepreneurship is, thus, a result from the interplay of individual and regional predispositions that influence the quantity and quality of entrepreneurial endeavours (Feldman, 2001; Florida et al., 2017; Garretsen et al., 2019; Sternberg, 2009).

However, entrepreneurial endeavors are not homogenous and a targeted support of a specific type of entrepreneurial activities requires detailed information about the types of interest. For regional innovation policies like the smart specialisation strategy (S3), which builds upon innovative entrepreneurship (Braunerhjelm et al., 2010; D'Adda et al., 2019), it is important to differentiate between innovative and general entrepreneurial activity. This differentiation is motivated by different effects and antecedents of innovative and general entrepreneurial activities; their impact on the regional economic development differs, they are pursued based on different motives, and require distinct conditions of contextual factors (Hayton & Cacciotti, 2013). Based on these considerations two questions arise:

RQ1: How does the regional embeddedness of an individual relate to regional (innovative) business opportunity perception that drives the quantity of perceived opportunities?

RQ2: How does the understanding of (innovative) entrepreneurship, governing the quality of perceived opportunities, differ in distinct regional settings?

To answer these questions, this study conducts a survey in three regional groups in Germany with a representative sample of the overall regional population regarding the distribution of age, gender and educational attainment. The first group of regions is characterised by long-standing patterns of high entrepreneurship rates and high proportions of innovative entrepreneurship. The second group involves regions with low entrepreneurship rates and high proportions of innovative entrepreneurship. The third group shows low entrepreneurship rates and low proportions of innovative entrepreneurship.

The survey contained two parts. First, the relation between region-individual interactions and the likelihood of perceiving business opportunities, which corresponds to the quantity of perceived opportunities on the regional level, is analysed. In this step, binary logistic regression analyses generate empirical evidence on the relation between business opportunity recognition and regional embeddedness of individuals. Second, the shared regional understanding of innovative and general entrepreneurship, also known as its mental representation that governs the quality of perceived opportunities, is investigated. Differences between the conceptions of entrepreneurship that are present in distinct regional settings, and

measured in the questionnaire via an implicit procedure, are identified. In both analysis steps, general and innovative business opportunity perception were taken into consideration.

The analyses show four main results. First, regional embeddedness matters in recognising general and innovative business opportunities. Especially the perception of the economic environment relates to the perception of regional opportunities. Second, innovative ventures are found to pull the recognition of general business opportunities. Thus, support of innovative ventures has a short- and long-term impact since these enable opportunity recognition and strengthen the regional entrepreneurship tradition, which is also revealed to foster the perception of general business opportunities. Third, the analyses of mental representations did not support the presence of a specific regional pattern or a shared mental representation of people that recognise opportunities. A more detailed view uncovered that regional differences in mental representations appear when the sub-group of people that perceive opportunities is investigated. Fourth, the study delivers empirical evidence that a lower proportion of innovative ventures in a region is not reasoned by a lower quantity of recognised innovative business opportunities. Thus, supporting innovative ideas in their earliest stages may help overcome a shortage of innovative ventures. Fifth, the perception of innovative business opportunities is less dependent on the regional context than the perception of general business opportunities.

Besides extending the empirical evidence on how opportunity perception is related to regional embeddedness and regional mental representation of entrepreneurship, the study contributes in two additional ways. First, the simultaneous consideration of multiple layers of regional embeddedness and their effects on opportunity recognition enables the identification of the relational importance of each component. Second, the study uses an implicit measurement of mental representations that bases itself upon research from the cognition sciences. This approach offers a new perspective on mental representations relevant to entrepreneurial behaviour and enables informed interventions to steer regional mental representations. The generated insights can help to improve holistic policy approaches to stimulate entrepreneurial activities in a targeted way.

The remainder is organised as follows. Chapter two discusses the interplay of opportunity recognition and regional environment on four levels: actor, network, environment and cultural. Chapter three presents the primary data collection. Chapter four describes the methodological approach of the study. Chapter five presents the results of the implicitly

measured mental representations and binary logistic regression analyses. Finally, the paper concludes with a discussion of the findings in Chapter six.

2 State of the art

2.1 Opportunity perception

Regions need people who recognise opportunities for innovation and development to enhance regional value generation (Fritsch & Wyrwich, 2018; Valliere, 2013). Although this is widely acknowledged, the definition of opportunities and their recognition vary in the field of entrepreneurship (Hansen et al., 2011; Riquelme, 2013). Definitions range from generating opportunities in a creative process, developing ideas into new ventures and situations in which it becomes possible to deliver new values for customers (Hansen et al., 2011; Riquelme, 2013). However, these definitions have in common that opportunity recognition is considered fundamental to the entrepreneurial process as it represents the starting point (Riquelme, 2013; Shane & Venkataraman, 2000; Venkataraman, 1997). It is argued that opportunity recognition lays the foundation for developing new goods and services by positively influencing entrepreneurial intentions and decisions to found a new venture (Ferrero & Bessiere, 2016; Lindsay et al., 2009; Qian et al., 2013; Riquelme, 2013).

Despite varying definitions, there are two types of conceptualisations of opportunities that individuals may recognise (Szerb et al., 2019). The first, more general, one concerns the mobilisation of resources and the exploitation of arbitrage possibilities, which does not necessarily require innovation as a component (Szerb et al., 2019; Kirzner, 1973). Pursuing such opportunities increases the balance in markets (Ferreira et al., 2017). In contrast, the second type of opportunity is created by new connections between distinct fields of specialisation, which introduces structural change and disruption of market dynamics (Grillitsch, 2019). To pursue this kind of opportunity, innovation and challenging the way of doing things are key components (Cantner et al., 2017; Clydesdale, 2012; Schumpeter, 1934). Acting upon these two types of opportunities is likely to result in different entrepreneurial endeavours with distinct impacts on regional development.

Although these opportunities are distinct in their influences and requirements, the critical first step in the entrepreneurial process, conceptualised as the identification, evaluation and exploitation of these two types of opportunities, is to be sensitive to information about patterns in the environment (Ferrero & Bessiere, 2016; Riquelme, 2013; Shane & Venkataraman, 2000; Valliere, 2013). This alertness allows to recognise unmet customer needs and innovative

resource usage in their environment and, thus, perceive previously overlooked opportunities (Riquelme, 2013; Valliere, 2013; Kirzner, 1979, 1997).

Empirical research finds that the ability to perceive opportunities differs widely between individuals (Valliere, 2013). While some perceive or create opportunities regularly, others are not alert to these opportunities (Valliere, 2013). Thus, one of the fundamental research interests in entrepreneurship is to understand which characteristics and circumstances lead to the recognition of opportunities and ultimately to the persistence of regional entrepreneurship patterns (Riquelme, 2013; Shane & Venkataraman, 2000; Valliere, 2013; Venkataraman, 1997).

2.2 Regional embeddedness of opportunity perception

Many studies analyse entrepreneurs as isolated and homogenous entities and neglect the embeddedness of entrepreneurs in a broader context (Ferreira et al., 2017; Goktan & Gunay, 2011). This approach overlooks context and differences between types of entrepreneurship and opportunities and, thus, repeats problematic assumptions (Hayton & Cacciotti, 2013; Wheadon & Duval-Couetil, 2019). Rather than individual traits of entrepreneurs alone, their interaction with context variables shapes the entrepreneurial process (Aldrich & Cliff, 2003; Audretsch & Belitski, 2017; Fernandez-Serrano et al., 2019; Ferreira et al., 2017; Goktan & Gunay, 2011; Mason & Brown, 2014; Veciana & Urbano, 2008). Local influence is transferred through the experience of situations taking place in a specific regional context which leads to a regionally bounded human agency (Huggins & Thompson, 2019, 2020). In this vein, entrepreneurship is interpreted as a social process that historically builds upon specific groups of people in a regional bounded context (Florida et al., 2017; Huggins & Thompson, 2020). Thus, it is highly relevant to understand entrepreneurship as a process conducted by individuals embedded into a local framework with history (Audretsch & Belitski, 2017; Autio et al., 2014; Nayak & Maclean, 2013).

Based on these considerations, opportunity recognition as the first critical step in the entrepreneurial process cannot be understood in isolation but requires considering the characteristics of the entrepreneur and their embeddedness in the regional context (Fernandez-Serrano et al., 2019; Huggins & Thompson, 2020; Riquelme, 2013; Sarason et al., 2010). This means that the existence of opportunities alone is not sufficient for entrepreneurial activities to take place, but environmental conditions and characteristics of the entrepreneur are of relevance (Fernandez-Serrano et al., 2019; Huggins & Thompson, 2020; Riquelme, 2013; Szerb et al., 2019). However, people embedded in a regional context are not fully knowledgeable about the regional conditions and the structure of the system (Huggins &

Thompson, 2020). Thus, not the objective evaluation of the environmental conditions, but the subjective perceptions of these are important. The perception represents the filter through which regionally embedded people see regional opportunities and the type of opportunities they perceive (Audretsch & Belitski, 2017; Fernandez-Serrano et al., 2019; Ferreira et al., 2017).

The reinforcement of a regional entrepreneurship pattern depends on two complementary factors resulting from the interaction between opportunity perception of individuals and the regional context – the quantity and quality of perceived regional opportunities. The quantity of perceived opportunities relates to the regional embeddedness of an individual on actor, network, environment and cultural level. The quality of perceived opportunities depends on the understanding what entrepreneurship is and which role it fulfils. Thus, the mental representations are studied in the regional setting and compared with each other. Further, the group of people that perceive opportunities are contrasted by those that do not perceive any. Figure 2.1 illustrates the conceptual framework of this study. The propositions are developed in the following sections.

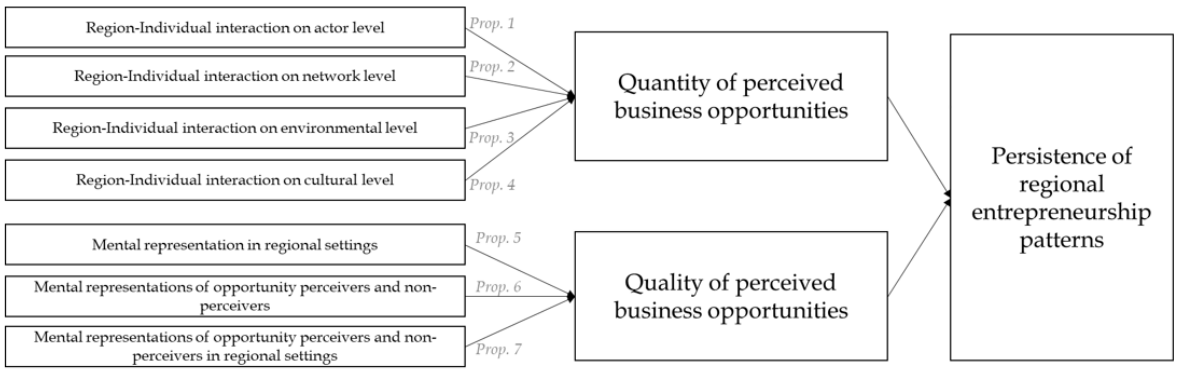


Figure 2.1: Conceptual model of the study
Source: Own illustration

2.3 Quantity of perceived regional business opportunities

2.3.1 Region-individual interaction on actor level

The impact of personality traits on entrepreneurial activities has been studied extensively in former research. Starting with Schumpeter (1934), who describes entrepreneurs as breakers of routines and going against the odds, the prototypical innovative entrepreneur is often described as an individualist with high inner-directedness (Cantner et al., 2017; Krueger et al., 2000). Furthermore, uncertainty acceptance, individualism, and power proximity relate to innovative entrepreneurship (Hayton & Cacciotti, 2013; Rinne et al., 2012; Shane, 1993; Williams & McGuire, 2010). However, the influence of personality traits on entrepreneurial

behaviour is temporarily unstable and more proximate measures, to the decision to become an entrepreneur, balance out the impact (Cantner et al., 2017; Hayton & Cacciotti, 2013; Shane, 1993; Wennekers et al., 2007).

On regional level, there are attempts to measure the influence of aggregated personality traits on regional economic growth. Based on the geographical psychology approach (Rentfrow et al., 2008), it is found that personality traits influence local economic growth by impacting entrepreneurial activities (Garretsen et al., 2019; Obschonka et al., 2013, 2015). Reasons for geographical patterns of personality traits are argued to be local role-modelling processes and selective migration, i.e. people with similar personality traits are attracted by regions that provide a good fit (Fritsch et al., 2019; Garretsen et al., 2019; Jokela et al., 2015; Obschonka et al., 2013; Rentfrow et al., 2008). Thus, the fit of personality traits with the perceived dominant personality in the regional context is acknowledged to be relevant for entrepreneurial activities. However, there is a research gap in understanding how the good fit between individual and regional personality influences entrepreneurial behaviour (Huggins & Thompson, 2020).

If one identifies himself or herself strongly with other inhabitants of the region, it is hypothesised that the person assumes that his or her perceived shortage in products or services may be of value for others in the region as well and, thus, is more likely to perceive regional business opportunities. Therefore, the first proposition states:

Proposition 1: The perceived personality fit of an individual in a region relates to the regional business opportunity recognition.

2.3.2 Region-individual interaction on network level

A further widely acknowledged aspect of entrepreneurship is its interdependence with social networks. It is argued that it is unlikely that entrepreneurs develop their business in isolation, but rather the embeddedness into a social structure matters in the entrepreneurial process (Almeida & Teixeira, 2017; Rae, 2005; Riquelme, 2013). The opportunity perception of the entrepreneur is even found to be determined by the personal networks, and the maintenance and development of these personal networks are acknowledged to be a key success factor (Grillitsch, 2019; Ozgen & Baron, 2007; Riquelme, 2013; Spilling, 2011). Former research finds a positive relationship between the number of social contacts, especially the usage of weak ties, and opportunity perception (Riquelme, 2013). However, the relevance of strong and weak ties for opportunity perception varies across different societal structures as collective and individualistic societies (Ma et al., 2011).

The most relevant groups in an entrepreneur's social network are friends, family, and colleagues (Siemens, 2010; Zhu et al., 2019). Especially in the case of inexperienced students, entrepreneurial friends and their emotions towards entrepreneurship play a crucial role in the entrepreneurial intention (Zhu et al., 2019). Thus, social contacts act as role models and provide resources that are even more relevant at the beginning of the entrepreneurial process (Siemens, 2010; Zhu et al., 2019).

The observation of role models in the social network and their attitude towards entrepreneurship can be understood as norms that establish themselves by social interactions and are largely sub-conscious (Andersson & Koster, 2011; Arenius & Minniti, 2005; Cantner et al., 2017; Fritsch et al., 2019; Laine, 2016; Minniti, 2005). Although this mechanism seems to be relevant for entrepreneurial intentions in many cases, it is found that the relevance of these norms is moderated by group identification (Cantner et al., 2017). Thus, it can be suspected that embeddedness in a regional context is also highly relevant to evaluate regional role models' efficiency because it governs how present region-specific role models are for an individual. As a result, the second proposition is formulated:

Proposition 2: The share of social contacts of an individual located in the same region relates to regional business opportunity recognition.

2.3.3 Region-individual interaction on environment level

The persistence of self-employment proportions in a region can be partly explained by the persistence of regional resources and regional industrial structure (Fritsch & Kublina, 2019; Qian et al., 2013). Especially market structures characterised by dynamic developments, e.g. a growing industry, increased demand for products and technological development, are associated with higher opportunity perception (Riquelme, 2013). Moreover, the resources and the knowledge that spills over from established firms in the region enable entrepreneurial ventures to excel and allow for more resource and knowledge combinations (Feldman, 2014; Gonzalez-Pernia et al., 2012).

Although these findings support the hypothesis that market heterogeneity may cause opportunity perception, former research argues that market diversity is rather a symptom of high levels of new business formation than a source (Fritsch & Kublina, 2019; Riquelme, 2013). Accordingly, new ventures, especially innovative ones, can be interpreted as manifestations of regional knowledge spill-overs (Acs et al., 2009, 2013; Fritsch & Wyrwich, 2018). Thus, the subjective perception of innovative new ventures is hypothesised to relate to the recognition of underlying knowledge resources available in the region which governs opportunity

perception (Fernandez-Serrano et al., 2019). Therefore, the third proposition is stated as follows:

Proposition 3: The perception of the business environment, especially the perception of innovative and new ventures, relates to regional business opportunity recognition.

2.3.4 Region-individual interaction on cultural level

Informal institutions defined as a framework for actions perceived as desirable or appropriate within a regional context are found to form social, economic and political interactions (Langevang et al., 2015; Urbano & Alvarez, 2014). More specifically, informal institutions that regulate entrepreneurial activities are singled out as the main component of informal institutions related to economic growth (Beugelsdijk, 2007; Garretsen et al., 2019).

These informal institutions can be interpreted as regional entrepreneurship culture, characterised by shared perceptions, expectations and beliefs of the regional population (Almeida & Teixeira, 2017; Hayton & Cacciotti, 2013; Laine, 2016; Ogunsade & Obembe, 2016). By providing a general orientation of the prioritisation of values within a region, the entrepreneurship culture affects not only the number of new ventures but also their types and impact on economic development (Aparicio et al., 2016; Baumol, 1990; Bowen & De Clercq, 2008; Eunni & Manolova, 2012; Ferreira et al., 2017; Laine, 2016; Mueller & Thomas, 2000; Ogunsade & Obembe, 2016; Urbano & Alvarez, 2014).

The regional entrepreneurship culture is observed to change only very slowly, which provides an explanation for the path-dependency of the regional entrepreneurial behaviour (Feldman, 2014; Fritsch et al., 2019; Fritsch & Kublina, 2019; Fritsch & Wyrwich, 2018b; North, 1994; Nunn, 2012; Williamson, 2000). Furthermore, this empirical evidence hints at a self-perpetuation of the regional entrepreneurship culture via intergenerational transmission of entrepreneurial values, which tame the uncertainty of entrepreneurial activities (Fritsch et al., 2019; Laine, 2016).

However, the effect of entrepreneurial culture on the types of entrepreneurship is mixed. While some argue that the culture channels entrepreneurial talents toward productive entrepreneurship (Baumol, 1990), others find evidence for distinct influences of specific parts of the institutional framework on different types of economic sectors (Agostino et al., 2020; Valdez & Richardson, 2013). The fourth proposition is formulated as follows:

Proposition 4: Regional cultures of entrepreneurship in general and innovative entrepreneurship relate to regional business opportunity recognition.

2.4 *Quality of perceived regional opportunities*

The cognitive perspective allows to connect the findings that prior experience, knowledge, and skills (Ardichvili et al., 2003; Park, 2005; Shane & Venkataraman, 2000) influence the alertness of individuals and firm performance. All of these factors form the mental framework of an individual. As the mental framework represents a simplified version of the reality of each individual (Valliere, 2013), it is shaped by individual experiences and makes sense of new situations based on knowledge and past experiences (Gioia & Chittipeddi, 1991; Mitchell et al., 2007; Riquelme, 2013; Valliere, 2013). Mental representations are parts of the overall mental framework of an individual that describe the understanding of a specific concept (such as entrepreneurship) in this individual's world view. Mental frameworks are essential to connect the dots between changes in the environment, e.g. technological progress, market dynamics, demographic change and other factors, and recognise opportunities that arise (Riquelme, 2013). This approach to opportunity recognition emphasises that opportunities are recognised by those that are prepared to see them by their mental framework (Baron & Ensley, 2006; Krueger & Brazeal, 1994; Riquelme, 2013; Strong, 2013). In line with this reasoning, it is expected that the quality of perceived business opportunities depends on the mental framework.

Furthermore, it is suspected that the recognition of business opportunities is not evenly distributed across regions because the resulting spatial pattern of types of entrepreneurship is persisting over long periods (Andersson & Koster, 2011; Fotopoulos & Storey, 2017; Fritsch & Wyrwich, 2014, 2017a, 2018; Sternberg, 2009). This empirical evidence is widely understood as support for the existence of a region-specific mental framework or cognitive institution that is continuing to live by socialising individuals with the regional mental framework and changes only gradually over long periods enabling opportunity recognition of a specific quality in the first place (Fritsch & Wyrwich, 2014, 2017b, 2018; Langevang et al., 2015; North, 1994; Ogunsade & Obembe, 2016). However, it can be argued that regional mental frameworks, which may also be interpreted as cultural capital, do not have value on their own (Laine, 2016). Only if individuals embody the cultural capital, will it give rise to regional-specific business opportunity recognition (Laine, 2016). Thus, opportunity recognition is governed by the mental framework of each individual, which is influenced by the environment and regional cognitive institutions (Ferrero & Bessiere, 2016). Therefore, the fifth proposition is stated as follows:

Proposition 5: Distinct long-standing regional entrepreneurship patterns are reflected in different mental representations of entrepreneurship.

However, some researchers argue that not the regionally shared values (or regional cognitive institutions) impact entrepreneurial activities but rather that entrepreneurs have a common set of values that drive them to found ventures which is independent from the regional environment (McGrath et al., 1992). Thus, the sixth proposition is formulated:

Proposition 6: Individuals that perceive business opportunities in their regional environment differ in their mental representation of entrepreneurship from those that do not see any opportunities.

Lastly, it can be suspected that there is an interaction between the regional setting and the shared set of values (or mental frameworks) of entrepreneurs. Therefore, the seventh proposition is stated:

Proposition 7: Within distinct regional settings, individuals that perceive business opportunities in their regional environment differ in their mental representation of entrepreneurship from those that do not see any opportunities.

3 Data sampling

The goal of this study is to gain an understanding of the processes that reinforce a regional entrepreneurship pattern over and over again. For this purpose, three groups of regions are of special interest, because these show a long-standing entrepreneurial pattern. The selection of regions was guided by data published by Fritsch and Wyrwich in 2018 and 2019, based upon German planning regions (Fritsch & Wyrwich, 2018, 2019). The level of planning regions in Germany can be compared to labour market areas in the USA (Fritsch & Wyrwich, 2018). First, regions inhibiting a long-standing pattern of entrepreneurial activities in general and innovative entrepreneurial activities were considered.[6] Then, in a second step, regions were assigned by combining these factors. This approach results in three regional groups. The first group contains regions with long-standing patterns of high entrepreneurship rates and high proportions of innovative entrepreneurship. The second group involves regions with low entrepreneurship rates and high proportions of innovative entrepreneurship. The third group

[6] The assignment of Fritsch and Wyrwich (2019) of each German planning region to a quintile in terms of self-employment rates in 1907, 1925 and the average of rates between 2010 and 2016 were used to identify the regions with a general long-standing entrepreneurship pattern. Those regions that showed the lowest variance in the assignment into a specific quintile over these three observations were considered to inhibit a long-standing general entrepreneurial pattern. The same procedure was applied on the basis of the data published by Fritsch and Wyrwich (2018) focusing on technology-intensive and science-based industries. Self-employment rates in 1907, 1925 and the average of rates between 2000 and 2014 were used for this purpose. The identified regions were considered to inhibit a long-standing innovative entrepreneurship pattern.

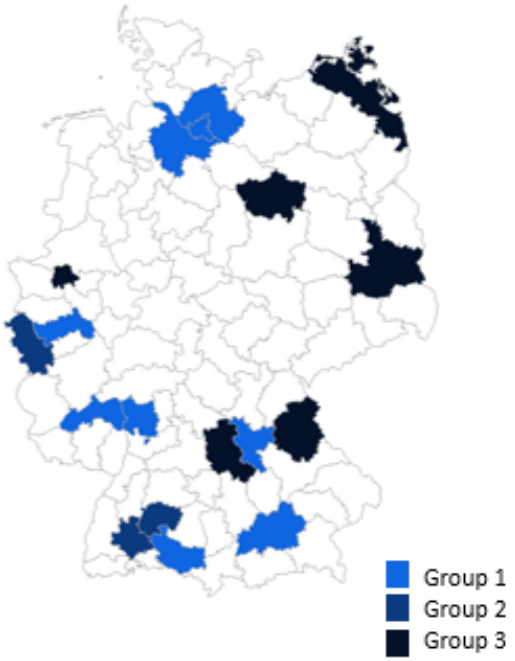
shows low entrepreneurship rates and low proportions of innovative entrepreneurship. For the combination of high entrepreneurship rates and low proportions of innovative entrepreneurship no regions could be detected.

In order to address the research questions, an online survey in eighteen German planning regions clustered into these three groups, containing 550 subjects, was conducted between 2nd and 15th January 2020. The participants of the study were contacted via a market research company that has access to a pool of paid respondents.[7] To participate in the study, respondents had to fulfil two main requirements. First, all participants had to be at least 18 and at maximum 65 years old, which corresponds to the age when a full capacity to contract is given and before pension in Germany. Second, only respondents that indicated living in one of the studied regions were eligible to participate in the study.

In order to gain representative insights into those regional groups, the population statistics provided by the Federal Institute for Research on Building, Urban Affairs, and Spatial Development are taken as a reference to define the representative proportions of respondents to specific sub-groups for the sampling via an online questionnaire. The population statistics and the distribution of respondents over three criteria – gender, age and educational status were used to construct a representative sample.[8] These criteria were chosen to avoid biases in the sample since these factors are likely to impact entrepreneurial activities undertaken by the respondents (e.g. Arenius & Minniti, 2005; Gallardo & Scammahorn, 2011). Figure 3.1 displays the assignment of German regions to the factor combinations. The selected regions distribute themselves over Germany in the pattern as illustrated. Apart from the second group of regions clustering more in the west of Germany, the distribution does not appear to be biased in a clear geographical direction.

[7] 2,250 clicks were registered and with 550 full questionnaires the 24% of the respondents passed the quality assurance tests and continued to the end of the questionnaire.

[8] For the aimed distribution of the sample over these three criteria, please see Table 8.1 in the appendix. The number of respondents in this table corresponds to the un-cleaned data set after the primary data collection. Figure 8.1, in the appendix, illustrates the distribution of respondents over German planning regions.



Planning region names:

Group 1: Long-standing patterns of high entrepreneurship rates and high proportions of innovative start-ups – *201= Hamburg; 306=Hamburg-Umland-Süd; 104=Schleswig-Holstein Süd; 510=Köln; 702=Rheinhessen-Nahe; 605= Starkenburg; 801= Bodensee-Oberschwaben; 910= München; 906= Industrieregion Mittelfranken*

Group 2: Long-standing patterns of low entrepreneurship rates and high proportions of innovative start-ups – *501= Aachen; 806= Neckar-Alb; 809= Schwarzwald-Baar-Heuberg*

Group 3: Long-standing patterns of low entrepreneurship rates and low proportions of innovative start-ups – *1202= Lausitz-Spreewald; 1303= Vorpommern; 1501= Altmark; 509= Emscher-Lippe; 917= Westmittelfranken; 914= Oberpfalz-Nord*

Figure 3.1: German regions with long-standing entrepreneurship patterns surveyed
Source: Own illustration

4 Research design

The research design of this study contains two main steps. First, the region-individual interactions that predict the quantity of regional opportunity perception are analysed. Second, the quality of perceived opportunities depends on the mental representation of entrepreneurship and is the subject of investigation. The data and methodological approach applied for each of these steps are described in the following.

4.1 Quantity of regional opportunity perception

To analyse the region-individual interactions and the recognition of regional business opportunities, the explicit responses made by the respondents were cleaned to ensure the validity of the results.[9] Binary logistic regressions consider two dependent variables: (1) perception of innovative regional business opportunities and (2) perception of regional business opportunities in general. Three sets of control variables – individual controls,

[9] To ensure data quality sampled by the survey, a mechanism is included in the questionnaire to exclude low quality responses. Respondent`s answers in matrix-style questions are checked for quality by assessing the variance. If the value of the variance equals zero, the respondents are screened out. The sampled data is further analysed to ensure the quality. A respondent´s share of missing values in for the research relevant questions is calculated. In case this exceeds 15%, the respondent is excluded from the data set. Although this pattern could have multiple reasons, it could hint at low motivation and therefore lower validity of the given answers (Barge & Gehlbach, 2012). This cleaning procedure resulted in removing five respondents from the sample. Lastly, composed measures as the personality profile suffer greatly from missing values. This is overcome by mean value imputation.

personality traits and interest controls – are used to ensure the robustness of the results.[10] The model applied in this study is the following with X corresponding to the respective dependent variable:

$$\log\left(\frac{p(X)}{1-p(X)}\right) = Constant + \beta_1 * Actor\ level\ embeddedness + \beta_2 * Network\ level\ embeddedness + \beta_3 * Environmental\ level\ embeddedness + \beta_4 * Cultural\ level\ embeddedness + Individual\ Controls + Personality\ trait\ controls + Interest\ controls \quad (1)$$

4.1.1 Dependent variables

Regional business opportunity perception is surveyed as described in the following. Two questions asked the respondent to indicate 1) whether a business opportunity within the regional environment is recognised and 2) whether an innovative business opportunity within the regional environment is recognised. The wording of the included questions is based on the German-language questions of the GEM (Global Entrepreneurship Monitor) Adult Population Survey, as asked by the GEM Germany country team in the 2018 survey year.[11] First, respondents indicated their opportunity perception on a 5-point-Likert scale. Then, this was converted to a binary variable by summarizing the upper two (opportunities are perceived) and the bottom two classes (no opportunities are perceived). Finally, all respondents that indicated the middle of the Likert scale, i.e. expressing neither opportunity perception nor no opportunity perception, were removed for analysis.[12] Table 4.1 shows that the share of opportunity perception is similar in both cases – general and innovative opportunities.

Table 4.1: Descriptive statistics of the regional business opportunity perception
Source: Own calculation based upon primary data collection

Statistic	N	Share of perception	St. Dev.
General business opportunities within the region *(1=perceived opportunities; 0= no opportunities perceived)*	305	37.7%	0.485
Innovative business opportunities within the region *(1=perceived opportunities; 0= no opportunities perceived)*	305	38.0%	0.486

[10] The validity of the results is ensured by controlling for the assumption of linearity between the log of odds and continuous independent variables. Furthermore, influential data points are identified by the value of the absolute standardised residuals. The variance inflation factor assessment tests for multicollinearity issues. Lastly, all models are tested against a null model containing only the constant. For the correlation coefficients see Table 8.3 and Table 8.4 in the appendix.
[11] The question formulations were adapted by including 'within your current designated region' in both cases and 'innovative' for the assessment of the innovative opportunity recognition.
[12] This procedure causes a loss in sample size, but ordinal logistic regression analyses were not applied due to multicollinearity issues and the violation of the proportional odds assumption.

4.1.2 *Independent variables*

The embeddedness of the respondent in the regional innovation system is assessed as described in the following. Since a systemic perspective requires actor, network, environmental, and cultural level, those were included in the questionnaire. On the actor-level, the identification with the regional personality is operationalised with the Big 5 personality profile, which was answered individually, and once the subject was asked to give the answers for a typical person from their designated region.[13] In the case of only a slight difference between those two scales, it is interpreted as a high identification with the regional personality. For the purpose of the subjective alignment of the own and the regional personality, it does not matter if the regional personality was evaluated differently by other respondents. The respondents indicated how many friends, family members, and colleagues live in the same region on the network level.[14] The environmental level, more specifically defined as the economic environment, is depicted in the perceived share of young firms, innovative companies and innovative young firms in the region.[15] The cultural level is included by two dummy variables that describe whether a long-standing entrepreneurship pattern of general entrepreneurship or innovative entrepreneurship is present in the designated region of the respondent. Table 4.2 summarises the descriptive statistics of the variables. The most pronounced fit between regional and individual personality is regarding the dimension of openness. However, the personality fit seems to be limited on average. The presence of social contacts in the region and the perception of an economic environment are characterised by large sample variances.

[13] The assessment of the personality traits operationalised according to Rammstedt et al. (2013).
[14] This information was surveyed by applying slider questions ranging from 0% until 100%.
[15] This information was surveyed by asking the respondent to estimate the share of these types of businesses in their designated region, ranging from 0% until 100%.

Table 4.2: Descriptive statistics of the regional embeddedness variables
Source: Own calculation based upon primary data collection

Statistic	N	Mean	St.Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Extraversion fit with region	545	0.991	0.784	0.000	0.500	1.000	1.500	4.000
Agreeableness fit with region	545	0.817	0.709	0.000	0.500	0.500	1.000	4.000
Conscientiousness fit with region	545	0.814	0.726	0.000	0.500	0.500	1.000	4.000
Neuroticism fit with region	545	0.878	0.758	0.000	0.500	0.665	1.299	4.000
Openness fit with region	545	1.074	0.864	0.000	0.500	1.000	1.500	4.000
Friends in the region	544	29.250	22.689	1.000	11.000	22.000	39.000	101.000
Family members in the region	544	42.590	24.377	1.000	21.750	41.000	63.250	101.000
Colleagues in the region	543	42.586	27.653	1.000	18.000	41.000	67.000	101.000
Perception of young firms in the region	545	61.938	29.607	1.000	44.000	70.000	84.000	101.000
Perception of innovative companies in the region	545	52.128	34.707	1.000	15.000	61.000	81.000	101.000
Perception of innovative young firms in the region	545	56.448	33.707	1.000	24.000	65.000	85.000	101.000
Innovative entrepreneurship culture *(1= tradition exists; 0= no such a tradition)*	545	0.666	0.472	Dummy variable				
General entrepreneurship culture *(1= tradition exists; 0= no such a tradition)*	545	0.334	0.472	Dummy variable				

Moreover, the control variables are structured into three separate sets. First, demographic variables and personal contact with entrepreneurship were surveyed. Especially the variables age, gender, educational attainment and work experience are found to influence entrepreneurial activities by former studies (e.g. Arenius & Minniti, 2005; Fritsch & Kublina, 2019; Fritsch & Wyrwich, 2018; Gallardo & Scammahorn, 2011; Jones-Evans et al., 2011). Second, since the personality profile evidently influences entrepreneurial activities undertaken by the person (Fritsch & Wyrwich, 2017a, 2017b, 2018), the personality traits as measured by the Big 5 model are assessed. Third, questions aimed at identifying the interests of the respondents in the context of entrepreneurship are included. In this vein, prior research has found that media attention can increase an individual's probability of becoming entrepreneurially active (Urbano & Alvarez, 2014). Table 4.3 summarises the descriptive statistics of the control variables.

Table 4.3: Descriptive statistics of the control variables
Source: Own calculation based upon primary data collection

	Statistic	N	Mean	St.Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Individual control variables	Period of residence	544	20.623	16.004	1.000	7.000	18.000	30.250	66.000
	Holding an university degree *(1= holding a degree; 0= does not hold a degree)*	545	0.141	0.349			Dummy variable		
	Age	545	44.653	13.381	20.000	33.000	46.000	57.000	66.000
	Gender *(1= Male; 0= Female)*	545	0.470	0.500			Dummy variable		
	Self-employed *(1= self-employed; 0=not self-employed)*	545	0.048	0.213			Dummy variable		
	Knowing an entrepreneur *(1=knowing an entrepreneur; 0= not knowing an entrepreneur)*	543	0.449	0.498			Dummy variable		
Personality control variables	Extraversion	545	2.982	1.068	1.000	2.500	3.000	3.600	5.000
	Agreeableness	545	3.238	0.824	1.000	2.500	3.500	4.000	5.000
	Conscientiousness	545	3.809	0.816	2.000	3.000	4.000	4.500	5.000
	Neuroticism	545	2.758	0.983	1.000	2.000	2.500	3.500	5.000
	Openness to experience	545	3.409	1.048	1.000	2.500	3.500	4.500	5.000
Interest control variables	Attending events about Start-ups *(0= attended events; 1=not attended any events)*	528	0.864	0.343			Dummy variable		
	Experience with foundations *(0= has experience; 1= has no experience)*	533	0.756	0.430			Dummy variable		
	Work experience in small and new firms *(1= has experience; 0= has no experience)*	536	0.368	0.483			Dummy variable		
	Watching TV shows about Start-ups *(1= watches TV shows regularly or occasionally; 0= does not watch TV shows)*	544	0.579	0.494			Dummy variable		

4.2 Quality of regional opportunity perception

The concept of newly founded firms is contrasted by the concept of mid-sized companies because mental representations are not informative itself, but only in comparison with a closely related concept. By comparing these concepts, the specifics which are exclusively associated with newly founded firms, and are not in close association with mid-sized companies, can be identified. The mental representation, thus, uncovers what the unique expectations are of how an entrepreneur behaves and ultimately defines what kind of opportunities he or she pursues. Mid-sized companies are used as counterpart because these are presumed to be established, which is not the case for newly founded firms.

To reveal the regional mental representations of entrepreneurship, the approach as described by Birkholz and Kühn (2021) is applied, which is based on an implicit measurement procedure using reaction times. Implicit measurement of attitudes is applied because explicit response schemes can be biased by socially desirable answers (Krosnick, 1999; Wittenbrink, 2007). Using reaction times as an implicit measurement instrument that is more robust against willing correction of first associations overcomes drawbacks of explicit responses (Wittenbrink, 2007).

The procedure works as follows. The words 'newly founded firms' and 'mittelstand' (German mid-sized companies) are assigned to one button on the keyboard. Words are displayed in the middle of the screen for 500 msec and then the respondent sees either the word 'newly founded firm' or 'mittelstand'. The subject needs to push the according key as precisely and fast as possible to indicate if 'newly founded firm' or 'mittelstand' is visible on the screen. Both combinations (e.g. 'Cooperation' followed by 'newly founded firm' and 'Cooperation' followed by 'mittelstand') appear once. Theoretical considerations of semantical networks assume a faster response if the word is more strongly associated with the concept.[16] For example, a respondent is seeing 'Cooperation' for 500 msec right before 'newly founded firm', he needs 400 msec to press the correct button, and in case 'mittelstand' follows 'Cooperation', he presses the correct button 600 msec. Then, it is deduced that this respondent associates 'Cooperation' more closely with 'newly founded firm' than with 'mittelstand'. A cleaning process ensures the validity of the data.[17] The association strength is then quantified by the relative difference of those reaction times; the values are calculated by applying the following formula. This formula is applied for every word in Table 4.4, the formula displays the case of the word 'Cooperation':

$$Association\ strength = \frac{Reaction\ time\ in\ msec\ for\ combination\ of\ 'Cooperation'\ and\ 'newly\ founded\ firm'}{Reaction\ time\ in\ msec\ for\ combination\ of\ 'Cooperation'\ and\ 'mittelstand'} \qquad (2)$$

[16] Semantic networks are mental landscapes that organise knowledge and associations. This approach explains the effect of semantic priming, i.e., that word recognition is improved when a related word is read shortly before, with the activation of associations that are linked to each other in semantic networks. For an overview see Neely (1991).

[17] First, high error rates (pressing the wrong button) are suspicious since it could indicate that the respondent did not understand the task correctly. Therefore, subjects having more than 25% errors in prime-target-combinations are removed from the data set. Furthermore, wrong button presses are not set to a specific value, but deleted. The second procedure aims to prevent explicit or accidental indications. Reaction times faster than 100 msec and slower than 1000 msec are removed based upon this consideration (Payne, 2001). Moreover, to exclude individual outliers, reaction times of more than the individual mean plus two times the individual standard deviation are removed as well (Wittenbrink, 2007). This cleaning procedure resulted in the deletion of 16 respondents from the sample. For the correlation coefficients see Table 8.2 in the appendix.

The terms used in this implicit association task were defined along with the components of the innovation system approach – actors, networks and the environment – and are the same as in the study conducted by Birkholz and Kühn (2021). Table 4.4 shows the descriptive statistics of the reaction time measurement. Whenever the mean value equals 1, the respective term has no particular association with one of the concepts (newly founded firms or mid-sized companies). In the case the value is lower than 1, the word is associated with newly founded firms, and if the value is higher than 1, it indicates that the association is directed towards mid-sized companies. On average, the values in Table 4.4 show that all the tested words are more closely associated with mid-sized companies.

Table 4.4: Descriptive statistics of the mental representation of entrepreneurship
Source: Own calculation based upon primary data collection

	Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Actor level	Possibility	354	1.066	0.380	0.516	0.850	1.031	1.218	5.735
	Necessity	365	1.062	0.342	0.163	0.856	1.019	1.193	4.555
	Experience	341	1.059	0.299	0.491	0.876	1.010	1.197	2.168
	Youth	352	1.069	0.279	0.389	0.883	1.038	1.200	3.090
	Role model	377	1.028	0.249	0.473	0.861	0.998	1.186	1.949
	Trouble maker	353	1.044	0.270	0.512	0.869	1.020	1.185	2.153
Network level	Demand	360	1.041	0.259	0.514	0.862	1.022	1.189	1.904
	Freedom	365	1.067	0.287	0.320	0.876	1.029	1.208	2.038
	Funding	376	1.026	0.240	0.360	0.864	1.015	1.187	1.770
	Bureaucracy	367	1.020	0.278	0.472	0.830	0.997	1.152	2.823
	Cooperation	371	1.043	0.289	0.492	0.835	1.006	1.210	2.099
	Autonomy	348	1.041	0.258	0.463	0.863	1.017	1.197	2.032
Environment level	Career	373	1.044	0.266	0.351	0.854	1.006	1.213	1.871
	Insecurity	379	1.077	0.298	0.433	0.896	1.038	1.208	3.135
	East Germany	371	1.065	0.258	0.265	0.892	1.053	1.210	1.951
	West Germany	357	1.066	0.308	0.429	0.861	1.034	1.214	2.647
	Northern Germany	354	1.047	0.268	0.280	0.866	1.013	1.195	2.153
	Southern Germany	361	1.075	0.265	0.579	0.883	1.033	1.224	2.073
	Progress	379	1.041	0.287	0.428	0.863	1.009	1.166	3.284
	Regression	363	1.058	0.270	0.491	0.879	1.024	1.209	2.143

Proposition 5 is validated by comparing the mental representations of entrepreneurship between the three regional groups. To validate *Proposition 6*, the respondents indicating that they perceive (innovative) regional opportunities and those that stated perceiving none are compared across all regional groups. *Proposition 7* is tested by comparing the respondents indicating that they perceive (innovative) regional opportunities and those that stated perceiving none are compared within each regional group.

5 Results

5.1 Quantity of regional opportunity perception

In order to test *Proposition 1*, *Proposition 2*, *Proposition 3* and *Proposition 4*, the driving forces of the perception of regional opportunities to found a new venture are looked at in further detail. Table 5.1 and Table 5.2 display the results of the regression models with the perception of regional business opportunities as a dependent variable.

Specifications 1 to 4 in Table 5.1 estimate the effects of the independent variables on the perception of business opportunities in the region in general. A clear coherence in these models can be found on the actor level, environment level, and cultural level. On the actor level, the larger the difference between the conscientiousness level of the respondent and the perceived regional stereotype, the less likely it is to perceive a general business opportunity. The same is true, as a tendency, for the personality trait openness. On the network level, there is the tendency that the more colleagues are located in the same region as the respondent, the more likely it is to perceive general business opportunities. Further, on the environmental level, the perception of opportunities is positively related to the perception of young firms, innovative companies and, as a tendency, innovative young firms in the region. However, the most significant impact on general opportunity recognition is the presence of a culture of innovative entrepreneurship by increasing the probability of opportunity perception by 136% to 172%, depending on the model specification.

In contrast, specifications 5 to 8 in Table 5.2 analyse the relation of independent variables and the perception of innovative business opportunities in the region. It is evident that, in the case of innovative business opportunities, the only consistent findings are on the environmental level and network structures. On the network level, the presence of colleagues in the same region as the respondent is positively related to the recognition of innovative business opportunities. Furthermore, on the environmental level, the perception of innovative companies and, as a tendency, the perception of innovative young firms in the region increase the probability of innovative business opportunity recognition.

Based upon these findings, *Propositions 1*, *2*, and *4* are partly confirmed, as these can be confirmed only for one type of business opportunities. *Proposition 3* can be confirmed in the case of both types of business opportunities.

Although the interpretability of coefficients of control variables in regression analyses is limited (Hünermund & Louw, 2020), a few observations can be made. First, it comes as a

surprise that educational attainment and gender are only important for the perception of innovative business opportunities but not for recognising general opportunities and do not affect entrepreneurial activities in all forms (Arenius & Minniti, 2005; Gallardo & Scammahorn, 2011). Second, the personality traits from the respondent are not found to be significant for the perception of business opportunities, contradicting former research (Hayton & Cacciotti, 2013; Rinne et al., 2012; Shane, 1993; Williams & McGuire, 2010). This finding suggests that personality traits are not the driving factor of regional opportunity perception if the region-individual interaction is considered. Thus, this result supports that neglecting the regional environment in entrepreneurship studies lead to biased outcomes. Third, attending regional events about young firms increases the likelihood of perceiving opportunities. This finding supports that regional events have an impact on the entrepreneurial process. Last, watching TV shows that address entrepreneurial activities relates to a higher likelihood of recognising general business opportunities but not innovative ones. This result could suggest that the TV shows focus on general business opportunities and rarely on innovative ones.

Overall, the results indicate that general opportunity perception is more related to the regional embeddedness of the respondents than in the case of innovative business opportunity recognition. However, the share of colleagues in the same region as the respondent and the perception of innovative companies in the region show larger coefficients in the case of innovative business opportunity recognition than in the case of general opportunity perception. Based on these findings, it can be deduced that recognising innovative business opportunities relies on fewer regional factors than the perception of general business opportunities. Whereas recognising innovative opportunities depends on the business and innovation context, the perception of general opportunities is related to a mix of personal embeddedness and regional context factors. It can be concluded that the regional innovation system does not primarily drive innovative ventures; but once established and perceived, these trigger the perception of general business opportunities in the region.

Table 5.1: Binary logistic regression results – business opportunities in general
*Note: *p<0.1, **p<0.05, ***p<0.01 and standard errors displayed in parentheses, OR represents the odds ratio of the coefficients*
Source: Own calculation based upon primary data collection

		Business opportunities in general							
		(1)		(2)		(3)		(4)	
		β	OR	β	OR	β	OR	β	OR
Actor level	Extraversion	-0.171	0.843	-0.159	0.853	-0.116	0.890	-0.118	0.889
		(0.188)		(0.195)		(0.205)		(0.220)	
	Agreeable-ness	0.253	1.287	0.320	1.377	0.296	1.345	0.386*	1.471
		(0.204)		(0.211)		(0.218)		(0.224)	
	Conscientious-ness	-0.492**	0.612	-0.454**	0.635	-0.480**	0.619	-0.501**	0.606
		(0.211)		(0.220)		(0.226)		(0.236)	
	Neuroticism	0.070	1.073	0.171	1.186	0.134	1.144	0.195	1.215
		(0.193)		(0.203)		(0.214)		(0.222)	
	Openness	-0.137	0.872	-0.244	0.783	-0.443**	0.642	-0.474**	0.622
		(0.167)		(0.176)		(0.215)		(0.229)	
Network level	Friends	0.009	1.009	0.008	1.008	0.008	1.008	0.008	1.008
		(0.006)		(0.006)		(0.007)		(0.007)	
	Family members	-0.001	0.999	0.002	1.002	0.001	1.001	-0.001	0.999
		(0.005)		(0.005)		(0.005)		(0.006)	
	Colleagues	0.007*	1.007	0.008*	1.008	0.008*	1.008	0.007	1.007
		(0.004)		(0.005)		(0.005)		(0.005)	
Environment level	Young firms	0.020***	1.020	0.020**	1.020	0.019**	1.019	0.019**	1.019
		(0.007)		(0.008)		(0.008)		(0.009)	
	Innovative companies	0.019***	1.020	0.022***	1.022	0.021***	1.021	0.021***	1.022
		(0.007)		(0.007)		(0.007)		(0.008)	
	Innovative young firms	0.013**	1.013	0.012*	1.012	0.012*	1.012	0.008	1.008
		(0.006)		(0.006)		(0.007)		(0.007)	
Cultural level	General entrepreneurship	-0.396	0.673	-0.410	0.664	-0.544	0.580	-0.568	0.566
		(0.346)		(0.364)		(0.382)		(0.401)	
	Innovative entrepreneurship	0.909***	2.482	0.862**	2.368	0.899**	2.458	1.002**	2.723
		(0.350)		(0.369)		(0.379)		(0.410)	
Individual control variables	Period of residence			-0.010	0.990	-0.008	0.992	-0.005	0.995
				(0.010)		(0.011)		(0.011)	
	Holding an university degree			0.418	1.519	0.408	1.504	0.391	1.478
				(0.414)		(0.418)		(0.426)	
	Age			-0.001	0.999	-0.004	0.996	0.007	1.007
				(0.012)		(0.013)		(0.014)	

	Gender			-0.415	0.660	-0.472	0.624	-0.252	0.777
				(0.296)		(0.305)		(0.324)	
	Self-employed			1.183	3.264	1.097	2.995	1.225	3.404
				(0.720)		(0.746)		(0.802)	
	Knowing an entrepreneur			-0.500*	0.607	-0.411	0.663	-0.260	0.771
				(0.298)		(0.305)		(0.327)	
Personality control variables	Extraversion					0.070	1.073	0.041	1.042
						(0.163)		(0.171)	
	Agreeable-ness					-0.031	0.969	-0.122	0.885
						(0.189)		(0.199)	
	Conscientiousness					0.025	1.025	0.035	1.036
						(0.212)		(0.221)	
	Neuroticism					0.010	1.010	-0.029	0.971
						(0.168)		(0.177)	
	Openness to experience					0.298	1.347	0.333*	1.395
						(0.186)		(0.200)	
Interest control variables	Attending events about start-ups							-1.102**	0.332
								(0.453)	
	Experience with foundations							0.127	1.135
								(0.437)	
	Work experience in small and new firms							0.344	1.411
								(0.358)	
	Watching TV shows about start-ups							0.595*	1.813
								(0.346)	
Model specifications	Constant	-3.481***	0.031	-3.444***	0.032	-4.281**	0.014	-3.479	0.031
		(0.0675)		(1.245)		(1.698)		(2.156)	
	Observations	303		300		300		285	
	Log Likelihood	-157.698		-150.271		-148.565		-136.429	
	Akaike Inf. Crit.	343.397		340.542		347.129		330.858	

Table 5.2: Binary logistic regression results – innovative business opportunities
*Note: *p<0.1, **p<0.05, ***p<0.01 and standard errors displayed in parentheses, OR represents the odds ratio of the coefficients*
Source: Own calculation based upon primary data collection

		Innovative business opportunities							
		(5)		(6)		(7)		(8)	
		β	OR	β	OR	β	OR	β	OR
Actor level	Extraversion	-0.068	0.934	-0.058	0.944	-0.020	0.980	-0.052	0.949
		(0.190)		(0.199)		(0.203)		(0.220)	
	Agreeable-ness	-0.009	0.991	0.090	1.094	0.088	1.091	0.194	1.214
		(0.211)		(0.215)		(0.217)		(0.230)	
	Conscientious-ness	-0.233	0.792	-0.233	0.792	-0.229	0.795	-0.323	0.724
		(0.205)		(0.215)		(0.221)		(0.244)	
	Neuroticism	-0.111	0.895	-0.173	0.842	-0.212	0.809	-0.062	0.940
		(0.198)		(0.208)		(0.219)		(0.234)	
	Openness	-0.249	0.780	-0.252	0.778	-0.319	0.727	-0.232	0.793
		(0.167)		(0.172)		(0.207)		(0.229)	
Network level	Friends	-0.001	0.999	-0.003	0.997	-0.003	0.997	-0.005	0.995
		(0.006)		(0.006)		(0.006)		(0.007)	
	Family members	-0.001	0.999	0.0003	1.000	0.001	1.001	-0.001	0.999
		(0.005)		(0.005)		(0.005)		(0.005)	
	Colleagues	0.012***	1.013	0.013***	1.013	0.013***	1.013	0.015***	1.015
		(0.004)		(0.005)		(0.005)		(0.005)	
Environment level	Young firms	0.009	1.009	0.008	1.008	0.008	1.008	0.003	1.003
		(0.007)		(0.007)		(0.007)		(0.008)	
	Innovative companies	0.021***	1.021	0.025***	1.025	0.024***	1.025	0.031***	1.032
		(0.007)		(0.007)		(0.007)		(0.008)	
	Innovative young firms	0.016***	1.016	0.013**	1.013	0.012**	1.012	0.010	1.010
		(0.006)		(0.006)		(0.006)		(0.007)	
Cultural level	General entrepreneurship	-0.335	0.715	-0.203	0.816	-0.214	0.807	-0.014	0.986
		(0.337)		(0.352)		(0.365)		(0.389)	
	Innovative entrepreneurship	0.606*	1.833	0.451	1.570	0.422	1.525	0.349	1.418
		(0.341)		(0.352)		(0.358)		(0.394)	
Individual control variables	Period of residence			-0.004	0.996	-0.003	0.997	-0.006	0.994
				(0.011)		(0.011)		(0.012)	
	Holding an university degree			0.758*	2.134	0.759*	2.136	1.143**	3.136
				(0.412)		(0.416)		(0.446)	
	Age			-0.019	0.981	-0.019	0.981	-0.014	0.986
				(0.012)		(0.012)		(0.014)	

	Gender			-0.820***	0.440	-0.872***	0.418	-0.829**	0.436
				(0.296)		(0.308)		(0.331)	
	Self-employed			0.215	1.240	0.199	1.220	-0.065	0.937
				(0.780)		(0.805)		(0.852)	
	Knowing an entrepreneur			-0.081	0.922	-0.055	0.946	0.048	1.049
				(0.289)		(0.294)		(0.328)	
Personality control variables	Extraversion					0.106	1.112	0.018	1.018
						(0.154)		(0.170)	
	Agreeable-ness					-0.032	0.969	-0.059	0.943
						(0.181)		(0.191)	
	Conscientiousness					-0.017	0.983	0.014	1.014
						(0.197)		(0.215)	
	Neuroticism					0.085	1.089	0.089	1.093
						(0.171)		(0.180)	
	Openness to experience					0.109	1.115	0.046	1.047
						(0.175)		(0.190)	
Interest control variables	Attending events about start-ups							-1.449***	0.235
								(0.486)	
	Experience with foundations							0.410	1.507
								(0.433)	
	Work experience in small and new firms							-0.553	0.575
								(0.369)	
	Watching TV shows about start-ups							0.186	1.204
								(0.348)	
Model specifications	Constant	-2.592***	0.075	-1.119	0.327	-1.677	0.187	0.534	1.706
		(0.595)		(1.231)		(1.607)		(2.097)	
	Observations	303		302		302		286	
	Log Likelihood	-162.236		-155.438		-154.857		-137.023	
	Akaike Inf. Crit.	352.472		350.875		359.715		332.046	

5.2 Quality of regional opportunity perception

To test *Propositions 5*, and *6* the differences in reaction times per word are analysed. Table 5.3 shows the profiles of the three regional groups and the profiles of opportunity perceivers versus non-perceivers – for business opportunities in general and for innovative business opportunities.

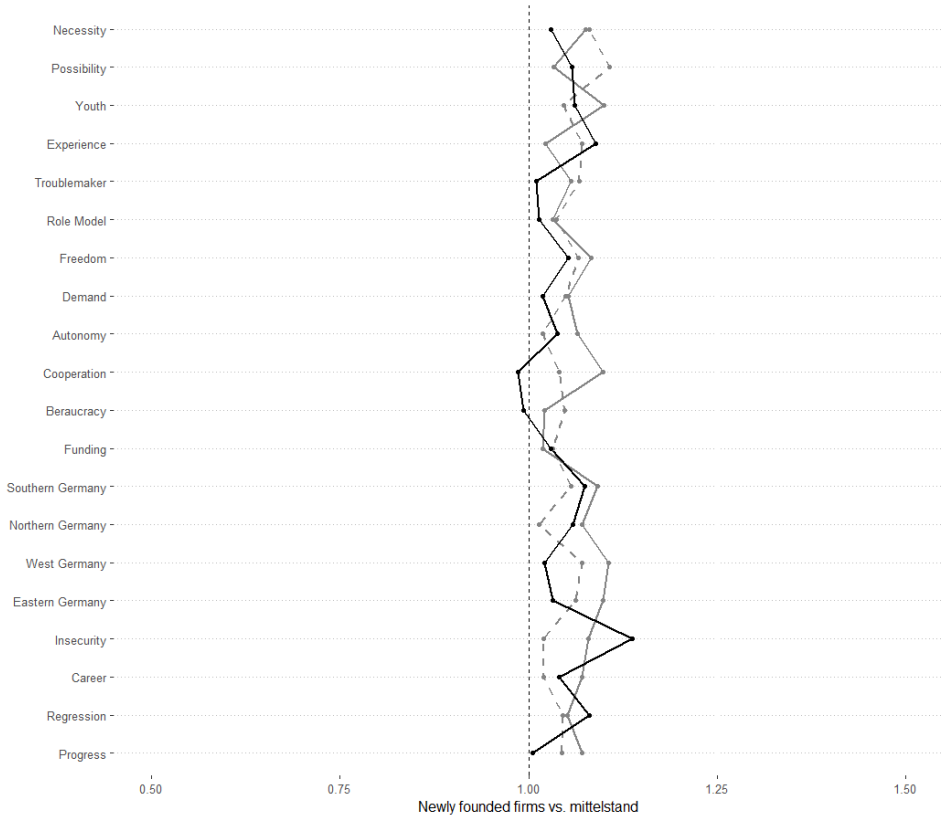
Proposition 5, stating that long-standing regional entrepreneurship patterns are reflected in different mental representations of entrepreneurship, is only partly confirmed. Although the profiles of the regional groups are not congruent to each word, the differences between these profiles are not distinct enough from each other to confirm a distinctive pattern.

Proposition 6, stating that individuals who perceive business opportunities differ in their mental representation from those that do not, is rejected. The recognition of general and innovative business opportunities has nearly the same level of responses. 21% of respondents recognise business opportunities in their regional environment in both cases. Moreover, the profiles related to perceiving and non-perceiving the opportunities differ only slightly. However, the following words describing the environment in which entrepreneurs are embedded in ('Southern Germany', 'Northern Germany', 'West Germany', 'East Germany', 'Insecurity', 'Career', 'Regression', 'Progress') show a marginal distinctiveness between perceivers and non-perceivers. However, there is no evidence of a distinct culture of opportunity perceivers on average.

The main result of this analysis is that neither perceiving business opportunities nor the regional environment alone explain the persistence of regional differences in entrepreneurial activities. Therefore, as a next step, the combination of these factors is investigated in further detail to test *Proposition 7*.

Table 5.3: Mental representations of entrepreneurship in regional groups and of opportunity perceivers and non-perceivers
Source: Own calculation based upon primary data collection

Regional comparison

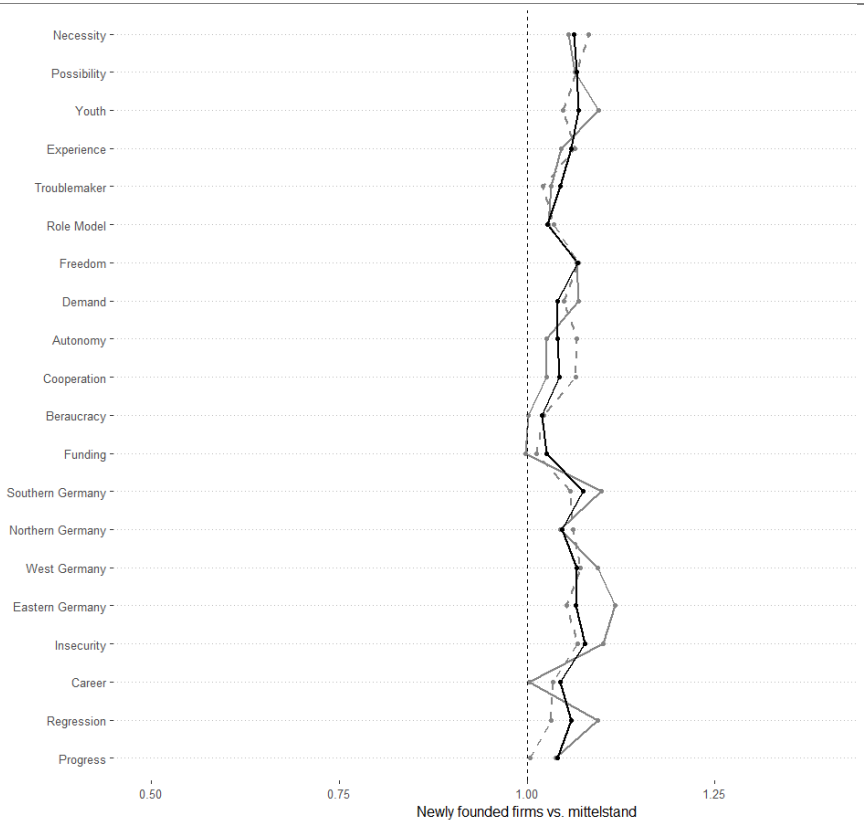
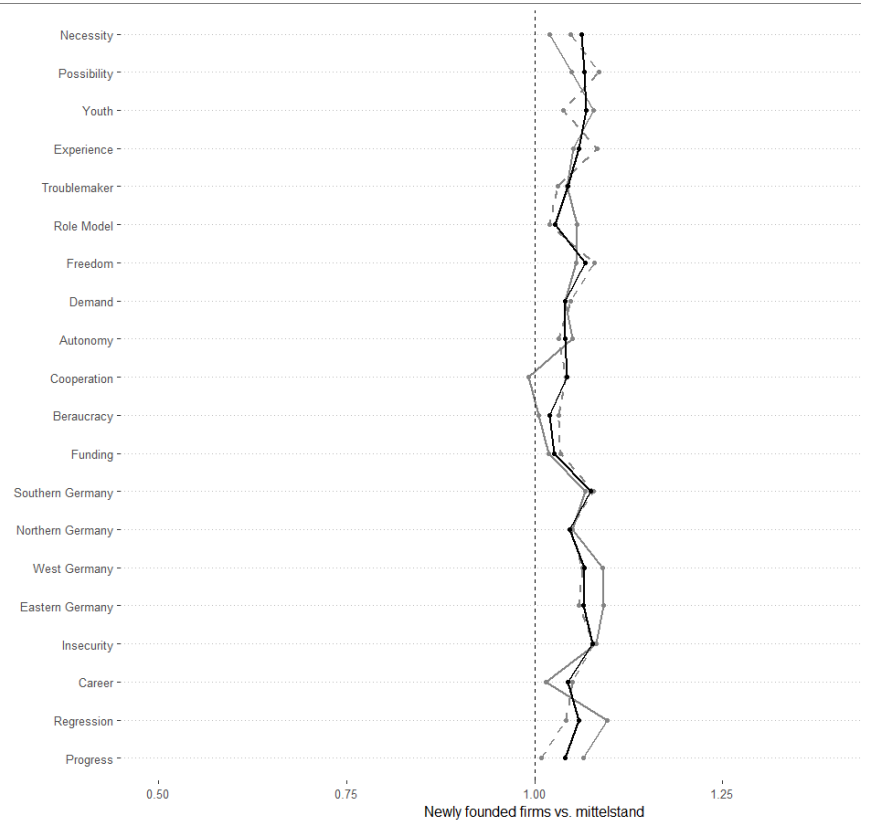


Longterm pattern

Region 1 (grey solid line): High start-up rates & High proportion of innovative start-ups

Region 2 (grey dashed line): Low start-up rates & High proportion of innovative start-ups

Region 3 (black solid line): Low start-up rates & Low proportion of innovative start-ups

	General opportunity perception vs. no perception	Innovative opportunity perception vs. no perception
		
Opportunity recognition	No opportunity recognition (grey dashed line): 185 (34.644%) Opportunity recognition (grey solid line): 113 (21.161%) NA: 236 (44.195%) Overall sample (black solid line): 534	No opportunity recognition (grey dashed line): 183 (34.270%) Opportunity recognition (grey solid line): 113 (21.161%) NA: 238 (44.569%) Overall sample (black solid line): 534

5.3 Quality of regional opportunity perception in regional groups

Table 5.4 illustrates the profiles from perceivers and non-perceivers of business opportunities within the three regional groups. The right column of the table corresponds to the recognition of business opportunities in general, and the left column relates to the recognition of innovative business opportunities. Four main observations can be made by having a closer look at the combination of opportunity perception and regional groups.

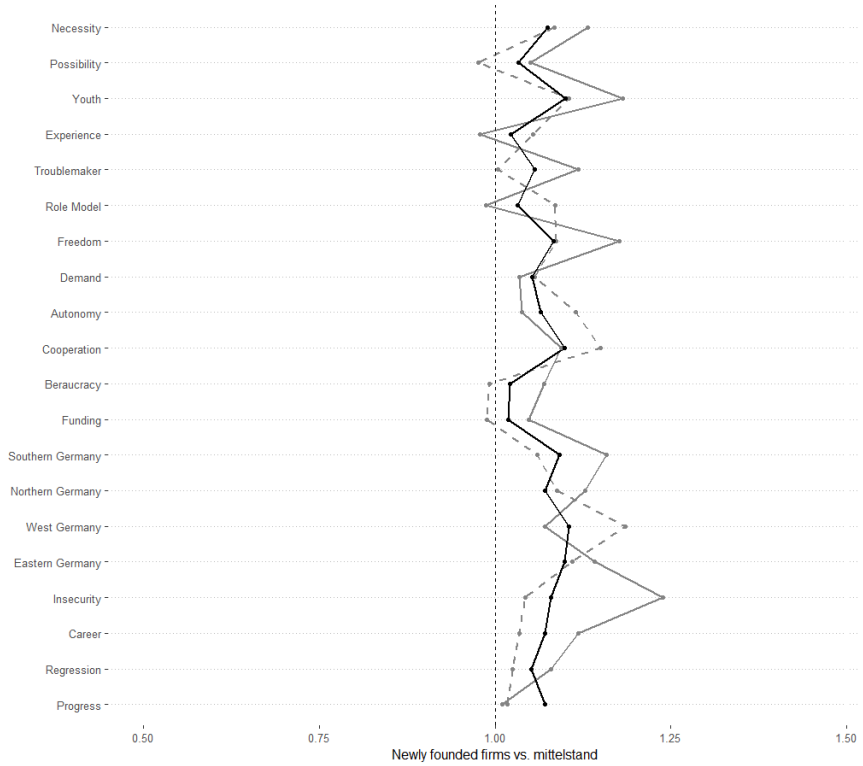
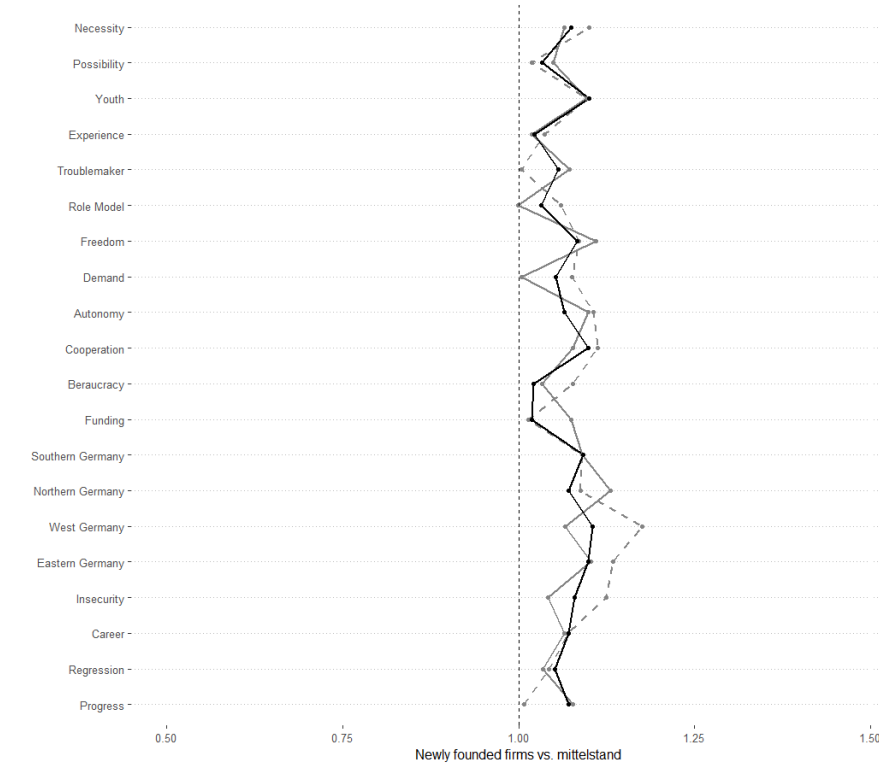
First, the number of recognised opportunities does not differ in the regional groups between general and innovative ones. This finding is surprising because one could expect that in a regional group with traditionally low shares of innovative ventures, innovative business opportunities are recognised less often. However, in contrast to this intuition, the result suggests that these opportunities are not less often recognised but less likely to be pursued in certain regional settings.

Second, the highest share of non-recognition is in the regional group characterised by low entrepreneurship rates and a low proportion of innovative entrepreneurship. This finding confirms that the regional culture is reflected in opportunity recognition patterns.

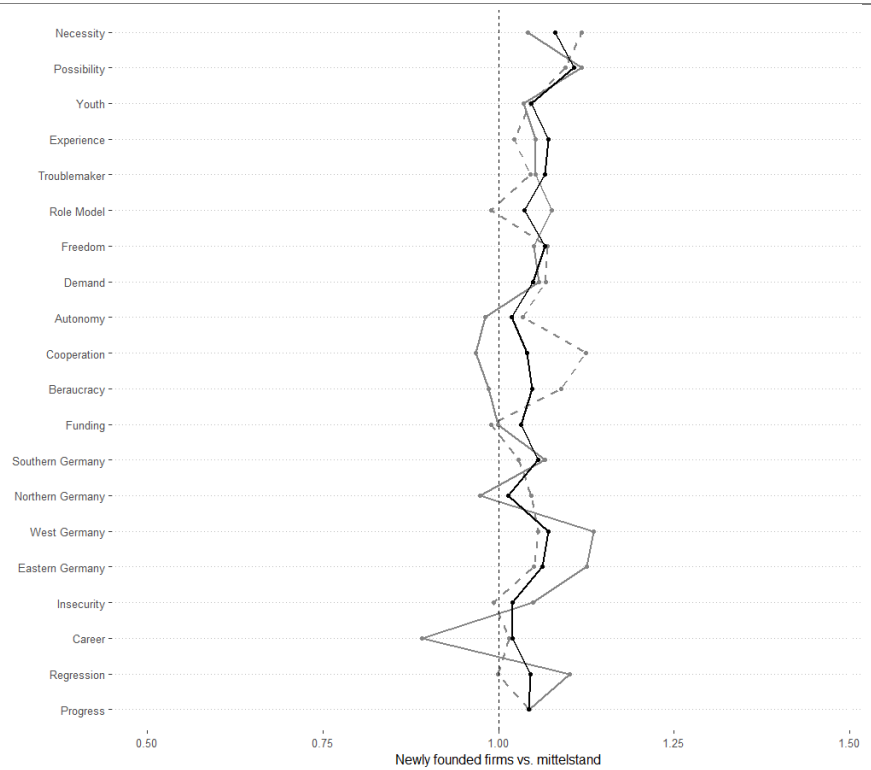
Third, looking at the regional groups, the difference between opportunity perceivers and non-perceivers increases. Hence, the regional mindset is based on a regional mental representation of opportunity perceivers, at least in the case of general opportunity perception.

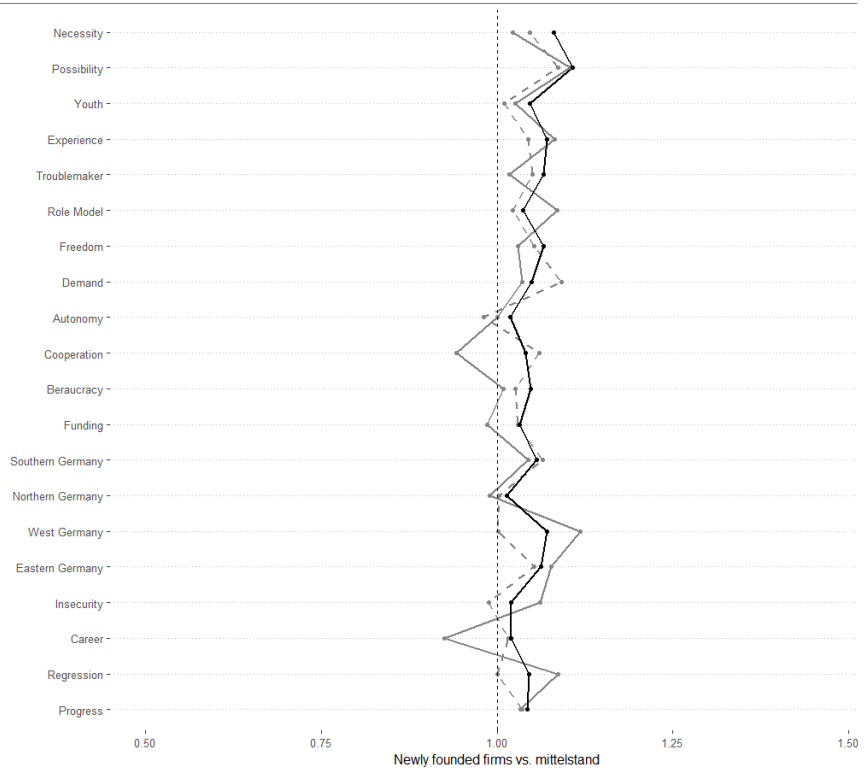
Fourth, mental representations of perceivers and non-perceivers differ more significantly in the case of general business opportunities. The recognition of innovative business opportunities is less related to a specific regional mental representation of entrepreneurship than the recognition of general ones. This confirms one´s intuition that innovative business opportunities are less connected to a stereotype of entrepreneurs because these are more diverse than general business opportunities influenced by specific trends. Thus, the *Proposition 7* can be confirmed.

Table 5.4: Mental representation of entrepreneurship of general opportunity perceivers and non-perceivers in the regional groups
Source: Own calculation based upon primary data collection

	General opportunity recognition	**Innovative opportunity recognition**
	Region 1	
		
Opportunity recognition	No opportunity recognition (grey dashed line): 59 (33.146%) Opportunity recognition (grey solid line): 37 (20.787%) NA: 82 (46.067%) Overall sample (black solid line): 178	No opportunity recognition (grey dashed line): 63 (35.393%) Opportunity recognition (grey solid line): 37 (20.787%) NA: 78 (43.820%) Overall sample (black solid line): 178

Region 2



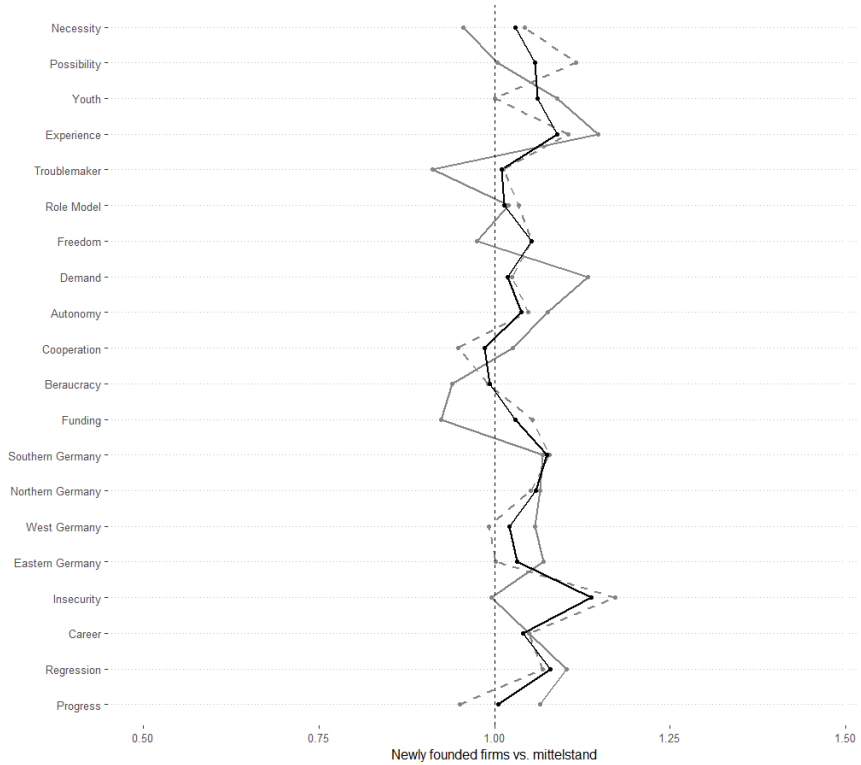


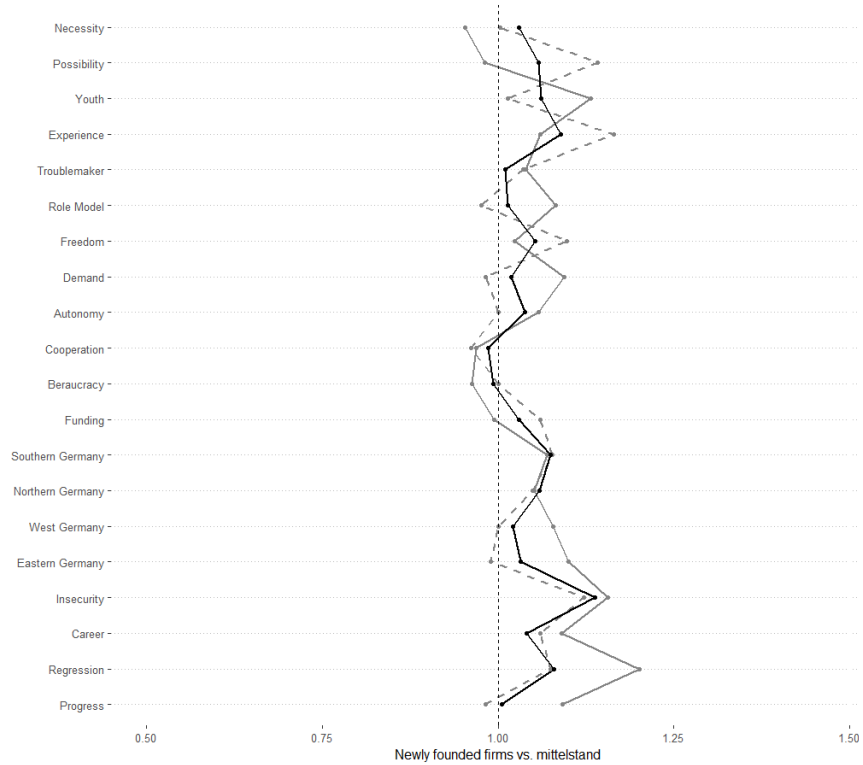
Opportunity recognition

No opportunity recognition (grey dashed line): 56 (31.285%)
Opportunity recognition (grey solid line): 45 (25.140%)
NA: 78 (43.575%)
Overall sample (black solid line): 179

No opportunity recognition (grey dashed line): 53 (29.609%)
Opportunity recognition (grey solid line): 45 (25.140%)
NA: 81 (45.251%)
Overall sample (black solid line): 179

Region 3





Opportunity recognition

No opportunity recognition (grey dashed line): 70 (39.548%)
Opportunity recognition (grey solid line): 31 (17.514%)
NA: 76 (42.938%)
Overall sample (black solid line): 177

No opportunity recognition (grey dashed line): 67 (37.853%)
Opportunity recognition (grey solid line): 31 (17.514%)
NA: 79 (44.633%)
Overall sample (black solid line): 177

6 Discussion and conclusion

In order to explain time-invariant geographical patterns of entrepreneurial activities, various factors were subject to investigation of former research. Personality traits of entrepreneurial inclined people and their distribution across regions, their social networks, the regional economic environment in which they are embedded in, and regional institutions, with particular attention paid to regional cultures, are of key interest in explaining geographical patterns. This study contributes to this discussion by considering the interplay of these factors to identify their relative importance for the most essential step in the entrepreneurial process – the recognition of business opportunities in the regional environment. Furthermore, this study distinguishes between general and innovative business opportunities because of their distinct influences on regional economies. A primary data collection was conducted via a representative survey in three regional groups selected by their long-standing pattern of entrepreneurial activities. Binary logistic regressions were applied to identify relations between region-individual interactions and the quantity of opportunity perception. A reaction time measurement uncovered implicit mental representations of entrepreneurship and, thus, the quality of opportunity perception. The following results can be drawn from the study.

First, binary logistic regressions reveal that embeddedness in the regional innovation system matters for the perception of regional business opportunities. Although there are differences between recognition of general and innovative business opportunities and their relation to regional embeddedness, it is noteworthy that the environment is important for the perception of both. Thus, this result contributes to the empirical evidence that the perception of the regional environment of respondents matters for their ability to perceive general and innovative business opportunities (Audretsch & Belitski, 2017).

In the case of recognising general business opportunities, all levels – actor, network, environment, and cultural – inhibit at least one variable with a significant relation to the recognition of general business opportunities. Regional culture is found to be of the highest relevance for general business opportunity perception. This result adds evidence to former findings (Riquelme, 2013).

In the case of innovative business opportunities, only the levels of environment and networks show significant relations to innovative opportunities' perception. This finding highlights that potential innovative entrepreneurs are less influenced by their environment when recognising opportunities. However, the results show a dependence on the social environment they are

embedded in, contradicting former considerations that the social context only plays a negligible role for these potential entrepreneurs in this stage of the entrepreneurial process (Cantner et al., 2017).

The observation that long-standing regional entrepreneurship cultures matter cannot be made for the case of innovative business opportunities. Rather, innovative companies present and perceived in a region have a strong signalling power and enhance the perception of more general business opportunities. Therefore, it seems more valuable to fund programs focusing more specifically on innovative entrepreneurial endeavours rather than following a one-size-fits-all approach, confirming former policy advice (Szerb et al., 2019). Furthermore, once innovative ventures are founded, the results support the assumption that these act as a pull factor for more entrepreneurial activities (Fritsch et al., 2019). Moreover, this effect is revealed to have a short-term impact if innovative companies are perceived and a long-term effect when established as a regional tradition. However, for this mechanism to work, it is insufficient to increase the numbers of innovative ventures and may not even be necessary, but the existing innovative companies need to be perceived. This corresponds to the notion that the presence of innovative entrepreneurial activities alone is not per se the panacea for economic growth but needs to be complemented by other circumstances (Gonzalez-Pernia et al., 2012). Hence, it could be beneficial to invest in awareness-increasing measures to increase the perception of innovative businesses in the region.

Second, the analysis of the mental representations of entrepreneurship found no evidence either for the existence of a distinct regional conception of entrepreneurship or for the existence of a shared conception of people that recognise business opportunities. This result contradicts expectations based upon former empirical evidence that long-standing patterns of entrepreneurial activities translate into distinctive associations and preferences in the context of entrepreneurial activities (Couttenier & Sangnier, 2015; Huggins & Thompson, 2020). However, the investigation of mental representations of people who perceive business opportunities compared to those who do not recognise any within the regional groups reveals that the mental representations are distinctive. This finding suggests that not the overall regional mental representation of entrepreneurship matters for distinctive regional entrepreneurial activities, but rather the pattern of people that perceive opportunities within these regions. Thus, the regional conception of entrepreneurship is not homogenous, and the conception of entrepreneurship of people that recognise business opportunities can diverge from the overall conception, which calls for a tailored investigation of these. A further result in this line is that the perception of innovative opportunities is related to mental

representations of entrepreneurship to a lower degree than in the case for general opportunity perception. Hence, regional mental representations of entrepreneurship differ for different kinds of opportunities.

Additionally, this study revealed that the total number of recognised general business opportunities and innovative business opportunities does not differ. This finding shows that the lower proportion of innovative new ventures is not linked to less perceived opportunities, but to specific regional settings. The Schumpeterian entrepreneur, thus, is not a rare case on the stage of opportunity recognition but turns into it during later stages of the entrepreneurial process, which leads to the assumption that potential innovative entrepreneurs are rare (Cantner et al., 2017). This result corresponds to the notion that no regional culture can be seen as superior to others (Hayton & Cacciotti, 2013) but that the broader regional framework is more likely to make a difference. One possible reason for this regional variation in innovative business opportunity realisation could be the presence of highly innovative environments and that in these not opportunity recognition but the ability to exploit opportunities drives the outcome of entrepreneurial activities (D'Este et al., 2012; Ferrero & Bessiere, 2016). Thus, the perception of innovative companies in the region simultaneously enables the perception of innovative business opportunities and puts up a barrier to entry for these ventures. Therefore, regions with low proportions of innovative new ventures may take this as a starting point to evaluate the support programs for these ventures in the early phase of their appearance and especially pay attention to entry barriers for new innovative ventures. This policy advice goes in line with the notion that policies should view entrepreneurial activities and their quality in light of the regional entrepreneurship ecosystem (Szerb et al., 2019).

Concluding from these results, two more general policy recommendations can be derived. First, this study highlights the importance of designing policies that support the whole entrepreneurial process and not only specific parts of it confirming the calls for a holistic policy approach to entrepreneurship (Audretsch & Belitski, 2017; Cantner et al., 2017; Garretsen et al., 2019). Rather than stimulating the number of new ventures, policy makers are required to concentrate on the interplay of entrepreneurial activities, their quality, and their regional embeddedness, strengthening the approach of 'place-sensitive' policies (Garretsen et al., 2019; Iammarino et al., 2017). Second, the regional mental representation of entrepreneurship is not deterministic for current and future entrepreneurial activities but can be steered (Feldman, 2014; Fritsch & Wyrwich, 2018; Huggins & Thompson, 2020). To prevent an uncontrolled intervention into regional mental representations, monitoring the regional mental representations offers the chance to steer these patterns in a targeted way via awareness

campaigns (Fritsch & Wyrwich, 2018; Huggins & Thompson, 2020). Although this task is long-term, its effects are potentially long-lasting and can transform a lagging region into an active entrepreneurial region (Fritsch & Wyrwich, 2018; Sorenson, 2017).

Nevertheless, the study has several limitations, paving the way for future research. First, the reaction time measurements are sensitive to low attention of respondents. Because the respondents' environment cannot be controlled in an online setting; this could have led to measurement errors of the reaction times. Thus, individual reaction times cannot be interpreted in the conducted design. Based on these considerations, the values of the reaction time measurements are only interpreted on group level. Second, the 5-point Likert scale transformation into a binary variable (recognition vs. no recognition of business opportunities) comes with a decrease in sample size available for the logistic regressions. However, this loss was not to be avoided to be able to compare the qualitative difference between perceiving and non-perceiving business opportunities. Third, this study is limited in its geographical scope. Future research may also explore the conceptions of entrepreneurship in regions that do not show a time-invariant pattern of entrepreneurial activities. Fourth, regional mental representations of entrepreneurship are likely to change gradually over time. Thus, it may be a valuable avenue for future research to track regional association profile changes and events related to these changes over time. Fifth, this study only covers a subset of characteristics of regional embeddedness; the reality is far more complex than can be reflected in the conducted analyses (Audretsch & Belitski, 2017). Future research may complement the variables of this study that describe other aspects of the entrepreneurial ecosystem. A further aspect in this line is that the embeddedness levels – actor, network, environment and cultural – are likely to interact with each other in complex ways. This study neglects this complexity for the sake of identifying main driving forces of regional opportunity perception, but future research may close this gap by applying machine learning methods that are capable of disentangling these complex interactions partially.

In a nutshell, this study addressed the two primary research questions by showing empirically a distinctive regional conception of entrepreneurship in the sub-group of people who perceive business opportunities. There is no evidence for a homogenous regional conception of entrepreneurship. Moreover, this study supports the importance of the interplay of individual and regional factors for the recognition of general and innovative business opportunities. However, the recognition of innovative business opportunities is less dependent on this interaction, but once converted into innovative companies, these act as a pull factor for general business opportunity perception.

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8 Appendix

Table 8.1: Overview of the distribution of the sample
Source: Own calculation based upon primary data collection

	High start-up rates & high proportion of innovative start-ups			**Low start-up rates generally & high proportion of innovative start-ups**			**Low start-up rates & low proportion of innovative start-ups**		
	Distribution in the region	# Respondents in the sample	Realised quotes	Distribution in the region	# Respondents in the sample	Realised quotes	Distribution in the region	# Respondents in the sample	Realised quotes
Male	54%	98	54%	54%	98	54%	52%	96	52%
Female	46%	85	46%	46%	85	46%	48%	88	48%
18-25	13%	24	13%	14%	27	15%	10%	19	10%
26-30	10%	17	9%	11%	18	10%	9%	16	9%
31-50	42%	75	41%	39%	72	39%	39%	71	39%
51-65	35%	67	37%	36%	66	36%	41%	78	42%
Without tertiary education	83%	151	83%	86%	157	86%	90%	166	90%
With tertiary education	17%	32	17%	14%	26	14%	10%	18	10%
Overall		183			183			184	

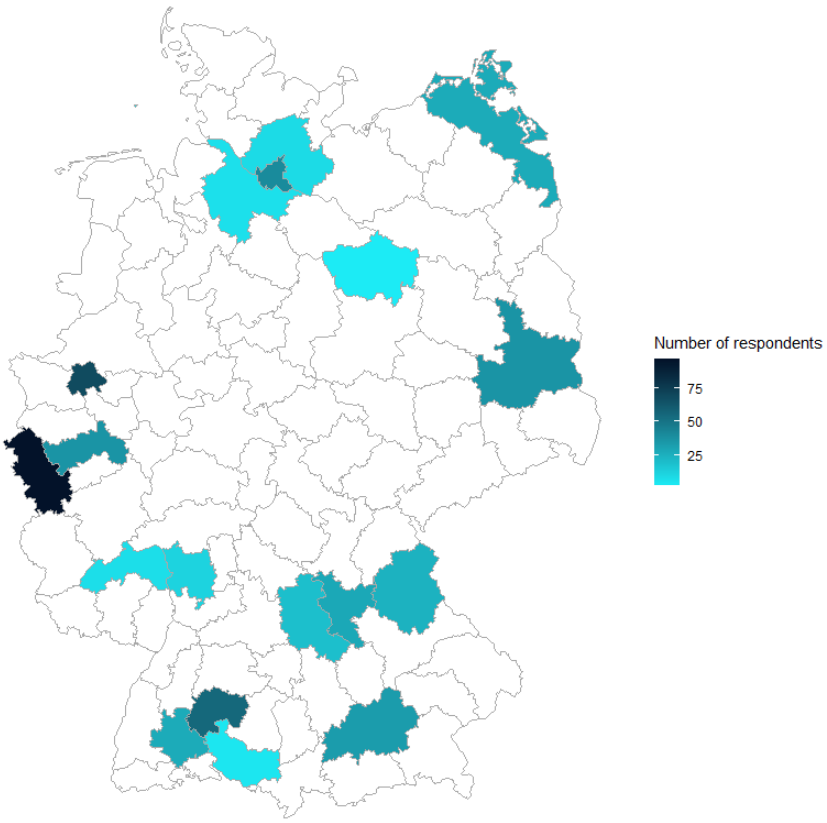

Figure 8.1: Distribution of survey respondents over Germany
Source: Own illustration based upon primary data collection

Table 8.2: Correlation matrix – reaction time measurements
Source: Own calculation based upon primary data collection

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**	**p**	**q**	**r**	**s**	**t**
Possibility (a)	1	-0.007	-0.049	0.01	0.083	0.024	0.053	0.073	-0.007	0.057	0.202	0.093	0.103	0.122	-0.019	-0.008	0.008	0.055	0.025	-0.004
Necessity (b)	-0.007	1	-0.005	0.008	-0.022	0.03	0.009	0.087	0.031	-0.135	0.156	0.025	0.061	-0.108	-0.05	0.106	0.026	0.036	0.07	0.042
Experience (c)	-0.049	-0.005	1	0.081	0.059	-0.023	-0.012	-0.12	-0.091	0.023	0.054	0.07	0.046	0.022	0.056	0.062	0.092	0.006	-0.002	-0.007
Youth (d)	0.01	0.008	0.081	1	-0.073	0.046	0.048	0.06	0.035	0.051	0.072	0.061	-0.039	0.024	-0.025	0.022	0.048	-0.031	0.054	0.018
Career (e)	0.083	-0.022	0.059	-0.073	1	-0.013	-0.048	-0.105	0.102	0.089	0.073	-0.036	-0.085	-0.048	0.144	-0.01	-0.06	-0.019	0.005	0.009
Insecurity (f)	0.024	0.03	-0.023	0.046	-0.013	1	0.042	-0.018	-0.001	0.115	0.023	0.144	-0.042	0.138	0.065	0.126	-0.044	-0.009	0.023	0.005
East Germany (g)	0.053	0.009	-0.012	0.048	-0.048	0.042	1	0.122	0.071	0.116	0.078	0.013	0.038	-0.038	0.047	-0.012	0.124	0.078	-0.009	-0.056
West Germany (h)	0.073	0.087	-0.12	0.06	-0.105	-0.018	0.122	1	0.135	0.004	0.043	0.016	0.007	0.126	-0.031	-0.02	-0.047	-0.027	-0.015	0.003
Northern Germany (i)	-0.007	0.031	-0.091	0.035	0.102	-0.001	0.071	0.135	1	0.116	0.054	-0.037	-0.04	0.027	0.001	-0.015	-0.019	0.196	0.037	0.014
Southern Germany (j)	0.057	-0.135	0.023	0.051	0.089	0.115	0.116	0.004	0.116	1	0.042	0.066	-0.049	0.077	0.095	0.099	0.175	0.031	-0.017	0.061
Progress (k)	0.202	0.156	0.054	0.072	0.073	0.023	0.078	0.043	0.054	0.042	1	0.068	0.11	0.095	0.146	-0.079	0.008	0.029	-0.028	-0.005
Regression (l)	0.093	0.025	0.07	0.061	-0.036	0.144	0.013	0.016	-0.037	0.066	0.068	1	0.064	0.113	-0.016	0.014	-0.01	-0.041	-0.001	0.032
Demand (m)	0.103	0.061	0.046	-0.039	-0.085	-0.042	0.038	0.007	-0.04	-0.049	0.11	0.064	1	-0.121	0.134	-0.05	-0.008	0.193	0.005	-0.161
Freedom (n)	0.122	-0.108	0.022	0.024	-0.048	0.138	-0.038	0.126	0.027	0.077	0.095	0.113	-0.121	1	0.022	0.043	0.102	-0.077	-0.051	0.001
Funding (o)	-0.019	-0.05	0.056	-0.025	0.144	0.065	0.047	-0.031	0.001	0.095	0.146	-0.016	0.134	0.022	1	0.059	-0.027	0.205	0.031	0.117
Bureaucracy (p)	-0.008	0.106	0.062	0.022	-0.01	0.126	-0.012	-0.02	-0.015	0.099	-0.079	0.014	-0.05	0.043	0.059	1	0.056	0.13	0.076	0.032
Cooperation (q)	0.008	0.026	0.092	0.048	-0.06	-0.044	0.124	-0.047	-0.019	0.175	0.008	-0.01	-0.008	0.102	-0.027	0.056	1	0.154	-0.086	0.034
Autonomy (r)	0.055	0.036	0.006	-0.031	-0.019	-0.009	0.078	-0.027	0.196	0.031	0.029	-0.041	0.193	-0.077	0.205	0.13	0.154	1	-0.077	0.102
Role model (s)	0.025	0.07	-0.002	0.054	0.005	0.023	-0.009	-0.015	0.037	-0.017	-0.028	-0.001	0.005	-0.051	0.031	0.076	-0.086	-0.077	1	-0.012
Trouble maker (t)	-0.004	0.042	-0.007	0.018	0.009	0.005	-0.056	0.003	0.014	0.061	-0.005	0.032	-0.161	0.001	0.117	0.032	0.034	0.102	-0.012	1

Table 8.3: Correlation matrix logistic regression variables – main variables
Source: Own calculation based upon primary data collection

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
Perception of general opportunities (a)	1	0.809	-0.081	0.019	-0.125	-0.041	-0.066	0.367	0.358	0.368	0.193	0.072	0.167	0.103	0.015
Perception of innovative opportunities (b)	0.809	1	-0.085	-0.056	-0.084	-0.096	-0.105	0.298	0.373	0.356	0.13	0.055	0.232	0.087	-0.008
Extraversion fit with region (c)	-0.081	-0.085	1	0.101	0.14	0.283	0.17	-0.067	-0.12	-0.014	-0.049	0.021	0.012	0.068	-0.03
Agreeableness fit with region (d)	0.019	-0.056	0.101	1	0.144	0.192	0.035	0.012	-0.126	0.03	-0.089	-0.06	-0.101	0	-0.046
Conscientiousness fit with region (e)	-0.125	-0.084	0.14	0.144	1	0.21	0.097	-0.017	-0.053	-0.039	-0.079	-0.1	-0.032	-0.007	-0.05
Neuroticism fit with region (f)	-0.041	-0.096	0.283	0.192	0.21	1	0.081	-0.091	-0.101	0.03	-0.092	-0.091	-0.042	0.002	0.014
Openness fit with region (g)	-0.066	-0.105	0.17	0.035	0.097	0.081	1	-0.047	0.005	0.028	-0.025	-0.025	0.014	-0.015	-0.101
Friends in the region (h)	0.367	0.298	-0.067	0.012	-0.017	-0.091	-0.047	1	0.443	0.481	0.15	0.068	0.159	-0.001	0.025
Family members in the region (i)	0.358	0.373	-0.12	-0.126	-0.053	-0.101	0.005	0.443	1	0.503	0.205	0.13	0.16	-0.01	-0.066
Colleagues in the region (j)	0.368	0.356	-0.014	0.03	-0.039	0.03	0.028	0.481	0.503	1	0.17	0.066	0.138	0.033	0.02
Start-ups (k)	0.193	0.13	-0.049	-0.089	-0.079	-0.092	-0.025	0.15	0.205	0.17	1	0.441	0.348	-0.032	-0.027
Innovative companies (l)	0.072	0.055	0.021	-0.06	-0.1	-0.091	-0.025	0.068	0.13	0.066	0.441	1	0.187	-0.123	-0.118
Innovative Start-ups (m)	0.167	0.232	0.012	-0.101	-0.032	-0.042	0.014	0.159	0.16	0.138	0.348	0.187	1	-0.063	-0.045
General entrepreneurship (n)	0.103	0.087	0.068	0	-0.007	0.002	-0.015	-0.001	-0.01	0.033	-0.032	-0.123	-0.063	1	0.501
Innovative entrepreneurship (o)	0.015	-0.008	-0.03	-0.046	-0.05	0.014	-0.101	0.025	-0.066	0.02	-0.027	-0.118	-0.045	0.501	1

Table 8.4: Correlation matrix logistic regression variables – control variables
Source: Own calculation based upon primary data collection

		p	**q**	**r**	**s**	**t**	**u**	**v**	**w**	**x**	**y**	**z**	**aa**	**ab**	**ac**	**ad**
Individual control variables	Period of residence (p)	1	-0.003	0.398	-0.067	-0.008	-0.013	0.009	-0.015	-0.036	-0.075	-0.066	0.063	0.065	0.004	-0.091
	Holding an university degree (q)	-0.003	1	0.017	0.019	0.132	0.015	-0.054	0.008	-0.024	-0.05	0.025	0.039	-0.018	0.008	-0.038
	Age (r)	0.398	0.017	1	0.004	0.127	-0.028	-0.024	0.103	0.132	-0.125	-0.033	0.112	-0.178	-0.088	-0.152
	Gender (s)	-0.067	0.019	0.004	1	-0.021	0.055	0.157	0.029	0.106	0.08	0.109	0.077	0.057	0.057	-0.076
	Self-employed (t)	-0.008	0.132	0.127	-0.021	1	-0.081	0.008	0.062	0.042	-0.091	0.077	0.014	-0.318	-0.154	-0.001
	Knowing an entrepreneur (u)	-0.013	0.015	-0.028	0.055	-0.081	1	-0.151	-0.025	-0.1	0.062	-0.153	0.24	0.196	0.202	-0.089
Personality control variables	Extraversion (v)	0.009	-0.054	-0.024	0.157	0.008	-0.151	1	0.045	0.216	-0.285	0.201	-0.123	-0.068	-0.109	0.203
	Agreeableness (w)	-0.015	0.008	0.103	0.029	0.062	-0.025	0.045	1	0.221	-0.099	0.053	-0.019	-0.013	-0.016	0.045
	Conscientiousness (x)	-0.036	-0.024	0.132	0.106	0.042	-0.1	0.216	0.221	1	-0.219	0.183	-0.03	-0.123	-0.073	0.085
	Neuroticism (y)	-0.075	-0.05	-0.125	0.08	-0.091	0.062	-0.285	-0.099	-0.219	1	-0.062	0.053	0.029	0.031	-0.073
	Openness to experience (z)	-0.066	0.025	-0.033	0.109	0.077	-0.153	0.201	0.053	0.183	-0.062	1	-0.104	-0.133	-0.071	0.057
Interest control variables	Attending events about start-ups (aa)	0.063	0.039	0.112	0.077	0.014	0.24	-0.123	-0.019	-0.03	0.053	-0.104	1	0.195	0.178	-0.227
	Experience with foundations (ab)	0.065	-0.018	-0.178	0.057	-0.318	0.196	-0.068	-0.013	-0.123	0.029	-0.133	0.195	1	0.394	-0.103
	Work experience in small and new firms (ac)	0.004	0.008	-0.088	0.057	-0.154	0.202	-0.109	-0.016	-0.073	0.031	-0.071	0.178	0.394	1	-0.155
	Watching TV shows about start-ups (ad)	-0.091	-0.038	-0.152	-0.076	-0.001	-0.089	0.203	0.045	0.085	-0.073	0.057	-0.227	-0.103	-0.155	1

Chapter 3

Do not Judge a Business Idea by its Cover: The Relation between Topics in Business Ideas and Incorporation Probability

Jessica Birkholz

Abstract

It is of key importance to identify the degree of novelty of business ideas in an early stage, so that targeted support of these different types of entrepreneurship is possible. Selection of business ideas for investments and support programs rely on quantitative and qualitative metrics. The qualitative assessment, however, is biased by subjective impressions and experiences of the decision-maker. Therefore, this paper examines the narrative of business idea descriptions to improve the estimations of the incorporation probability by advancing the objectivity of qualitative metrics. The paper aims to answer two questions: 1) Are there differences in topic prevalence in novel and non-novel business ideas?, and 2) How does the composition of topics related to a business idea influence its incorporation probability? Structural topic modelling and classification tree analysis are applied on business idea descriptions from a competition in Bremen, Germany, from 2003 until 2019. The results show that business idea descriptions are a rich source of information to identify both novel ideas and those with higher incorporation prospects.

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JEL classifications: O30; L26; O38

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1 Introduction

Entrepreneurship is widely acknowledged to be of key importance for economic development and tackling societal challenges. Thus, it is not surprising that the stimulation of entrepreneurship is on top of the agenda for policy makers. Assuming all entrepreneurial activities to be homogenous in their antecedents and effects on their environment, policy measures introduced to stimulate entrepreneurship follow a non-selective funding practice. The assumption that this funding practice leads to the best entrepreneurship outcomes is biased. Not all entrepreneurs contribute to economic development and the solution of societal challenges in the same proportion depending on their degree of novelty. Entrepreneurial activities with a high degree of novelty, as defined by Dahlqvist & Wiklund (2012), are characterised by affecting a great geographical area and a wide range of customers. Moreover, entrepreneurial activities with high and low degree of novelty are pursued based on different motivations and antecedents as well as the path to incorporation differs. Thus, a targeted stimulation of promising entrepreneurial activities is desirable to enable the maximisation of impact of different kinds of entrepreneurship.

Therefore, the challenge is to identify at an early stage the entrepreneurial activities that lead to novelty and successful incorporation (Minola et al., 2017). Investors concentrate in the first phase of screening of entrepreneurial business ideas on quantifiable metrics as the characteristics of the targeted market, the entrepreneurial team, and resources (Song et al., 2008; Rasmussen & Sorheim, 2012). In a second stage of this process investors rely on qualitative criteria to base their investment decision on, e.g. the presentation and communication of the business idea (McAdam & Marlow, 2011). This step is known to be highly influenced by subjective judgements of the investors (Drnovsek et al., 2018). This is why many authors call for more research to extent objective metrics in this process (Gundry et al., 2016; McAdam & Marlow, 2011; Meyskens & Carsrud, 2013; Pandey et al., 2017). Especially, this research call focusses on business ideas itself and a more diversified set of indicators to identify successful and novel ventures (McAdam & Marlow, 2011; Meyskens & Carsrud, 2013; Pandey et al., 2017; Pare et al., 2011).

The purpose of this study is to examine the relation between the narrative of novel and non-novel business ideas and the probability of a business idea turning into a new venture operating on the market, which will be referred to as the incorporation probability in the following. The narrative, the written description of a business idea, contains different topics (e.g. customer segment, main product). To fulfil the purpose of this study, data from a business

idea competition in Bremen, Germany in the time period from 2003 until 2019 is used. 247 text descriptions classified as novel business ideas and 182 text descriptions of non-novel business ideas were handed in to the competition. Machine learning techniques are applied to answer two questions: 1) Are there differences in topic prevalence in novel and non-novel business ideas? and 2) How does the composition of topics influence the incorporation probability? To answer these, structural topic modelling (Roberts et al., 2014) and classification tree analysis (James et al., 2013; Strobl et al., 2009) are employed.

The analyses yield four main results. First, differences in topic prevalences, the frequencies every topic appears in a text corpus, in novel business ideas and non-novel ones are identified. Topics connected to the products and key processes for revenue generation, intention and orientation type of the business occur in different frequency in novel and non-novel business ideas. Second, the interdependence of topics and their importance for incorporation probability differ depending on the degree of novelty of the business ideas. Third, novel entrepreneurship is not a homogeneous group of entrepreneurial activities. Besides technology entrepreneurship, there exists a hybrid entrepreneurship that combines the development of new technologies with social purposes. Fourth, the conventional wisdom that novel business ideas have lower incorporation rates due to higher risks or challenges, cannot be confirmed by this study. Rather, the data suggests that the incorporation probability depends on the structure and combination of topics. Even more, the topic structure of a business idea proves to be more important than traditional indicators like, for example, team size.

Besides these results, the study contributes in three more aspects. First, it delivers conclusions about the underexplored pre-foundation stage of entrepreneurial activities and a more detailed understanding of the differences between novel and non-novel business ideas. Second, the pre-foundational information is connected to incorporation probability rather than entrepreneurial intentions. This translates into an application-oriented approach, providing valuable insights for the design of targeted entrepreneurship policies. Moreover, early stage investors and managers of accelerators can apply these results and the methodological procedure for the selection of promising entrepreneurial projects in the screening phase. Third, it develops a strategy to gain insights about the incorporation potential directly out of non-numeric business idea descriptions. Traditional indicators do not – or only indirectly – measure this potential and profit from being complemented by this information.

The remainder of this paper is organised as follows: the next chapter discusses the theoretical background of the entrepreneurship stimulation policies and the propositions of this study are presented. In Chapter three the business idea competition data base for the analysis is described. The methodological approach taken by this study, consisting out of structural topic modelling and classification tree analysis, is outlined in Chapter four. The empirical findings are presented in Chapter five. The paper entails a discussion of the results in Chapter six and concludes in Chapter seven.

2 State of the art

2.1 The problem of non-selective support of entrepreneurship

There is good reason to support entrepreneurial activities. Entrepreneurs often take on issues that the government cannot tackle and open new development paths to counteract societal and environmental challenges. However, a non-targeted support of entrepreneurial activities neglect the heterogeneity of their impact. The differentiation of entrepreneurship into two types is found by former research to be especially distinct in their dynamics – novel and non-novel entrepreneurship endeavours. The first type of entrepreneurial activities provides services or products with a high degree of novelty which may translate into innovations. Entrepreneurial opportunities that are characterised by the possibility to provide new services and products to a broad geographical area and to a broad range of customer groups build the basis for this type of entrepreneurial activities (Dahlqvist & Wiklund, 2012). The second type of entrepreneurial activities is characterised by a lower degree of novelty and makes use of arbitrage possibilities, relying on the mobilisation of resources (Dahlqvist & Wiklund, 2012).

Advancements in economic development stem from highly innovative and technology based entrepreneurial endeavours and cannot be attributed to non-novel new ventures (Autio & Yli-Renko, 1998; Shane, 2009). Two dynamics lead to this phenomenon. First, evidence suggests that most new ventures try to gain access to an existing market with already existing products and services entering competitive industries with high failure rates (Hurst & Pugsley, 2011; Johnson, 2004; Shane, 2009). This is also reflected in current findings on the German case that highlight that economic aspirations like increased income, which is a driving force for profitability and growth of ventures play only a minor role in motivating potential entrepreneurs (Sternberg et al., 2020). This lack of economic aspirations is correlated with a lower probability that business ideas are turned into new ventures (Hossinger et al. 2021). Second, the typical new venture does not innovate by any measurable margin (Hurst &

Pugsley, 2011). Although a large share of innovative activities are done by small businesses, it is not the case that the typical new and small venture is innovative (Hurst & Pugsley, 2011).

Because in Germany only 10.3% of all entrepreneurial projects can be classified as innovative (Sternberg et al., 2020)[18], the approach of a non-selective funding practice of entrepreneurial activities has a main difficulty: The goal of many policy measures to stimulate as many entrepreneurial activities as possible is unlikely to contribute to economic development (Shane, 2009). Especially initiatives for supporting academic entrepreneurship are characterised by conflicting goals, leading to a non-selective funding practice (Sandström et al., 2018). This implies, that the evaluation of the effectiveness of these programs is hardly possible and the consultation is not tailored to the specific needs of the entrepreneurial endeavours (Rasmussen & Wright, 2015; Sandström et al., 2018).

The distinction of entrepreneurial activities depending on their degree of novelty, enables support programs to aim at either opening new economic development paths or to tackle societal challenges by mobilising resources. However, designing targeted policies that focus on providing support in the beginning of the entrepreneurial process causes two issues. First, business ideas have to be classified depending on their degree of novelty and, second, out of these ideas those with higher incorporation prospects need to be identified.

2.2 Decision-making processes to select business ideas

Entrepreneurial opportunities that are characterised by a high degree of novelty, imply that the possible return on investment is likely to be high, because an entrepreneur that acts upon this possibility is addressing a broad scope of geographical areas and customer groups (Dahlqvist & Wiklund, 2012). Thus, it is suspected that business ideas in this vein are of key interest for investors, although the uncertainties connected to novel business ideas are considerable caused by the need of investments prior to market entry (McAdam & Marlow, 2011). Based on this consideration the principles of the decision-making process of investors can guide public support programs of entrepreneurship that similarly aim to identify these kind of business ideas.

Investment decisions are usually made in two main steps that focus on different criteria the business ideas have to fulfil to pass (Rasmussen & Sorheim, 2012; Minola et al., 2017). The first stage of the decision-making process is the screening of many proposals to identify those that deserve further consideration (Minola et al., 2017; Tyebjee & Bruno, 1984; Zacharakis & Meyer,

[18] An entrepreneurial project is defined as innovative when it aims at sectors with middle to high technology intensity (Sternberg et al., 2020).

2000). This procedure focusses on quantifiable criteria as for example the sustainability and the growth potential of a business idea (McAdam & Marlow, 2011). There is extensive research on which, mostly quantifiable, factors investors base their investment decision on. Factors classified in the categories related to the market, to the product, to the managerial competences of the entrepreneurial team, external barriers, resource capacities, competitive strategies, the characteristics of customers, and financial characteristics of the venture or more specifically the potential revenue of the investment are listed in former studies (Pare et al., 2011). Song et al. (2008) comprised these factors in a meta-analysis to the categories market and opportunity, entrepreneurial team, and resources.

The second stage of the decision-making process relies on qualitative criteria as for example the vision of the entrepreneur, to convey the essence of the business opportunity (McAdam & Marlow, 2011), preparedness of the entrepreneurs (Chen et al., 2009; Rasmussen & Sorheim, 2012), a promotion focus and perceived feasibility of the business idea (Drnovsek et al., 2018). Intangible assets in regard to communication are of crucial importance for the success of a business idea in this second stage of the process, especially because entrepreneurs at this early stage typically cannot refer to a convincing track record of achievements (Rasmussen & Sorheim, 2012; van Werven et al., 2019). However, the effect of the communication of the same business idea can vary depending on the fit between investors and entrepreneurs (Cox et al., 2017) and the cognitive schema that govern the attention and information evaluation of the investors (Drnovsek et al., 2018). Hence, the decision-making process in which business ideas are evaluated is characterised by a large degree of subjectivity.

As the screening and reviewing of business ideas is known to be a time-consuming task, former studies aimed at reducing the effort needed to perform this procedure by automatising it (Minola et al,. 2017; Zacharakis & Meyer, 2000; Roure & Keeley, 1990). Actuarial models not only reduce the time needed to identify promising business ideas, but also overcome the subjectivity of human assessment by weighting all information cues equally whereas experts are biased by their cognitive schema and experiences (Zacharakis & Meyer, 2000). Moreover, these models are shown to often outperform experts in the fields of bank lending and psychological evaluations (Zacharakis & Meyer, 2000). It is assumed that this is also relevant for the case of highly novel entrepreneurial projects because these are more difficult to communicate and the estimation of their potential depends more on subjective evaluations, thus, information asymmetries are still a burden to access external funding (Proksch et al., 2017). Although this approach of actuarial models is not new, one part of business idea descriptions was neglected in former models – a factor for success or failure of business ideas

– their narrative (McAdam & Marlow, 2011; Rasmussen & Sorheim, 2012). An incorporation of the narratives of business ideas into an actuarial model provides the benefit that the qualitative assessment of business ideas can be complemented by an unbiased model that enable experts and investors to classify the idea more objectively as novel or non-novel and estimate their incorporation prospects and, thus, opens the way for more efficient targeted entrepreneurship support.

2.3 Importance of business idea narratives

Business idea descriptions provide a rich resource for information in early phases of the entrepreneurial process (Pare et al., 2011). New venture ideas, as defined by Davidsson (2015), are imagined future ventures. Related to this, Vogel (2017) defines venture concepts as the nascent stage of a business model and a vague understanding of its components. Thus, a business idea can be defined as a description of new venture ideas and concepts of how this imagined business works and how revenue is generated (Klofsten, 2005). Thus, it is very closely related to the vision of the entrepreneur and mission statements of organisations, which play a central role in organisational strategy (Kirk & Nolan, 2010; Pandey et al., 2017), stakeholder perceptions (Pandey et al., 2017), and activities and ideology of the organisation (Fox, 2006; Pandey et al., 2017). Thus, business ideas and their narratives provide information, which is likely to lay the foundation for subsequent developments and performance of the incorporation (Davidsson, 2015; O'Connor, 2002; Pandey et al., 2017; Pare et al., 2011; Vogel, 2017).

A combination of business idea characteristics and the observation if the business idea is incorporated to a later point in time, provides application-oriented results for designing early entrepreneurship funding programs by enabling the identification of business ideas with higher prospects (Chattopadhyay & Ghosh, 2008). Although the business idea may be subject to change over time, entrepreneurs have to consider the relational and temporal commitments related to the initial business idea, thus, changing the core concept comes with restrictions (Berends et al., 2021). Despite the key importance of the narratives of business ideas, studies on these are rare. Thus, this study has two purposes. The first aims to identify differences in the narrative between novel and non-novel business ideas. The second purpose is dealing with the influence the narrative structure has on the incorporation probability of business ideas.

2.3.1 Differences between novel and non-novel business ideas in regard to prevalent topics

To be able to make use of the business idea narrative as an unbiased indicator for novel ideas, it is of key importance to identify topics, i.e. subparts of the narrative, within the business ideas

which allow a distinction between novel and non-novel business ideas. Former research finds evidence for differences between entrepreneurial projects with high and low novelty in entrepreneur´s characteristics like balanced skill set (Stuetzer et al., 2013), industry experiences (Friar & Meyer, 2003) and mindset (Klofsten, 2005). Furthermore, venture´s characteristics like team size (Friar & Meyer, 2003) and cooperation with external partners (Munoz-Bullon et al., 2015) are found to differ. These findings lead to the assumption that novel and non-novel business ideas aim to enter different industries, markets and have different customer groups which is connected to the underlying entrepreneurial opportunity structure (Dahlqvist & Wiklund, 2012). Thus, the assumption is that there are topics central to novel business ideas, which play only a minor role in non-novel business ideas and vice versa. This is likely to translate into different topic proportions, i.e. the narrative, in the business ideas. In addition, it can be argued that topics are combined with each other in a different manner in novel or non-novel business ideas. Therefore, it is suspected that the relations between topics differ with the degree of novelty of the business ideas. Thus, two proposition are formulated as follows:

Proposition 1: There are differences between topic proportions in novel and non-novel business ideas.

Proposition 2: Correlations between topics associated with novel and non-novel business ideas differ.

2.3.2 Relation of topics and incorporation probability of business ideas

The second unanswered issue, related to the design of targeted support programs for entrepreneurship types, is the relevance of each topic to the incorporation probability of the business idea in each of these types (McAdam & Marlow, 2011; Meyskens & Carsrud, 2013; Pandey et al., 2017).

As the enactment of novel entrepreneurial opportunities is often connected to high-technology or growing industries and a broader spectrum of customers that are addressed than it is the case for non-novel endeavours (Dahlqvist & Wiklund, 2012), it is hypothesised that these activities require different behaviours and visions of the entrepreneurs to be successfully incorporated. This is underlined by theoretical considerations made by Schumpeter (1934) and Kirzner (1973). The innovative entrepreneur described by Schumpeter (1934) is characterised by specific personality traits and attitudes that enable the entrepreneur to go against the odds and break with routines. In contrast to this, the non-innovative entrepreneur as described by Kirzner (1973) is interpreted as an individual attentive to its environment and mobilising resources to use arbitrage possibilities. This highlights that the entrepreneurial activities as well as the actors pursuing those, differ depending on the degree of novelty, implying that the

mechanisms of incorporation differ as well. Although widely acknowledged that there is not a one-size-fits-all solution to transform a business idea into a new venture, it remains unclear which narratives serve as determinants of incorporation probability of business ideas of the two types. Successfully incorporated business ideas are hypothesised to be able to provide insights about which narratives correspond to an existing opportunity that the entrepreneurial project acted upon (Vogel, 2017). Thus, two propositions are stated as follows:

Proposition 3: The combination of topics influence the incorporation probability of business ideas.

Proposition 4: The determinant topics for the incorporation probability differ for novel and non-novel business ideas.

3 Data

This paper makes use of data gathered by 'BRIDGE', which provides consultation for anyone interested in business foundation coming from the academic environment of Bremen and Bremerhaven. 'BRIDGE' offers individual or team coaching as well as workshop series. Once a year, they organise a business idea competition called 'CampusIdeen'. This event is taking place since 2003 continuing until 2019. Submissions to this event contain a detailed description of business ideas along guiding questions provided by 'BRIDGE'. This text data offers a description of ideas before their incorporation and therefore offers rarely existing pre-foundation information. The submitted business ideas are evaluated by an expert jury that consist of members of the entrepreneurial ecosystem in Bremen and Bremerhaven. A jury of six to eight experts is staffed with members of the tertiary institutions involved in the 'BRIDGE' network[19], members of the chamber of commerce and companies that sponsored the competition that also act as investors. Long-standing cooperation between these partners facilitated a stable composition of actors of the local entrepreneurship ecosystem in the expert jury. The jury was instructed to evaluate the business idea submission based on a questionnaire, including aspects as novelty and creativity of the business idea, the conclusiveness of the idea, the degree of a realistic implementation, and the economic potential of the idea. These aspects were surveyed in all years under investigation in a consistent

[19] These tertiary institutions include the University of Bremen, the City University of Applied Sciences Bremen, the University of Applied Sciences in Bremerhaven and the Jacobs University Bremen. Jury members from these institutions were professors in the field of entrepreneurship or deputy rectors. Moreover, the Bremer Aufbau-Bank is member of the 'BRIDGE' network.

manner.[20] The consistent design of the competition and its long-time of existence favour building a coherent data base for further analysis based on submissions.

3.1 Data preparation

The texts submitted to the 'CampusIdeen' competition were filtered in a four-step procedure. First, the submissions were checked manually to ensure only serious and complete submissions are considered in the analysis.[21] In addition, multiple submissions of an idea of the same entrepreneur in multiple years were deleted from the data set, keeping only the first handed in. Second, Curriculum Vitaes were removed from the submission texts since the structure of these cannot be compared to continuous text and, therefore, may bias the results. To avoid overrepresentation of words and formulations appearing in the submission form of 'BRIDGE', guiding questions as well as headlines were removed from the submission texts. Third, stop words, i.e. words delivering no meaning, are removed. To do so, the ISO stop word list of the German language was applied. The remaining text data was lemmatised. Words classified as adposition, auxiliary, coordinating conjunction, determiner, numeral, particles, pronouns, subordinating conjunction, adverb, interjection and auxiliary verbs[22] were added to the list of stop words.[23] Fourth, words appearing in over 90% of the submissions and words appearing in less than 10% of the business ideas are removed, because otherwise these could bias the results of the topic model (Birkholz et al., 2021). The retrieved unigrams build the basis for the subsequent topic model.[24]

Table 3.1 shows the mean and median number of words per submission differentiated by their degree of novelty. These indicate longer submission texts for novel business ideas than for non-novel ones. The similarity of the standard deviation in both cases suggests that the difference in submission length is not caused by greater variety of word usage. More submissions are classified as novel which results in a proportionally higher number of total words considered.

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[20] The quantitative scale used to measure the fulfilment of these criteria were consistently surveyed by using a 5-point Likert scale. Regarding the wording of the criteria, only in the case of novelty and creativity of the business idea changed slightly. In the years 2005 until 2008 this criterion was surveyed by referring to the novelty of the concept and from 2009 onwards this was extended by creativity of the concept. Other criteria that changed across these years in their quantitative assessment (changes in the scale) and, thus, were not considered for analysis.

[21] A submission is not considered serious, when the text consists of less than half a page and not all questions in the submission form are answered.

[22] Including modal verbs as subgroup of auxiliary verbs.

[23] Since lemmatisation for the German language is not entirely classifying words in a correct manner, these words were checked manually.

[24] The alternative use of n-grams would come with the risk to create artificial word combinations resulting from removing stop words from the text corpus. Moreover, bigrams and unigrams appear to be highly correlated to each other in former research, meaning that the use of bigrams does not provide a substantial improvement compared to the conservative approach to make use of unigrams (Braga et al., 2009).

Table 3.1: Descriptive statistics of the text descriptions based on the submitted business ideas
Source: Calculation based on business ideas submitted to 'CampusIdeen' competition from 2005-2019 with a jury rating of novelty with higher than average score (novel business ideas) and lower than average score (non-novel business ideas)

	Novel business ideas	**Non-novel business ideas**
Mean count of words per submission	746.324	699.467
Median count of words per submission	708	658
Standard deviation of the word count per submission	434.014	435.653
Sum of words over all submissions	184,342	127,303
Number of submissions	247	182

3.2 Degree of novelty of business ideas

Submissions from 2005 onward are rated by an expert jury evaluating their degree of novelty. This rating serves as a basis to classify the submissions. A rating above average in newness is interpreted as novel and a rating below average in this criterion is associated with non-novel business ideas.[25]

Figure 3.1 illustrates the number of submissions to the competition, separated in novel and non-novel, in each year and for each team size. No clear time trend in the number of submissions, or their degree of novelty is evident.[26] The vast majority of submissions are handed in by individuals and teams of two. In neither of these two graphics a year or a specific team size is associated with especially high or low shares of novel ideas.

[25] The submissions were rated on a 5-point-Likert scale from one or more jury members. The arithmetic mean of all available jury ratings was used in case of more than one evaluation. The mean value (2.95 on the Likert-scale) across all submissions in all years was used to classify the business idea submissions as above or below average novel. The alternative to use the median value (3 on the Likert-scale) to split the data set into novel and non-novel business ideas is not taken into consideration here, because this approach would lead to the loss of 88 business ideas that have an evaluation equal to the median value. Thus, an assignment to one group (novel or non-novel) is for these business ideas not possible. However, when the analyses of Chapter 5.2, 5.3, and 5.4 are conducted with the median split sample, only slight changes in the results are evident, showing the robustness of the findings. The results of the robustness checks are available upon request.

[26] The NAs in the Figure 3.1 correspond to missing data on the rating of novelty. Since all submissions can be used in the first analysis step, independently of the availability of the rating of the novelty, these data points are also displayed in the figures.

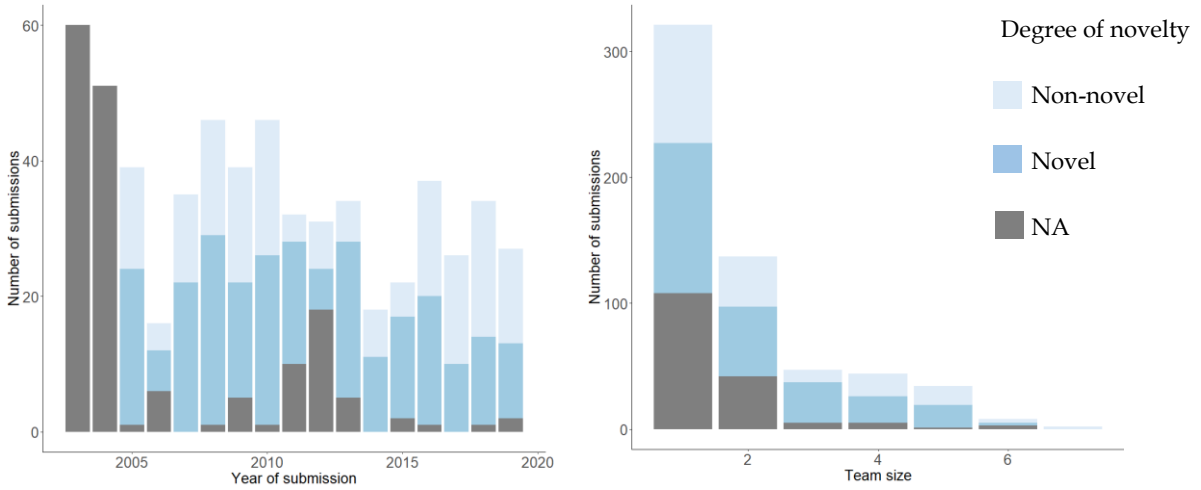


Figure 3.1: Number of novel and non-novel submissions to the business idea competition per year (left figure) and per team size (right figure)
Source: 'CampusIdeen' competition submissions 2003-2019

3.3 Incorporation probability of business ideas

Whether a business idea came into existence or not is retrieved by manually checking company websites, social media profiles of the entrepreneurs and information the transfer office had. The data collection was done in September 2020, which corresponds to one year after the last business idea competition.[27] The incorporation rate is 24% in the case of non-novel business ideas and 27% in the case of novel ones.

4 Methodological approach

In order to test the propositions, a four-step analytical procedure is applied. The research design proceeds after the data filtering process with structural topic modelling to reveal latent topics in business ideas. Since the topic modelling approach does not require information about the degree of novelty, all submission texts, amounting to 593 documents with a total of 400,854 words, are utilised for this step. In a second step, novel and non-novel business ideas are compared to identify differences in topic proportions. As this step requires complete information about the meta-data of a business idea, due to incompleteness of submission data, in total 429 documents can be considered. Third, the correlations between the topics are analysed to reveal the topic compositions of novel and non-novel business ideas. The data used for this step is equivalent to the former step. Fourth, the results of the topic model are employed to estimate two classification trees – one explaining the foundation success of novel ideas and one explaining the foundation success of non-novel ideas. This last step makes usage

[27] The timeframe of one year is chosen because it becomes unlikely for a business to be founded after this period (Capelleras & Greene, 2008; Carter et al., 1996).

of meta-data of the business ideas similarly as in the second and third step, thus again 429 documents can be analysed.

4.1 Topic modelling

Topic modelling as an unsupervised machine learning technique, makes identification of thematic structures in text data possible without the need of human assessment and thus is able to generate text classifications un-influenced by individual researchers (Lee & Kang, 2018; Storopoli, 2019). Due to the rising importance of text data, topic modelling is applied in economic analyses. For example Ambrosino et al. (2018) applied topic modelling to uncover topics discussed in economic scientific literature and illustrated the development of the discipline over time. A similar methodological approach was used by Lee and Kang (2018) to identify topics in the field of technology and innovation management studies. Other than using the topic modelling approach to examine the scientific literature, Arora et al. (2020) analysed website data to examine dynamic capabilities of new ventures. Moreover, this analytical approach is transferable for the analysis of open ended survey questions as shown by Roberts et al. (2014).

Latent Dirichlet Allocation (LDA) is one of the most common algorithms to perform topic modelling and was introduced by Blei, Ng and Jordan in 2003. The procedure is based on the co-occurrence of words in documents without taking grammatical structures into account. If two words are co-occurring together more often than they would in a random collocation of words, the probability based algorithms evaluate these words as connected to each other (Birkholz et al., 2021). This approach is extended by Roberts et al. (2014) to structural topic modelling (STM). In contrast to the LDA algorithm, the STM procedure enables an incorporation of meta-data of the analysed documents.

For the creation of the topic model, this paper controls for two aspects. First, the year of submission is taken into account. It is reasonable to assume that specific topics are driven by trends. For example, business ideas in context of the development of apps may be rare in earlier years of the competition, growing in importance only in the latest years. The prevalence of such a topic is not especially insightful since it depends more on the technological progress coming along with the years rather than a shift in entrepreneur's minds. Second, the team size is considered when creating the topic model. Business ideas written by a bigger team, are likely to describe the synergies between team members and their individual qualifications more extensively than individually written submissions.

Although topic modelling does not rely on many a priori defined indicators, it is necessary to determine a suitable number of topics. Following the advice of Chang et al. (2009), semantic coherence and exclusivity[28] are considered to determine an appropriate number of topics. Figure 4.1 shows the indicators over a range of number of topics.[29] Both plots show a salient point around ten topics. Plotting the semantic coherence and exclusivity of each topic in each topic model against each other is applied to identify the topic model with high exclusivity and high semantic coherence, which is considered to be ideal (Chang et al., 2009). The topic model containing eight topics fulfils this to the largest extent.[30]

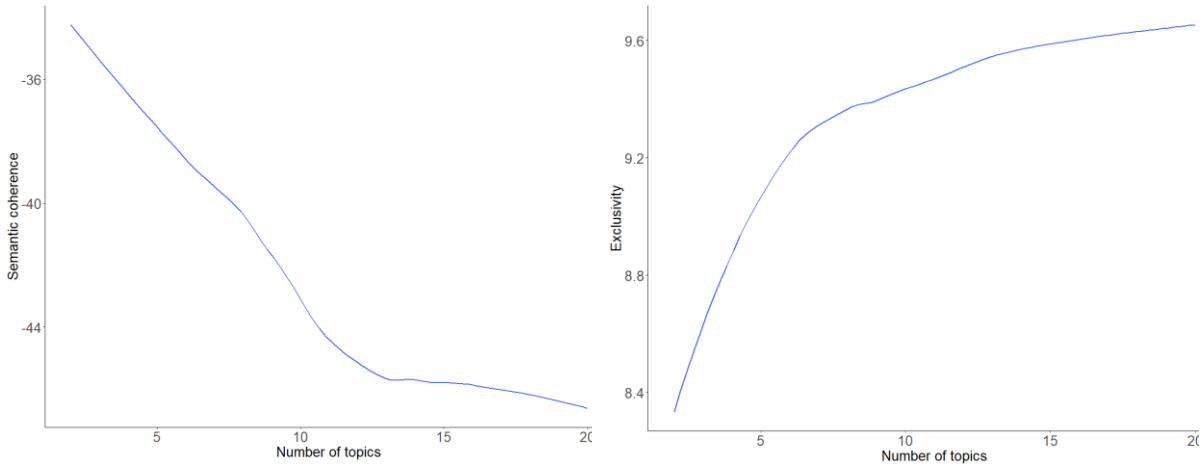


Figure 4.1: Semantic coherence (left figure) and exclusivity (right figure) per number of topics
Source: Own calculation

In order to validate the first and the second proposition, topic proportions within novel business ideas are compared to these in non-novel ones. Welch´s two sample t-tests (Welch, 1947) are applied to identify significant differences in proportions. In a second step, correlation networks are calculated to reveal the topic structures of novel and non-novel business ideas.

4.2 Classification tree analysis

The eight topics identified by the former analytical step, are implemented in the estimation of classification trees to retrieve their impact on the incorporation probability of business ideas. Every business idea has a probability to contain a topic. For example a business idea can have a 0.10 expected share of topic 1, 0.25 expected share of topic 2, and so on amounting over all

[28] Semantic coherence reflects if a human being would divide the topics in a similar way and exclusivity expresses the uniqueness of the words a topic consist of (Silge 2018; Chang et al. 2009).
[29] A range from two up to twenty topics were considered. More topics than that did not seem to be appropriate in light of the sample size of 593 business ideas. Furthermore, the trend in the Figure 2 appears to show a clear trend, thus the inclusion of more topics would lead to the same result.
[30] The topic models refer to the Pareto optimal one out of 50 runs as incorporated by the R package 'stm', function 'manyTopics'. See Figure 9.1 in the appendix for the distribution of the topics over the documents, Table 9.1 for the correlation of topics in their occurrence and the similarity of topics measured by the cosine index.

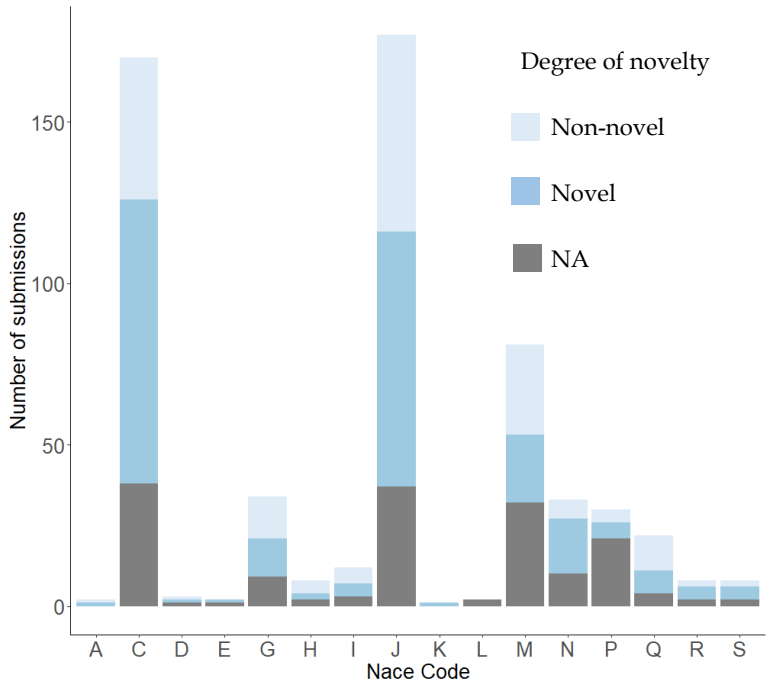
topics to 1. These data points are now merged with meta-data of the business idea to obtain a full data set. In order to validate the third and fourth proposition, one classification tree is estimated for the subset of novel business ideas and one classification tree for the subset of non-novel ideas.[31]

Logistic and probabilistic regression models have a shortcoming. The result of these models allows the reader to identify the factors with the biggest influence on the outcome, but it does not reflect human decision making in an easily transferable manner and, thus, does not clearly lead to advice on policy design (James et al., 2013; Strobl et al., 2009). Classification trees are an approach to address this issue. By dividing the predictor space into non-overlapping regions guided by the classification error rate, the classification tree approach aims at the identification of combinations of factors leading in this study to a prediction of incorporation or no incorporation of business ideas with this combination (Milanovic Glavan et al., 2015). Additionally, classification trees are able to handle qualitative predictors without the requirement of dummy variables. Because of these characteristics of classification trees, this approach was applied to identify turning points in business process orientation (Milanovic Glavan et al., 2015) and to estimate the economic success of an entrepreneur (Chattopadhyay & Ghosh, 2008).

4.2.1 Control variables

To reveal the relationship between topics and incorporation probability, control variables describing the industrial environment are included. The distribution of the business idea submissions over the 'Nomenclature générale des Activités économiques dans les Communautés Européennes' (NACE) classification of industries is given in Figure 4.2. The most prominent domains are manufacturing (C), and information and communication (J).

[31] Please see Table 9.2 and Table 9.3 in the appendix for the correlation matrices of all variables considered in the analyses.



Legend of NACE Codes

(A) Agriculture, forestry and fishing
(C) Manufacturing
(D) Electricity, gas, steam and air conditioning supply
(E) Water supply; sewerage, waste management and remediation activities
(G) Wholesale and retail trade; repair of motor vehicles and motorcycles
(H) Transportation and storage
(I) Accommodation and food service activities
(J) Information and communication
(K) Financial and insurance activities
(L) Real estate activities
(M) Professional, scientific and technical activities
(N) Administrative and support service activities
(P) Education
(Q) Human health and social work activities
(R) Arts, entertainment and recreation
(S) Other service activities

Figure 4.2: Distribution of business ideas over industry classifications (NACE)
Note: The industry classification is assigned to the business ideas with manual evaluation of each submission text
Source: 'CampusIdeen' competition submissions 2005-2019

A further set of control variables are jury ratings describing the quality of the business ideas. The data shows that novel business ideas reach higher mean scores in conclusiveness, realistic implementation, and economic potential than the non-novel business ideas, as shown in Table 4.1. Furthermore, the variety in novel business ideas is higher reflected by the higher standard deviations in all variables.

Table 4.1: Descriptive statistics of jury ratings of business ideas
Source: 'CampusIdeen' competition submissions 2005-2019

Statistic	**N**	**Mean**	**St. Dev.**	**Min**	**Pctl (25)**	**Pctl (75)**	**Max**
Non-novel business ideas							
Conclusiveness	182	2.363	0.835	1	2	3	4.5
Realistic Implementation	182	2.565	0.924	1	2	3	5
Economic Potential	182	2.052	0.736	1	1.5	2.5	4
Novel business ideas							
Conclusiveness	247	2.963	0.924	1	2.3	3.5	5
Realistic Implementation	247	2.991	0.937	1	2.3	3.7	5
Economic Potential	247	2.694	0.877	1	2	3.1	5

5 Results

5.1 Identification of latent topic structures in business ideas

Table 5.1 illustrates the result of the topic model. Topic 3 has the highest expected share in the overall text corpus of 20%. With roughly 8% share of the overall text corpus, Topic 1 is the least appearing topic. The most common words per topic and illustrative text excerpts[32] are the basis for the topic labels, which describe the main theme of the business ideas.

The result shows that the topics are meaningful and very distinct from each other, which speaks for the previous consideration for coherence and exclusivity. The topic 'Development of technical devices and software' reflect the description of the creation of a prototype of devices or software solutions (e.g. 'software', 'device', 'development'). 'Consultancy for individuals' is thematically concentrated on the labour market and individual qualifications (e.g. 'labour', 'university', 'possibilities'). 'Customer orientation' focuses on customer needs and market niches in B2C (Business-to-Consumer) markets (e.g. 'product', 'customer', 'target group'). The topic 'Social entrepreneurship' describes local projects with societal impact (e.g. 'project', 'children', 'location'). 'Process development' deals with supportive consultancy services for process development for firms (e.g. 'development', 'demand', 'service'). 'Business consultancy' aims at activities to provide firms with consultancy in various departments (e.g. 'company', 'euro', 'market'). 'Project orientation' are descriptions focussing on planning and execution of projects as a service not restricted to any domain (e.g. 'implementation', 'creation', 'service'). The topic 'Social media platforms' deals with the exchange of different types of media with new or existing social contacts (e.g. 'app', 'platform', 'media').

The topics can be clustered into three categories: First, *products and key processes for revenue generation,* which the idea builds upon, are represented. This is especially evident for the topics 'Development of technical devices and software', 'Consultancy for individuals', 'Process development', 'Business consultancy' and 'Social media platforms'. Second, the *orientation type of a business* describing the way the entrepreneurs approach the market, are covered with the topics 'Customer orientation' and 'Project orientation'. Business ideas with a higher share of the topic 'Customer orientation' rely on knowledge about their customers to align the business with the demands to provide value. 'Project orientation', on the other hand, is informed by an iterative process of business development through the acquisition of projects. Third, the topics not only reflect the main focus of the business ideas, but also hint at the *intention* of the

[32] The text excerpts cannot be shown here due to confidentiality of the data.

entrepreneurs. This is especially present in the case of the topic 'Social entrepreneurship', showing a focus on societal impact of the activities.

Table 5.1: Topics identified by structural topic modelling analysis based on all business idea submissions
Source: Own calculation

Topic cluster	**Topic Label**	**Expected topic share**	**Most common 10 terms (English translation and *German word stems*)**
Products and key processes for revenue generation	Development of technical devices and software (Topic 3)	20.1%	product, system, software, figure, device, market, simple, idea, existing, development *produkt, system, softwar, abbildung, geraet, markt, einfach, ide, besteht, entwicklung*
Products and key processes for revenue generation	Consultancy for individuals (Topic 2)	14.4%	bremen, offer, students, work, city, bremish, university, possibilities, working, offered *bremen, angebot, studenten, arbeit, stadt, bremer, universitaet, moeglichkeiten, arbeiten, angeboten*
Orientation type of a business	Customer orientation (Topic 6)	13.9%	product, customers, Germany, target group, design, customer, online, important, competition, offer *produkt, kunden, deutschland, zielgrupp, design, kund, onlin, wichtig, konkurrenz, angebot*
Intention	Social entrepreneurship (Topic 8)	12.2%	idea, project, concept, children, find, interest, theme, contact, providing, location *ide, projekt, konzept, kinder, finden, interess, thema, kontakt, bietet, ort*
Products and key processes for revenue generation	Process development (Topic 7)	11.9%	development, demand, data, network,service, goal, see, information, concept, additionally *entwicklung, bedarf, daten, netzwerk, servic, ziel, sieh, informationen, konzept, zusaetzlich*
Products and key processes for revenue generation	Business consultancy (Topic 4)	10.6%	company, customers, euro, collaboration, service, GmbH, market, Germany, market, costs *unternehmen, kunden, euro, mitarbeit, dienstleistung, gmbh, markt, deutschland, market, kosten*
Orientation type of a business	Project orientation (Topic 5)	8.9%	field, implementation, planning, let, creation, context, offer, service, market, innovation *bereich, umsetzung, geplant, lassen, erstellung, rahmen, anbiet, dienstleistungen, markt, innov*
Products and key processes for revenue generation	Social media platforms (Topic 1)	7.9%	app, user, platform, internet, online, website, media, market, information, facebook *app, nutzer, plattform, internet, onlin, websit, media, market, informationen, facebook*

5.2 *Identification of differences between novel and non-novel business ideas in topic proportions*

In order to identify peculiarities of novel business ideas in the topic structure, the documents of business ideas are divided in two groups. One group containing novel business ideas, and the other group consisting out of non-novel business ideas. By comparing the expected shares of the former mentioned topics in these two groups, it is possible to identify the key topics present in novel business ideas. Figure 5.1 illustrates the distribution of topic shares in the two groups of business ideas.

The expected shares differ significantly in five of eight topics. Thus, the main finding of this analysis is that the proportion of topics in business ideas has the power to reveal the degree of novelty and, thus, is a building block for the understanding of novel business ideas. Based on this result, the first proposition can be confirmed.

Two topics are significantly more associated with novel business ideas compared to non-novel business ideas. These topics are 'Development of technical devices and software' and 'Process development'. They correspond to the generation of new or the improvement of technologies and processes, taking a proactive approach and the exploration of new ways of doing something.

Three topics are significantly more prominent in business ideas rated as non-novel compared to shares in novel business ideas. The first topic is 'Customer orientation'. This topic reflects a demand driven approach aiming at incremental satisfaction of customer needs rather than producing novelties. The second topic is 'Social entrepreneurship'. This confirms the traditional assignment of 'Social entrepreneurship' to a non-profit and non-innovative sector (Wilson & Post, 2013), since this topic is concerned with problem solving rather than developing innovations. The last topic is 'Consultancy for individuals'. These topics are similar in the sense that they focus on the identification and adaptation to demands, societal issues, and changing labour market conditions. They represent more a reactive than a proactive approach to the business context, which explains their link to non-novel ideas.

For the topics 'Social media platforms', 'Business consultancy', and 'Project orientation' there are no significantly different expected shares between the two groups. Since these topics are more general, it is likely that these complement the former topics in diverse ways.

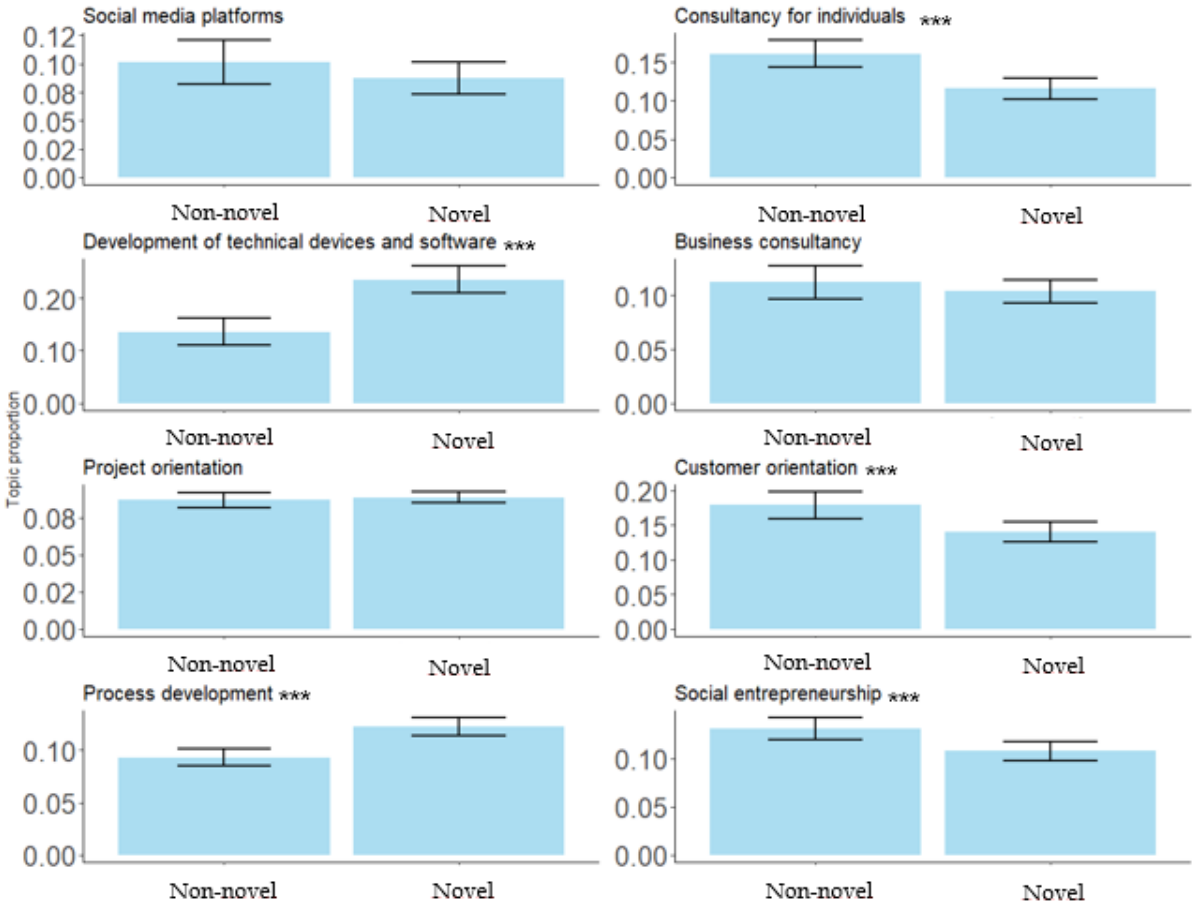


Figure 5.1: Comparison of topic proportions in novel and non-novel business ideas
*Note: The error bars corresponds to a confidence interval of 95%; *** corresponds to a significant difference with a p-value lower than 0.01*
Source: Own calculation

5.3 Analysis of topic interdependencies of novel and non-novel business ideas

To properly discriminate novel and non-novel business ideas, not only the proportion per topic is relevant, but also how the topics are interrelated to each other. For this purpose, the correlation structures of topics are examined for novel and non-novel business ideas as illustrated in Figure 5.2. The dots in the graphics represent the variables and the blue coloured ones highlight the variables that were identified in the former step as mainly appearing in novel or non-novel business ideas. Green lines between the variables indicate positive correlations and red ones correspond to negative relations. The transparency of the edges reflect the significance of correlation.

A main result from this analysis is that topics correlate with each other and the co-occurrence structures of topics differ between novel and non-novel business ideas. Thus, the second proposition is confirmed.

The relations between the topics in the case of novel business ideas reveal that 'Development of technical devices and software' (Tp3) serves as an indicator for novel ideas when this topic is central to the idea and not combined with other topics. The second topic associated with novel business ideas 'Process development' (Tp7) can be used as an indicator for novelty when combined with 'Business consultancy' (Tp4) and 'Project orientation' (Tp5). The degree of novelty is likely to be diminished by combining 'Process development' (Tp7) with 'Customer orientation' (Tp6), 'Social entrepreneurship' (Tp8), 'Social media platforms' (Tp1), and 'Consultancy for individuals' (Tp2).

Business ideas focussing on the topics 'Consultancy for individuals' (Tp2) and 'Social entrepreneurship' (Tp8) are likely to be non-novel. Moreover, ideas solely emphasising 'Customer orientation' (Tp6) can be assumed to be non-novel.

The meta-variables 'Economic Potential' (E_P), 'Realistic Implementation' (RIs) and 'Conclusiveness' (Cnc), in particular, show more links between themselves and the topics in the case of non-novel business ideas.[33] These findings could be explained by the difficulty to evaluate novel business ideas precisely due to their liability of newness. Also other context factors of the business ideas, namely team size and year of submission, show an impact on the topical structure.

[33] This finding indicates that the expert jury of the business idea competition attests non-novel business ideas dealing with 'Business consultancy' (Tp4) higher 'Economic Potential' (E_P) and 'Conclusiveness' (Cnc). Moreover, the jury evaluated non-novel business ideas featuring a 'Project orientation' (Tp5) more positively in terms of economic prospects (E_P), conclusiveness (Cnc) and realistic implementation (RIs).

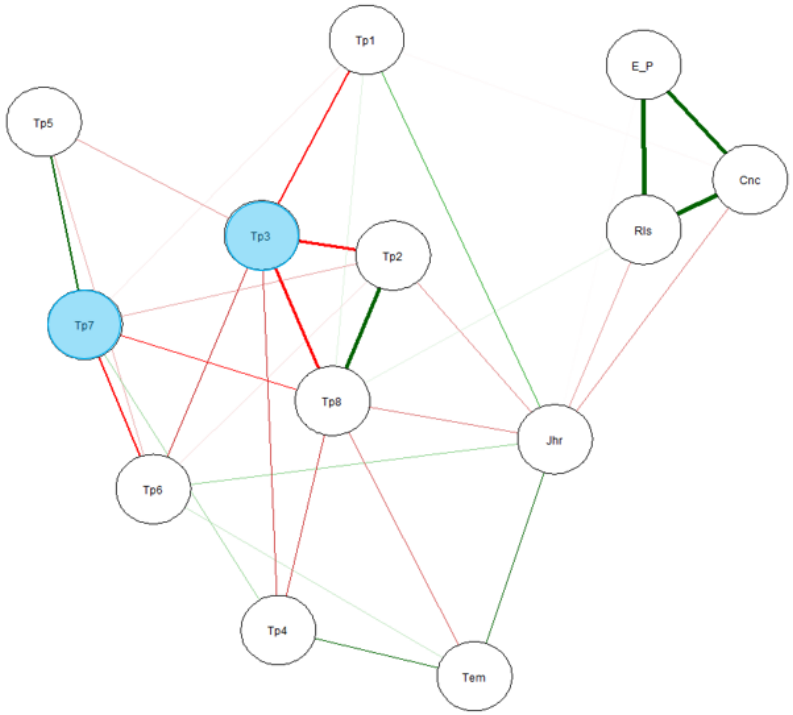
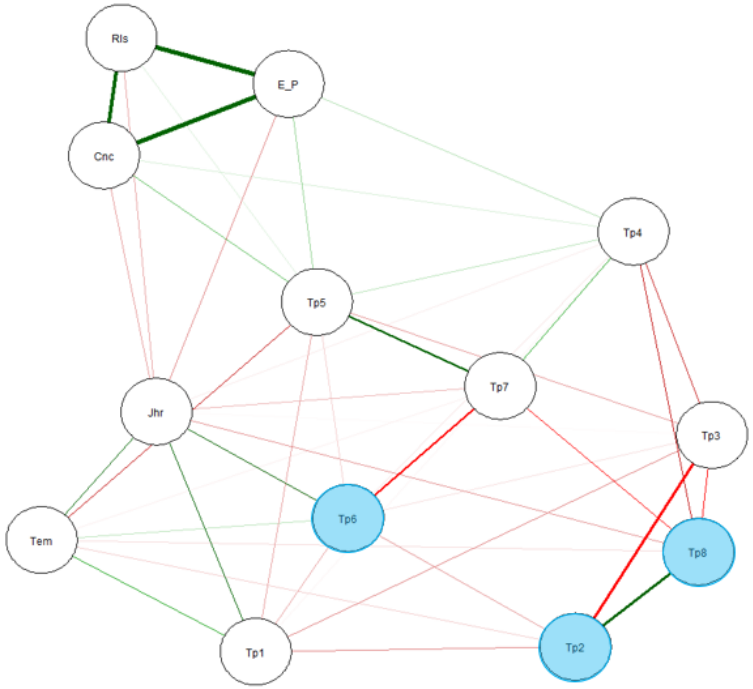
Novel business ideas	Non-novel business ideas	
		*Legend of topics* (Tp1) Social media platforms (Tp2) Consultancy for individuals (Tp3) Development of technical devices and software (Tp4) Business consultancy (Tp5) Project orientation (Tp6) Customer orientation (Tp7) Process development (Tp8) Social entrepreneurship

Figure 5.2: Correlation networks of novel and non-novel business ideas
Note: The colour of the links correspond to negative (red) and positive (green) correlations. The transparency of the edges reflect the Pearson correlation coefficients. For correlation coefficients please see Tables 9.2 and 9.3 in the appendix. The blue nodes in the graphic represent the topics identified to be specific for novel and non-novel business ideas.
Source: Own construction

5.4 *Analysis of incorporation probabilities for topic compositions of novel and non-novel business ideas*

Classification trees are applied to examine the interplay of topic structures of business ideas and their impact on incorporation probability. The results are illustrated in Figure 5.3. The first performed split corresponds to the most important variable to explain the incorporation probability. The value depicted behind the split variable is equal to the threshold dividing the business ideas into the right and the left branch of the tree which makes the most precise prediction. In case the condition is fulfiled, the reader follows the left branch of the splitting criteria. If the condition is not fulfiled, the reader follows the right branch. The terminal nodes of the classification trees show the prominent prediction ('No Foundation' or 'Foundation') for the path leading there. Beneath this result the ratio of observations fulfilling either 'No Foundation' or 'Foundation' as outcome is displayed for this terminal node. Both decision trees show splits even if the prediction in both resulting terminal nodes is 'No Foundation'. This is because the algorithm performs a split if this improves the purity of the terminal node.

Two main findings can be drawn from the analysis. First, the topics are the main drivers of the classification trees and not the meta-data as team size, year, economic potential, or realistic implementation.[34] Additionally to the topics, only industry classifications and the conclusiveness of the business idea are of importance. Thus, it can be confirmed that the topic structure of business ideas contains worthy information about the incorporation probability, and therefore, the third proposition is valid. Second, the splitting criteria cover topics concerning the base product or process of the business idea as well as the business orientation and entrepreneurial intention. The data suggests that the evaluation of business ideas and their prospect of incorporation requires a detailed investigation of these aspects of the business idea. This finding confirms the fourth proposition.

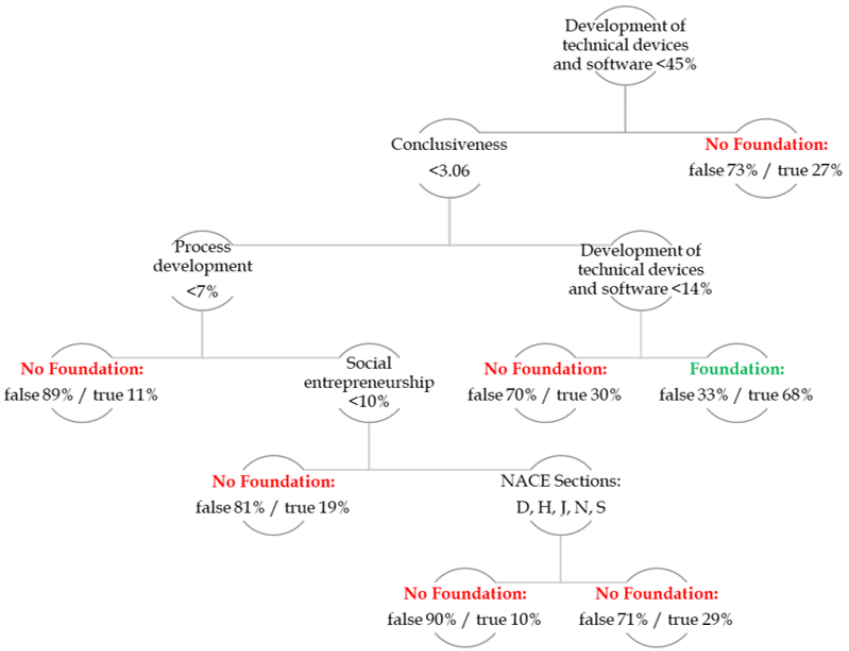
Additionally, in both trees the prediction is 'No Foundation' in most cases. This finding is expected because the majority of business ideas do not get incorporated.[35] Moreover, the classification tree for non-novel business ideas follows a simpler structure than the tree for

[34] Using a random forest based upon decision trees is performed as a robustness check, but the result still holds true. For this purpose all business ideas were applied in one analysis to ensure that the effect is not driven by the degree of novelty or by the sample with a jury rating. The variable importance, as the main result of the random forest analysis, is illustrated in Figure 9.2 in the appendix.

[35] Misclassification rate is not reported in the graphs as this measure is not insightful. This is because the majority of business ideas are not incorporated. Thus, it is expected that most predictions of the decision trees are 'No Foundation' and misclassifies the majority of incorporated business ideas.

novel ones. This could stem from a lower sample size for the former classification tree and the condition that each leave must at least contain 30 business ideas.

Novel business ideas



Non-novel business ideas

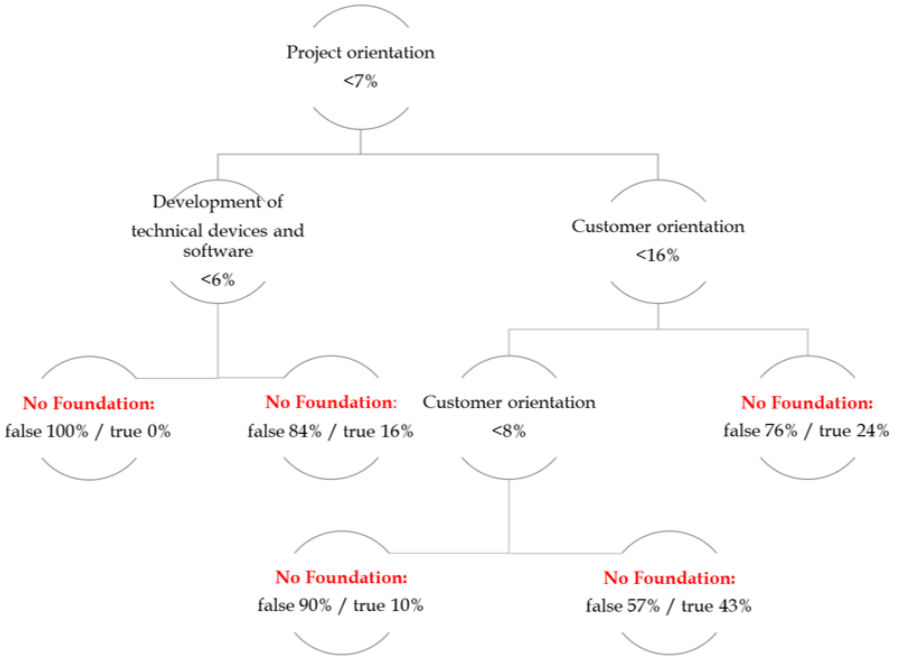


Figure 5.3: Results of the classification tree analyses for novel and non-novel business ideas
Note: The sample sizes correspond to the number of submitted documents that are classified as innovative or non-innovative (number of novel observations: 247; number of non-novel observations: 182)
Source: Own calculation

5.4.1 *Novel business ideas*

The classification tree on the left side of Figure 5.3 is based on the novel business ideas. The most important splitting criteria for novel business ideas is 'Development of technical devices and software' (Topic 3). In case a business idea´s description with a higher share than 45% assigned to this topic, this business idea is not likely to be incorporated. Not even a third of business ideas showing this topic structure is successful. However, when a high score in 'Conclusiveness' of the business idea is given, a share of 'Development of technical devices and software' (Topic 3) between 14% and 45% leads to the highest share of incorporations (68% incorporations). Hence, potential entrepreneurs aiming at the development of technical solutions should be very explicit about their plan to develop a technical device or software. However, a too narrow focus on this also hampers incorporation probability. Therefore, it seems advisable to not only focus on the development of the technical solution, but also keep other factors, like e.g. market orientation, in mind.

A different path visible in this classification tree is when technical solutions show a lower share than 45% of the business idea and are less conclusive. In this case the involvement of 'Process development' and 'Social entrepreneurship' helps to avoid high rates of incorporation failures. Nevertheless, when the business idea aims at industries in agriculture, forestry and fishing (A), transportation and storage (H), information and communication (J), administrative and support service activities (N) or other service activities (S) the incorporation probability is limited to 10%.

While the first path focusses solely on the development of technical devices and software, the second path shows that novel business ideas profit from combination of various topics.

5.4.2 *Non-novel business ideas*

The classification tree on the right side of Figure 5.3 reflects the pattern within the non-novel business ideas. 'Project orientation' (Topic 5) divides the business ideas into two paths. Business ideas with a share of 'Project orientation' lower than 7% overall show lower chances of incorporation compared to those focussing on 'Project Orientation'. Non-project oriented, and non-novel, ideas should avoid the 'Development of technical devices and software' (Topic 3) because when taken into consideration all business ideas were not incorporated. Following the track of higher shares in 'Project orientation' (Topic 5), either a higher share than 16% in 'Customer orientation' (Topic 6) or a lower share than 8% yields higher incorporation chances. This pattern indicates that non-novel business ideas require a clear focus on one market - either B2C (as reflected in Topic 6) or other clients.

6 Discussion

This study analyses the topics appearing in novel and non-novel business ideas. The topics identified in this study, reflect three aspects of entrepreneurial activity – entrepreneurial intentions, business orientation and main products or processes. Thus, the application of topic modelling as a technique to analyse content of texts, contribute to the existing literature by assessing not only objective goals but also entrepreneurial motivations and operation modes. This provides so far unused, information to differentiate entrepreneurial activities (Hurst & Pugsley, 2011; Shane, 2009).

The first research question of this study, if topic structures differ between novel and non-novel business ideas, can be answered with a yes. The narratives of novel and non-novel business ideas differ in their topic proportions. In addition, the correlations between the topics and meta-data provide a differentiated perspective on the narratives of business ideas. The topic proportions already give a hint at how to identify novel business ideas, which is further enhanced by taking the correlations between the topics into account. This enables a more distinct promotion of novel entrepreneurship activities and, thus, answers the call of former researchers (Hurst & Pugsley, 2011; Shane, 2009). Summarising the empirical evidence, it cannot only be confirmed that the basis of the business idea, the product or process, is of critical relevance for determining the degree of novelty (McAdam & Marlow, 2011), but also that entrepreneurial intentions and business orientation are important differences between novel and non-novel business ideas. Moreover, not only topic proportions differ in these two groups of business ideas, but also their correlation with external factors. Non-novel business ideas show higher correlations between the topic structure and jury ratings in economic potential, conclusiveness, and degree of realistic implementation. In contradiction to the findings of Pare et al. (2011), the team size does not have a relation to the meta-variables 'Economic Potential', 'Realistic Implementation', and 'Conclusiveness', i.e. greater team sizes do not improve the overall quality of the business idea. However, the result indicates a positive correlation between team size and 'Customer orientation' and a negative relation to 'Social entrepreneurship'. The latter finding corresponds to notions that social entrepreneurship stems from highly individual experiences that may cancel each other out in a bigger team (Asarkaya & Keles Taysir, 2019; Mair & Noboa, 2003). The data suggests that team size influences ideas and perspectives embedded in the topic structure (Munoz-Bullon et al., 2015; West, 2007). This corresponds to findings of former literature, stating that the heterogeneity of

a team influences the entrepreneurial orientation of a business idea (Diánez-González & Camelo-Ordaz, 2016).

The second research question of this study, i.e. if the topic composition of a business idea relates to its incorporation probability, can be also answered with yes. The incorporation probability of business ideas is related to their particular topic structure. This finding not only confirms former observations from entrepreneurial promotion programs that the base product or process is a main determinant (Klofsten, 2005; McAdam & Marlow, 2011), but goes beyond that. The results of this study show that not only base products and processes are of key importance, but also entrepreneurial intention as well as business orientation. This holds true for novel and non-novel business ideas. However, the importance of each specific topic differs depending on the degree of novelty of each idea.

Novel business ideas show two distinct paths in the analysis. The first string of successful novel business ideas focusses on technology and software development. The second path is characterised by a broader approach taking social aspects and the improvement of processes into account. These insights suggest that there are two types of novel business ideas – specialised on a technical solution or a broader approach for process improvement. In the case of novel entrepreneurship, the results underline former research, that focussing on technical solutions and neglecting the marketing side and the balance between supply and demand leads to lower incorporation probabilities (Friar & Meyer, 2003; Teece, 2010; Youtie et al., 2012). This finding goes in line with the requirement of novel entrepreneurs to communicate their idea in a concise manner to be able to access necessary external, initial funding (Rasmussen & Sorheim, 2012). In comparison to technical solutions, the development of processes seems to require a broader perspective involving as well social and environmental (e.g. industry) aspects. This type of entrepreneurial activities could be interpreted as hybrids joining social purposes with economic rationality (Wilson & Post, 2013). Following the hybrid entrepreneurship path, business ideas should avoid aiming at service driven industries. These industries may be easier to enter but also have higher failure rates due to more competition (Johnson, 2004; Shane, 2009). This study confirmed this to be even true in the pre-foundational stage of the entrepreneurial process.

In case of non-novel business ideas, project-oriented services with a clear focus on a customer segment lead to the highest incorporation rate. This result points to the relevance of market- and customer orientation, also highlighted by former research (Meyskens & Carsrud, 2013).

Entrepreneurial endeavours with a low degree of novelty serve a purpose through the transfer of knowledge and skills and use opportunities for arbitrage.

To sum up the empirical findings, business ideas are a multifaceted phenomenon and a distinction in only novel or non-novel may not be enough to design valuable policies. Therefore, the results suggest that the topic structure of business ideas is a valuable source to target promotion measures of entrepreneurial activities (Hurst & Pugsley, 2011; Shane, 2009). Based upon the results of this study, a more differentiated promotion of novel business ideas becomes possible. First, topic proportions in business idea descriptions can hint at the degree of novelty. This may be used in consultancy of potential entrepreneurs and the allocation of resources in programs aiming at the promotion of novel entrepreneurship. Second, to attract novel entrepreneurial endeavours to apply for funding programs, the call for applications may use words appearing often in the desired topics.

Finally, there are some limitations of this study giving way to further research. First, incorporation probability is the output variable the study opts at. Reasons why an idea is not incorporated are manifold and cannot be solely explained by variables included in the analysis. The reasons why business ideas fail to be incorporated may be subject of future research. This also holds true for additional control variables not available in the used data set, especially variables that describe the team member characteristics. The data set applied in this study does not provide full information about all team members and their characteristics. However, for a subset of the solo-entrepreneurs the relations between individual characteristics and degree of novelty and incorporation success of the business ideas are only weak.[36] Second, this study differentiates between novel and non-novel business ideas. However, novel entrepreneurship might not be the only desirable outcome, but also entrepreneurial endeavours transferring knowledge and skills or tackling a societal challenge. Third, the definition of novelty may be subject of change in the time period 2005 until 2019 due to technological progress. Incorporation of more indicators of novelty other than expert opinions may be beneficial, especially because the expert committees in the investigated business idea competition may not be representative for general expert assessments. Especially, a multi-item measurement of this variable, e.g. aligned with the one proposed by Dahlqvist and Wiklund (2012), would be beneficial to gain more fine-grained information on

[36] For this robustness check, the phi-coefficient was calculated. The values were between -0.152 and 0.295. The variables considered in this step were gender, being a scientific employee, affiliation with an University, affiliation with an University of Applied Sciences, educational background in economics and business administration, educational background in natural sciences, educational background in engineering, possession of an academic degree and possession of a PhD.

how the jury arrives at their assessment. Fourth, the incorporation of a business idea is primarily the decision by the entrepreneurs and does not represent a purely external assessment of the business idea. Thus, future research could be done by collecting more information on market success to avoid bidirectional causality. However, since it would restrict the sample in a severe manner and an incorporation without any external approval is unlikely, this study concentrates on this stage of the entrepreneurial process. Moreover, it has been shown that the perceived feasibility that an incorporation of a business idea depends on the knowledge of the entrepreneurs. Since in this study all business ideas are handed in by entrepreneurs with a background in tertiary education, the evaluation of the feasibility of business ideas is not assumed to be dispersed by this fact (Bergmann, 2017). Fifth, this study builds upon a sample that represents only business ideas in Bremen and Bremerhaven, Germany. Although Bremen is a federal state which is known to represent Germany well and is often used as a test market for products, future research could extend the data base. By sampling more data from other business idea competitions, more sophisticated methods to build classification trees with training and test data would become possible (e.g. pruning and cross validation techniques). Such a procedure would allow a more accurate determination of the model accuracy, without the need to restrict the decision tree growing process to a minimum sample size of 30 at the terminal nodes, as done in this study. In this line, the long period covered in this study (2003-2019) could come with the limitation that technological progress changed the relation between topics and incorporation probability. This study provides an averaged picture over the whole time period under investigation. Sampling data from diverse competitions would allow the detection of the most recent trends. Sixth, the advancement of stemming algorithms in the German language seems to be valuable for future research. So far, not every word is correctly stemmed in the German language. However, stemming is necessary because it allows for the unification of most of the terms (Birkholz et al., 2021).

7 Conclusion

To foster innovation and wealth generation as well as finding solution for societal challenges, the stimulation of entrepreneurial activities is of great importance for policy makers. However, the policies often follow a non-selective funding practice and, thus, do not offer targeted support programs for different types of entrepreneurial activities. This non-selective funding practice is criticised and researchers call for targeted entrepreneurship policies. Selection of business ideas for investments and support programs rely on quantitative and qualitative

metrics. The qualitative assessment, however, is biased by subjective impressions and experiences of the decision-maker. To advance the objectivity of the assessment of business ideas, the purpose of the present paper is to examine the topic structures of novel and non-novel business ideas and their effect on the incorporation probability. Texts describing business ideas submitted to a business idea competition are the basis for the topic modelling and classification tree analyses conducted in this study. In summary, the results show that the topic structure of business ideas provide a source of information to discriminate novel from non-novel business ideas and can be applied to predict the incorporation probability of ideas. These findings help to design targeted entrepreneurship policies and the selection of promising entrepreneurial projects for early stage investors and managers of accelerators.

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9 Appendix

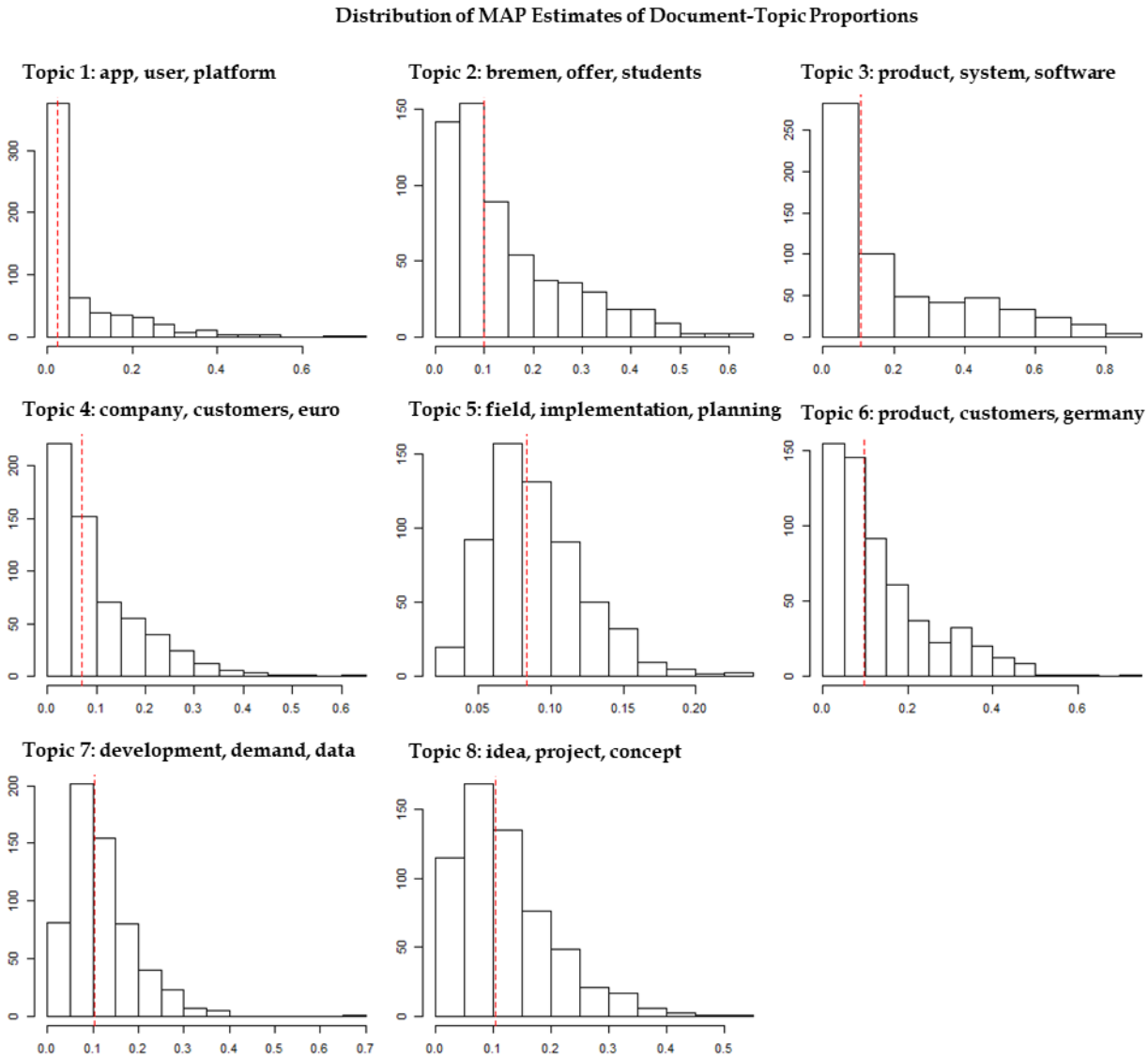

Figure 9.1: Distribution of topics over submissions to the 'CampusIdeen' competition from 2003-2019
Source: Own calculation

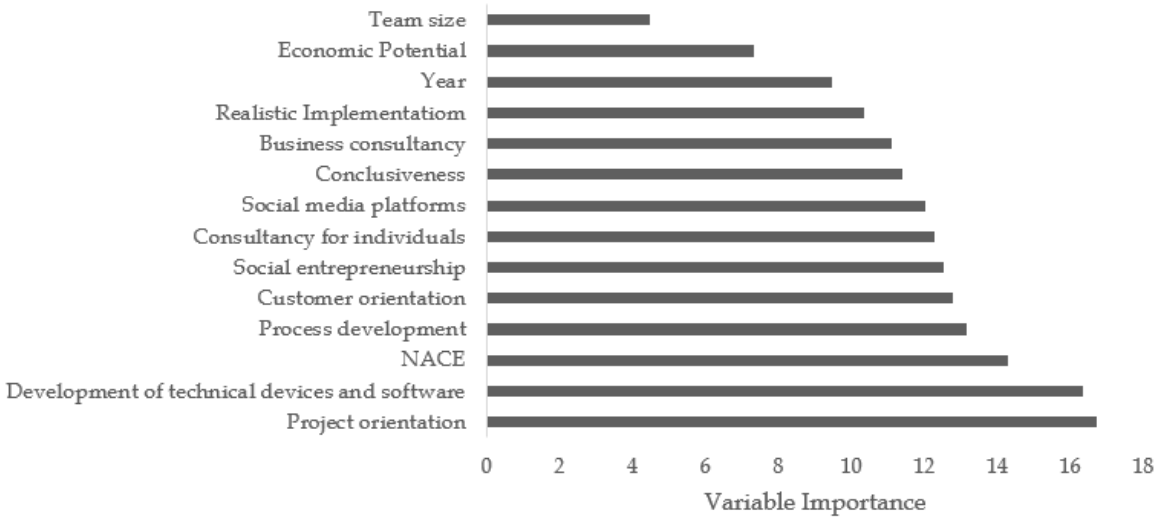

Figure 9.2: Variable importance as revealed by the random forest analysis based upon all submitted business ideas
Note: The importance was measured by the mean decrease in Gini-index and the sample size is n=593
Source: Own calculation

Table 9.1: Similarity and correlation of topics
Note: The similarity of topics is measured by the cosine index and the correlation is measured by the Pearson coefficient (in parentheses)
Source: Own calculation

	Topic 1	**Topic 2**	**Topic 3**	**Topic 4**	**Topic 5**	**Topic 6**	**Topic 7**	**Topic 8**
Topic 1								
Topic 2	0.133 (-0.148)							
Topic 3	0.122 (-0.313)	0.104 (-0.586)						
Topic 4	0.089 (-0.098)	0.065 (-0.051)	0.105 (-0.294)					
Topic 5	0.059 (-0.119)	0.078 (0.131)	0.116 (-0.244)	0.050 (0.119)				
Topic 6	0.123 (-0.025)	0.125 (-0.179)	0.420 (-0.228)	0.278 (-0.097)	0.060 (-0.186)			
Topic 7	0.134 (-0.167)	0.094 (-0.157)	0.158 (0.083)	0.051 (0.155)	0.033 (0.414)	0.066 (-0.454)		
Topic 8	0.111 (0.000)	0.047 (0.582)	0.177 (-0.526)	0.088 (-0.253)	0.059 (-0.064)	0.060 (0.028)	0.152 (-0.322)	

Table 9.2: Correlation matrix of included variables into the classification tree analysis for novel business ideas
Note: The sample size is n=247
Source: Own calculation

	Topic 1	**Topic 2**	**Topic 3**	**Topic 4**	**Topic 5**	**Topic 6**	**Topic 7**	**Topic 8**	**Year**	**Team**	**Conclusiveness**	**Realistic Implementation**	**Economic potential**
Topic 1													
Topic 2	-0.08												
Topic 3	-0.44	-0.56											
Topic 4	-0.11	0.02	-0.28										
Topic 5	-0.07	0.10	-0.20	0.10									
Topic 6	0.00	-0.15	-0.29	-0.10	-0.18								
Topic 7	-0.14	-0.19	0.08	0.20	0.43	-0.43							
Topic 8	0.15	0.60	-0.54	-0.27	-0.09	0.05	-0.36						
Year	0.27	-0.22	-0.08	0.08	-0.04	0.20	-0.03	-0.22					
Team	0.07	-0.12	-0.11	0.32	0.03	0.17	-0.03	-0.24	0.30				
Conclusiveness	-0.13	0.05	-0.01	0.05	0.03	-0.02	0.02	0.09	-0.22	-0.04			
Realistic Implementation	0.08	0.10	-0.09	-0.01	-0.02	-0.11	0.05	0.15	-0.19	-0.07	0.67		
Economic potential	-0.05	-0.12	0.10	0.06	0.02	-0.07	0.06	-0.08	-0.13	-0.03	0.66	0.68	

Table 9.3: Correlation matrix of included variables into the classification tree analysis for non-novel business ideas
Note: The sample size is n=182
Source: Own calculation

	Topic 1	**Topic 2**	**Topic 3**	**Topic 4**	**Topic 5**	**Topic 6**	**Topic 7**	**Topic 8**	**Year**	**Team**	**Conclusiveness**	**Realistic Implementation**	**Economic potential**
Topic 1													
Topic 2	-0.22												
Topic 3	-0.22	-0.52											
Topic 4	-0.15	-0.11	-0.28										
Topic 5	-0.20	0.14	-0.21	0.19									
Topic 6	-0.20	-0.20	-0.16	-0.16	-0.17								
Topic 7	-0.14	-0.12	0.11	0.28	0.44	-0.48							
Topic 8	-0.11	0.52	-0.41	-0.29	-0.12	-0.01	-0.31						
Year	0.33	-0.16	-0.15	-0.16	-0.12	0.38	-0.19	-0.21					
Team	0.28	-0.17	0.01	-0.10	-0.30	0.18	-0.15	-0.17	0.38				
Conclusiveness	-0.07	0.06	-0.10	0.17	0.24	-0.07	0.04	0.01	-0.20	0.01			
Realistic Implementation	0.04	0.02	-0.09	0.10	0.17	-0.08	0.00	0.01	-0.20	-0.12	0.66		
Economic potential	-0.11	0.04	-0.06	0.19	0.21	-0.08	0.11	-0.04	-0.22	-0.07	0.70	0.67	

Chapter 4

Transforming Regional Knowledge Bases: a Network and Machine Learning Approach to Link Entrepreneurial Experimentation and Regional Absorptive Capacity

Jessica Birkholz

Abstract

This study explores the regional innovation system characteristics that build the basis for the regional absorptive capacity of entrepreneurial knowledge. Regionalised patent data is combined with firm level and regional information for German regions over the period 1995 until 2015. Network analysis is applied to identify regional innovation system characteristics on three different layers: 1) cooperation between incumbents, 2) learning regimes, and 3) the technological knowledge base. Random forest analyses on basis of conditional inference classification trees are used to identify the most important characteristics for the regional absorption of entrepreneurial knowledge in general and on different efficiency levels. It is shown that characteristics on all three layers impact the regional absorption of entrepreneurial knowledge. Further, the direction and magnitude of the effect regional innovation system characteristics have on the regional knowledge absorption vary across different levels of absorption rates. It is concluded that for a successful implementation of policies to increase the impact of entrepreneurial knowledge on regional development, the regional innovation system needs to be monitored and adapted continuously.

Keywords: Entrepreneurship; Regional absorptive capacity; Smart specialisation strategy

JEL classifications: L26; O33; D85

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1 Introduction

Knowledge is a critical success factor for regional economic performance (Caragliu & Nijkamp, 2012). In dynamic economic environments and in times of ever growing globalisation, fast technological progress, and changing demand patterns, existing knowledge can become obsolete quickly (Neffke et al., 2018). This results in deprivation of regional competitive advantages (Neffke et al., 2018; Tushman & Anderson, 1986). To counteract this, a modern innovation policy has to fulfil two objectives: 1) fostering the generation of knowledge and 2) fostering the absorption and implementation of the new knowledge into the knowledge base, which turns it into a potential competitive advantage (Qian & Jung, 2017; Uyarra, 2019). Thus, the generation of new knowledge is necessary but not sufficient to build regional competitive advantages. System-wide innovative activities are required to transform knowledge into an advantage (Caragliu & Nijkamp, 2012).

This needs to be considered by regional innovation policies, such as the smart specialisation strategy (S3). A key element in this increasingly important policy approach is the 'entrepreneurial discovery', which is seen as the missing link between knowledge and economic growth (Braunerhjelm et al., 2010; D'Adda et al., 2019; Foray et al., 2012). According to this perspective, entrepreneurs are, due to their involvement into the development of technologies, in the position to not only create and use knowledge but also to introduce dynamism into the regional economy (Carlsson et al., 2013; D'Adda et al., 2019; Malerba & McKelvey, 2020; Schumpeter, 1934).

Former research finds that the effects of entrepreneurship on the regional economy, i.e. the symbiosis of entrepreneurial and incumbents, are conditioned by characteristics of regional innovation systems. Thus, the same entrepreneurship may be in the position to kick off system-wide innovative activities in one region but not in another (Fernandez-Serrano et al., 2019; Szerb et al., 2019). This underlines the importance of a regionally embedded view on entrepreneurship and its effects, because a universal, well-defined relationship between firm foundation rates, innovative activities, and economic growth is not found in empirical studies (Fritsch, 2008). Therefore, regional absorption mechanisms – the identification, assimilation and exploitation of knowledge – are a key factor to be considered when designing policies which aim at the development of regional knowledge bases via entrepreneurial discovery processes.

The overall rational of policies such as the S3, i.e. the exploitation of regional strengths for competitive advantages, can only be fulfiled with an in-depth understanding of mechanisms

in regional innovation systems (Uyarra, 2019). However, it has been criticised that these policies and scientific research do not pay enough attention to the diffusion of the knowledge generated by entrepreneurial experimentation (Lindholm-Dahlstrand et al., 2019; Uyarra, 2019). Despite the broad application of the absorptive capacity concept and acknowledgement of its multi-dimensional character, so far researchers mostly looked at it as a static resource rather than a multi-layered capability (Camisón & Forés, 2010; Choi & Park, 2017; Distel, 2019; Molina-Morales et al., 2019; Russo-Spena & Di Paola, 2019; Schmidt, 2005). Empirical studies frequently measure absorptive capacity through Research and Development (R&D) activities (Cohen & Levinthal, 1990). This only takes into account a fraction of the absorptive capacity construct. For the purpose of designing effective policy interventions, a deeper understanding of regional innovation system characteristics that build regional absorptive capacities is inevitable.

These considerations call for an integrated perspective on entrepreneurship and regional absorptive capacity. This study aims to contribute to the understanding on how to improve regional absorptive capacities for entrepreneurial knowledge (Lane et al., 2002; Schmidt, 2005). Moreover, this study addresses the calls from former researchers to analyse the micro-level processes that shape structural change (Boschma, 2017; Grillitsch, 2019; Uyarra, 2010) and its effects on the regional level (Pihlajamaa, 2018; Schmidt, 2005; Szerb et al., 2019).

The purpose of this study is to analyse the effect and the importance of the regional innovation system characteristics for the regional absorptive capacity of entrepreneurial knowledge. The present study analyses German regions in the time frame from 1995 until 2015. The applied data set consists of regionalised patent data combined with firm level and regional information. Specifics of regional innovation systems are assessed by network indicators on three different layers that enable identification, assimilation, and exploitation of knowledge: 1) cooperation between incumbents, 2) learning regimes, and 3) the technological knowledge base. These are subsequently implemented into two random forest analyses based on conditional inference classification trees and correlational analyses to answer three overarching research questions:

RQ1: Which regional innovation system characteristics enabling identification, assimilation, and exploitation of knowledge are the most important for absorbing entrepreneurial knowledge?

RQ2: Which regional innovation system characteristics enabling higher efficiency in identification, assimilation, and exploitation of knowledge are the most important for absorbing entrepreneurial knowledge?

RQ3: Which effect do these important regional innovation system characteristics have on different levels of entrepreneurial knowledge absorption?

The main contribution of this study is twofold. First, it is shown that regional absorptive capacity is a multi-dimensional concept. Key factors for the absorption of entrepreneurial knowledge are identified in each layer of the regional innovation system - cooperation between incumbents, learning regimes, and technological knowledge bases. The results suggest that regional innovation system characteristics have a heterogeneous association to regional absorption rates across different levels of absorption of entrepreneurial knowledge. Second, this study shows the explanatory power of machine learning techniques in innovation system research by allowing complex interactions and high correlation between independent variables. The approach taken by this study enables to analyse regional innovation systems in a holistic way. Identifying the driving factors of networks, which build absorptive capacities, would not be possible with commonly used multivariate statistical methods. While multivariate methods reduce the complexity of innovation systems to a set of simple relationships, the approach taken in this study considers the complex nature of regional innovation systems.

The remainder of this paper is organised as follows. The second chapter discusses the interplay of entrepreneurial experimentation, regional innovation systems, and regional absorptive capacity. In Chapter three the patent, firm, and regional level data base of this study is described. Chapter four presents the methodological approach with focus on random forest analyses on basis of conditional inference classification trees. The results are outlined in Chapter five and discussed in Chapter six.

2 State of the art

2.1 Regional innovation policies and entrepreneurial experimentation

Scientific debates emphasise the importance of knowledge and innovation as key drivers of structural change, economic development, and competitive advantages (Ferreira Moutinho, 2016; Grillitsch, 2019; Lindholm-Dahlstrand et al., 2019; Lopez-Bazo & Motellon, 2018; Teirlinck & Spithoven, 2019). It is argued that competitive advantages do not depend any longer on natural resources or other traditional inputs, but on creation of new knowledge and ideas as well as their incorporation (David & Foray, 2002; Ferreira Moutinho, 2016; Furman & Hayes, 2004). There are two main reasons to view knowledge as a regional resource for competitive advantages. First, innovative economic activities are unequally distributed, and

geographical clustering of knowledge-intensive activities results in self-sufficient regional innovation systems (Asheim & Gertler, 2006; Teirlinck & Spithoven, 2019). Second, tacit knowledge is most commonly shared via personal contacts, and these are assumed to be facilitated by spatial proximity, which enhances the capacity of localised learning (Asheim & Gertler, 2006; Asheim & Isaksen, 2002; Bathelt et al., 2004; Storper & Venables, 2004; Teirlinck & Spithoven, 2019). Therefore, it is proposed that the sub-national level is appropriate to capture knowledge dynamics (Acs & Armington, 2004). The regional knowledge base, which accumulates itself in the long term, lies the foundation for subsequent innovative activities (Balland & Rigby, 2017). For this reason, the development of knowledge bases is targeted by innovation policy (D'Adda et al., 2019).

One of the most notable policy-related conceptual advancements is the S3 which was a radical novelty in EU regional policy (Pyka et al., 2019). The smart specialisation approach is assumed to create more diversity among regions by focussing on already existing technological domains in which superior innovative capabilities can be found and diversification of these into related sectors (D'Adda et al., 2019; Foray, 2018). By acknowledging the systemic nature of innovation, the S3 aims at the transformation of the economic structures of a region (Foray, 2018; Pyka et al., 2019). One main novelty is that it follows a bottom-up approach, i.e. an 'entrepreneurial discovery process' guides the transformation of the regional knowledge base (D'Adda et al., 2019; Foray et al., 2011; Uyarra, 2019). Therefore, entrepreneurs are of key importance for knowledge creation and diffusion and, thus, regional development (Braunerhjelm et al., 2010). It is argued that entrepreneurs have superior knowledge to choose the most promising domains for future development (D'Adda et al., 2019). Here, the focus lies on innovative entrepreneurs, directly involved in the development of technologies (D'Adda et al., 2019). A regional innovation system relies on entrepreneurs who look for a way to exploit knowledge, which is left unused by incumbents (Acs et al., 2009; Neffke et al., 2018; Qian & Jung, 2017). This is further supported by the finding that entrepreneurs are especially important to generate growth from unrelated variety in a region (Fritsch & Kublina, 2018). With increasingly more complex innovation systems and exponentially rising opportunities for knowledge recombination, this entrepreneurial function becomes a main driver of economic development (Grillitsch, 2019; Schumpeter, 1934). Even more importantly, entrepreneurial experimentation is required to kick off system-wide activities from incumbents (Lindholm-Dahlstrand et al., 2019). Thus, the transformative capabilities stemming from entrepreneurs are an essential element for structural change in regions (Grillitsch, 2019).

Although this process of entrepreneurial discovery and the transformation of regional knowledge bases can occur spontaneously and in a decentralised manner, policy can aim at maximising its impact (Foray, 2018). By diverging from conventional regional policies that were funding industries and technologies, which did not require a detailed investigation of the regional diversification potential, policy makers are confronted with new challenges. Policy makers who want to implement the rational of the smart specialisation need to consider the regional knowledge base to design new entrepreneurship policy interventions instead of replicating successful policies issued in other regions (Foray, 2018; Mason & Brown, 2014; Spigel, 2017; Szerb et al., 2019).

2.2 Constitution of the regional absorptive capacity

To be able to design an efficient regional innovation policy, which builds upon entrepreneurial experimentation as well as innovative activities performed by incumbents, it is of crucial importance to understand the dynamics between entrepreneurial and incumbents.

Empirical research struggles to find a well-specified relationship between the emergence of new firms, innovative activities, and economic growth (Fritsch, 2008). A reason might be that the transformative capabilities of entrepreneurial experimentation only come into play when the regional innovation system absorbs the newly generated knowledge and, consequently, kicks off system-wide experimentations including incumbent firms (Caragliu & Nijkamp, 2012; Foray, 2018; Lindholm-Dahlstrand et al., 2019).

The link between entrepreneurial experimentation and regional knowledge base transformation is the regional absorptive capacity (Qian & Jung, 2017). Absorptive capacity is the ability to "*identify, assimilate and exploit knowledge from the environment*" (Cohen & Levinthal, 1989, p. 569). Despite several modifications of this concept[37], common ground is that absorptive capacity is a multidimensional construct (Schmidt, 2005). The concept of absorptive capacity is not limited to its original firm level perspective but can be transferred to the regional level (Schmidt, 2005). For the prosperity of regional innovation systems and to create competitive advantages over other regions, it is of key importance to identify, assimilate, and exploit newly generated knowledge stemming from intraregional entrepreneurial experimentation. Unexploited knowledge spills over to other regions when the regional innovation system is not suited to absorb it appropriately (Caragliu & Nijkamp, 2012).

[37] For an overview see Zahra & George, 2002.

Entrepreneurial and incumbent firms are required to have a symbiotic relationship in order to form a well-functioning innovation system (Lindholm-Dahlstrand et al., 2019). Although entrepreneurial firms can initiate short-run structural change in an innovation system, the persistence of this change is limited due to high failure rates of these firms (Neffke et al., 2018). Further, less access to capital markets, difficulties in acquiring external financial resources, and the lack of human capital prevent entrepreneurial firms from exploiting the full commercial potential of their generated knowledge (Carpenter & Petersen, 2002; Colombo & Grilli, 2007; Lindholm-Dahlstrand et al., 2019). In contrast to this, incumbent firms can rely on their accumulated knowledge and experiences in the market and, thus, can scale up the application of knowledge (Lindholm-Dahlstrand et al., 2019). However, these firms avoid exploring new knowledge but rather refine their accumulated base (Arvanitis & Woerter, 2015; Neffke et al., 2018; Pihlajamaa, 2018; Rothaermel & Deeds, 2004). In conclusion, entrepreneurial and incumbent firms have respective advantages at different stages of the innovation process and, therefore, take on complementary roles in an innovation system (Baumol, 2002; Lindholm-Dahlstrand et al., 2019). Due to the division of tasks within the innovation process, in which entrepreneurial ventures produce radical new knowledge and incumbent firms absorb this and develop it further, knowledge production (i.e. the generation of new knowledge) and knowledge absorption (i.e. the identification, assimilation, and exploitation of existing knowledge) are two distinct processes. These processes are conducted by different actors and follow different regularities. Thus, knowledge absorption can be understood as a coordination mechanism between different actors in an innovation system (Pihlajamaa, 2018). Following these considerations, the first proposition is stated as follows:

Proposition 1: Entrepreneurial knowledge production does not equal entrepreneurial knowledge absorption in regard to underlying mechanisms.

2.3 Regional absorptive capacity and regional innovation system characteristics

The regional absorptive capacity is likely to be influenced by context specifics (Pihlajamaa, 2018). Since the absorptive capacity is built in a path-dependent manner, contextual differences can exist in how information and knowledge is transferred in a region (Cantner & Graf, 2008; Cohen & Levinthal, 1990). This context specificity can be consulted to explain different impacts of the same type of entrepreneurship in two distinct innovation systems (Fernandez-Serrano et al., 2019; Teirlinck & Spithoven, 2019). Thus, the effect of entrepreneurial experimentation depends on the framework conditions of the regional innovation system, which are governing the process of regional knowledge absorption.

To analyse these characteristics, regional innovation systems can be broken down into three parts – a set of nodes, the relations between these nodes, and formal or informal rules which determine the interactions (Pyka et al., 2019). Through this system of nodes and relations, knowledge is transferred or constructed among heterogeneous actors (Boschma et al., 2014). This means, regional absorptive capacity requires collective action. In this regard the collective action governs the efficiency of the absorption process. These considerations lead to the second and third proposition:

Proposition 2: Regional innovation system characteristics are important for the absorption of entrepreneurial knowledge in general.

Proposition 3: Regional innovation system characteristics are important for the efficiency of the absorption of entrepreneurial knowledge.

However, because of the complex nature of regional innovation systems, it is unlikely that the indicators have a linear relation to the innovation outcome of the system (Pyka et al., 2019). Absorption rates differ between regions, within these different levels of absorption rates it is likely that the characteristics of the regions differ. Therefore, it is hypothesised that regions with the same level of knowledge absorption have the same characteristics in common. Thus, the fourth proposition is stated as follows:

Proposition 4: The relation of regional innovation system characteristics to the regional absorption of entrepreneurial knowledge differs between levels of absorption rates.

3 Data

3.1 Creation of the data set

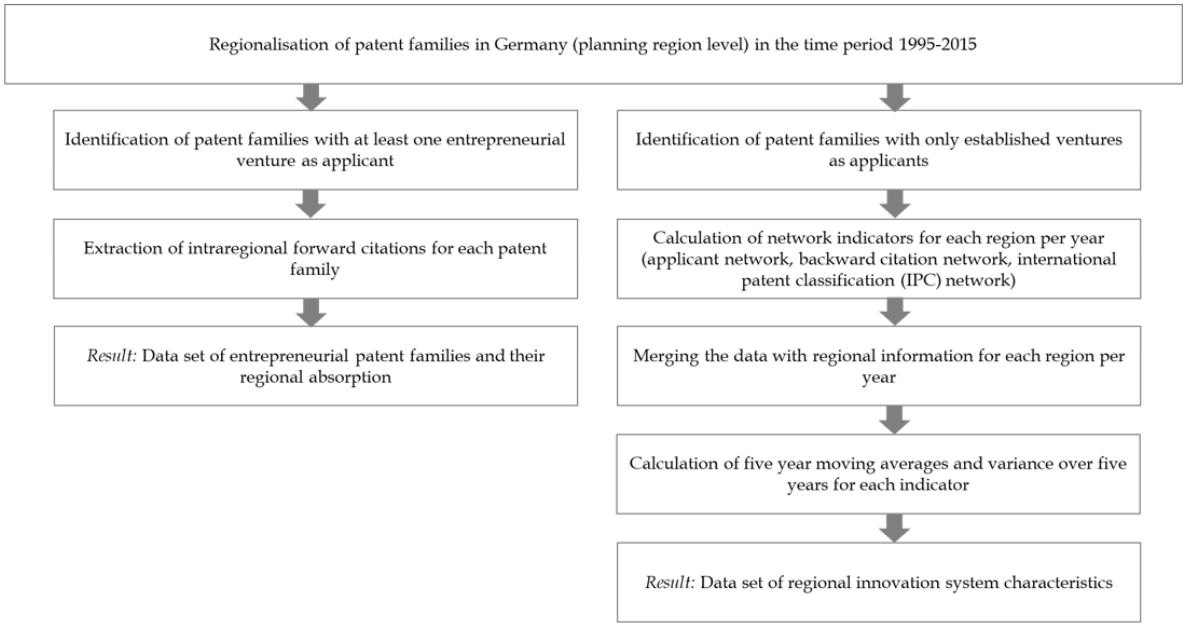


Figure 3.1: Description of the data set creation
Source: Own illustration

The data set creation is illustrated in Figure 3.1. Patent data from PATSTAT 2017b serves as basis for all steps and is combined with information from the data base Orbis from Bureau van Dijk. The data collection is based upon patent families in this study, which will be referred to as patents in the following.[38] Regional information are obtained from INKAR data base provided by the Federal Institute for Research on Building, Urban Affairs, and Spatial Development (BBSR) and merged to the data set. This information is based on planning regions, which can be compared to labour market areas in the USA (Fritsch & Wyrwich, 2018).

All patents with at least one German applicant[39] in the time frame from 1995 until 2015 are regionalised based upon the applicant address.[40] From this, two sets of patents are created –

[38] Patent applications that share the same priority filings are clustered into a patent family. In this study DOCDB families are used. The date of the patent family is assessed by the earliest filing date of the priority filing in this family. Because this study aims to investigate the knowledge creation processes and does not aim to assess the economic value of the knowledge created, it is not differentiated between granted and non-granted patent applications.

[39] This study makes use of networks that are built upon applicants and not on inventors. The reason for this is that this study is concerned with the absorption processes as a coordinative endeavour between different types of firms and actors rather than between individuals. Thus, this approach provides insights for foremost firm centred innovation policies.

[40] The start of the time frame (1995) corresponds to the earliest point in time in which a reliable geographical assignment can be assured, because of an adjustment in postal codes in Germany in 1993. Considering a time lag of two years until a patent filing becomes public for others, it is likely that filings

one set containing patents where at least one of the applicants is an entrepreneurial venture, and the other set comprising patents that are not filed by entrepreneurial ventures. This allows the creation of two distinct data sets, which are described in the following.

3.1.1 Creation of the entrepreneurial patent data set

Patents filed by at least one entrepreneurial venture, while defining entrepreneurial ventures as being not older than five years[41], are identified via the data base Orbis from Bureau van Dijk. Subsidiaries and ventures having daughter companies are excluded from this sample ensuring the regional origin of the knowledge. The retrieved patents are looked up in PATSTAT 2017b to have accurate information about the address where the patent was filed. The address information of Orbis from Bureau van Dijk may not equal the address on the patent caused by moving of the company to another location. However, in some cases, the patents did not include information on the applicant address. Then, this missing data is complemented by address information of the corresponding venture from the data base Orbis from Bureau van Dijk.

As a next step, all forward citations in a five year time frame, beginning with the earliest publication date of the priority filing, are identified for each patent.[42] Taking the earliest publication date instead of the earliest filing date of the patents ensures that the patent and its content are made available for other actors. In case entrepreneurial knowledge is cited within the region of its origin, it is counted as an intraregional absorption.Note that only citations regionalised within German regions can be considered for further analysis. This procedure results in a data set of entrepreneurial patents in Germany in the time frame from 1995 until

from 1993 and 1994 indicate old postal codes. Therefore, the data collection started with the year 1995. The end of the time frame considered in this study is reasoned by data availability in PATSTAT 2017b.

[41] Although entrepreneurial ventures are often defined by being younger than ten years (Kollmann et al., 2020; Puig et al., 2014), there is evidence that the failing rates decrease with every year of the venture´s existence (Yang & Aldrich, 2017). This indicates that entrepreneurial ventures are getting more settled in a regional innovation system with each year of existence. To ensure that the entrepreneurial patents in this study can be viewed as mostly external to the regional innovation system, a stricter definition of entrepreneurial ventures, i.e. being not older than five years, is applied in this study.

[42] The five year time frame was chosen because 66% of all intraregional citations take place in this period. A ten year time frame would cover 87% of all intraregional citations, but would lead to a significant shrinkage of the analysable data set to the time period 1995 until 2005. Moreover, this study concentrates on the short- to mid-term effects of entrepreneurial patents because otherwise the generated knowledge might be already obsolete and does not serve as a basis for regional competitive advantages. Figure 8.1 in the appendix displays the cumulative distribution of citations over years.

2010[43]. Overall the data set contains 1,344 patents owned by 5,346 firms that are either entrepreneurial or an incumbent that is collaborating with an entrepreneurial firm.

3.1.2 Creation of the regional innovation system characteristics set

The identified entrepreneurial patents are then subtracted from the set of regionalised patents in Germany in the time period from 1995 until 2015.[44] This leaves this data set only with patents filed by established actors. Based on this, structural characteristics of each regional innovation system for each year can be assessed. Entrepreneurial patents are not considered for this step, because this study views entrepreneurial ventures as external to the regional innovation system since these ventures are not deeply grounded in the regional networks. Incumbents that need to identify, assimilate, and exploit the entrepreneurially generated knowledge are interpreted as established regional innovation system.

Connecting this with the concept of Cohen and Levinthal (1989), the collective absorption of knowledge generated by entrepreneurial experimentation requires three different layers in regional networks – one for identification, one for assimilation, and one for exploitation. To assess the structural characteristics of an established innovation system, these three layers are identified for each region in each year between 1995 and 2015. Their construction is summarised in Table 3.1. First, identifying new knowledge in the regional innovation system can be interpreted as a knowledge facilitating task of connected actors in the region. A network of incumbents with joint innovative activities in one region enables this identification as it allows information flows between incumbents on multiple levels. This network is operationalised with nodes corresponding to patent applicants, and edges show a joint patent application. Second, assimilation requires an efficient learning regime in the regional innovation system. A regional network of innovations and their connection to antecedents is considered essential for the assimilation. This network is operationalised with patents as nodes and the edges between them are backward citations. All backward citations from patents are considered. Third, abilities needed to exploit new knowledge highly depend on the structure of the regional knowledge base. A network with specialised knowledge and common combinations between these describes the regional knowledge base. This network is operationalised with four-digit international patent classifications (IPC) as nodes and the edges describe the co-occurrence of IPC classes in one patent family.

[43] For the years 2011 until 2015 the five year time frame to identify citations would only consist out of less than five years because the data is only available until 2015.

[44] Although not further included in the entrepreneurial patent data set, it is ensured that entrepreneurial patents from 2011 until 2015 are removed from the regional innovation system characteristics set.

Table 3.1: Overview of networks and their operationalisation
Source: Own elaboration

Network	Rationale	Nodes	Edges
Identification	Knowledge facilitating via cooperation	Incumbents	Joint innovative activities
		Measurement: Patent applicants	*Measurement:* Co-occurrence of patent applicants on one patent
Assimilation	Learning regime	Innovations	Former innovations
		Measurement: Patents applications	*Measurement:* Backward citations of patent applications
Exploitation	Knowledge base	Specialised knowledge blocks	Combination of knowledge blocks
		Measurement: IPC classes	*Measurement:* Co-occurrence of IPC classes on one patent

The size of these networks, the structure, and the fragmentation as well as the stability of these network characteristics over time describe the regional innovation system context. First, the size of networks gives the framework in which knowledge flows and combinations can occur. Second, the structure of networks displays the transfer of knowledge. Third, the fragmentation gives insights about the multiplicity of regional innovation systems. Fourth, the consistency of these network characteristics plays an important role for planning innovative activities within the system.

Network indicators, which are listed in the following section, are calculated for each of these networks in every year and region. To this resulting data set, regional information (which is listed in the next section) is merged. Because the regional absorption of entrepreneurial patents is studied in a five year time window, five year moving averages for all indicators of this data set are calculated. Further, the variance of the values in this time period is determined. These mean and variance values represent the second data base – the regional innovation system characteristics in Germany in the time frame from 1995 until 2015.

3.2 Variables of the data set

3.2.1 Dependent variable – regional absorptive capacity

The dependent variable in this study is the regional absorptive capacity of entrepreneurial knowledge. To estimate this variable, the number of entrepreneurial patents and the number of intraregional citations of these patents are used. The ratio of patents that cite entrepreneurial

patents within the same region and in the following five years and entrepreneurial patents of a region in a given year forms the dependent variable. This procedure results in an efficiency ratio which captures the average intraregional citations of each entrepreneurial patent. This connects to the efficiency score proposed by Zahra and George (2002).[45] Otherwise the dependent variable would be biased by the number of entrepreneurial patents a region has. Thus, the equation for the dependent variable reads as:

$$Regional\ absorptive\ capacity = \frac{Number\ of\ patents\ citing\ the\ entrepreneurial\ patents\ within\ the\ same\ region}{Number\ of\ entrepreneurial\ patents\ in\ a\ given\ year\ in\ a\ given\ region} \quad (1)$$

This efficiency ratio of the absorption of entrepreneurial knowledge decides about the speed at which a regional innovation system can build up competitive advantages on basis of entrepreneurial experimentation. To compare the varying absorption capacities of different regions, this study considers only the relative value of the efficiency ratio and leaves the interpretation of the absolute values aside. Therefore, the distribution of the ratios over all regions and years is applied to convert this ratio into a factor variable with five levels. The first level contains all ratios which are zero, which corresponds to no absorption of entrepreneurial patents at all. The region in this first level of absorption rates, thus, do not use entrepreneurial experimentation as a source for competitive advantage. The remaining levels two to five correspond to the quartiles of the remaining distribution. Absorption rates in the second or third level mean to lose competitiveness over time, when having equal rates of entrepreneurial knowledge production, in comparison to other regions. Absorption rates in the level four or five enable a region to build up competitive advantages more rapid than other regions based on entrepreneurial experimentation. Table 3.2 summarises the distribution of the observations. It is visible that the fifth level of absorption rates has the highest range of absorption rates and the highest variance of rates of all levels.

[45] The authors argue that the efficiency factor of absorptive capacity is equal to the ratio of 'Realised absorptive capacity' (RACAP) to 'Potential absorptive capacity' (PACAP) (Zahra & George, 2002). The measure applied in this study follows this approach and interprets intraregional citations as RACAP and the sum of entrepreneurial patents as PACAP.

Table 3.2: Description of absorption quartiles
Source: Own summary based on the distribution of the collected data

	No absorption *(Level 1)*	**Low absorption rates** *(Level 2)*	**Rather low absorption rates** *(Level 3)*	**Rather high absorption rates** *(Level 4)*	**High absorption rates** *(Level 5)*
Number of observations	874	85	85	85	85
Range of absorption rates	0.000	0.034-0.167	0.167-0.286	0.308-0.533	0.536-7.667
Variance of absorption rates	0.000	0.001	0.001	0.005	0.902

3.2.2 Independent variables – regional innovation system characteristics

The independent variables of interest in this study are the network indicators which describe the regional innovation system characteristics. As outlined above the chosen indicators reflect the size, the structure, the fragmentation, and the stability over time of the three networks. Table 3.3 summarises the indicators connected to each characteristic.

First, the size of the networks is assessed by the number of edges and vertices. Second, the structure is deduced by the indicators density, transitivity, and relative diameter. While density measures the connectedness in the overall network, transitivity and diameter are calculated on basis of the biggest component of the network. Following the small-world hypothesis, transitivity is applied as a measure for clustering and diameter as a measure for longest shortest distance between two vertices. However, the diameter measurement is influenced by the network size which is corrected by taking the ratio of the diameter and the number of vertices in the biggest component. Third, the fragmentation of the networks is assessed. Because all of the variables are highly dependent on the network size, the percentage of isolated vertices from all vertices of the network, the ratio of the number of components and the number of vertices[46] in the network as well as the ratio of cutpoints and components are all taken into consideration. The isolated vertices and the number of components of a network indicate if the regional innovation system can be described as one network or rather a collection of networks and clusters. The number of cutpoints hint at the stability of the components in the network. Lastly, the variance of all of the above mentioned indicators in five year moving windows are taken into consideration because the consistency of the variables in the citation period relates to the stability of the network characteristics.

[46] A component consist out of two vertices at least. Otherwise (if it is just one vertex) it is evaluated as an isolate.

Table 3.3: Overview of independent network variables
Source: Own elaboration

Network characteristics	Network indicators
Size	Count of edges
	Count of vertices
Structure	Density
	Transitivity
	Relative Diameter
Fragmentation	Percentage of isolates
	Relative number of components
	Relative number of cutpoints
Stability over time	Variances of all former indicators over five years

3.2.3 Control variables - regional context variables

Additionally, regional variables are included in the analyses as controls. These indicators, which are listed in Table 3.4, show the availability and density of human capital in the regional innovation system. The data source for these variables is INKAR provided by the Federal Institute for Research on Building, Urban Affairs, and Spatial Development (BBSR). All variables included in this study are available over the whole investigated time period on planning region level. These variables are measured as follows:[47] Regional potential describes the population potential of municipalities within the perimeter of 100 kilometres. It is measured by the sum of the municipality population weighted by the area divided by thousand. This measure reflects the possibility of local interactions. The number of students is assessed by the number of students at universities and universities of applied science per 1,000 inhabitants. The share of high school leavers with matriculation standard is the share of high school completers that are permitted to enrol in university of all school leavers. Inhabitant density is described by the sum of inhabitants divided by the area of a region. Inhabitant-employee density is the sum of inhabitants and employees that commute to the region which are not inhabitants divided by the area of a region. Moreover, the variance of these indicators is taken into consideration as well.

[47] The data sources applied for the calculation of these measures by the Federal Institute for Research on Building, Urban Affairs, and Spatial Development (BBSR) can be accessed at: https://www.inkar.de/.

Table 3.4: Overview of control variables
Source: Own elaboration

	Indicators
Regional variables	Regional potential
	Number of students
	Share of high school leavers with matriculation standard
	Inhabitant density
	Inhabitant-employee density
	Variances of all former indicators over five years

4 Methodological approach

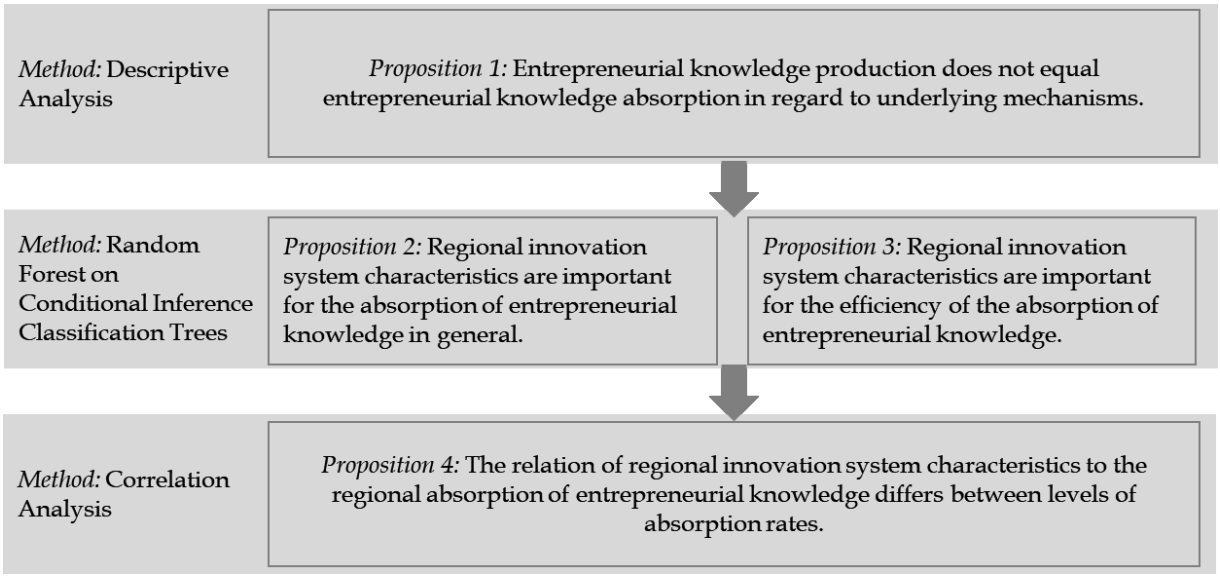


Figure 4.1: Research design of the study
Source: Own illustration

The research design of this study is illustrated in Figure 4.1. After *Proposition 1* is evaluated by applying descriptive analysis, *Proposition 2* and *Proposition 3* are tested by making use of random forest analyses on the basis of conditional inference classification trees. Lastly, *Proposition 4* is examined with the help of correlation analysis.

To test *Proposition 1* a descriptive analysis is performed. The geographical pattern of knowledge creation by entrepreneurs (i.e. the number of entrepreneurial patents in a region) and the knowledge absorption by incumbents (i.e. the ratio of entrepreneurial patents in the region and the intraregional citations of these patents) are considered in this step. To compare regional competitive advantages, not absolute but only relative values are taken into consideration. By doing so, the following can be observed: On the one hand which regions are able to generate entrepreneurial knowledge over-proportionally, and on the other hand which

regions are able to use entrepreneurial knowledge over-proportionally as source for innovative activities by incumbents? The first step of the analysis is thus to investigate the overlap of these to identify if regions with a high level of knowledge production show also high levels of knowledge absorption.

For the purpose to identify the most relevant regional innovation system indicators for 1) the absorption of entrepreneurial knowledge in general and 2) the efficiency of the absorption of entrepreneurial knowledge, random forest analyses based on conditional inference classification trees are conducted. There are four main reasons for this methodological approach instead of a multivariate procedure. First, medium to high correlations of the network indicators between each other poses a problem to multivariate statistical models which are most commonly used.[48] Second, the number of variables that can be imputed in a multivariate model is limited by the sample size. Third, multivariate models could be misleading in this case because these could be easily mis-specified. By taking an explorative approach, the assumption of multivariate models that all important variables are included could be violated. Fourth, multivariate models are not able to include all possible interactions between the variables considered (Strobl et al., 2009a). Conditional inference classification tree analysis overcomes these issues by following a data-driven approach which enables the use of a broad set of indicators and takes account of all possible interaction effects reflecting the complexity of regional innovation systems (Strobl et al., 2009a).

The machine learning algorithm divides the predictor space into non-overlapping regions. This means that the algorithm creates decision trees where one criterion splits the data set into two, these are further split, and so on until a stopping criterion is reached. In the case of conditional inference classification trees – an advancement of the original classification tree approaches proposed by Breiman et al. (1984) and Quinlan (1986; 1993) – the algorithm relies on the p-value of correlations between the independent variables to determine the tree's splitting criteria (Strobl et al., 2009a).[49] Using the conditional approach to build the classification trees avoids the selection bias of former algorithms that favour variables with many possible splits (Hothorn et al., 2006).

[48] Considering the whole data set, the correlations between the regional innovation system indicators are higher than 0.5 in 9% of the cases. When only observations with a regional absorption of entrepreneurial knowledge higher than zero are considered, then 12% of the correlations are higher than 0.5. Full correlation matrices are available upon request.

[49] For an extensive overview of the functioning of the regression tree approaches, see Strobl et al. (2009a), and for the case of conditional inference trees, see Hothorn et al. (2006) for a description.

One major shortcoming of single classification trees is, however, that these are known to be sensitive to changes in the data (Strobl et al., 2009a). This is overcome by so-called 'ensemble' methods (Strobl et al., 2009a). Random forest, as the most prominent algorithm of this kind, creates a set of trees on random samples of the data set (Strobl et al., 2009a). To build the random samples a bootstrapping procedure is applied (Strobl et al., 2009a).[50] By comparing the multiple trees built on these bootstrapped samples, the algorithm retrieves the average importance of each variable and, thus, is a more robust measure than one single tree (Strobl et al., 2009a). Reasoned by these advantages, in this study random forest analyses on basis of conditional inference classification trees are conducted. Moreover, to avoid biased variable importance measures by high correlations between the independent variables, the conditional permutation importance is calculated.[51] This means that the covariance structure of the data set is kept equal to prevent correlated indicators to appear more important than uncorrelated ones. However, the random forest approach comes with some variability in the results by changing the starting conditions (i.e. seeds for the algorithm and the number of trees grown). Therefore, these two conditions are varied and the results of the algorithms are compared. All variables that appear in at least two specifications with an importance score in the top ten are identified as showing robust predictive power.

To test *Proposition 2*, a random forest analysis with a binary dependent variable describing if the region absorbs entrepreneurial knowledge or not (intraregional absorption of entrepreneurial knowledge equal to zero vs. intraregional absorption of entrepreneurial knowledge greater than zero) is performed. *Proposition 3* is validated by performing a separate random forest analysis with a factor variable as dependent variable describing the efficiency of regional absorption of entrepreneurial knowledge (levels of knowledge absorption). This distinction into two analyses is reasoned by the expectation that the dynamics of absorbing entrepreneurial knowledge are different than the dynamics differentiating levels of absorption efficiency.

Lastly, *Proposition 4* is tested by comparing the correlation between the variables that were found to be important in the former step, and the efficiency of regional knowledge absorption of entrepreneurial knowledge. Because regional innovation systems are complex and a linear

[50] Bootstrapping is a statistical resampling method that draws multiple sub-samples of the original data set that are equal in size. This procedure is used for multiple purposes with the aim to calculate a robust result that does not depend on random variability in the original data set (James et al., 2013; Strobl et al., 2009a).

[51] For the analyses of this study, the R package 'party' and the included 'cforest' and conditional 'varimp' functions are applied as suggested by Strobl et al. (2009b).

relation over all observations is unlikely, the correlation is calculated for each level of absorption rates separately by applying the Spearman correlational analysis. This procedure shows the differing importance of each variable for each level of absorption. This way the magnitude and direction of the correlations between the regional innovation system indicators and the efficiency of the regional absorption of entrepreneurial knowledge are identified.

5 Results

5.1 Entrepreneurial knowledge production and its regional absorption

To validate *Proposition 1*, the geographical patterns of entrepreneurial knowledge production and regional absorption of entrepreneurial knowledge are compared. Figure 5.1 shows the results.

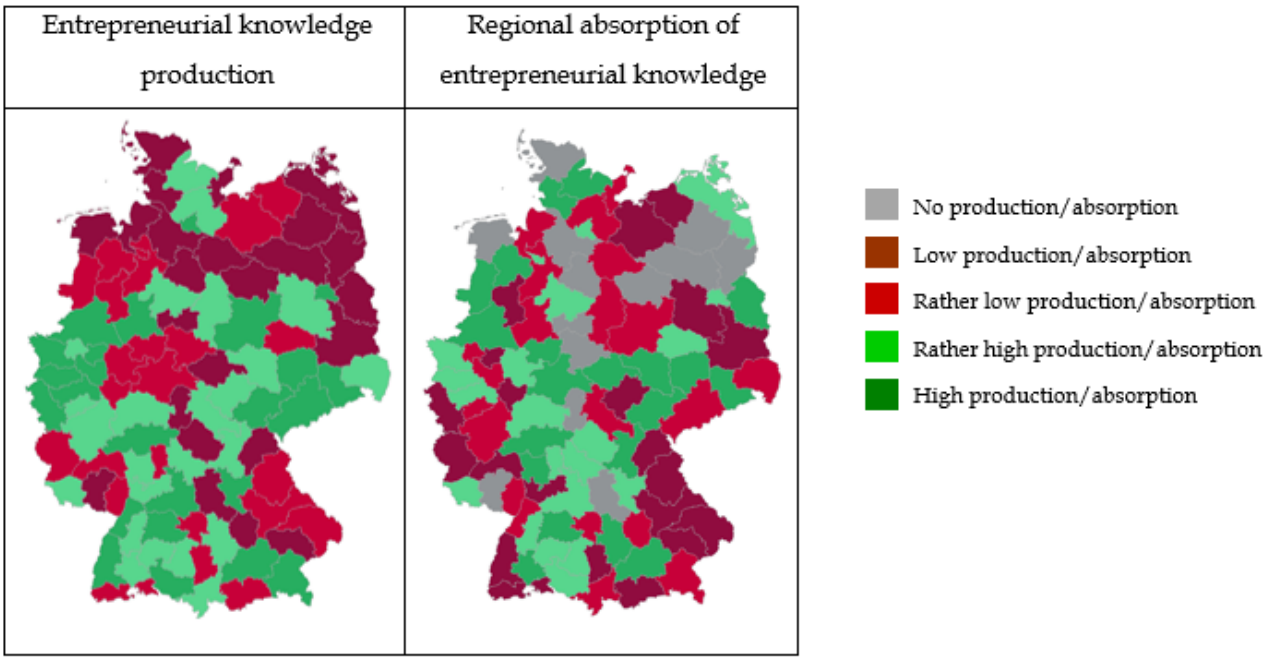


Figure 5.1: Geographical patterns of entrepreneurial knowledge production and its regional absorption
Source: Own illustration based on calculations on basis of the collected data in the period 1995 until 2010

Looking at the entrepreneurial knowledge production, a north-south divide is visible. The northern part of Germany has more regions characterised by low and rather low entrepreneurial knowledge production than the southern part. This finding reflects that in the southern part of Germany are more big cities with more population and companies and, thus, more entrepreneurial activities. The geographical pattern of the regional absorption of entrepreneurial knowledge shows a different distribution. Although one could argue that the northern part of Germany has more regions having no absorption of entrepreneurial knowledge than the south, a clear north-south divide cannot be validated. This is a first piece

of evidence that the regional knowledge production and the absorption of entrepreneurial knowledge are not equally distributed.

As a second step to complement the graphical analysis, the relevant numbers of entrepreneurial knowledge production and its regional absorption are investigated in further detail.[52] The regions with the highest entrepreneurial knowledge production, i.e. the sum of entrepreneurial patents in the period of 1995 until 2010, are Munich (910), Berlin (1101) and Stuttgart (810). This result confirms ones intuition, because these regions are metropolises and are known to be technological hubs. Turning to the regional absorption of entrepreneurial knowledge, i.e. the mean ratio of intraregional citations and entrepreneurial patents, the best performing regions are mid Schleswig-Holstein (101), western Upper Franconia (912) and northern Thuringia (1602). This comes as a surprise. Partly this result could be reasoned by the fact that these regions do have less entrepreneurial patents and it could be easier to identify, assimilate, and exploit a few entrepreneurial patents than a few hundred. However, regions with even lower entrepreneurial production rates do not show systemically higher absorption rates even the reverse is partially true since the correlation between these variables is 0.241. Finally, the correlation between the level of entrepreneurial knowledge production and the level of regional absorption is calculated, which results in a value of 0.459. Because these values can be classified as low to medium, *Proposition 1*, stating that entrepreneurial knowledge production does not equal its regional absorption, can be confirmed.

5.2 Importance of the regional innovation system characteristics for absorption

First, the networks that are considered in the following analyses are looked at in further detail. Table 5.1 summarises the descriptive statistics over all networks in the data set. The networks show great variance in the average size on all three levels – identification, assimilation, and exploitation. Moreover, the networks are on average highly clustered but show low density.

Table 5.1: Descriptive statistics over all networks in the data set
Note: The sample size is n=1,214.
Source: Own calculation on basis of the collected data in the period 1995 until 2010

Statistic	**Mean**	**St. Dev.**	**Min**	**Pctl(25)**	**Pctl(75)**	**Max**
Identification network – Average values						
Number of edges	23.009	40.137	0	4	23.333	307.667
Number of vertices	92.695	104.883	2.667	31.708	109.167	843
Transitivity	0.429	0.246	0	0.233	0.63	0.994
Density	0.008	0.012	0	0.003	0.008	0.139

[52] Table 8.1 in the appendix summarises all relevant numbers of entrepreneurial knowledge production and absorption per planning region in the period 1995 until 2010.

Share of isolates	0.763	0.086	0.449	0.706	0.825	1
Number of relative components	0.097	0.029	0	0.078	0.117	0.193
Number of relative cutpoints	0.108	0.106	0	0.024	0.166	0.833
Relative diameter	0.413	0.102	0	0.363	0.486	0.622
Identification network – Volatility values						
Number of edges	1,781.79	19,050.09	0	7.467	185.892	297,984.80
Number of vertices	1,063.14	5,268.42	1.2	29.792	270.192	70,130.17
Transitivity	0.142	0.093	0	0.052	0.21	0.3
Density	0.0003	0.002	0	0	0.00003	0.027
Share of isolates	0.012	0.013	0	0.004	0.016	0.116
Number of relative components	0.002	0.003	0	0.001	0.003	0.029
Number of relative cutpoints	0.022	0.057	0	0.001	0.019	0.667
Relative diameter	0.025	0.019	0	0.011	0.035	0.096
Assimilation network – Average values						
Number of edges	215.586	494.159	1	18.75	169.708	4,317.50
Number of vertices	238.935	537.932	2	27.2	197.4	4,918
Transitivity	0.074	0.061	0	0.031	0.109	0.5
Density	0.084	0.166	0.0004	0.008	0.059	1
Share of isolates	0	0	0	0	0	0
Number of relative components	0.321	0.076	0.11	0.271	0.373	0.5
Number of relative cutpoints	0.625	0.298	0	0.432	0.776	2.658
Relative diameter	0.409	0.147	0.042	0.298	0.528	0.703
Assimilation network – Volatility values						
Number of edges	11,850.66	65,364.71	0	51.167	1,959.88	1,297,516
Number of vertices	6,418.88	45,516.20	0	80.267	1,292.77	1,406,044
Transitivity	0.014	0.033	0	0.001	0.011	0.5
Density	0.015	0.043	0	0	0.0004	0.328
Share of isolates	0	0	0	0	0	0
Number of relative components	0.003	0.004	0	0.001	0.004	0.029
Number of relative cutpoints	0.075	0.2	0	0.013	0.073	2.806
Relative diameter	0.014	0.012	0	0.006	0.02	0.07
Exploitation network – Average values						
Number of edges	171.2	277.056	1	39.2	167.4	2,386
Number of vertices	107.305	79.682	3.333	46	136.292	452
Transitivity	0.549	0.162	0.167	0.428	0.659	1
Density	0.033	0.031	0.011	0.018	0.036	0.424
Share of isolates	0.212	0.074	0.051	0.167	0.244	0.852

Number of relative components	0.159	0.071	0.005	0.105	0.213	0.33
Number of relative cutpoints	1.502	1.963	0	0.451	1.785	20.5
Relative diameter	0.264	0.135	0.018	0.155	0.373	0.624
Exploitation network – Volatility values						
Number of edges	3,358.70	13,337.73	0.7	174.625	1,376.78	176,416.80
Number of vertices	254.234	450.571	2.967	51.792	209.367	3,782.27
Transitivity	0.023	0.047	0	0.003	0.02	0.267
Density	0.001	0.012	0	0.00001	0.0001	0.21
Share of isolates	0.007	0.017	0.00003	0.001	0.006	0.257
Number of relative components	0.002	0.003	0	0.0005	0.002	0.052
Number of relative cutpoints	1.881	12.278	0	0.052	0.372	181.175
Relative diameter	0.009	0.009	0	0.002	0.012	0.063
Regional variables – Average values						
Regional potential	401.669	367.845	65	200.9	438.9	2,501
Number of students	22.861	15.038	0	8.992	33.763	91.133
Share of high school leavers with matriculation standard	26.216	6.446	14.183	21.508	30.346	55.35
Inhabitant density	368.359	537.467	44.5	138.375	363.458	3,845.00
Inhabitant-employee density	496.031	732.216	57.5	181.333	462	5,204.50
Regional variables – Volatility values						
Regional potential	19.487	153.287	0	0.7	9.067	3,905.37
Number of students	5.769	14.872	0	0.528	6.339	253.022
Share of high school leavers with matriculation standard	15.716	22.882	0.011	0.975	25.597	152.246
Inhabitant density	39.864	280.363	0	0.8	9.367	6,187.20
Inhabitant-employee density	113.103	824.623	0	1.467	20.167	20,527.10

As a next step, the results of the random forest analyses based upon conditional inference classification trees are illustrated in Table 5.2. The variables that were identified to be important in at least two out of four specifications are marked with an 'X' in the table.[53]

Reviewing the results of the analyses for the identification network, which is defined by all patent applicants in the region and their joint patenting activities, it becomes clear that the size and the fragmentation of this network influences regional absorption. To regionally absorb entrepreneurial knowledge at all, the amount of cooperation between incumbents in the region and the volatility of the number of clusters are most important. These findings are coherent as both indicators make the point that the structure of cooperation and the stability of cooperation

[53] For the results of each specification see Figure 8.2 and Figure 8.3 in the appendix.

clusters matters. Regarding the efficiency of regional absorption of entrepreneurial knowledge only the number of incumbents in the region is relevant. This result provides evidence for the importance of the symbiotic relationship of incumbents and entrepreneurs for a functioning regional innovation system.

The results for the assimilation network, characterised by patent applications in the region and their regional antecedents, indicate that the structure and fragmentation of the network influence absorption rates. For regional absorption in general, the volatility of the number of cutpoints, which represent bottlenecks in regional technology development trajectories, matters the most. For the efficiency of regional absorption processes the diameter, representing the longest trajectory of regional knowledge accumulation, is a central aspect. Thus, the regional absorption of entrepreneurial knowledge relates to the flexibility of the regional learning regime, but for an efficient absorption the construction of the main development trajectory is important.

The exploitation network, built by the knowledge blocks patents rely on and their co-occurrence, affects the regional absorption of entrepreneurial knowledge by its size, its structure, and its fragmentation. For the purpose of regional absorption in general, the number of regionally available knowledge blocks and the volatility of the share of isolated ones are most important. The exploitation network is the most important one for the efficiency of regional absorption processes as in this network the majority of important variables are located. The number of knowledge blocks available in the region and their interconnectedness remain relevant when looking at the efficiency of regional knowledge absorption. Additionally, to the volatility of isolated knowledge blocks, the average and the volatility of network density matter.

Moreover, regional conditions describing the supply in human capital, represented by regional potential and number of students, as well as their interconnectedness, represented by inhabitant and inhabitant-employee density, are relevant for regional absorption processes. The control variables region and year influence only whether there exists absorption or not, but not the efficiency of absorption processes.

Based on the empirical evidence presented, *Proposition 2* and *Proposition 3*, which state that regional innovation system indicators influence the absorption processes, can be confirmed.

Table 5.2: Importance of variables for entrepreneurial knowledge absorption
Source: Own summary based on random forest analyses

			No absorption vs. absorption		**Efficiency of absorption**	
Network	Network characteristics	Network indicators	Mean Value	Variance Value	Mean Value	Variance Value
Identification	Size	Count of edges			X	
		Count of vertices	X			
	Structure	Density				
		Transitivity				
		Relative Diameter				
	Fragmentation	Percentage of isolates				
		Relative number of components		X		
		Relative number of cutpoints				
Assimilation	Size	Count of edges				
		Count of vertices				
	Structure	Density				
		Transitivity				
		Relative Diameter				X
	Fragmentation	Percentage of isolates				
		Relative number of components				
		Relative number of cutpoints		X		
Exploitation	Size	Count of edges				
		Count of vertices	X		X	
	Structure	Density			X	X
		Transitivity				
		Relative Diameter				
	Fragmentation	Percentage of isolates		X		X
		Relative number of components				
		Relative number of cutpoints				
Control Variables		Regional potential		X	X	
		Number of students	X			
		Share of high school leavers with matriculation standard				
		Inhabitant density				X
		Inhabitant-employee density			X	

	Year	X	
	Region (NUTS1)	X	

5.3 Development of important variables across absorption levels

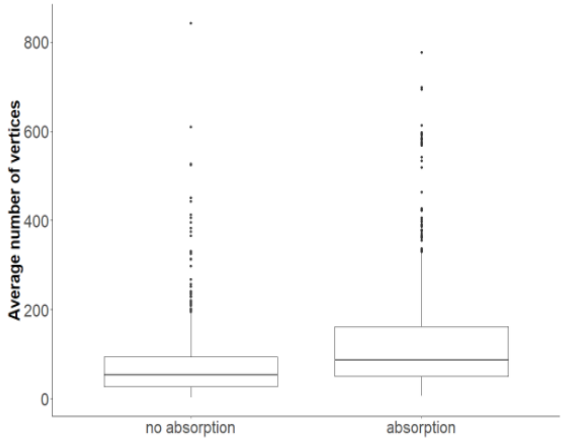
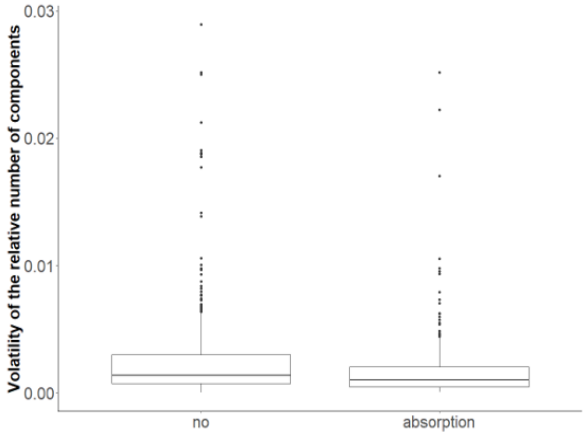
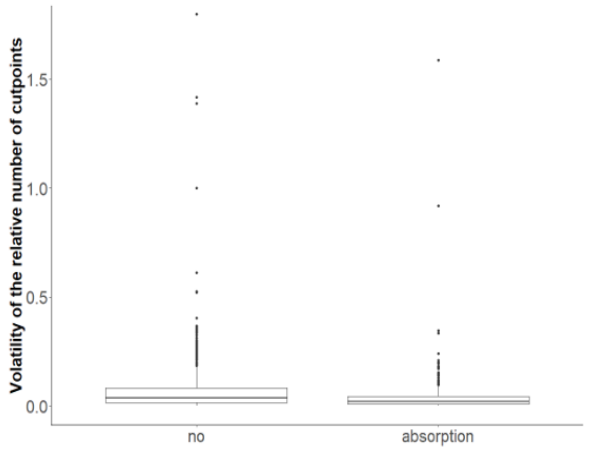
5.3.1 Regional absorption vs. no regional absorption of entrepreneurial knowledge

The variables that were identified as important for regional absorption of entrepreneurial knowledge in general are analysed in further detail in the following. Table 5.3 summarises the distribution of the variables important to classify a regional innovation system as absorbing or non-absorbing.

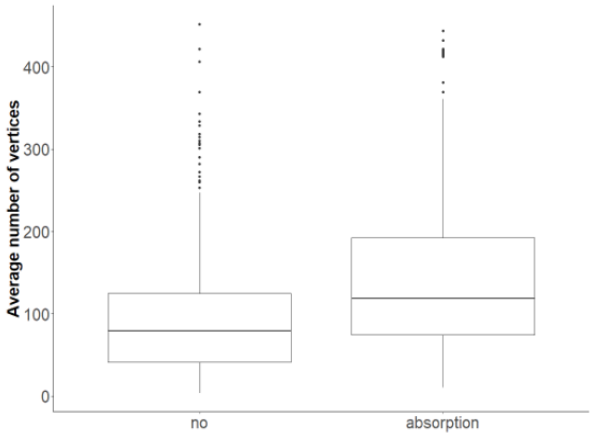
In the case of no absorption, the identification and exploitation network consist out of less vertices. This means that non-absorbing systems have less incumbents and less knowledge blocks available. Furthermore, these systems have less students, i.e. less human capital supply.

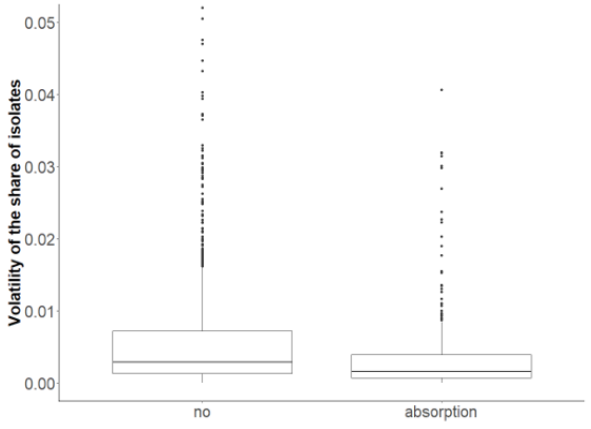
Additionally, regional innovation systems that do not absorb entrepreneurial knowledge are more unstable in regard to three variables: 1) the amount of components in the identification network, i.e. the amount of cooperation clusters, 2) the amount of cutpoints in the assimilation network, i.e. the amount of bottlenecks in the regional trajectories, and 3) the share of isolates in the exploitation network, i.e. unconnected knowledge blocks. These findings hint at the relevance of the predictability of developments in regional innovation systems for the absorption of entrepreneurial knowledge. However, stability in regional potential, which describes the contact potential of inhabitants, is not associated with intraregional absorption of entrepreneurial knowledge.

Table 5.3: Comparison of important variables between absorbing and non-absorbing regional innovation systems
Source: Own illustration based upon descriptive analyses on the collected data; Note: The plots of volatility of the relative number of cutpoints in the assimilation network, volatility of the share of isolates in the exploitation network, and the volatility of regional potential omitted several outliers from the plots for the purpose of illustration

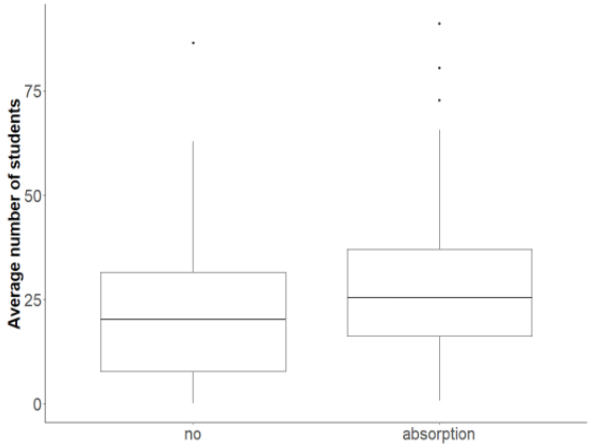
	Average values	**Volatility values**
Identification		
Assimilation		

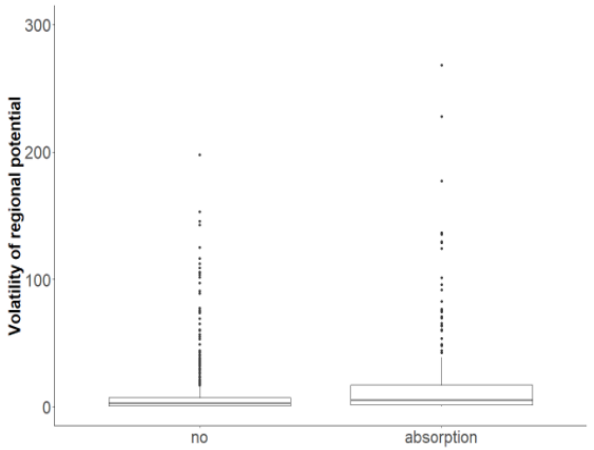
Exploitation





Regional variables





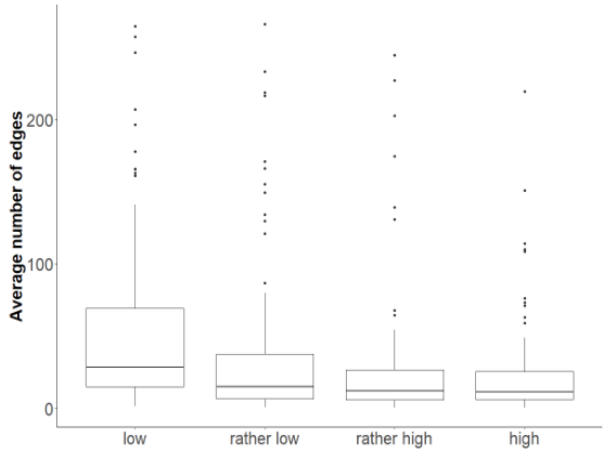
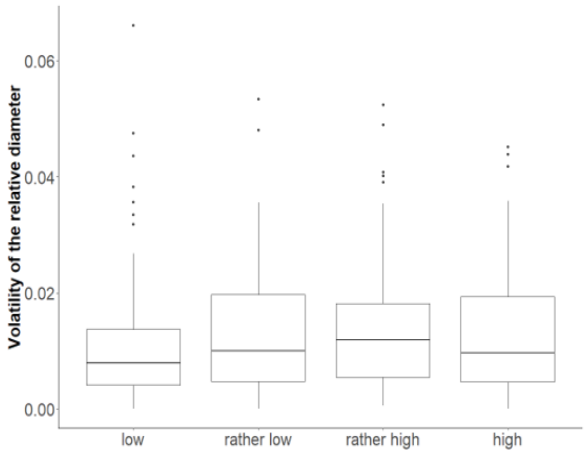
5.3.2 *Efficiency of absorption*

The development of the important variables across the efficiency levels of absorption of entrepreneurial knowledge is illustrated in Table 5.4.

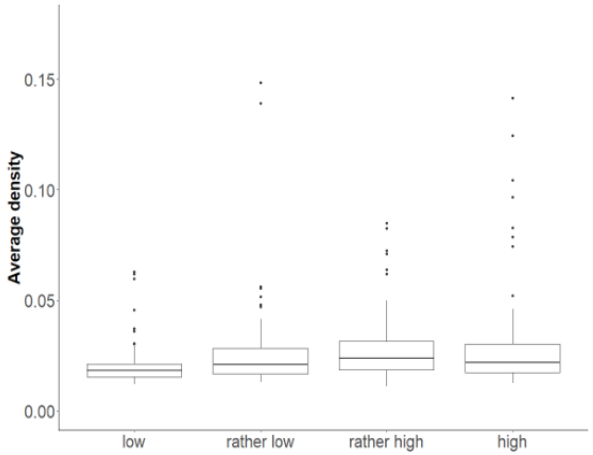
The efficiency of knowledge absorption increases with the decrease in two network indicators: 1) edges in the identification network, i.e. cooperation ties between incumbents and, 2) vertices in the exploitation network, i.e. regionally available knowledge blocks. Only density in the exploitation network, i.e. the connectedness of the regional knowledge base, is observed to increase over the absorption levels. These findings hint at the relevance of specialised incumbents in a regional innovation system. Less cooperation ties between these might imply lower possibilities for lock-ins. Further, a decreasing regional potential and inhabitant-employee density are associated with higher absorption rates. This finding might correspond to the fact that metropoles, where a high density of human capital is usual, do not rely on entrepreneurial knowledge to build a competitive advantage.

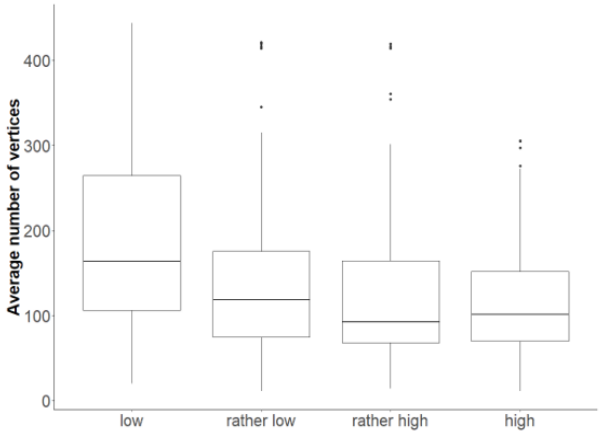
Regarding the important variables describing the volatility of network characteristics, higher knowledge absorption is associated with the increase of instability in three variables: 1) relative diameter in the assimilation network, i.e. the length of the longest trajectory, 2) share of isolates in the exploitation network, i.e. share of unconnected knowledge blocks in the regional knowledge base, and, to a lesser degree, 3) density of the exploitation network, i.e. connectedness of the regional knowledge base. These findings highlight the importance of flexible main trajectories and knowledge bases for the intraregional absorption of entrepreneurial knowledge. In contrast to this, stable rather than flexible inhabitant density of a region is associated with higher absorption levels.

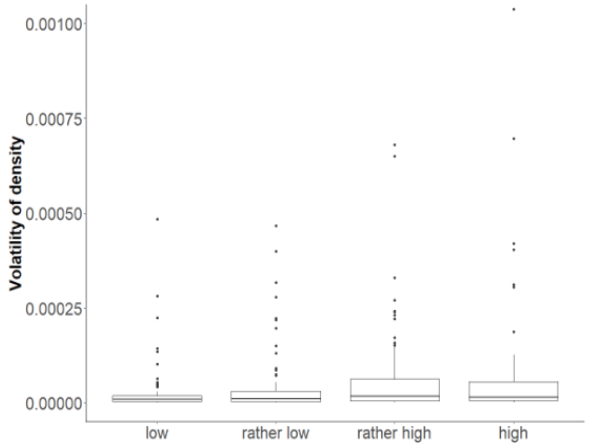
Table 5.4: Comparison of important variables between regional innovation systems with different levels of absorption
Source: Own illustration based upon descriptive analyses on the collected data; Note: The plots of average values and volatility values of the density in the exploitation network and, the volatility of inhabitant density omitted several outliers from the plots for the purpose of illustration

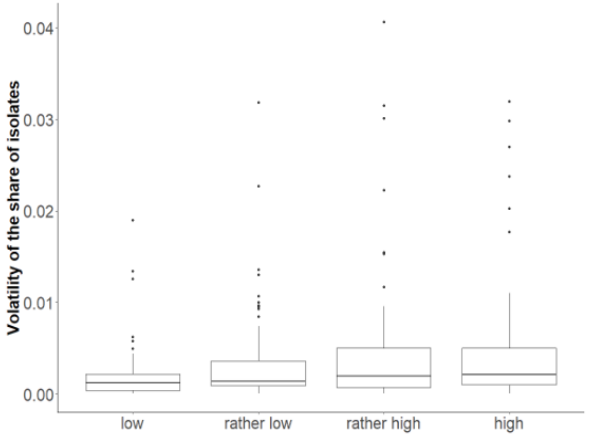
	Average values	**Volatility values**
Identification		
Assimilation		

Exploitation

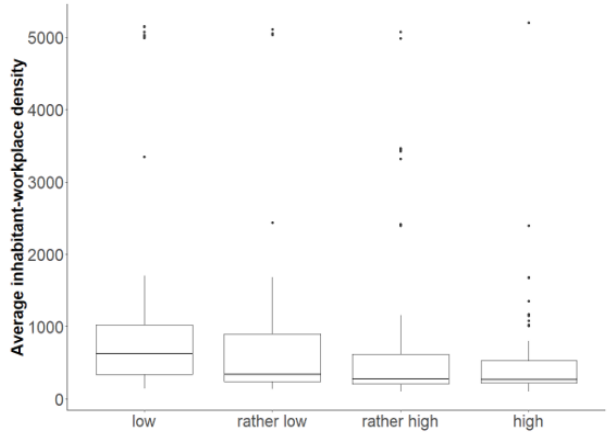


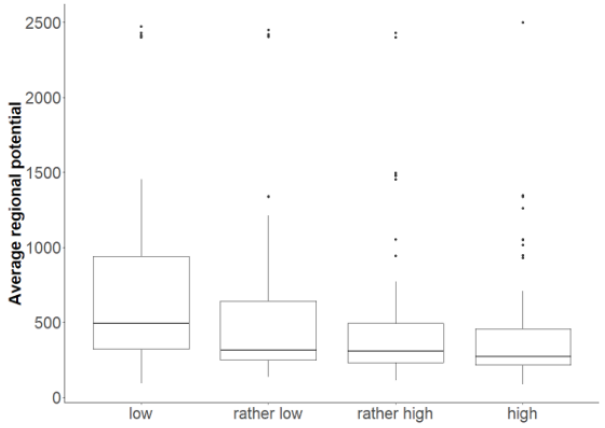


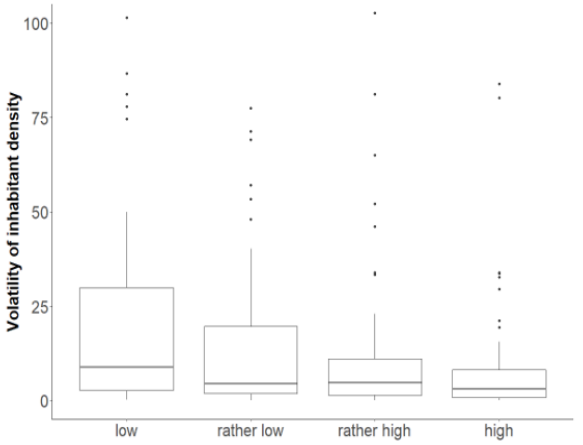




Regional variables







5.4 Relation between regional innovation system characteristics within levels of absorption

The former analyses revealed the variables that influence whether a region has no, low, rather low, rather high, or high absorption of entrepreneurial knowledge. In the next step, the different levels of absorption are analysed in more detail. It will be examined, which variables impact the efficiency of knowledge absorption within each absorption level. These findings help to gain a more detailed understanding of the factors that relate to success within these levels and eventually enable regions to climb one level. Table 5.5 shows all significant Spearman correlations and their respective p-value.[54]

Within the level of *low* absorption, the density of the exploitation network is positively correlated with absorption rates. A negative relation is found between the volatility of the size of the identification network and absorption rates. The volatility of the number of cutpoints in the assimilation network, i.e. the flexibility of bottlenecks in regional trajectories, is positively associated with absorption of entrepreneurial knowledge in this level. In contrast to this, population density in various specifications (regional potential, inhabitant density, and inhabitant-employee density) is negatively correlated with absorption rates. Thus, a stable sized regional innovation system, a well-connected knowledge base, and a flexible learning regime are advantages to do better than other regions in this level of knowledge absorption.

Regional innovation systems with a *rather low* absorption level show a negative relation to regional variables and their volatility. In this level, the number of students and the share of high school leavers with matriculation standard, i.e. the supply of human capital, as well as population density, measured as inhabitant and inhabitant-employee density, are negatively related to absorption rates. Furthermore, regions with a higher flexibility in inhabitant-employee density show less absorption of entrepreneurial knowledge. Therefore, in this level, a regional innovation system having settled regional environments absorbs more entrepreneurial knowledge.

The level of *rather high* intraregional absorption of entrepreneurial knowledge shows a negative relation between volatility of transitivity in the identification network and absorption rates. Stability in the clustering of the incumbent network, thus, predicts higher absorption rates.

[54] In the Table 5.5 the Spearman correlations are shown because there is reason to suspect that the Pearson correlations are biased because of outliers in the data. Further, regional innovation systems are complex in their nature and the detection of monotonic relations is more suitable than to expect to find linear relationships between the variables.

Regional innovation systems with *high* intraregional absorption show the most significant relations. Smaller networks in all three definitions – identification, assimilation, and exploitation – perform better than bigger networks. Moreover, the density of all networks is positively correlated with absorption rates within this level. The amount of cutpoints is in all three networks negatively associated with the absorption of entrepreneurial knowledge. These findings provide evidence that small, specialised, highly connected regional innovation systems have an advantage in absorbing entrepreneurial knowledge. Transitivity and relative diameter in context of the exploitation network are positively related to absorption rates, whereas in the assimilation network only relative diameter shows a positive link. The share of isolates plays a positive role in the identification and exploitation networks. Further, a higher relative number of components in the assimilation and exploitation networks predict higher absorption rates. Thus, regional innovation systems that build upon specialised clusters and cross-over connections between these clusters are favourable as well as the existence of one consistent regional learning regime. Stability in the size of all three networks, in the number of cutpoints in the exploitation network, i.e. bottlenecks of technology combinations, and in the number of students is favourable for the absorption of entrepreneurial knowledge. However, flexibility in variables of structure and fragmentation, except the number of cutpoints, is positively associated with intraregional absorption. Based upon these findings it can be derived that regional innovation systems that keep their basic characteristic - clusters which are connected via short paths – benefit from remixing clusters over time. Population density measures (regional potential, inhabitant density, and inhabitant-employee density) are negatively related to absorption rates within this level. This might hint at a lower dependency on entrepreneurial knowledge for competitive advantages in regions that are characterised by a dense supply in human capital, which is the case for metropoles.

Table 5.5: Spearman correlations of network indicators across absorption levels
Note: p-value are displayed in parentheses. Only correlations with a maximum p-value of 0.1 are shown in the table
Source: Own calculation results

			Low absorption		**Rather low absorption**		**Rather high absorption**		**High absorption**	
			Mean Value	Variance Value	Mean Value	Variance Value	Mean Value	Variance Value	Mean Value	Variance Value
Net-work	Network characteristics	Network indicators								
Identification	Size	Count of edges		-0.206 (0.059)					-0.336 (0.002)	-0.276 (0.011)
		Count of vertices		-0.215 (0.048)					-0.393 (0.000)	-0.292 (0.007)
	Structure	Density							0.264 (0.015)	0.339 (0.002)
		Transitivity						-0.205 (0.060)		
		Relative Diameter								0.239 (0.028)
	Frag-mentation	Percentage of isolates							0.197 (0.071)	0.203 (0.063)
		Relative number of components								0.278 (0.010)
		Relative number of cutpoints							-0.420 (0.000)	
Assimilation	Size	Count of edges							-0.374 (0.000)	-0.298 (0.006)
		Count of vertices							-0.391 (0.000)	-0.311 (0.004)
	Structure	Density							0.402 (0.000)	0.407 (0.000)
		Transitivity								
		Relative Diameter							0.279 (0.010)	
		Percentage of isolates								

	Frag-mentation	Relative number of components					0.286 (0.008)	
		Relative number of cutpoints		0.188 (0.085)			-0.255 (0.019)	
Exploitation	Size	Count of edges					-0.418 (0.000)	-0.383 (0.000)
		Count of vertices					-0.406 (0.000)	-0.229 (0.035)
	Structure	Density	0.303 (0.005)				0.329 (0.002)	0.262 (0.015)
		Transitivity					0.354 (0.001)	0.285 (0.008)
		Relative Diameter					0.368 (0.001)	0.218 (0.046)
	Frag-mentation	Percentage of isolates					0.330 (0.002)	0.255 (0.019)
		Relative number of components					0.370 (0.000)	0.361 (0.001)
		Relative number of cutpoints					-0.378 (0.000)	-0.276 (0.011)
Control Variables		Regional potential	-0.209 (0.055)				-0.246 (0.023)	
		Number of students		-0.272 (0.012)				-0.289 (0.007)
		Share of high school leavers with matriculation standard		-0.212 (0.052)				
		Inhabitant density	-0.234 (0.031)	-0.213 (0.050)			-0.282 (0.009)	
		Inhabitant-employee density	-0.243 (0.025)	-0.212 (0.052)	-0.214 (0.049)		-0.290 (0.007)	

6 Discussion and conclusion

Entrepreneurial experimentation offers the chance to extend a regional knowledge base and kick off system-wide experimentation. However, the effectiveness of the entrepreneurial experimentation to give rise to regional competitive advantages is governed by the regional absorptive capacity. The current literature argues that the absorptive capacity of a region is formed by regional context factors (Lopez-Bazo & Motellon, 2018; Malerba & McKelvey, 2020; Solano et al., 2020; Szerb et al., 2019). This study contributes to this discussion by investigating the regional innovation system characteristics that influence the regional absorption of entrepreneurial knowledge. Regionalised patent data, which is combined with firm level information from German regions over the period 1995 until 2015, build the basis for the analyses. Regional innovation systems are represented by networks on three levels: 1) applicant networks to show the cooperation between actors (identification network), 2) backward citation networks as representation for learning regimes (assimilation network), and 3) technological class networks (exploitation network) to make the knowledge base visible. Forward citations from entrepreneurial patents are used as an indicator of the success of the regional absorption process. Network indicators are applied as independent and the regional absorption success as dependent variable. These variables are implemented in random forest analyses on basis of conditional inference classification trees.

Proposition 1 of this study, stating that the stimulation of entrepreneurial knowledge production is not sufficient to kick off system-wide absorption of this knowledge, is confirmed. Regional innovation systems that are characterised by a large amount of entrepreneurial knowledge production are not the same as those regions that make the most use of this knowledge production.

Proposition 2 and *Proposition 3*, which assume that regional innovation system indicators can explain the regional absorption of entrepreneurial knowledge in general, but also its efficiency, are confirmed. Regional innovation systems that do not show any intraregional absorption of entrepreneurial knowledge tend to have less innovative incumbents, a smaller knowledge base, and less human capital supply. They are also less stable in all three networks – identification, assimilation, and exploitation, which emphasises the relevance of predictability of innovation system developments for regional absorption processes. Regional innovation systems with efficient absorption of entrepreneurial knowledge are characterised by specialised incumbents and a flexible learning regime as well as a flexible knowledge base.

The knowledge base is the most important network layer to differentiate the absorption level of regional innovation systems. In this vein, this study contributes in three ways: First, the applicant network is differentiated from the learning regime, represented by the backward citation network, to direct the attention to the distinct importance of these on regional absorptive capacity. By doing so, further evidence on the importance of applicant networks in which knowledge is shared and of the coordination mechanisms regional absorption is based on, is provided. Also, it is shown that the regional learning regime is an important level on its own (Malerba & McKelvey, 2020; Pihlajamaa, 2018). Second, the study confirms the important role of regional knowledge bases for the absorption of new knowledge (Cohen & Levinthal, 1990; Solano et al., 2020). Third, the volatility of regional innovation system characteristics is taken into consideration. The results support that stability of network structures relate to the success and efficiency of regional absorption of entrepreneurial knowledge.

Proposition 4 is concerned with the relation of regional innovation system characteristics and the varying regional absorption rates of entrepreneurial knowledge within one absorption level – no absorption, low, rather low, rather high, and high absorption. Although the importance of regional networks is widely acknowledged in the literature, the direction of the effects of network indicators is debated. This study contributes to the literature by providing insights that the direction and magnitude of relations between regional innovation system characteristics and knowledge absorption changes on different absorption levels. Regional innovation systems with low absorption profit from a stable size, a well-connected knowledge base and a flexible learning regime. Within the level of rather low absorption rates, regional environments with less changes due to human capital supply and a lower density is beneficial. The third level with rather high absorption rates favour the stable clustering of incumbents. High absorption rates relate to smaller sized regional innovation systems that are flexible, but keep their key characteristic – clusters which are connected via short paths.

Overall, these findings reject the view that a larger knowledge base is per se better, as the size of the knowledge base does not appear to be important across all levels but rather multiple indicators on different levels govern the processes of regional absorption of entrepreneurial knowledge (Arvanitis & Woerter, 2015; Molina-Morales et al., 2019; Russo-Spena & Di Paola, 2019).

In most cases the regional variables, describing connectedness of the regional population, are negatively correlated with the regional absorptive capacity. This is a surprising finding since density of the population is commonly evaluated as being conducive to absorptive capacity

(Molina-Morales et al., 2019; Schmidt, 2005). One explanation could be that regional innovation systems, which rely strongly on regional human capital and tacit knowledge exchange, reject ideas from unusual sources, like entrepreneurial experimentation (Pihlajamaa, 2018). Further, high density of human capital is prominently given in metropoles and these may not rely on entrepreneurial experimentation to build or sustain competitive advantages, but rely on established actors.

The main finding of this study is that different regional mechanisms are needed to unfold the entrepreneurial potential. A policy approach focussing on only the stimulation of entrepreneurial knowledge generation delivers inconsistent outcomes because the regional absorption processes are not considered. Therefore, policy makers are required to monitor not only the regional entrepreneurial activities but also the mechanisms needed for regional absorption of this entrepreneurially produced knowledge (Solano et al., 2020). This goes in line with the critics of the smart specialisation approach that the diffusion of knowledge is a distinct and inevitable part for its success which requires more attention (Lindholm-Dahlstrand et al., 2019; Uyarra, 2019). To design regional policies that aim at entrepreneurial discovery processes, which enable the transformation of whole regions, requires a detailed understanding of regional absorption processes. Besides that, machine learning techniques, like the random forest analysis conducted in this study, demonstrate great explanatory power for the kind of data analysed in this study. Often, for the analysis of regional innovation systems, where indicators are highly dependent on each other, commonly applied multivariate statistics are unable to provide satisfying results. Therefore, machine learning techniques are of special importance for future research.

Nevertheless, the scope of the study is limited, paving the road for future research. First, regionalised patent data is used as basis for the analysis. This comes with the difficulty that the regional entrepreneurial knowledge and its regional absorption is underestimated because not every patent includes address information. However, there is no reason to assume that the subset of patents with regional information is systematically different from the patents that include information on the location. Future research may also validate the results of this study on a different regional level as on the second 'Nomenclature des unités territoriales statistiques' (NUTS) level. Second, patent data is a proxy for the innovative activities in the regional innovation system (Jaffe, 1993). Due to the non-patenting of certain industries, this data is incomplete. Future research could complement patent data with other types of data, e.g. surveys or news data, to capture a holistic picture of regional innovative activities. Third, the methodological approach in this study, conducting a random forest analysis based upon

conditional inference classification trees, comes with the limitation that the used model is pooled. Due to computational restrictions it was also not possible to control for regional effects for every region (96 planning regions) but only on federal state level. Future research may use the data on a more sophisticated model allowing the exploitation of the panel structure of the data, controlling for regional effects. Fourth, the regional innovation systems, which are pooled in this analysis, are different in size. This can cause multiple network indicators to be influenced. However, as these network indicators capture unique aspects, the explanatory power of each indicator is not eliminated. As the random forest analysis based upon conditional inference trees is not influenced by correlations between explanatory variables, the procedure has the ability to retrieve the unique contribution of each variable. Fifth, the scope of the variables analysed in this study is not comprehensive but rather reflects the basic network indicators. It could be beneficial for future research to focus on one class of indicators and compare different specifications of these. Lastly, the split of the observations into the second to fifth level of absorption, which is based on the distribution of the data, comes with a limitation. As seen before, the variance in the fourth quartile, the fifth level of absorption, is greater than in the other three. This may explain why the fourth quartile shows more relations to regional innovation system characteristics. Although, this split has the benefit that the conditional inference classification trees are not biased due to imbalances in class sizes, future research may validate the results by choosing different data splits.

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8 Appendix

Table 8.1: Regional entrepreneurship activity and regional absorptive capacity
Source: Own summary based on calculations on basis of the collected data in the period 1995 until 2010

		Knowledge production		**Knowledge absorption**		
Planning region code (ROR Code)	German planning region name	Sum of entrepreneurial patents	Quantile in knowledge production	Sum of intraregional citations on entrepreneurial patents	Mean ratio of entrepreneurial patents and intraregional citations	Quantile in knowledge absorption
101	Schleswig-Holstein Mitte	58	3	30	0.517	4
103	Schleswig-Holstein Ost	19	1	2	0.105	2
104	Schleswig-Holstein Süd	74	3	7	0.095	2
105	Schleswig-Holstein Süd-West	15	1	3	0.200	4
201	Hamburg	173	4	28	0.162	3
301	Braunschweig	67	3	8	0.119	2
302	Bremen-Umland	32	2	3	0.094	2
303	Bremerhaven	13	1	1	0.077	2
304	Emsland	31	2	7	0.226	4
307	Hannover	79	3	14	0.177	3
309	Lüneburg	13	1	1	0.077	2
310	Oldenburg	31	2	10	0.323	4
311	Osnabrück	34	2	1	0.029	1
401	Bremen	54	2	9	0.167	3
501	Aachen	129	4	5	0.039	1
502	Amsberg	45	2	8	0.178	3
503	Bielefeld	108	4	8	0.074	2
504	Bochum/Hagen	142	4	12	0.085	2
505	Bonn	61	3	5	0.082	2
506	Dortmund	97	4	4	0.041	1

507	Duisburg/Essen	155	4	26	0.168	3
508	Düsseldorf	212	4	33	0.156	3
509	Emscher-Lippe	54	3	6	0.111	2
510	Köln	137	4	24	0.175	3
511	Münster	133	4	33	0.248	4
512	Paderborn	53	2	13	0.245	4
513	Siegen	38	2	2	0.053	1
601	Mittelhessen	70	3	10	0.143	3
602	Nordhessen	32	2	6	0.188	4
604	Rhein-Main	190	4	52	0.274	4
605	Starkenburg	76	3	15	0.197	4
701	Mittelrhein-Westerwald	73	3	8	0.110	2
702	Rheinhessen-Nahe	53	2	3	0.057	1
703	Rheinpfalz	40	2	3	0.075	2
704	Trier	49	2	1	0.020	1
801	Bodensee-Oberschwaben	97	4	17	0.175	3
802	Donau-Iller (BW)	65	3	9	0.138	3
803	Heilbronn-Franken	97	4	18	0.186	3
804	Hochrhein-Bodensee	39	2	1	0.026	1
805	Mittlerer Oberrhein	105	4	12	0.114	2
806	Neckar-Alb	63	3	9	0.143	3
807	Nordschwarzwald	70	3	11	0.157	3
808	Ostwürttemberg	38	2	4	0.105	2
809	Schwarzwald-Baar-Heuberg	55	3	19	0.345	4
810	Stuttgart	347	4	69	0.199	4
811	Südlicher Oberrhein	88	4	5	0.057	1
812	Unterer Neckar	78	3	4	0.051	1
901	Allgäu	56	3	6	0.107	2
902	Augsburg	63	3	19	0.302	4
903	Bayrischer Untermain	45	2	8	0.178	3

904	Donau-Iller (BY)	50	2	2	0.040	1
905	Donau-Wald	52	2	1	0.019	1
906	Industrieregion Mittelfranken	154	4	23	0.149	3
907	Ingolstadt	20	1	2	0.100	2
908	Landshut	25	1	1	0.040	1
909	Main-Röhn	22	1	3	0.136	3
910	München	464	4	97	0.209	4
911	Oberfranken-Ost	30	1	2	0.067	1
912	Oberfranken-West	54	3	28	0.519	4
913	Oberpfalz	41	2	2	0.049	1
914	Oberpfalz-Nord	32	2	1	0.031	1
915	Regensburg	35	2	2	0.057	1
916	Südostoberbayern	82	4	11	0.134	2
918	Würzburg	58	3	10	0.172	3
1001	Saar	77	3	11	0.143	3
1101	Berlin	456	4	79	0.173	3
1201	Havelland-Fläming	77	3	4	0.052	1
1202	Lausitz-Spreewald	19	1	1	0.053	1
1203	Oderland-Spree	30	1	8	0.267	4
1302	Mittleres Mecklenburg/Rostock	39	2	1	0.026	1
1303	Vorpommern	14	1	2	0.143	3
1304	Westmecklenburg	39	2	1	0.026	1
1401	Oberes Elbtal/Osterzgebirge	192	4	36	0.188	4
1402	Oberlausitz-Niederschlesien	68	3	5	0.074	2
1403	Südsachsen	208	4	22	0.106	2
1404	Westsachsen	137	4	33	0.241	4
1502	Anhalt-Bitterfeld-Wittenberg	43	2	6	0.140	3
1503	Halle/S.	79	3	26	0.329	4
1504	Magdeburg	116	4	12	0.103	2
1601	Mittelthüringen	54	3	1	0.019	1

1602	Nordthüringen	26	1	15	0.577	4
1603	Ostthüringen	152	4	55	0.362	4
1604	Südthüringen	77	3	8	0.104	2
102	Schleswig-Holstein Nord	17	1	0	0	0
305	Göttingen	35	2	0	0	0
306	Hamburg-Umland-Süd	8	1	0	0	0
308	Hildesheim	17	1	0	0	0
312	Ost-Friesland	19	1	0	0	0
313	Südheide	25	1	0	0	0
603	Osthessen	4	1	0	0	0
705	Westpfalz	26	1	0	0	0
917	Westmittelfranken	25	1	0	0	0
1204	Prignitz-Oberhavel	22	1	0	0	0
1205	Uckermark-Barnim	3	1	0	0	0
1301	Mecklenburgische Seenplatte	8	1	0	0	0
1501	Altmark	1	1	0	0	0

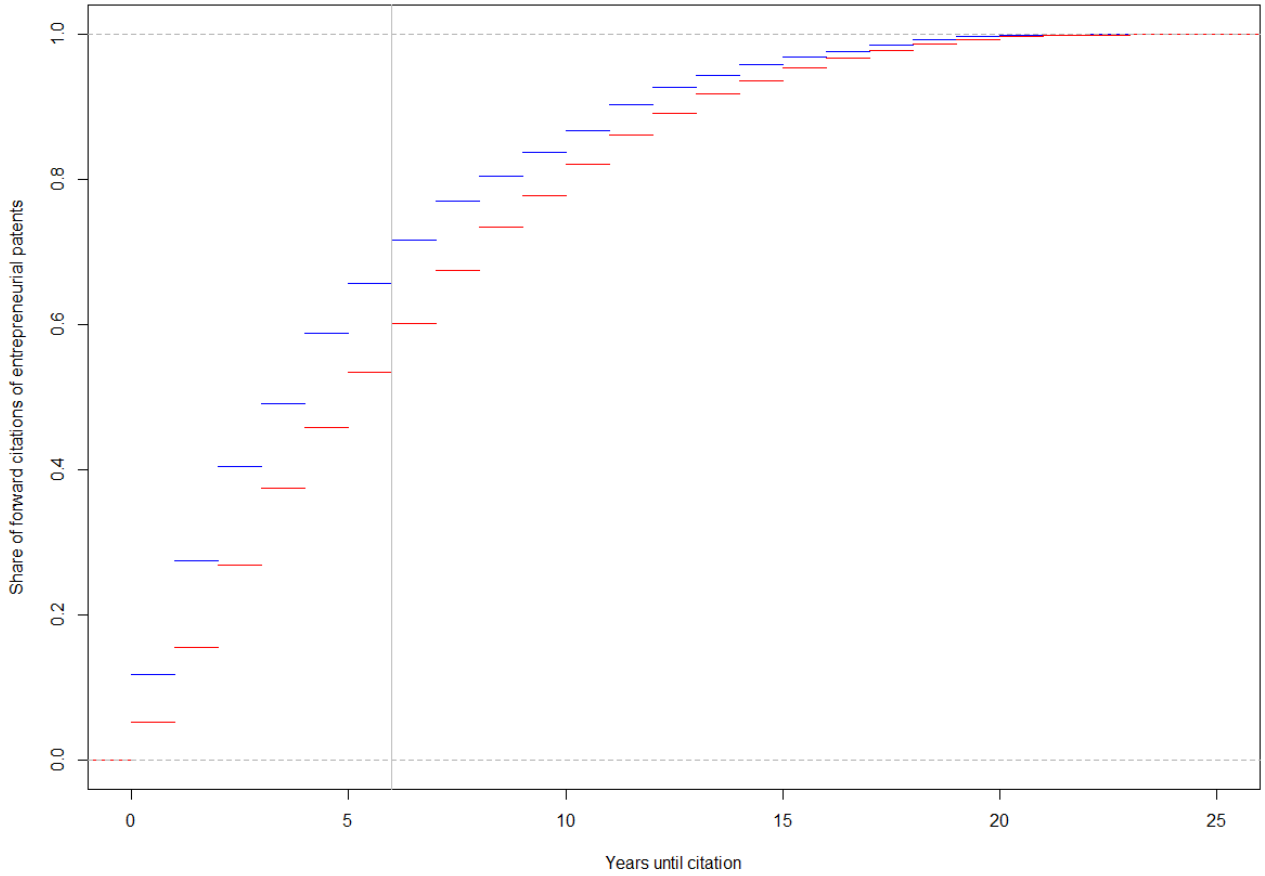
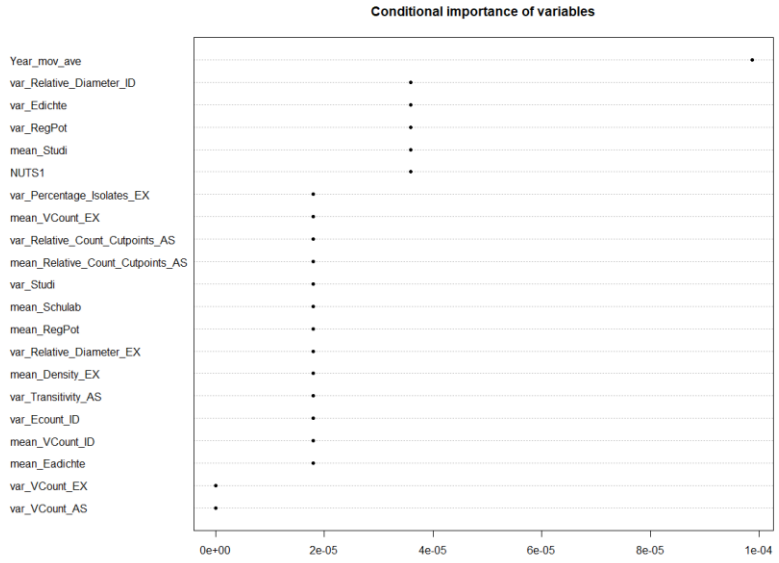
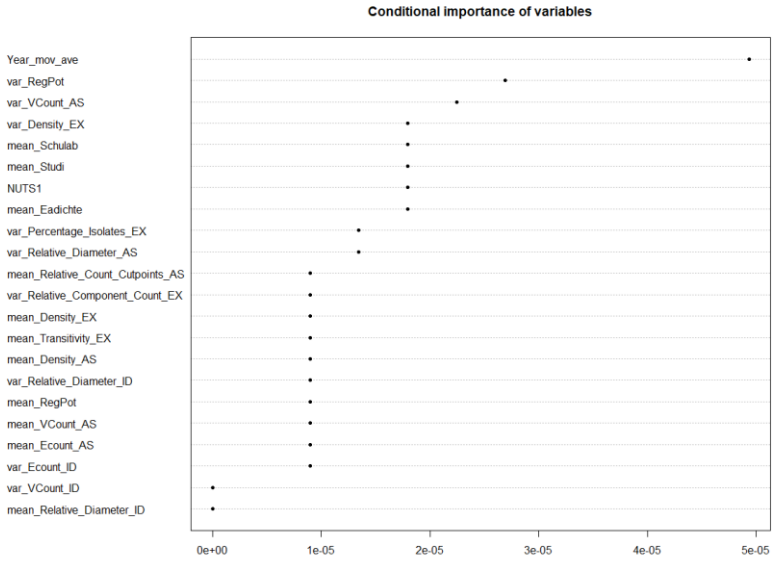


Figure 8.1: Cumulative distribution of intraregional citations (blue) and interregional citations (red)
Source: Own illustration based on collected data in the period 1995 until 2010

No Absorption vs. Absorption



Seed: 1234
Number of trees: 250
Correct classification rate: 74.629%



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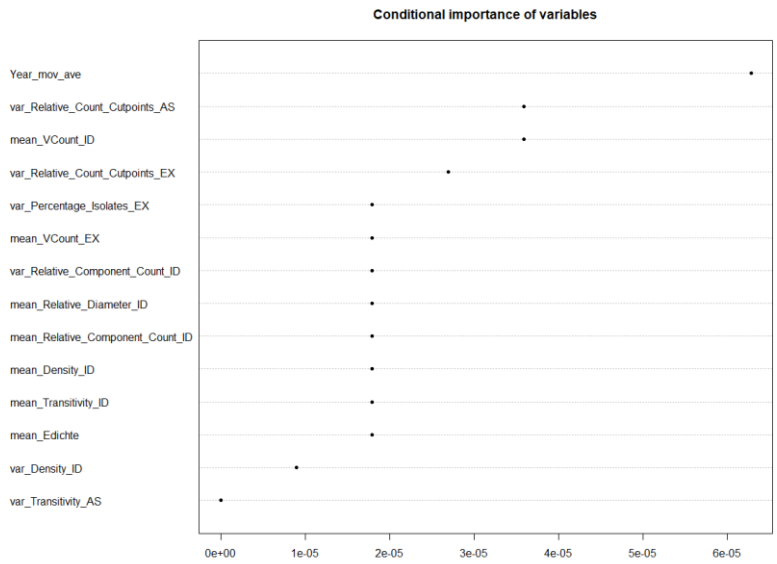
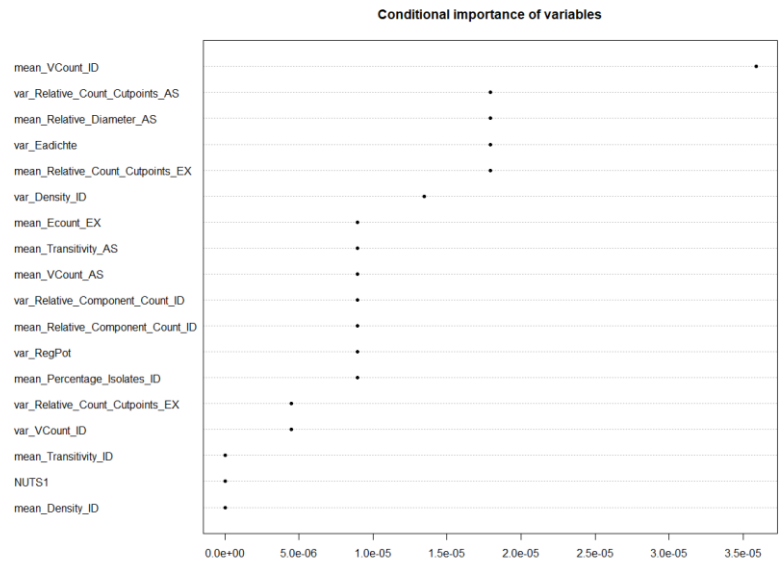
Number of trees: 500
Correct classification rate: 74.794%





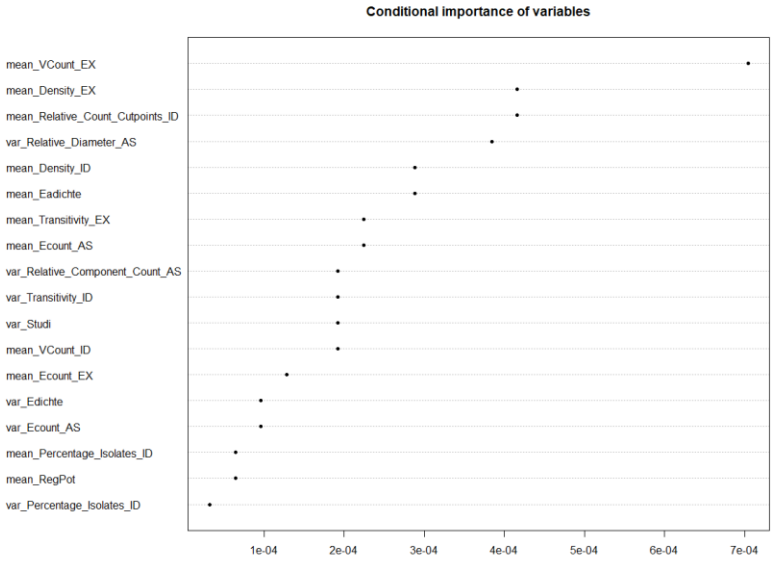
Seed: 2021 Number of trees: 250 Correct classification rate: 74.712%	Seed: 2021 Number of trees: 500 Correct classification rate: 74.712%

Variables
(replace XX with ID for identification, AS for assimilation and EX for exploitation network)

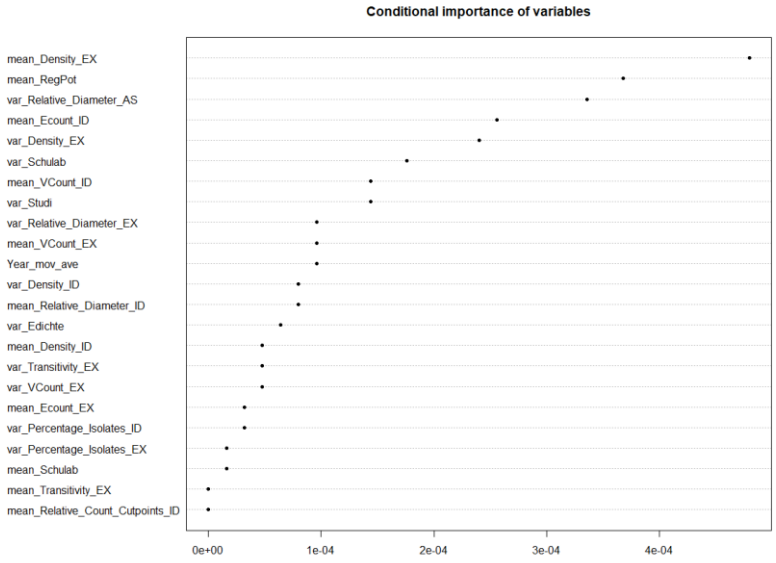
Average / Volatility regional potential	mean_RegPot / var_RegPot
Average / Volatility number of students	mean_Studi / var_Studi
Average / Volatility share of high school leavers with matriculation standard	mean_Schulab / var_Schulab
Average / Volatility inhabitant density	mean_Edichte / var_Edichte
Average / Volatility inhabitant-employee density	mean_Eadichte / var_Eadichte
Average / Volatility count of edges	mean_Ecount_XX / var_Ecount_XX
Average / Volatility count of vertices	mean_VCount_XX / var_VCount_XX
Average / Volatility transitivity	mean_Transitivity_XX / var_Transitivity_XX
Average / Volatility density	mean_Density_XX / var_Density_XX
Average / Volatility share of isolates	mean_Percentage_Isolates_XX / var_Percentage_Isolates_XX
Average / Volatility number of relative components	mean_Relative_Component_Count_XX / var_Relative_Component_Count_XX
Average / Volatility number of relative cutpoints	mean_Relative_Count_Cutpoints_XX / var_Relative_Count_Cutpoints_XX
Average / Volatility relative diameter	mean_Relative_Diameter_XX / var_Relative_Diameter_XX

Figure 8.2: Specifications of random forest analyses for no absorption vs. absorption of entrepreneurial knowledge
Source: Own illustration based on random forest analyses on the collected data

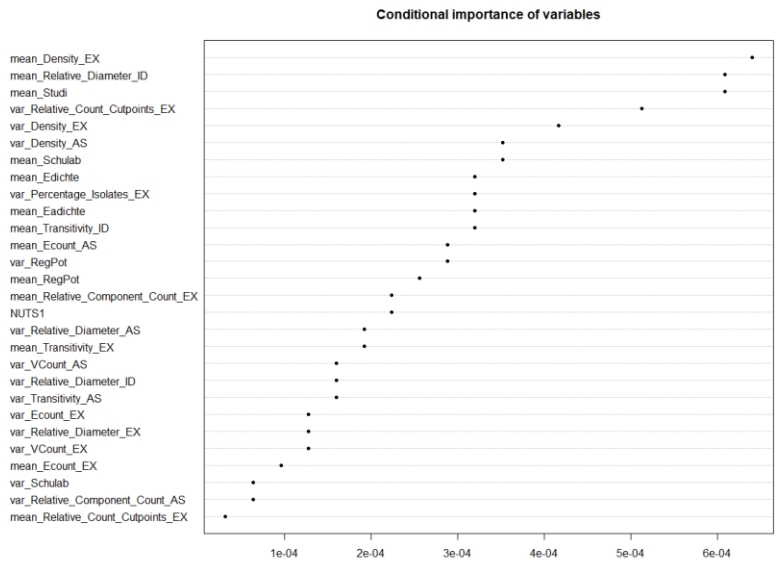
Efficiency of absorption

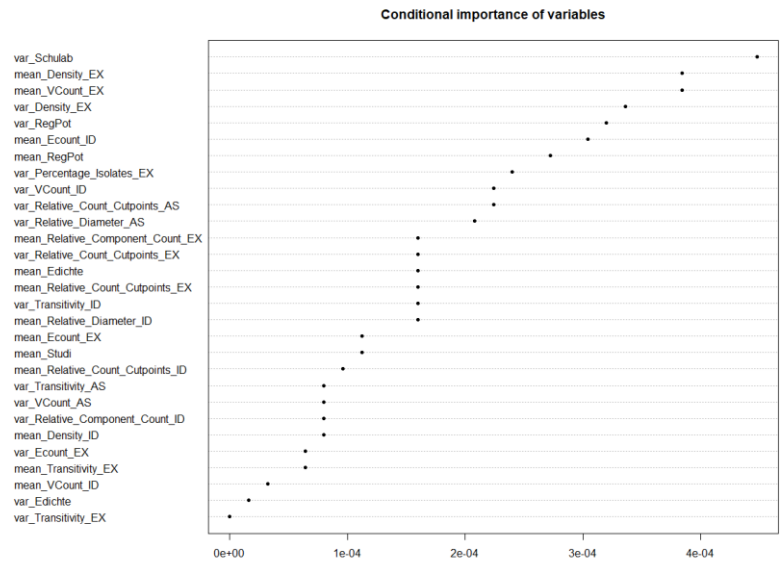


Seed: 1234
Number of trees: 250
Correct classification rate: 28.235%



Seed: 1234
Number of trees: 500
Correct classification rate: 30.294%





Seed: 2021 Number of trees: 250 Correct classification rate: 27.941%	Seed: 2021 Number of trees: 500 Correct classification rate: 28.824%

Variables
(replace XX with ID for identification, AS for assimilation and EX for exploitation network)

Average / Volatility regional potential	mean_RegPot / var_RegPot
Average / Volatility number of students	mean_Studi / var_Studi
Average / Volatility share of high school leavers with matriculation standard	mean_Schulab / var_Schulab
Average / Volatility inhabitant density	mean_Edichte / var_Edichte
Average / Volatility inhabitant-employee density	mean_Eadichte / var_Eadichte
Average / Volatility count of edges	mean_Ecount_XX / var_Ecount_XX
Average / Volatility count of vertices	mean_VCount_XX / var_VCount_XX
Average / Volatility transitivity	mean_Transitivity_XX / var_Transitivity_XX
Average / Volatility density	mean_Density_XX / var_Density_XX
Average / Volatility share of isolates	mean_Percentage_Isolates_XX / var_Percentage_Isolates_XX
Average / Volatility number of relative components	mean_Relative_Component_Count_XX / var_Relative_Component_Count_XX
Average / Volatility number of relative cutpoints	mean_Relative_Count_Cutpoints_XX / var_Relative_Count_Cutpoints_XX
Average / Volatility relative diameter	mean_Relative_Diameter_XX / var_Relative_Diameter_XX

Figure 8.3: Specifications of random forest analyses for efficiency of regional absorption of entrepreneurial knowledge
Source: Own illustration based on random forest analyses on the collected data

Chapter 5

Antecedents of Entrepreneurship During the First COVID-19 Shock: Mental Representations of Entrepreneurship and Preferences of Business Models during the Crisis

Jessica Birkholz
Jarina Kühn

Abstract

Crises entail uncertainties regarding future developments for individuals and for the economy as a whole. This paper examines the relation between the resulting crisis expectations and two antecedents of entrepreneurship – explicit business model preferences and implicit mental representations of entrepreneurship – in the early phase of the COVID-19 crisis. For this purpose, we conducted an online quasi-experiment in the core phase of the first shutdown in Germany. Binary logistic regressions are applied to identify the relation between crisis expectations and explicit business model preferences. The implicit mental representations of groups of respondents, characterised by similar crisis expectations, are compared with each other. There are three main results of the study: First, the crisis comes along with differences in explicit business model preferences in both characteristics – their main income source and the role of entrepreneurs. Second, implicit mental representations of entrepreneurship vary with crisis expectations. Third, rather than the existence of the crisis per se, the individual crisis expectations in different affected areas (work place security, income stability, health and economic development) are important as they show a distinct influence. We conclude that the crisis expectations formed in the early phase of the crisis impact the antecedents of entrepreneurship and therefore future entrepreneurial activities.

Keywords: Crisis; Entrepreneurship; Business models; Mental representations

JEL classifications: D83; D84; D87; D91; L26

Publication: A former version of this chapter is published as working paper.

Working paper: Birkholz, J. & Kühn, J. (2021). Entrepreneurship Perception during the first COVID-19 Shock: Mental Representations of Entrepreneurship and Preferences of Business Models during the Pandemic. *Bremen Papers on Economics & Innovation*, *No. 2105*. https://doi.org/10.26092/elib/824

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1 Introduction

The COVID-19 crisis has had an impact on economic structures all over the world in a formerly unknown magnitude (World Bank, 2020). It is unlikely that the economy will return to its pre-crisis state after the COVID-19 crisis, but rather give rise to long-lasting economic transformations (Cepel et al., 2020). Hope for economic recovery is put into the adaptability of entrepreneurs to changing environmental conditions brought forward by this crisis (Santos et al., 2017; Williams & Vorley, 2015). As entrepreneurs may be the fastest to respond to drastically changed demand patterns and changed expectations for their societal role, entrepreneurship is widely acknowledged as an agenda setter for future developments (Hanusch & Pyka, 2006; McCann & Ortega-Argilés, 2016; Schumpeter, 1934). To counteract possible negative impacts on entrepreneurial activities, it is of crucial importance to gain fine-grained information on the impacts of the crisis. Since the influences in the beginning of the crisis lay the foundation for further developments, the effects in this period are of key interest (Kuckertz et al., 2020).

In former crises, multiple effects on diverse levels of entrepreneurship were observed. Entrepreneurial processes are impacted in early stages (latent and early entrepreneurship) as well as in later stages (e.g. firm registrations) (Klapper & Love, 2011; Vegetti & Adascalitei, 2017). Moreover, the type of new ventures is impacted by crises. Entrepreneurial activities are subject to change in explicit as well as implicit terms. Explicit changes in business models correspond to different demand patterns. In pre-crisis and post-crisis periods, revenue generating processes and required resources differ (Bertschek & Erdsiek, 2020; Cucculelli & Peruzzi, 2020; Giotopoulos et al., 2017). Implicit changes represent different understandings of an entrepreneur´s societal role. The importance of social norms and motivations to start a new venture changes during crises (Santos et al., 2017; Vegetti & Adascalitei, 2017).

The general problem is that crises are unique events which are difficult to compare to each other. Many of the former crises like the financial crisis of 2008/2009 were shown to serve as accelerators of structural change. Through this, unprofitable business models became obsolete and companies were pushed to innovate (Archibugi et al., 2013). The COVID-19 crisis differs in this respect due to the nature of the shock. In contrast to other crises uncovering economic system failures, the COVID-19 crisis is created exogenously by the spread of a virus. Thus, the obsolescence of business models cannot be driven by market efficiency, making the impact of the COVID-19 crisis on economic structures unpredictable (Kuckertz et al., 2020). However, all crises have in common that they inhibit uncertainties for future developments on the

individual (work place security, income stability, health) as well as on the economic level (economic development).

The specific problem is that the relation between uncertainties brought forward by a crisis and entrepreneurial activities in its early stages is unclear (Filipovic et al., 2018; Ratten, 2020; Santos et al., 2017; Vegetti & Adascalitei, 2017). Since uncertainties in this regard unfold their effects on the level of individual crisis expectations, an approach on a cognitive level is required to disentangle the cognitive black box (Devetag, 1999; George & Bock, 2011).

The main concern of this paper is to shed light on the question of whether the crisis expectations at the start of the COVID-19 crisis shape the antecedents of entrepreneurial activities by influencing the individual cognition about entrepreneurship. Preferred types of business models and the understanding of the societal role of entrepreneurs are of key importance in this regard. Therefore, the purpose of this paper is twofold. The first aim is to examine the relation between crisis expectations at the start of the COVID-19 crisis and explicit business model preferences. For this purpose, binary logistic regression analysis is applied. Second and subsequently, the relation between crisis expectations at the start of the COVID-19 crisis and implicit mental representation of entrepreneurship is investigated. Thus, significant differences between reaction times from a choice-reaction-time task are calculated and analyses of co-variances are conducted. In order to reach these goals, an online survey with 249 participants was carried out during the first shutdown in April and May 2020 in Germany.

The main result of the study is that expectations in the early phase of the crisis influence the antecedents of entrepreneurial activities. First, the analyses reveal that the crisis comes along with differences in explicit business model preferences in both characteristics – their main income source and the role of entrepreneurs. Second, implicit mental representations of entrepreneurship differ with crisis expectations. Third, rather than the existence of the crisis per se the individual crisis expectations in different affected areas (work place security, income stability, health and economic development) are important as they show a distinct influence. Fourth, the study shows that the cognitive level is of key importance in structural change.

The remainder is organised as follows: the next chapter discusses the theoretical background of the interplay of cognition, entrepreneurship and crisis expectations and derives propositions for the analysis. In Chapter three the data base of this study and the methodological approach are outlined. Chapter four proceeds to present the empirical

findings. The paper entails a discussion of the results in Chapter five. Chapter six concludes with final remarks.

2 State of the art

2.1 The COVID-19 crisis

In the beginning of 2020, the Corona virus reached Germany. The COVID-19 pandemic turned into an economic crisis in Germany due to the sudden spread of the virus without any chance to prepare, threatening economic goals (Fragouli, 2016; Kuckertz et al., 2020). The COVID-19 crisis is characterised by a global scope, a simultaneous demand and supply shock, and an unknown time period (James, 2020; Ratten, 2020). These features of the crisis result in a formerly unknown uncertainty and economic downturn worldwide.

Private demand collapsed as a response to shutdowns and social distancing, which were put in place to contain the spreading of the virus, and shortages in income due to short-time working (Clemens et al., 2020; Dong et al., 2021; Loxton et al., 2020). In addition to these measures, experiencing an event like a pandemic leads to behavioural and therefore consumption changes (Forbes, 2017; Loxton et al., 2020). Moreover, a severe crisis such as the COVID-19 crisis reshapes economic structures not only in the short run but also affects people´s cognition thus leading to longer-lasting changes in institutions (James, 2020). These changes in institutions are likely to affect entrepreneurial activities from their antecedents onwards.

2.2 Cognition and entrepreneurship

Mental changes do not appear randomly, but depend on the individual´s mental framework. Mental frameworks can be described as knowledge representations structured in networks. In the case of semantic networks, knots correspond to, for example, events or objects and the links show the association of these knots. If one is remembered of a specific object, other objects and events linked to this are remembered as well (Neely, 1991). These knowledge structures form mental templates for subsequent decision-making (Shepherd & Patzelt 2018, Dutton & Jackson 1987) and are accessible to the individual through two distinct processes. Cognitive processes can be based on system 1 or 2 (Kahneman, 2003; Mishra et al., 2007; Evans, 2003; Sloman, 2002). System 1 includes instinctive and fast processes based on associative learning operating mainly beyond awareness (ibid.). System 2 is controlled, rule based, slow, serial and deliberative, capable of simulations of the future (ibid.). Although both cognitive processes are relevant for the antecedents of entrepreneurship, they are likely to affect different aspects.

How an entrepreneur behaves in ordinary actions is more likely to be driven by implicit beliefs and thus System 1. This is reflected in implicit mental representations of entrepreneurship. Forming explicit preferences of business models requires deliberative decision-making, thus, high-involvement cognitive processes that rely on System 2.

2.3 Perception of uncertainties during the COVID-19 crisis

Although crises are associated with rising uncertainties, not every individual is affected by these and does not perceive them in a similar fashion. A main driver of cognitive changes in crises are the perceptions of economic conditions on macro as well as on micro level (Fernandez-Urbano & Kulic, 2020). Based upon these perceptions, expectations for future developments are formed.

The perception of economic conditions, also known as consumer confidence, is found to influence decision-making processes and risk-taking behaviour (Stiglitz et al., 2018). Moreover, expected work place insecurity is proven to have multiple effects on psychological measures such as subjective well-being (Burchell, 2011; Fernandez-Urbano & Kulic, 2020; Geishecker, 2012; Knabe & Rätzel, 2011). Additionally, the COVID-19 crisis is likely to affect income stability as a related issue to job loss and short-time working. Further, the experience of a pandemic may lead to negative expectations regarding health. Based on these considerations, the COVID-19 crisis is differentiated into four crisis dimensions: 1) economic development on macro level and 2) work place security, 3) income stability and 4) health on micro level.

There is evidence indicating that crises continue to have an effect even after the end of the crisis (Fernandez-Urbano & Kulic, 2020). As such, individuals or organisations can take advantage of the opportunities that arise in the changing environment and realise substantial gains (Eisenhardt, 1989; Eisenhardt & Martin, 2000; Sirmon et al., 2007) – for example through the introduction of new business models. Therefore, it is predicted that the expectations in the four crisis dimensions at the start of the COVID-19 crisis influence entrepreneurial activities in a profound way in the years to come (Dieter, 2020).

2.4 Antecedents of entrepreneurial activities during crisis

Changes on individual, group, organisational or environmental level are likely to affect business models (George & Bock, 2011). However, for these changes to have a disruptive impact, a collective change of practices or attitudes needs to take place (Kuokkanen et al., 2019). Challenging everyday life, a collective change is forced by the COVID-19 crisis. Adaptations of the economic landscape to a shock are likely to be captured by business model

changes as these are sensitive to changing environmental conditions (Cucculelli & Peruzzi, 2020; George & Bock, 2011). Because of their adaptability, entrepreneurial activities and entrepreneurs play a crucial role in softening the shock of the crisis and in the economic recovery (Santos et al., 2017; Williams & Vorley, 2015).

Entrepreneurial activities aim at filling recognised market gaps and at the enactment of opportunities (George & Bock, 2011; Ratten, 2020). Whenever a new venture is founded to exploit these opportunities, business models determine how value is created (George & Bock, 2011; Pfeifer et al., 2017; Teece, 2010). The minimal definition of a business model is often determined by the processes creating value and the resources required (Bagnoli & Redigolo, 2016; Malone et al., 2006). However, it may also include the entrepreneur´s knowledge and experience (Druilhe & Garnsey, 2004), organisational culture (Mazurek, 2018) or even all structural elements of a venture which explain how the business works (George & Bock, 2011; Magretta, 2002). Another string of literature highlights the importance of the cognitive level for business models (Kamprath, 2015). In this vein, business models are understood as a simplified reflection of reality (Bagnoli & Redigolo, 2016; Page, 2014) or a set of assumptions about how a business may be successful (Downing, 2005; George & Bock, 2011). These approaches put emphasis on the subjectivity and perceptions of the environment (Druilhe & Garnsey, 2004). Therefore, the interdependent systemic background has a great influence on prevalent business models and on how entrepreneurs perceive their societal role (Burt et al., 2017; Ratten, 2020).

Former research finds that entrepreneurial activities are impacted by crises. An investigation of early entrepreneurship, defined as activities undertaken by individuals prior to firm registration, revealed that crises do not impact these as harshly as expected by observations on firm registrations (Vegetti & Adascalitei, 2017). However, the crisis affects latent entrepreneurship, defined as the individual´s desire to found a new venture (Vegetti & Adascalitei, 2017). This translates into declining firm registration developments during crises supporting the dependence of entrepreneurial activities on the current economic environment and the income level of the country (Klapper & Love, 2011; Paniagua & Sapena, 2015). Thus, crises affect entrepreneurial motivations, attitudes (early stage of entrepreneurship) as well as behaviours (firm registrations) (Vegetti & Adascalitei, 2017). However, not only the quantity of ventures can be affected but also their quality in terms of explicit business model specifications and their implicit mental representations of entrepreneurship.

2.4.1 Explicit business model preferences

The development of business models depends on environmental conditions (Cucculelli & Peruzzi, 2020; George & Bock, 2011). During crisis demand is drastically changed, which makes it reasonable to expect changes regarding processes for revenue generation and required resources that are needed to start a successful new venture. Thus, explicit business model preferences, as antecedents of entrepreneurial activities, are assumed to show a response to crisis expectations. What remains unclear is which crisis expectations relate to adaptations in explicit business model preferences. Thus, the research question 1 is formulated as follows:

RQ1: How are crisis expectations related to explicit business model preferences?

The aforementioned expectations in crisis dimensions – economic development, work place security, income stability and health – are expected to relate distinctively to explicit business model preferences. Natural catastrophes and healthcare crises are expected to heavily influence individual behaviour like consumption patterns (Forbes, 2017; Loxton et al., 2020). Entrepreneurial activities may aim at the uncovered gaps in medical services and equipment or other customer demands that have arisen (James, 2020; Ratten, 2020). These changes in business environment are likely to impact the preferred processes used to generate revenue and resources used.

Malone et al. (2006) proposed a typology of business models relying on observable and measurable characteristics. The authors developed a model distinguishing business models in accordance with two factors: The first factor is the main income source of the business. As main income source, products are either 1) financial products 2) physical products 3) intellectual property or 4) human services. The second factor is the role that the entrepreneur is taking. According to the model, the role of the entrepreneur is either 1) creator 2) distributor 3) landlord or 4) broker. Because this typology focusses on processes for revenue generation and required resources, it is especially well suited to tracking explicit business model preferences. Based upon the aforementioned considerations, four propositions are formulated as follows:

*Proposition 1: Negative expectations in **economic development** are related to explicit business model preferences.*
*Proposition 2: Negative expectations in **work place security** are related to explicit business model preferences.*

*Proposition 3: Negative expectations in **income stability** are related to explicit business model preferences.*

*Proposition 4: Negative expectations in **health** are related to explicit business model preferences.*

2.4.2 Implicit mental representations of entrepreneurship

When processing new information, the information is incorporated into prior knowledge through an individual's alignment of mental representations. This so-called structural alignment is a cognitive tool for individuals to compare objects, helping them understand new content, learn novel ideas and create new categories (Holland, 1986; Shepherd & Patzelt, 2018; Day & Gentner, 2007). The perception of these new information and events depend on interpretive schemata drawn from past experiences (Strong, 2013). The formation and modification of these knowledge networks and mental representations are involved in most high-level cognition to understand and manage the complex reality and are thus crucial when investigating concept formation, memory, inference and justice (Devetag, 1999). Since values, which may be partly unconscious and implicit, stem from cognitive representations of their needs (Rokeach, 1973; Schwartz, 1992), perception of new information and events may reshape subconscious associations and values. Therefore, neuronal structures such as semantic or knowledge networks are constantly adapting to environmental circumstances and newly acquired knowledge (Fuchs & Flügge, 2014). Since crises re-order economic activities on a large scale, individuals see themselves confronted with new information about how economic activities are performed. Thus, it is expected that implicit mental representations of entrepreneurship, forming the business environment, are subject to change during crises (James, 2020; Ratten, 2020).

Changes in implicit mental representations of entrepreneurship during crises can be identified by changing roles of social norms and role models, as well as adjustments in the motivations to start a new venture. In this vein, social norms have received increasing attention since social norms shape attitudes about entrepreneurship and therefore also shape entrepreneurial activities (Krueger et al., 2013; Santos et al., 2017). During the European economic crisis in 2008/2009, social norms are found to even constrain entrepreneurial activities, whereas role model perception shows a more pronounced positive influence during the crisis (Santos et al., 2017). What remains unclear is how the crisis affects the societal role – reflected in implicit mental representations – of entrepreneurs. Therefore, the second research question is formulated as follows:

RQ2: How are crisis expectations related to implicit mental representations of entrepreneurship?

The aforementioned expectations in crisis dimensions – economic development, work place security, income stability and health – are expected to relate distinctively to implicit mental representations of entrepreneurship. During crises, motivations to start a new venture change by pushing individuals into self-employment to avoid unemployment (Vegetti & Adascalitei, 2017). This phenomenon is likely to come along with other conceptions of entrepreneurship. Further, it could be reasoned that new work habits, which are established as a response to changed circumstances during crises, are related to adaptations in implicit mental representations of entrepreneurship as well.

Implicit mental representations do not form themselves in isolation but in distinction from characteristics of related concepts. Therefore, entrepreneurship is contrasted to mid-sized companies in Germany ('mittelstand'). German mittelstand is defined as medium-sized firms with a turnover between 1 million and 50 million Euro per year and with 10 to 499 employees, representing the largest proportion of firms in Germany.[55] They were chosen to function as counterparts to newly founded firms in the survey as they are presumed to be established and have a long tradition, which is not true for newly founded firms.

Further, implicit mental representations are context dependent. In this study, we choose the innovation system context because new ventures are embedded in this and change it through mechanisms like creative destruction (Schumpeter, 1934). Innovation systems consist of three components - actors, network structures and environment (Doloreux & Porto Gomez, 2017). Considerations by Burt et al. (2017) state that the interplay of actor, network and environmental level is dynamic and is subject to considerable changes over time. The goal is to quantify how the respondents associate entrepreneurship in contrast to mittelstand in this innovation system context. Based upon the aforementioned considerations, four propositions are formulated as follows:

*Proposition 5: Negative expectations in **economic development** are related to implicit mental representation of entrepreneurship.*
*Proposition 6: Negative expectations in **work place security** are related to implicit mental representation of entrepreneurship.*
*Proposition 7: Negative expectations in **income stability** are related to implicit mental representation of entrepreneurship.*

[55] Gabler Wirtschaftslexikon about mittelstand: https://wirtschaftslexikon.gabler.de/definition/mittelstand-40165/version-263557

*Proposition 8: Negative expectations in **health** are related to implicit mental representation of entrepreneurship.*

3 Data and methods

3.1 Sample and research design

An online survey with 249 participants was conducted from 13th April to May 5th 2020 in Germany. This time period reflects the core phase of the first shutdown in Germany. The survey was accessible through a variety of channels: It was advertised through the university website and that link was further shared via Facebook, Twitter, XING, LinkedIn, work and personal networks. The survey was designed for adults living in Germany.

Figure 3.1 illustrates the research design of this study. It follows one overall purpose: to examine the relation between crisis expectations at the start of the COVID-19 crisis and antecedents of entrepreneurship. Starting point is the independent variable of crisis expectations throughout four different crisis dimensions. Subsequently, two research questions following different methods are investigated separately using data from a survey designed for this purpose. First of all, the relation between crisis expectations to explicit business model preferences is examined. Therefore, binary logistic regressions are performed to evaluate the first four propositions. Secondly, the implicit mental representations of entrepreneurship contrasted to mittelstand based on choice-reaction-time tasks are assessed and analysed to answer the second set of propositions.

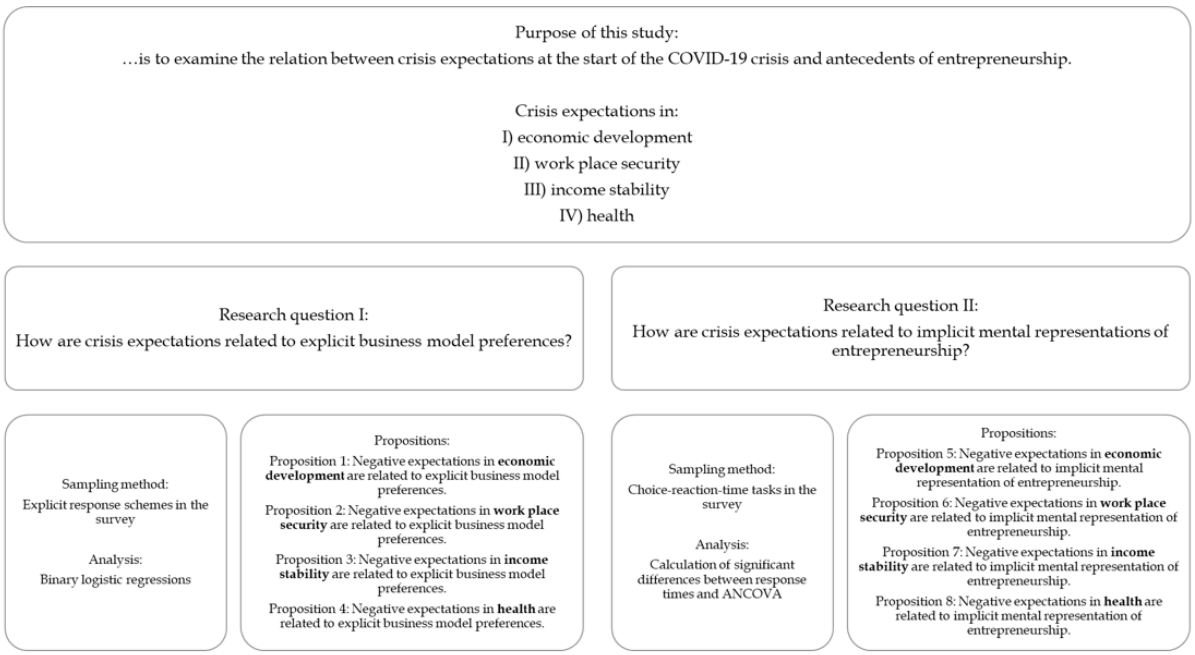

Figure 3.1: Research design of the study
Source: Own illustration

To assess the main variables of interest in this study, the respondents are asked to indicate their expectations on the developments in the next 12 months[56] in the four dimensions – 1) their health, 2) their income and financial security, 3) the security of their working place or possibilities in searching for a job, and 4) the macroeconomic perception of overall economic development.[57/58] The subjects' expectations regarding those four dimensions are measured on a continuous scale ranging from 1 'very negative' to 101 'very positive'. The respondent´s answers on these scales are transformed into an indicator of whether the expectations are positive (values >= 51) or negative (values <51). This transformation is reasoned by retrieving a qualitative differentiation between the responses (positive vs. negative) rather than incremental changes (very negative vs. moderate negative).

Furthermore, potentially influential crisis-related additional factors were assessed. On the one hand, personal information is surveyed, such as demographic variables (Luca et al., 2012), personality profile[59] (Brandstätter, 2011; Obschonka et al., 2013), degree of optimism[60] (Bernardo & Welch, 2001) as well as experiences with entrepreneurship, that are proven to

[56] The assessed time frame of 12 months is chosen because of its accessibility – it is a reasonable time frame that is indicating future trends while still not being as far ahead that predictions are hard to make.
[57] Overall economic development corresponds to the consumer confidence as used by former research (Fernandez-Urbano & Kulic, 2020; Merkle et al., 2003).
[58] See Table 8.3 in appendix for exact formulation of the question.
[59] Operationalised according to Rammstedt et al., 2013.
[60] Operationalised according to Glaesmer et al., 2008.

impact entrepreneurial activities. On the other hand, respondents were asked to indicate the impact of the virus containing measures on their work and leisure time.

Following a quasi-experimental approach (Reichardt, 2009), the sample is split into sub-samples representing the four treatments (negative expectations concerning the four crisis dimensions economic development, work place security, income stability and health). Since the respondents self-select themselves into these groups by their intrinsic expectations, a randomisation cannot be assured and thus the study qualifies itself as quasi-experimental (Döring & Bortz, 2016). The respondents can qualify themselves for more than one treatment by having negative expectations in multiple dimensions (economic development, work place security, income stability and health).[61] Table 3.1 shows an overview of the treatment groups and their characteristics in the most important control variables.

Table 3.1: Descriptive statistics of the most important variables over the categories of negative expectations as treatments
Note: standard deviations in parentheses
Source: Own summary based upon primary data collection

	Negative expectations as treatments				
	Economic development	Work place security	Income stability	Health	Full sample
Sample size	208 (83.5%)	106 (42.9%)	106 (42.6%)	85 (34.1%)	249
Average age	38 (16.358)	35 (15.618)	39 (17.549)	39 (17.152)	38 (16.319)
Share of women	59.2% (0.493)	58.1% (0.496)	63.2% (0.485)	64.3% (0.482)	57.1% (0.496)
Share of respondents having a tertiary education	67.8% (0.468)	67.0% (0.473)	64.2% (0.482)	69.4% (0.464)	67.1% (0.471)
Share of respondents affected by short-time working	5.9% (0.237)	6.0% (0.239)	7.9% (0.271)	2.4% (0.155)	5.4% (0.226)
Share of respondents working from home	64.3% (0.480)	62.6% (0.486)	59.4% (0.494)	67.1% (0.473)	63.0% (0.484)
Share of respondents having children	25.5% (0.437)	21.0% (0.409)	29.8% (0.460)	32.1% (0.470)	24.6% (0.432)
Share of respondents satisfied with the government[62]	87.2% (0.335)	86.5% (0.343)	90.5% (0.295)	89.3% (0.311)	87.7% (0.330)
Average perceived change leisure time *(1=no change at all; 101= very much)*	74.317 (23.700)	72.028 (25.356)	70.698 (26.647)	72.271 (26.100)	74.201 (24.494)
Average perceived change work time *(1=no change at all; 101= very much)*	56.463 (31.134)	54.049 (32.523)	53.765 (33.106)	50.750 (32.550)	56.493 (31.311)

[61] Figure 8.1 in the appendix illustrates the number of respondents having negative expectations within the time frame of the coming 12 months along the crisis dimensions and their overlap. It can be reasoned, that most negative expectations co-appear. Negative expectations in the context of economic development is the only dimension which appears in a large proportion alone. Consequently, the COVID-19 crisis reflects itself not only in an increased uncertainty as found by Loxton et al. (2020), but is likely to affect the economic situation in a distinctive manner.

[62] The rest of the respondents are either dissatisfied or neutral in the evaluation of governmental actions.

The variables do not significantly differ in dependence of the sub-group, indicating that control variables like age and education, or being affected by virus containing measures such as working from home, or the perceived change in leisure or work time do not relate to the perception in the crisis dimensions. The proportion of women, on the other hand, does show a trend: It is higher in the negative expectation samples than in the overall sample. This indicates that women predominantly have more negative expectations than men do. Consequently, as expected, perceptions are highly individual and the four crisis dimensions are sufficient to examine impacts on preferred explicit business models and implicit mental representations of entrepreneurship.

3.2 Explicit business model preferences

3.2.1 Dependent variables

Questions based on business model classification proposed by on Malone et al. (2006) were included in the form of two dimensions in the questionnaire: First, which products or services would be most likely the main income source, and secondly, how subjects would describe their role as entrepreneur if they were to become entrepreneurially active.[63] It may be noted that the respondents had a single choice task for the main income source as well as for the role of the entrepreneur. Therefore, only the main preference of business model characteristics was captured, excluding further preferences. For data preparation purposes, the required variables are controlled to ensure quality standards and the collected data was cleaned accordingly.[64] Descriptive statistics of the dependent variables are given in Table 3.2. A value of 1 corresponds to a respondent´s preferred choice, a value of 0 indicates a respondent does not favour this option over the others. *Physical products* and *intellectual property* are the most preferred main income sources and *creator* and *landlord* are the preferred roles of entrepreneurs.

[63] See questionnaire in the appendix 8.1 for the exact formulation of questions. The choice options were aligned with the framework given by Malone et al. (2006).

[64] For the cleaning process, respondents having a high proportion of missing data points might indicate low motivation and lower validity of the existing answers (Barge & Gehlbach, 2012). Although there could be alternative explanations for this response pattern, these subjects are removed from the data set. Secondly, matrix-style questions (e.g. optimism scale) are eliminated if the variance of the responses is greater than null. This step ensures that the subjects did not choose the same indication on a Likert-scale for all items in this item battery (Schonlau & Toepoel, 2015). Since this pattern indicates annoyance of respondents (Leiner, 2019; Schonlau & Toepoel, 2015), data from these should not be taken into account, thus it was excluded. Lastly, questionnaires with missing data (15%) were not taken into further consideration.

Table 3.2: Descriptive statistics for the dependent variables
Source: Own calculation based upon primary data collection

		N	Share of first preferences	St. Dev.
Main income source	Physical product	225	34.7%	0.477
	Financial product	225	4.9%	0.216
	Intellectual property	225	50.2%	0.501
	Human services	225	10.2%	0.304
Role of the entrepreneur	Creator	232	40.1%	0.491
	Distributor	232	10.8%	0.311
	Landlord	232	41.8%	0.494
	Broker	232	7.3%	0.261

3.2.2 Empirical approach

The first to fourth proposition are analysed with the help of binary logistic regressions. These are applied to reveal the relation of crisis expectations in terms of economic development, income stability, work place security and health – positive or negative – and the preference of business models. In order to do so, two models are specified, varying the dependent variable.[65] The first function incorporates the main income source as a dependent variable and the second function opts at explaining the role of the entrepreneur as a dependent variable. The model is formulated as follows:

$$\log\left(\frac{p(X)}{1-p(X)}\right) = Constant + \beta_1 * Economic\ development + \beta_2 * Income\ stability + \beta_3 * Work\ place\ security + \beta_4 * Health + Individual\ Controls + Corona\ controls \quad (1)$$

X corresponds to the dependent variables – main income sources and the role of the entrepreneur. Two sets of control variables are sequentially included in the model specifications to test for robustness. The first set of controls applies to the individual level. Personality traits (Big Five profile (Zhao & Seibert, 2006)), demographic variables (e.g. gender (Minniti & Naudé, 2010), age (Blanchflower et al., 2001; Lévesque & Minniti, 2006), educational attainment (Blanchflower, 2000; Jiménez et al., 2015)) and contact to entrepreneurs (e.g. knowing an entrepreneur (Lindquist et al., 2015)) are included. Second, changes in work and leisure time, as well as framework conditions, are taken into consideration in the COVID-19 control variable set. The descriptive statistics for these variables are shown in Table 8.4 in the appendix. The measures to contain the Corona virus, stronger affect the leisure time conditions

[65] Because emotions and thoughts resulting from the different crisis dimensions as independent variable exist before the explicit decision making on business models as dependent variable, endogeneity does not seem to be apparent.

of the respondents than their work conditions. At that point in time, most of the respondents were working from home but did not experience short-time working.

In order to ensure the validity of the results of the logistic regressions, the assumptions of the model are tested.[66] The correlations between the dependent and independent variables are depicted in Table 8.5 and Table 8.6 in the appendix. As the tables reveal, no high correlations can be identified in variables which will be included in one regression model later on.[67] Therefore, no variables have to be excluded.

3.3 Implicit mental representations of entrepreneurship

3.3.1 Data collection

Explicit response schemes have been criticised. Especially the fact that respondents may answer in a socially desirable way (Krosnick, 1999), covering their true opinion, is a drawback of explicit response schemes (Wittenbrink, 2007). Entrepreneurship as a topic may raise this issue due to biased narratives presented in media. Furthermore, in the case of measurement of associations, long response times may also lead to answers reflecting more explicit deliberations than an attitude. Therefore, the participants were asked to perform an implicit task, measuring their associations concerning newly founded firms and mittelstand. The chosen words are shown shortly in the middle of the screen (500 milliseconds) followed by either 'newly founded firm' (German: 'Neugründung') or 'mittelstand' (German: 'Mittelstand'). The respondent is asked to press the corresponding button as fast and precise as possible to indicate whether 'newly founded firm' or 'mittelstand' is shown on the screen.[68] This way, the aimed variables are hidden, making it less likely that respondents answer strategically (Wittenbrink, 2007). Based upon theoretical considerations of semantic priming[69], it is expected that the respondent is able to recognise 'newly founded firm' faster than

[66] The assumption of linearity between the log of odds and continuous independent variables is tested. Influential values are detected by the value of the absolute standardised residuals. To avoid multicollinearity issues, the variance inflation factor is applied as an indicator. Values below 5 are considered to be unproblematic. Moreover, models are tested with the Likelihood ratio test to ensure that they explain more than more than an empty baseline model. Models with a p-value below 0.1 are considered in the analysis. The quality assessment revealed, that not all of the dependent variables can be incorporated in a logistic regression (main income source: financial products, human services; role of the entrepreneur: broker [reasons were issues regarding the distribution of residuals and the fulfilment of the linear assumption which may be caused by low sample sizes in these cases]). Those three variables are not further included.

[67] All pairwise correlations are lower than 0.40.

[68] See Table 8.2 in appendix for exact formulation of the instruction.

[69] Semantic priming describes the effect, that word recognition is improved in speed or accuracy when a related word is shown shortly before. For an extensive overview, see Neely (1991).

'mittelstand' if the foregoing word is stronger associated with the concept of entrepreneurship. In order to be able to assess the differences between reaction times, each selected word is once preceding 'newly founded firm' and 'mittelstand'. The difference in time is interpreted as the direction of association. With regard to quality measures, a cleansing process ensures the explanatory power of the collected data.[70] The association strength is calculated as follows:

$$Association\ strength = \frac{Reaction\ time\ in\ msec\ for\ combination\ of\ selected\ word\ and\ 'newly\ founded\ firm'}{Reaction\ time\ in\ msec\ for\ combination\ of\ selected\ word\ and\ 'mittelstand'} \quad (2)$$

3.3.2 Dependent variables

To test propositions five to eight, words along the three components of an innovation system – actor, network and environmental level - were defined, for which reaction time measurements as described in the former section are conducted.[71] These build the dependent variables for the analysis.

The descriptive statistics for the retrieved implicit associations are shown in Table 3.3. A mean value of 1 corresponds to the phenomenon that the respective word is not associated with newly founded firms or mittelstand, but is a sign of indifference. If the value is higher than 1, the association is directed towards mittelstand and a value smaller than 1 indicates an association with newly founded firms. The results in Table 3.3 indicate a closer association of the tested words to mittelstand than to newly founded firms.

[70] Firstly, the error rate per subject is calculated. If a respondent presses the wrong button in more than 25% of the prime-target-combinations by keeping the target constant, it is suspected if the task was fully understood by the participant and the corresponding reaction time measurements were deleted. Moreover, wrong target identifications were also removed from the data set. Secondly, all responses having a faster reaction time than 100 milliseconds and the ones having a slower response indication than 1000 milliseconds were removed (Payne, 2001), ensuring that the answers can be seen as implicit and not made by explicit deliberations or by accident. Thirdly, individual outliers are removed by deleting responses, showing a slower reaction time than the individual mean plus two standard deviations (Wittenbrink, 2007).

[71] The particular words used for the semantic priming test were composed by a committee of innovation experts. To retrieve the most important concepts about entrepreneurship, the innovation experts were asked to indicate the first five associations which come to their mind when reminded of 'entrepreneurship'. All experts wrote down their associations on paper, which were collected after five minutes. This task was performed with all experts at the same time and place. Communication between the experts did not take place. We clustered the collected notes and extracted a representative word from each cluster. The extracted words are shown in Table 3.3 and are used in the survey in the reaction time task. All extracted words can be sorted to one level of innovation systems – actors, network or environment.

Table 3.3: Descriptive statistics of the mental representation of entrepreneurship
Source: Own calculation based upon primary data collection

		N	Mean	St. Dev.	Min	Pctl (25)	Median	Pctl (75)	Max
Actor level	Possibility	184	1.076	0.367	0.419	0.880	1.030	1.201	4.037
	Necessity	161	1.066	0.287	0.186	0.872	1.048	1.211	1.922
	Experience	165	1.056	0.250	0.391	0.868	1.056	1.216	1.939
	Youth	184	1.035	0.276	0.509	0.858	1.010	1.143	2.552
	Role model	181	1.033	0.277	0.443	0.834	1.000	1.160	1.867
	Trouble maker	167	1.058	0.267	0.543	0.881	1.013	1.196	1.989
Network level	Demand	176	1.025	0.264	0.554	0.827	0.996	1.163	1.987
	Freedom	168	1.034	0.253	0.402	0.856	1.002	1.198	1.782
	Funding	177	1.057	0.246	0.511	0.894	1.043	1.187	1.986
	Bureaucracy	164	0.996	0.23	0.127	0.826	0.975	1.143	1.655
	Cooperation	171	1.055	0.251	0.507	0.885	1.003	1.183	2.085
	Autonomy	167	1.003	0.255	0.581	0.833	0.961	1.162	2.396
Environmental level	Career	169	1.079	0.281	0.605	0.849	1.058	1.234	1.998
	Insecurity	170	1.050	0.287	0.494	0.847	1.027	1.219	2.075
	East Germany	165	1.054	0.266	0.558	0.892	1.015	1.182	2.057
	West Germany	163	1.019	0.265	0.515	0.834	1.016	1.170	2.111
	Northern Germany	168	1.001	0.231	0.503	0.862	0.973	1.127	1.817
	Southern Germany	166	1.088	0.265	0.553	0.915	1.076	1.226	1.921
	Progress	182	1.030	0.234	0.458	0.874	1.006	1.186	1.709
	Regression	170	1.057	0.272	0.441	0.881	1.016	1.176	2.096

3.3.3 Empirical approach

The implicitly measured association times to newly founded firms and mittelstand are assessed. It is tested whether there are differences in reaction times between the groups of respondents expecting positive changes in one of the crisis dimensions versus the subjects indicating negative expectations in those. Since there is reason to expect the approximate fulfilment of the central limit theorem, Welch´s two-sample t-tests are applied to identify significant differences. Analyses of covariance (ANCOVAs) are performed as a robustness check, making sure that crisis expectations are the main driver for observed differences.[72]

4 Results

4.1 COVID-19 crisis perceptions and explicit business model preferences

The results of the analysis of preferred explicit business models are divided into two dimensions: The results of the logistic regressions for the main income sources as dependent

[72] The ANCOVA results are available in Table 8.7 and Table 8.8.

variables are shown in Table 4.1 and Table 4.2, those for the role of the entrepreneur are summarised in Table 4.3 and Table 4.4.

The crisis expectations influence both business model dimensions, namely the main income source and the role of the entrepreneur, affecting business models in a distinct manner. Expectations in terms of courses in the next 12 months in the dimensions economic development and work place security play a key role in the preferred main income source. While expectations concerning economic development are of significance regarding the preferred entrepreneurial role too, expectations regarding work place security do not influence the preferred entrepreneurial role, but income stability does. Surprisingly, the results indicate that the two business model dimensions – main income source and entrepreneurial role – do not seem to be influenced by health expectations. These results support *Propositions 1, 2* and *3*, while contradicting *Proposition 4*.

A more detailed investigation into the direction and extent of impacts of the crisis expectations on the business model dimensions main income source and entrepreneurial role reveals more interesting results. The increases and decreases of the odds ratios associated with the crisis expectations indicate that the increases exceed the decreases multiple times for both business model dimensions, the main income source as well as the role of the entrepreneur.[73] The analysis of the main income sources of business models revealed that negative expectations in *economic development* leads to an increase in likelihood to prefer intellectual property about 93.7% - 186.9%, and to a much lower decrease of likelihood to prefer physical products about 72.5% - 65.6%. For *work place security,* an opposite pattern of business model choices can be observed. When having negative expectations, the likelihood to prefer physical products as main income source is increased from 92.2% to 140.3%, contrasted by a much lower decrease of 61.2% to 40.0% in the preference for intellectual property. The analysis in the dimension of the role of the entrepreneur yields a similar pattern. Again, negative expectations in *economic development* are associated with a higher increase in likelihood to prefer landlord as entrepreneurial role (119.1% - 186.5%) than it leads to a decrease in the likelihood to prefer creator (67.5% - 63.7%). Similarly, in the case of *income stability,* the increases (creator: 118.5% to 219.6%) exceed the associated decreases (distributor: 33.8%) multiple times.

Additionally, some control variables show a relation to the preferred business model specification. Personality traits and educational attainment are shown to be important for both

[73] The respondents had to choose one among four alternatives. Since this question type does not allow multiple answers, reversed effects are to be expected. However, the odds ratios would be similar in magnitude in the case of perfect substitution, which is not the case.

– the preference of the main income source and of the role of the entrepreneur. Watching TV shows about start-ups and expressing interest in entrepreneurial activities, only relates to the preference in main income sources, but not to the role of the entrepreneur. A preference for a specific role of the entrepreneur is related to work experience in small and new ventures as well as the experience a respondent has with the foundation of ventures. Circumstances during crisis as represented by the COVID-19 control variables relate to the preferred role of the entrepreneur. Satisfaction with governmental actions additionally impacts the preferred main income source.

The main results of the analysis of explicit business model preferences are 1) that the crisis expectations impact the preferred business models in multiple and distinct ways 2) that new business models are preferred rather than others become obsolete.

Table 4.1: Binary logistic regression results - main income source I
*Note: *p<0.1, **p<0.05, ***p<0.01 and standard errors displayed in parentheses, OR represents the odds ratio of the coefficients*
Source: Calculation based upon primary data collection

		Physical products					
		(1)		(2)		(3)	
		β	OR	β	OR	β	OR
Main variables	Negative expectations - economic development	-1.067***	0.344	-1.264***	0.282	-1.291***	0.275
		(0.390)		(0.448)		(0.495)	
	Negative expectations – work place security	0.654**	1.922	0.847**	2.333	0.877*	2.403
		(0.318)		(0.384)		(0.456)	
	Negative expectations – income stability	0.353	1.424	0.107	1.112	-0.001	0.999
		(0.332)		(0.396)		(0.469)	
	Negative expectations – health	-0.195	0.823	-0.381	0.683	-0.782*	0.458
		(0.329)		(0.379)		(0.459)	
Individual control variables	Extraversion			-0.155	0.856	-0.165	0.848
				(0.172)		(0.207)	
	Agreeableness			0.199	1.220	0.325	1.384
				(0.205)		(0.237)	
	Conscientiousness			0.501**	1.650	0.568**	1.765
				(0.228)		(0.286)	
	Neuroticism			0.404*	1.498	0.559**	1.749
				(0.211)		(0.251)	
	Openness to experience			-0.032	0.969	-0.064	0.938
				(0.173)		(0.189)	
	Optimism			-0.158*	0.854	-0.217**	0.805
				(0.082)		(0.096)	
	Holding an university degree			-0.932***	0.394	-0.699	0.497
				(0.349)		(0.429)	
	Age			0.008	1.008	-0.013	0.987
				(0.012)		(0.020)	
	Gender			-0.175	0.839	-0.158	0.854
				(0.370)		(0.425)	
	Self-employment			-0.570	0.566	-0.337	0.714
				(0.677)		(0.779)	
	Knowing an entrepreneur			-0.250	0.779	-0.315	0.730
				(0.501)		(0.615)	
	Experience with foundations			-0.221	0.802	0.143	1.154
				(0.496)		(0.621)	
	Work experience in small and new firms			0.248	1.281	0.275	1.317
				(0.361)		(0.427)	

	Watching TV shows about startups			0.895**	2.447	1.107**	3.025
				(0.370)		(0.431)	
COVID control variables	Short-time working					-0.185	0.831
						(0.870)	
	Working from home					0.723	2.061
						(0.493)	
	Children					-0.968	0.380
						(0.738)	
	Satisfaction with the government					-1.074*	0.342
						(0.606)	
	Change leisure time					0.012	1.012
						(0.009)	
	Change work time					-0.003	0.997
						(0.007)	
Model fit	Constant	-0.127	0.881	0.190	1.210	0.704	2.022
		(0.353)		(2.264)		(3.777)	
	Observations	223		212		179	
	Log Likelihood	-137.503		-114.372		-92.061	
	Akaike Inf. Crit.	285.006		266.745		234.122	

Table 4.2: Binary logistic regression results - main income source II
*Note: *p<0.1, **p<0.05, ***p<0.01 and standard errors displayed in parentheses, OR represents the odds ratio of the coefficients*
Source: Calculation based upon primary data collection

		Intellectual property					
		(4)		(5)		(6)	
		β	OR	β	OR	β	OR
Main variables	Negative expectations - economic development	0.661*	1.937	0.936**	2.551	1.054**	2.869
		(0.386)		(0.453)		(0.485)	
	Negative expectations – work place security	-0.511*	0.600	-0.948**	0.388	-0.797*	0.451
		(0.298)		(0.369)		(0.419)	
	Negative expectations – income stability	-0.324	0.723	0.169	1.184	0.170	1.185
		(0.312)		(0.372)		(0.425)	
	Negative expectations – health	0.160	1.173	0.247	1.280	0.246	1.279
		(0.309)		(0.363)		(0.420)	
Individual control variables	Extraversion			0.062	1.064	0.140	1.150
				(0.167)		(0.196)	
	Agreeableness			-0.205	0.815	-0.282	0.754
				(0.199)		(0.233)	
	Conscientiousness			0.131	1.14	-0.063	0.939
				(0.213)		(0.254)	
	Neuroticism			-0.506**	0.603	-0.574**	0.563
				(0.202)		(0.234)	
	Openness to experience			0.144	1.155	0.108	1.114
				(0.167)		(0.184)	
	Optimism			0.215***	1.240	0.297***	1.346
				(0.081)		(0.093)	
	Holding an university degree			1.446***	4.246	1.260***	3.525
				(0.361)		(0.439)	
	Age			-0.015	0.985	0.003	1.003
				(0.012)		(0.019)	
	Gender			0.174	1.190	0.232	1.261
				(0.359)		(0.395)	
	Self-employment			0.341	1.406	0.355	1.426
				(0.652)		(0.717)	
	Knowing an entrepreneur			0.302	1.353	0.259	1.296
				(0.465)		(0.555)	
	Experience with foundations			0.651	1.917	0.501	1.650
				(0.486)		(0.567)	
	Work experience in small and new firms			-0.305	0.737	-0.312	0.732
				(0.345)		(0.400)	

	Watching TV shows about startups			-0.855**	0.425	-0.953**	0.386
				(0.378)		(0.424)	
COVID control variables	Short-time working					1.281	3.600
						(0.989)	
	Working from home					-0.086	0.918
						(0.476)	
	Children					0.780	2.181
						(0.705)	
	Satisfaction with the government					0.619	1.857
						(0.599)	
	Change leisure time					-0.011	0.989
						(0.009)	
	Change work time					0.002	1.002
						(0.006)	
Model fit	Constant	-0.261	0.770	-4.308**	0.013	-7.898**	0.000
		(0.356)		(2.170)		(3.716)	
	Observations	223		212		179	
	Log Likelihood	-150.570		-119.827		-99.673	
	Akaike Inf. Crit.	311.139		277.655		249.347	

Table 4.3: Binary logistic regression results – role of the entrepreneur I
*Note: *p<0.1, **p<0.05, ***p<0.01 and standard errors displayed in parentheses, OR represents the odds ratio of the coefficients*
Source: Calculation based upon primary data collection

		Creator					
		(1)		(2)		(3)	
		β	OR	β	OR	β	OR
Main variables	Negative expectations - economic development	-1.015***	0.363	-1.076**	0.341	-1.125**	0.325
		(0.378)		(0.426)		(0.482)	
	Negative expectations – work place security	0.279	1.322	0.100	1.106	0.175	1.192
		(0.306)		(0.346)		(0.396)	
	Negative expectations – income stability	0.781**	2.185	1.162***	3.196	1.150***	3.158
		(0.320)		(0.379)		(0.432)	
	Negative expectations – health	0.121	1.128	-0.053	0.948	0.106	1.112
		(0.311)		(0.351)		(0.402)	
Individual control variables	Extraversion			-0.372**	0.689	-0.474**	0.623
				(0.168)		(0.199)	
	Agreeableness			0.291	1.338	0.332	1.394
				(0.198)		(0.233)	
	Conscientiousness			0.002	1.002	-0.054	0.947
				(0.205)		(0.248)	
	Neuroticism			0.109	1.115	0.191	1.210
				(0.194)		(0.230)	
	Openness to experience			0.342**	1.408	0.391**	1.478
				(0.166)		(0.185)	
	Optimism			-0.058	0.944	-0.064	0.938
				(0.077)		(0.087)	
	Holding an university degree			0.449	1.567	0.447	1.564
				(0.337)		(0.419)	
	Age			0.004	1.004	-0.001	0.999
				(0.011)		(0.018)	
	Gender			-0.322	0.725	-0.354	0.702
				(0.349)		(0.396)	
	Self-employment			0.533	1.704	0.356	1.428
				(0.688)		(0.767)	
	Knowing an entrepreneur			0.070	1.073	-0.069	0.933
				(0.434)		(0.527)	
	Experience with foundations			1.545***	4.688	1.487**	4.424
				(0.551)		(0.638)	
	Work experience in small and new firms			0.396	1.486	0.721*	2.056
				(0.337)		(0.399)	

	Watching TV shows about startups			-0.021	0.979	0.195	1.215
				(0.353)		(0.400)	
COVID control variables	Short-time working					1.374	3.951
						(0.964)	
	Working from home					0.212	1.236
						(0.445)	
	Children					-0.519	0.595
						(0.650)	
	Satisfaction with the government					-0.507	0.602
						(0.561)	
	Change leisure time					0.015*	1.015
						(0.008)	
	Change work time					-0.013**	0.987
						(0.006)	
Model fit	Constant	-0.067	0.935	-4.633**	0.010	-6.218*	0.002
		(0.335)		(2.220)		(3.503)	
	Observations	230		221		188	
	Log Likelihood	-147.348		-128.250		-104.152	
	Akaike Inf. Crit.	304.696		294.500		258.305	

Table 4.4: Binary logistic regression results – role of the entrepreneur II
*Note: *p<0.1, **p<0.05, ***p<0.01 and standard errors displayed in parentheses, OR represents the odds ratio of the coefficients*
Source: Calculation based upon primary data collection

		Landlord						Distributor	
		(4)		(5)		(6)		(7)	
		β	OR	β	OR	β	OR	β	OR
Main variables	Negative expectations - economic development	0.784** (0.391)	2.191	0.937** (0.439)	2.552	1.052** (0.499)	2.865	-0.059 (0.675)	1.316
	Negative expectations – work place security	0.131 (0.303)	1.140	0.113 (0.347)	1.120	0.088 (0.404)	1.092	0.428 (0.600)	0.824
	Negative expectations – income stability	-0.692** (0.318)	0.501	-0.592 (0.362)	0.553	-0.535 (0.425)	0.585	-1.435** (0.690)	0.662
	Negative expectations – health	-0.312 (0.311)	0.732	-0.180 (0.346)	0.835	-0.263 (0.418)	0.768	-0.428 (0.616)	0.835
Individual control variables	Extraversion			0.172 (0.159)	1.188	0.274 (0.197)	1.315	0.062 (0.244)	1.064
	Agreeableness			-0.351* (0.196)	0.704	-0.370 (0.233)	0.691	0.442 (0.329)	1.556
	Conscientiousness			0.130 (0.207)	1.139	0.168 (0.258)	1.183	-0.290 (0.336)	0.748
	Neuroticism			-0.401** (0.191)	0.670	-0.590** (0.235)	0.554	0.517 (0.328)	1.677
	Openness to experience			-0.048 (0.162)	0.953	-0.028 (0.187)	0.972	-0.369 (0.283)	0.691
	Optimism			0.148* (0.078)	1.160	0.168* (0.088)	1.183	-0.178 (0.127)	0.837
	Holding an university degree			0.796** (0.340)	2.217	0.718* (0.435)	2.050	-1.022** (0.500)	0.360
	Age			-0.021* (0.012)	0.979	-0.003 (0.020)	0.997	0.028* (0.017)	1.028
	Gender			0.417 (0.344)	1.517	0.479 (0.395)	1.614	0.247 (0.577)	1.280
	Self-employment			0.382 (0.609)	1.465	0.257 (0.688)	1.293	-1.002 (1.047)	0.367
	Knowing an entrepreneur			0.100 (0.435)	1.105	0.465 (0.538)	1.592	0.050 (0.736)	1.051
	Experience with foundations			-0.220 (0.472)	0.803	-0.393 (0.583)	0.675	-2.055*** (0.702)	0.128
	Work experience in small and new firms			-0.401 (0.331)	0.670	-0.683* (0.398)	0.505	-0.336 (0.547)	0.715

	Watching TV shows about startups			-0.217	0.805	-0.555	0.574	0.050	1.051
				(0.349)		(0.401)		(0.572)	
COVID control variables	Short-time working					-0.984	0.374		
						(0.847)			
	Working from home					-0.519	0.595		
						(0.457)			
	Children					1.008	2.740		
						(0.694)			
	Satisfaction with the government					1.105*	3.019		
						(0.629)			
	Change leisure time					-0.016*	0.984		
						(0.008)			
	Change work time					0.008	1.008		
						(0.006)			
	Constant	-0.674*	0.510	-1.380	0.251	-1.159	0.314	4.075	0.130
		(0.356)		(2.072)		(3.383)		(3.584)	
Model fit	Observations	230		221		188		221	
	Log Likelihood	-150.575		-130.467		-102.052		-61.318	
	Akaike Inf. Crit.	311.150		298.933		254.103		160.635	

4.2 Implicit mental representation of entrepreneurship during COVID-19 crisis

The results of implicit associations for newly founded firms in contrast to mittelstand during the COVID-19 crisis are illustrated in Figure 4.1.

Throughout all four tested crisis dimensions, there are significant differences between positive (dotted line) and negative (full line) expectations. This indicates that expectations in all crisis dimensions co-occur with differences in associations concerning newly founded firms in contrast to mittelstand. This is further confirmed by the conducted ANCOVAs, showing that the significant differences are not due to other variables. Only the red marked signs cannot be traced back to the crisis expectations. However, the extent of correlation between crisis expectations and implicit business models varies. Work place security does not seem to contribute as much as other perceptions to implicit association differences. This pattern may be due to the short-term impact of work place security compared to other crisis perceptions potentially inhibiting long-term effects. Thus, the results support *Propositions 5, 7* and *8*, while only partially supporting *Proposition 6*.

A more detailed look reveals, that expectations concerning economic development, income stability and health[74] co-occur with at least two significant differences in implicit associations on the environmental level. Thus, particularly the selected words on the environmental level depend on the expectations in the crisis dimensions. On the actor level, only one crisis expectation – namely income stability - indicates differences in implicit associations.[75] The network level does not seem to be correlated with expectations during the COVID-19 crisis.[76] Another finding is, that regarding significant items, associations particularly tend to be more closely related to mittelstand in the case of negative crisis expectations (8 of 9 cases).

The main results are that 1) expectations concerning all crisis dimensions are reflected in different implicit associations, forming mental representations 2) the crisis expectations are mainly reflected on the environmental level 3) expectations in work place security do not show a big impact and 4) in case of negative crisis expectations respondents tend to have stronger associations towards mittelstand than to newly founded firms.

[74] Although the perception of health issues is co-occurring with two significant differences, this result is taken with caution since one of the differences is not merely associated with the perception but rather with other factors.
[75] Although the perception of work place security is co-occurring with a significant difference, this result is taken with caution since it is only one item in the multi-item battery.
[76] Although the perception of health issues is co-occurring with a significant difference, this result is taken with caution since it is only one item in the multi-item battery.

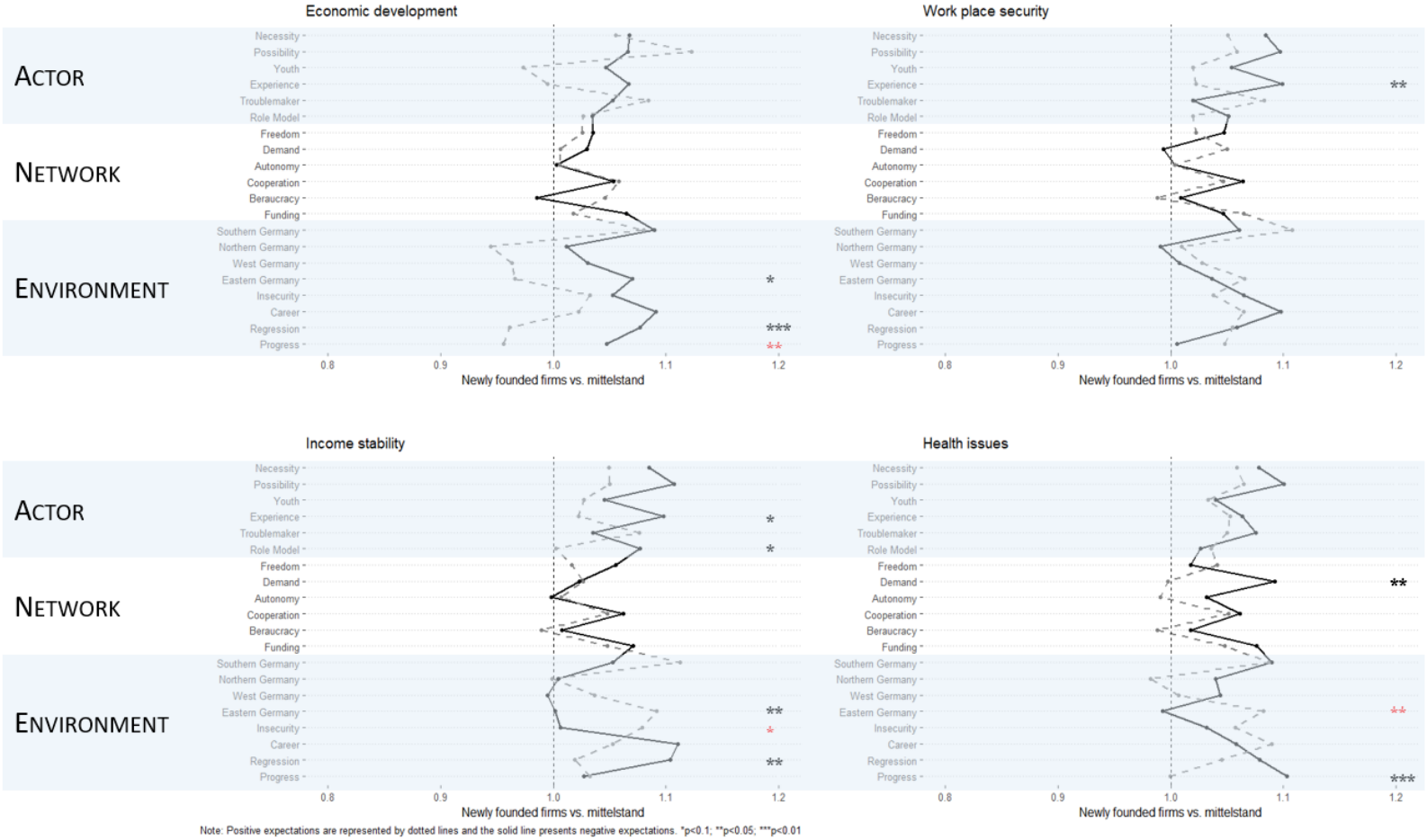

Figure 4.1: Mental representations of entrepreneurship compared by expectations formed in the beginning of the crisis
Source: Calculation based upon own data collection; Note: Sample sizes: Economic development: 189 negative, 40 positive; Work place security: 100 negative, 129 positive; Income stability: 99 negative, 130 positive; Health issues: 76 negative, 153 positive. Please note that the differences marked with a red significance sign cannot be attributed to the difference in crisis perception but to individual and contextual factors (please see Table 8.7 and 8.8 in the appendix). The black significance signs indicate a significant influence confirmed by the ANCOVA analysis or if the crisis perception is one of the top three predictors of this difference in implicit associations. The x-axis indicates whether the word on the y-axis is merely associated with the concept of newly founded firms (entrepreneurship) or mittelstand. The more the mean values are placed on the right-hand side of the Figure 4.1, the more the word tends to be associated with 'mittelstand'. The more left it is the more the word is associated with 'newly founded firms'. The vertical line at the x-value of 1 corresponds to an equally fast response time in both cases, without clear association with one of the concepts. The full line represents respondent´s associations having negative expectations throughout the four dimensions in the next 12 months. This is contrasted by the respondent´s associations having positive expectations which is shown as dotted line in the plots.

5 Discussion

The purpose of this study was to examine the relation between crisis expectations at the start of the COVID-19 crisis and the antecedents of entrepreneurship – explicit business model preferences and implicit mental representations of entrepreneurship.

The first research question can be answered as follows: Binary logistic regressions revealed that crisis expectations concerning economic development are of key importance to explicit business model preferences. Crisis expectations concerning work place security and income stability are relevant in one of the two business model characteristics – income source and role of the entrepreneur. Crisis expectations concerning health as a main aspect of this COVID-19 crisis surprisingly does not show a significant influence. These findings support previous research that entrepreneurial activities are most reactive in response to a crisis (Ratten, 2020). Further, these results advance the literature in proposing that even a step earlier, pre-foundational preferences for business models on an individual level are highly reactive. Whereas the crisis puts adversity on existing entrepreneurial ventures (Kuckertz et al., 2020), these analyses reveal a strong indication for quick adaptation of entrepreneurial processes to changing conditions during the crisis.

Moreover, from the perspective of society, this crisis does not make business models obsolete, but rather enhances a re-orientation to other business model types. Former successful business models which may be focussed in funding programs, are subject of considerable change. This finding suggests that programs stimulating entrepreneurial activities should not restrict themselves to specific business models, but rather broaden their scope in order to support the adaptation processes of entrepreneurial activities to changed conditions. This corresponds to the nature of this crisis not shaking out obsolete businesses but rather bringing forth valuable ones (Kuckertz et al., 2020).

Contrary to former research by Fernandez-Urbano and Kulic (2020), we cannot confirm a strong relation between social background and the perception of economic conditions. Interestingly, the crisis expectations correlate with objective conditions in the crisis (e.g. working from home, short-time working) only to a minor extent. This may be due to the initial state of the crisis in which short-time working and job loss may not be experienced by many of the respondents, underlining that crisis expectations are not necessarily bounded to objective conditions. This points towards the importance of considering expectations in the analysis of the effects a crisis has.

The second research question can be answered as follows: The examination of implicit mental representations of newly founded firms in contrast to mittelstand revealed that expectations during the crisis influence the conceptualisation of entrepreneurship in terms of their environmental embeddedness and, to a lesser extent, their actor characteristics. The network level remains unaffected by expectations during the crisis. When negative crisis expectations are present, implicit mental representations of mittelstand are more pronounced than those of newly founded firms. We deduce that an entrepreneurial mindset is pro-cyclical: This research shows entrepreneurial activities in the form of newly founded firms suffer from negative expectations during crisis and mittelstand is preferred. This may go back to a re-orientation of individuals towards basic needs as security during the crisis (Loxton et al., 2020) which may be more connected to the established mittelstand rather than to volatile entrepreneurial activities.

Since crisis expectations were identified to be the main driver of adaptations in implicit mental representations, policy interventions should take expectations more into account during a crisis. Information campaigns aiming at stimulating entrepreneurship during a crisis could especially address income stability.

The main contribution of this study is to show that expectations formed within a crisis impact entrepreneurial activities. This facilitates further research to investigate the effects of crises in greater detail, going beyond a binary macroeconomic phenomenon only. Further, the control variables included in this study may give rise to further research by delivering first insights into what determines the type of businesses.

Besides the strengths of the study, some limitations pave the way for further research. First, the gathered sample mainly consists of well-educated people who are surveyed once. Investigating how crisis expectations evolve in the course of the crisis in a broader population could be made possible by a longitudinal approach which covers various types of respondents. Second, future research could differentiate the main income sources and role of entrepreneurs further to gain more detailed information about the crisis influences. Third, the methodology of reaction time tasks to measure implicit associations could be applied to other fields and may be investigated in its robustness. Especially a random assignment of terms being displayed on the left versus on the right side could overcome the bias that right handers were faster reacting to mittelstand, being displayed always on the right side in our analysis. Further, although only accessible by laptop or computer, a limiting factor of this study is that the environments of participants in the study differed, as the study was accessible online.

6 Conclusion

This study was designed to investigate economic crisis developments from a bottoms-up perspective. 249 German citizens completed an online questionnaire measuring crisis developments implicitly as well as explicitly. These crisis dimensions were distinguished into positive or negative expectations on economic development, income stability, work place security and health. This study reveals new findings on the influence of expectations formed during a crisis on early entrepreneurial activities. First, the results show that entrepreneurship is related to differing crisis expectations from the beginning of the crisis onwards. However, the effects are manifold and also depend on individual characteristics. Nevertheless, they do not significantly depend on objective crisis circumstances reflected in work and leisure changes. Second, business models are affected by the crisis in terms of both their main income source and the role of the entrepreneur. Based on preferences of society, new business models are welcomed rather than others becoming obsolete. Third, implicit mental representations of entrepreneurship appear to depend on expectations during a crisis. Implicit mental representations of established mittelstand are more present than those of newly founded firms - the entrepreneurial mindset is pro-cyclical. Overall, the importance of the cognitive level in structural change and crisis is confirmed once more. Implications of these findings concern opportunities for introducing new business models onto the market to take advantage of the openness during crisis.

Overall, the study uncovers the influence of expectations during a crisis on explicit business model preferences as well as on implicit mental representations of entrepreneurship. The main contribution is a differentiated understanding of crises. Entrepreneurial activities are affected in their earliest stage – in its antecedents, namely explicit business model preferences and implicit mental representations of entrepreneurship. Therefore, it is of key importance to keep track of these changes and their effects on entrepreneurial activities.

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8 Appendix

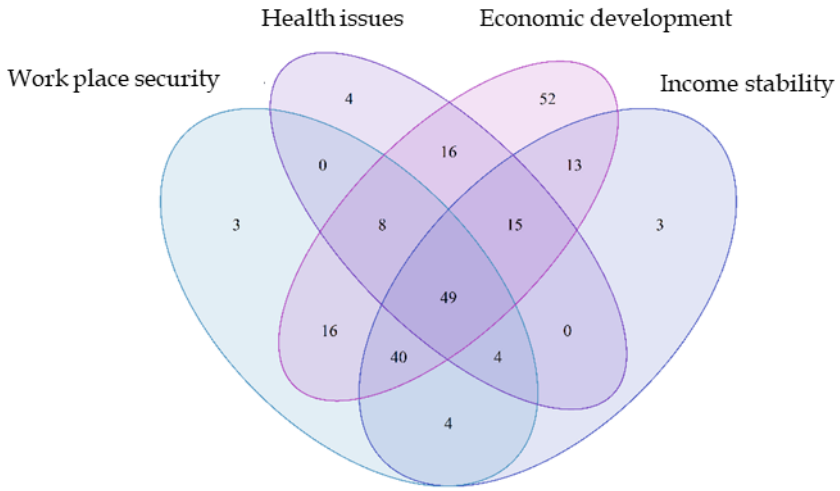

Figure 8.1: Venn diagram of negative expectations in crisis dimensions
Source: Own calculation based upon primary data collection

Table 8.1: Survey questions to assess preferred business models
Source: Own survey question based on Malone et al. (2006)

Business models
Question type: Single choice Instructions: Please imagine that you would like to start a business. Question: For which type of products or services can you most likely imagine to be active as an entrepreneur? • Physical products • Financial products • Intellectual property • Human services • Not specified
Question type: Single choice Instructions: Please imagine that you would like to start a business. Question: How do you imagine your role as an entrepreneur? • You produce something/create something new (Creator) • You refine and process existing products (Distributor) • You use your skills, capital or property (Landlord) • You trade with products (Broker) • Not specified

Table 8.2: Instruction for the reaction time task in the survey
Source: Own survey instruction

Associations
Question type: Reaction time task Instructions: Please press the "E" key with your left finger when you see the word “Neugründung” (newly founded firm). Please press the "I" button with your right finger "I" key when you see the word “Mittelstand” (mittelstand). Press the keys as fast as you can and try to make as few mistakes as possible. Two words will not ever appear at the same time. Between the words “Neugründung” and “Mittelstand”, other words [see words in Table 3.3] will appear briefly, where you should not press any key. To start, press "E".

Table 8.3: Survey questions to assess the crisis perceptions
Source: Own survey question

Crisis dimensions
Question type: Slider (very negative – very positive) Instructions: Please indicate how you feel about the events below. Please move the slider to the position that best matches your feeling. Question: I expect positive/negative impact in the next 12 months on... • my health. • the economic development in Germany. • my income and financial security. • my job security, or my job search

Table 8.4: Descriptive statistics for control variables
Source: Own calculation based upon primary data collection

		N	Mean/ Share	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Individual set of controls	Extraversion[77]	249	3.297	1.038	1	2.5	3.5	4	5
	Agreeableness[78]	249	3.384	0.834	1	3	3.5	4	5
	Conscientiousness[79]	249	3.742	0.806	1	3	3.5	4.5	5
	Neuroticism[80]	249	2.819	0.911	1	2	3	3.5	5
	Openness to experience[81]	249	3.554	0.993	1	3	3.5	4.5	5
	Optimism[82]	249	10.963	2.239	4	10	11	13	15
	Share of respondents holding an university degree	249	67.1%	0.471	0	0	1	1	1
	Age	249	38	16.319	20	26	30	50	85
	Share of women	247	57.1%	0.496	0	0	1	1	1
	Share of self-employed	249	8.8%	0.284	0	0	0	0	1
	Share of respondents knowing an entrepreneur	246	83.3%	0.373	0	1	1	1	1
	Share of respondents having experience with foundations	245	17.1%	0.378	0	0	0	0	1
	Share of respondents having work experience in small and new firms	243	48.6%	0.501	0	0	0	1	1
	Share of respondents watching TV shows about startups	248	25.4%	0.436	0	0	0	1	1
Corona set of controls	Share of respondents affected by short-time working	241	5.4%	0.226	0	0	0	0	1
	Share of respondents working from home	235	63.0%	0.484	0	0	1	1	1
	Share of respondents having children	244	24.6%	0.432	0	0	0	0	1
	Share of respondents satisfied with the government[83]	243	87.7%	0.330	0	1	1	1	1
	Change leisure time *(1=no changes at all; 101=very much)*	249	74.201	24.494	1	67	80	93	101
	Change work time *(1=no changes at all; 101=very much)*	227	56.493	31.311	1	25	67	81	101

[77] The value of 1 in the items of the personality profile indicate low proportion of this trait and a value of 5 indicates a high proportion of the respective trait.
[78] The value of 1 in the items of the personality profile indicate low proportion of this trait and a value of 5 indicates a high proportion of the respective trait.
[79] The value of 1 in the items of the personality profile indicate low proportion of this trait and a value of 5 indicates a high proportion of the respective trait.
[80] The value of 1 in the items of the personality profile indicate low proportion of this trait and a value of 5 indicates a high proportion of the respective trait.
[81] The value of 1 in the items of the personality profile indicate low proportion of this trait and a value of 5 indicates a high proportion of the respective trait.
[82] A higher value of 1 in this variable indicates the lowest possible degree of optimism and a value of 15 corresponds to the highest degree of optimism possible.
[83] A value of 0 indicates dissatisfaction with the governmental actions during the COVID-19 pandemic or a neutral opinion, a value of 1 corresponds to satisfaction with governmental actions.

Table 8.5: Correlation matrix of variables – main variables
Source: Calculation based upon primary data collection

	a	b	c	d	e	f	g	h	i	j	k	l
Physical products (a)		-0.19	-0.74	-0.24	0.34	0.08	-0.44	0.1	-0.17	0.1	0.04	-0.1
Financial products (b)			-0.24	-0.08	-0.02	0.01	-0.1	0.21	0.05	0.03	0.08	0.15
Intellectual property (c)				-0.3	-0.25	-0.11	0.44	-0.23	0.12	-0.09	-0.07	0.03
Human services (d)					-0.12	0.04	0.06	0.06	0.04	-0.04	-0.01	0
Creator (e)						-0.28	-0.72	-0.25	-0.14	0.13	0.22	0.14
Distributor (f)							-0.26	-0.09	-0.01	-0.12	-0.16	-0.13
Landlord (g)								-0.23	0.1	-0.02	-0.16	-0.14
Broker (h)									0.07	-0.07	0.05	0.13
Economic development (i)										0.16	0.14	0.12
Work place security (j)											0.38	0.09
Income stability (k)												0.37
Health issues (l)												

Table 8.6: Correlation matrix of variables – control variables
Source: Calculation based upon primary data collection

	m	**n**	**o**	**p**	**q**	**r**	**s**	**t**	**u**	**v**	**w**	**x**	**y**	**z**	**aa**	**ab**	**ac**	**ad**	**ae**	**af**
Extraversion (m)		0.15	0.12	-0.13	0.27	0.18	0.07	-0.13	0.11	0.13	-0.08	-0.16	0.1	0.09	-0.14	-0.17	0.12	0.05	0.1	-0.02
Agreeableness (n)			0.24	-0.12	0.06	0.25	0.11	0.19	0.23	0.04	0.08	-0.08	-0.04	0.06	0	0.08	-0.13	0.12	0.04	-0.02
Conscientiousness (o)				-0.12	0.12	0.17	0.02	0.3	0.19	0.15	-0.09	-0.15	0.08	0.11	0.13	-0.01	-0.28	0.06	0.18	0.04
Neuroticism (p)					-0.01	-0.13	-0.04	-0.05	0.25	-0.06	0.04	0.09	-0.04	0.07	0.02	-0.12	0.05	-0.01	-0.04	-0.01
Openness to experience (q)						0.19	0.05	0.02	0.03	0.11	-0.13	-0.16	0.14	0.05	-0.05	-0.12	0.01	-0.04	0.05	-0.01
Optimism (r)							-0.03	0.07	0.16	-0.1	-0.05	-0.05	-0.05	0.08	-0.04	-0.06	-0.13	0.06	0.1	-0.06
Holding an university degree (s)								-0.05	-0.03	0.13	-0.06	-0.12	0.14	0.01	0.1	-0.33	0.14	0.05	0.09	0.11
Age (t)									0.22	0.06	-0.19	-0.19	-0.02	-0.1	0.04	0.35	-0.76	0.09	-0.05	-0.08
Gender (u)										-0.02	-0.04	-0.08	-0.01	-0.04	0.11	0.02	-0.17	0.11	0.01	-0.03
Self-employed (v)											0	-0.48	0.23	0.01	-0.09	0	-0.07	0.12	-0.04	0.02
Knowing an entrepreneur (w)												0.13	-0.16	-0.03	0.02	0.01	0.16	0.04	0.06	0.06
Experience with foundations (x)													-0.33	0	0.02	0.05	0.19	-0.08	0.13	0.14
Work experience in small and new firms (y)														0.08	0.01	0.07	0.08	0.1	-0.05	0.01
Watching TV shows about startups (z)															-0.11	-0.06	0.1	0.01	-0.04	0.09
Short-time working (aa)																-0.22	0.05	0.14	-0.03	-0.16
Working from home (ab)																	-0.32	-0.01	-0.07	-0.22
Children (ac)																		-0.07	0.07	0
Satisfaction with government (ad)																			0.07	0.06
Change leisure time (ae)																				0.33
Change work time (af)																				

Table 8.7: ANCOVA results – economic development / health
Note: The probability value (F-value) is displayed
Source: Calculation based upon primary data collection

		East Germany	**Regression**	**Progress**	**Demand**	**East Germany**	**Progress**
	Constant	0.03	0.00	0.01	0.12	0.01	0.01
Crisis perceptions	Economic development	0.02	0.16	0.19			
	Work place security						
	Income stability						
	Health issues				0.02	0.37	0.01
Individual control variables	Extraversion	0.34	0.50	0.78	0.40	0.34	0.52
	Agreeableness	0.78	0.84	0.49	0.20	0.75	0.35
	Conscientiousness	0.17	0.60	0.47	0.98	0.22	0.30
	Neuroticism	0.72	0.82	0.55	0.78	0.35	0.76
	Openness to experience	0.04	0.48	0.39	0.61	0.08	0.30
	Optimism	0.99	0.57	0.47	0.06	0.85	0.45
	Holding an university degree	0.20	0.08	0.32	0.36	0.25	042
	Age	0.39	0.90	0.56	0.83	0.31	0.42
	Gender	0.28	0.78	0.54	0.51	0.28	0.56
	Self-employed	0.85	0.81	0.12	0.83	0.80	0.08
	Knowing an entrepreneur	0.45	0.63	0.10	0.22	0.55	0.20
	Experience with foundations	0.82	0.44	0.05	0.96	0.79	0.05
	Work experience in small and new firms	0.39	0.38	0.07	0.37	0.59	0.13
	Watching TV shows about startups	0.47	0.09	0.62	0.22	0.38	0.71
COVID control variables	Short-time working	0.97	0.14	0.07	0.47	0.80	0.04
	Working from home	0.22	0.80	0.48	0.55	0.34	0.26
	Children	0.88	0.80	0.47	0.67	0.59	0.72
	Satisfaction with government	0.19	0.38	0.11	0.19	0.21	0.09
	Change leisure time	0.72	0.77	0.46	0.60	0.71	0.34
	Change work time	0.37	0.33	0.14	0.92	0.25	0.05

Table 8.8: ANCOVA results – work place security / income stability
Note: The probability value (F-value) is displayed
Source: Calculation based upon primary data collection

		Experience	**Experience**	**Role model**	**East Germany**	**Insecurity**	**Regression**
	Constant	0.01	0.02	0.10	0.00	0.15	0.00
Crisis perceptions	Economic development						
	Work place security	0.06					
	Income stability		0.07	0.10	0.20	0.44	0.14
	Health issues						
Individual control variables	Extraversion	0.29	0.33	0.12	0.37	0.52	0.61
	Agreeableness	0.57	0.55	0.55	0.82	0.37	0.65
	Conscientiousness	0.73	0.98	0.16	0.30	0.18	0.51
	Neuroticism	0.63	0.82	0.18	0.35	0.54	0.72
	Openness to experience	0.79	0.76	0.98	0.06	0.99	0.47
	Optimism	0.63	0.73	0.70	0.80	0.19	0.72
	Holding an university degree	0.72	0.57	0.58	0.24	0.26	0.14
	Age	0.08	0.09	0.45	0.31	0.79	0.77
	Gender	0.88	0.91	0.47	0.30	0.95	0.73
	Self-employed	0.14	0.11	0.85	0.82	0.95	0.95
	Knowing an entrepreneur	0.23	0.25	0.73	0.48	0.78	0.53
	Experience with foundations	0.15	0.18	0.14	0.74	0.99	0.39
	Work experience in small and new firms	0.90	0.92	0.56	0.51	0.03	0.27
	Watching TV shows about startups	0.29	0.40	0.14	0.47	0.36	0.14
COVID control variables	Short-time working	0.73	0.83	0.16	0.62	0.42	0.23
	Working from home	0.35	0.24	0.96	0.37	0.90	0.68
	Children	0.21	0.14	0.75	0.57	0.12	0.97
	Satisfaction with government	0.84	0.81	0.45	0.18	0.92	0.21
	Change leisure time	0.64	0.67	0.97	0.71	0.88	0.75
	Change work time	0.11	0.10	0.28	0.25	0.86	0.22

Supplementary material

1 Questionnaire Chapter 2

Fragentext und Ausfüllanweisungen	**Antwortoptionen** ○ Einfachauswahl ⁞ Drop Down Auswahl […] Offene Frage □ Mehrfachauswahl ↔ Slider ○○○○○○ 5-stufige Likert-Skala + keine Angabe ⧖ Reaktionszeit-Messung ! Information	**Question text and filling instructions**	**Response options** ○ Single selection ⁞ Drop down selection […] Open question □ Multiple selection ↔ Slider ○○○○○○ 5-point Likert scale + no specification ⧖ Reaction time measurement ! Information
Seite 01		Page 01	
Herzlich Willkommen zu meiner kurzen Umfrage über die regionalen Unterschiede in der Unternehmenskultur. Die Umfrage dauert nur 20 Minuten und alle gesammelten Daten werden anonym verarbeitet. Die Ergebnisse der Umfrage lassen keine Rückschlüsse auf Ihre Person zu und werden ausschließlich zu wissenschaftlichen Zwecken ausgewertet. Bereits existierende Regionaldaten werden	!	Welcome to my short survey on regional differences in corporate culture. The survey takes only 20 minutes and all data collected will be processed anonymously. The results of the survey do not allow any conclusions to be drawn about you personally and will be analysed for scientific purposes only. Existing regional data will be linked to the results of the survey. It is your opinion that counts when	!

mit den Ergebnissen der Umfrage verbunden. Es kommt bei der Beantwortung der Fragen auf Ihre Meinung an und dabei existieren keine richtigen oder falschen Antworten. Wenn Sie sich bei der Beantwortung einer Frage unsicher sind, entscheiden Sie bitte aus Ihrem Gefühl heraus. Vielen Dank für Ihre ehrliche Meinung! Jessica Birkholz		answering the questions and there are no right or wrong answers. If you are unsure about answering a question, please decide based on your feelings. Thank you for your honest opinion! Jessica Birkholz	
Ich habe die Teilnahmebedingungen verstanden und erkläre mich einverstanden.	○ Ja ○ Nein → *Screenout*	I have understood the conditions of participation and agree to them.	○ Yes ○ No → *Screenout*
Seite 02		Page 02	
Bitte geben Sie an, welchem Geschlecht Sie zugehörig sind.	○ Männlich ○ Weiblich	Please indicate which gender you belong to.	○ Male ○ Female
In welchem Jahr sind Sie geboren?	⁞ _1 (2002) _48 (1955) _49 (in keinem der auswählbaren Jahre) → *Screenout*	What year were you born?	⁞ _1 (2002) _48 (1955) _49 (in none of the displayed years) → *Screenout*
Welchen höchsten Bildungsabschluss haben Sie?	○ Hauptschulabschluss ○ Mittlere Reife, Realschulabschluss, Fachschulreife	What is your highest level of education?	○ Certificate of Secondary Education ○ General Certificate of Secondary Education (GCSE), Technical college entrance qualification

	○ Fachhochschulreife, Abschluss einer Fachoberschule		○ Advanced technical college entrance qualification, Completion of a specialised secondary school
	○ Abitur, allgemeine oder fachgebundene Hochschulreife		○ Final secondary-school examinations, general or subject-specific higher education entrance qualification
	○ Bachelorabschluss → *Seite 18 anzeigen*		○ Bachelor's degree → *Show page 18*
	○ Masterabschluss, Diplom → *Seite 18 anzeigen*		○ Master's degree, diploma → *Show page 18*
	○ Promotion → *Seite 18 anzeigen*		○ Doctorate → *Show page 18*
	○ Keiner dieser Abschlüsse		○ None of these degrees
	○ Keine Angabe		○ No specification
Ist Deutsch Ihre Muttersprache?	○ Ja	Is German your mother tongue?	○ Yes
	○ Nein		○ No
Sind Sie Rechts- oder Linkshänder? Falls sie Beidhänder sind, geben Sie bitte an, mit welcher Hand Sie schreiben.	○ Rechtshänder	Are you right-handed or left-handed? If you are ambidextrous, please indicate with which hand you write.	○ Right-handed
	○ Linkshänder		○ Left-handed
	○ Keine Angabe		○ No specification
Seite 03		Page 03	
Wie lautet die Postleitzahl des Ortes, an dem Sie ihre Jungend überwiegend verbrachten?	[…] Offene Frage	What is the zip code of the place where you spent most of your youth?	[…] Open question

Bitte geben Sie eine vierstellige (vor 1993) oder eine fünfstellige Postleitzahl ein. Falls Sie die Postleitzahl nicht mehr wissen, geben Sie bitte den Ortsnamen an. Falls Sie zu der Zeit nicht in Deutschland gewohnt haben, geben Sie bitte das jeweilige Land an.		Please enter a four-digit (pre-1993) or a five-digit zip code. If you do not remember the zip code, please enter the town name. If you did not live in Germany at the time, please indicate the respective country.	
Was ist die Postleitzahl des Ortes, in dem Sie derzeit leben? Bitte geben Sie eine fünfstellige Postleitzahl ein.	[…] Offene Frage	What is the zip code of the town where you currently live? Please enter a five-digit zip code.	[…] Open question
Ab wann wohnen Sie bereits an Ihrem aktuellen Wohnort? Beginn	⁞ _01 (2020) _66 (1955) _67 (keine Angabe)	Since when do you live at your current residence? Start	⁞ _01 (2020) _66 (1955) _67 (no specification)
Bitte überlegen Sie, wo Sie sich in einem durchschnittlichen Monat normalerweise aufhalten (z.B. Ort der Schule, des Arbeitsplatzes, Arztbesuche, Freizeitaktivitäten, Besuch von Freunden und Familie). Bitte schätzen Sie nun ein, wie viele Kilometer, die am weitesten voneinander entfernten Orte auseinanderliegen. Bitte geben Sie eine ganze Zahl ohne Nachkommastellen ein.	[…] Offene Frage	Please think about where you usually spend your time in an average month (e.g. place of school, workplace, doctor's appointments, leisure activities, visiting friends and family). Now please estimate how many kilometres apart the places that are farthest apart are. Please enter a whole number without decimal places.	[…] Open question
Seite 04		Page 04	

Die nachfolgenden Aufgaben dienen der Ermittlung Ihrer Vorstellung von Konzepten wie "Neugründung", "Mittelstand", "Kreativität" und "Produktivität". Um Ihnen ein Beispiel für die Funktionsweise der Aufgabe zu geben, wird zunächst eine kurze Übung durchgeführt. Die Übung wird ca. 1 Minute und die beiden folgenden Aufgaben werden ca. 3 Minuten in Anspruch nehmen. Da Ihre Reaktionszeiten von entscheidender Bedeutung für die Auswertung sind, bitte ich Sie, Ihre volle Aufmerksamkeit auf die Bearbeitung der Aufgaben zu richten und so schnell wie möglich die Anweisungen auszuführen.	!	The following tasks are designed to determine your conception of concepts such as “newly founded firm”, “mittelstand”, “creativity”, and “productivity”. To give you an example of how the task works, a short exercise will be done first. The exercise will take about 1 minute and the two following tasks will take about 3 minutes. Since your reaction times are of crucial importance for the evaluation, we ask you to give your full attention to the processing of the tasks and to carry out the instructions as quickly as possible.	!
Seite 05		Page 05	
Bitte drücken Sie mit Ihrem linken Finger auf die Taste „E“, wenn Sie das Wort „Tier“ sehen. Bitte drücken Sie mit Ihrem rechten Finger auf die Taste „I“, wenn Sie das Wort „Person“ sehen. Drücken Sie die Tasten so schnell Sie können und versuchen Sie gleichzeitig, so wenig Fehler wie möglich zu machen. Es werden nie zwei Wörter gleichzeitig erscheinen.	⧖ Vorbild ⧖ Fortschritt ⧖ Freiraum ⧖ Norddeutschland ⧖ Förderung ⧖ Unsicherheit ⧖ Notwendigkeit	Please press the „E“ button with your left finger when you see the world “animal”. Please press the “I” key with you right finger when you see the word “person”. Press the keys as fast as you can while trying to make as less mistakes as possible. Two words will never appear at the same time. Between the words “animal” and “person” other words will appear briefly	⧖ Role Model ⧖ Progress ⧖ Freedom ⧖ Nothern Germany ⧖ Funding ⧖ Uncertainty ⧖ Necessity

Zwischen den Wörtern „Tier“ und „Person“ werden andere Wörter kurz eingeblendet, bei denen Sie keine Taste drücken sollen. Zum Starten drücken Sie „E“. TIER / PERSON	⧖ Rückschritt	where you should not press any key. To start, press “E”. ANIMAL / PERSON	⧖ Regression
	⧖ Jugend		⧖ Youth
	⧖ Süddeutschland		⧖ Southern Germany
	⧖ Bürokratie		⧖ Bureaucracy
	⧖ Westdeutschland		⧖ West Germany
	⧖ Erfahrung		⧖ Experience
	⧖ Kooperation		⧖ Cooperation
	⧖ Eigenverantwortung		⧖ Autonomy
	⧖ Unruhestifter		⧖ Troublemaker
	⧖ Ostdeutschland		⧖ East Germany
	⧖ Karriere		⧖ Career
	⧖ Möglichkeit		⧖ Opportunity
	⧖ Nachfrage		⧖ Demand
Seite 06		Page 06	
Bitte drücken Sie mit Ihrem linken Finger auf die Taste „E“, wenn Sie das Wort „Neugründung“ sehen. Bitte drücken Sie mit Ihrem rechten Finger auf die Taste „I“, wenn Sie das Wort „Mittelstand“ sehen. Drücken Sie die Tasten so schnell Sie können und versuchen Sie gleichzeitig, so wenig Fehler wie möglich zu machen. Es werden nie zwei Wörter gleichzeitig	⧖ Vorbild	Please press the “E” button with your left finger when you see the word “newly founded firm”. Please press the “I” key with your right finger when you see the word “mittelstand”. Press the keys as fast as you can while trying to make as less mistakes as possible. No two words will ever appear at the same time. Between the words “newly founded firm” and	⧖ Role Model
	⧖ Fortschritt		⧖ Progress
	⧖ Freiraum		⧖ Freedom
	⧖ Norddeutschland		⧖ Nothern Germany
	⧖ Förderung		⧖ Funding
	⧖ Unsicherheit		⧖ Uncertainty
	⧖ Notwendigkeit		⧖ Necessity

erscheinen. Zwischen den Wörtern „Neugründung“ und „Mittelstand“ werden andere Wörter kurz eingeblendet, bei denen Sie keine Taste drücken sollen. Zum Starten drücken Sie „E“. NEUGRÜNDUNG / MITTELSTAND *Filter: Wenn mehr als ein Viertel der Antworten fehlerhaft waren, dann Screenout*	⧖ Rückschritt ⧖ Jugend ⧖ Süddeutschland ⧖ Bürokratie ⧖ Westdeutschland ⧖ Erfahrung ⧖ Kooperation ⧖ Eigenverantwortung ⧖ Unruhestifter ⧖ Ostdeutschland ⧖ Karriere ⧖ Möglichkeit ⧖ Nachfrage	“mittelstand”, other words will appear briefly where you should not press any key. To start, press “E”. NEWLY FOUNDED FIRM / MITTELSTAND *Filter: If more than a quarter of the answers are mistaken, then screenout*	⧖ Regression ⧖ Youth ⧖ Southern Germany ⧖ Bureaucracy ⧖ West Germany ⧖ Experience ⧖ Cooperation ⧖ Autonomy ⧖ Troublemaker ⧖ East Germany ⧖ Career ⧖ Opportunity ⧖ Demand
Seite 07		Page 07	
Bitte drücken Sie mit Ihrem linken Finger auf die Taste „E“, wenn Sie das Wort „Kreativität“ sehen. Bitte drücken Sie mit Ihrem rechten Finger auf die Taste „I“, wenn Sie das Wort „Produktivität“ sehen. Drücken Sie die Tasten so schnell Sie können und versuchen Sie gleichzeitig, so wenig Fehler wie möglich zu machen. Es werden nie zwei Wörter gleichzeitig	⧖ Vorbild ⧖ Fortschritt ⧖ Freiraum ⧖ Norddeutschland ⧖ Förderung ⧖ Unsicherheit ⧖ Notwendigkeit	Please press the “E” button with your left finger when you see the word “Creativity”. Please press the “I” key with your right finger when you see the word “Productivity”. Press the keys as fast as you can while trying to make as less mistakes as possible. No two words will ever appear at the same time. Between the words “Creativity” and “Productivity”,	⧖ Role Model ⧖ Progress ⧖ Freedom ⧖ Nothern Germany ⧖ Funding ⧖ Uncertainty ⧖ Necessity

erscheinen. Zwischen den Wörtern „Kreativität“ und „Produktivität" werden andere Wörter kurz eingeblendet, bei denen Sie keine Taste drücken sollen. Zum Start drücken Sie „E“. KREATIVITÄT / PRODUKTIVITÄT *Filter: Wenn mehr als ein Viertel der Antworten fehlerhaft waren, dann Screenout*	⧖ Rückschritt	other words will appear briefly where you should not press any key. To start, press “E”. CREATIVITY / PRODUCTIVITY *Filter: If more than a quarter of the answers are mistaken, then screenout*	⧖ Regression
	⧖ Jugend		⧖ Youth
	⧖ Süddeutschland		⧖ Southern Germany
	⧖ Bürokratie		⧖ Bureaucracy
	⧖ Westdeutschland		⧖ West Germany
	⧖ Erfahrung		⧖ Experience
	⧖ Kooperation		⧖ Cooperation
	⧖ Eigenverantwortung		⧖ Autonomy
	⧖ Unruhestifter		⧖ Troublemaker
	⧖ Ostdeutschland		⧖ East Germany
	⧖ Karriere		⧖ Career
	⧖ Möglichkeit		⧖ Opportunity
	⧖ Nachfrage		⧖ Demand
Seite 08		Page 08	
Bitte geben Sie an ob Sie das Wort eher mit Neugründung oder Mittelstand in Verbindung bringen. Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht. *Filter: Wenn keine Angaben gemacht wurden, dann Screenout*	↔ Vorbild	Please indicate whether you associate the word more with newly founded firm or mittelstand. Please move the slider to the position that suits your feeling best. *Filter: In case no answers were recorded, then screenout*	↔ Role Model
	↔ Fortschritt		↔ Progress
	↔ Freiraum		↔ Freedom
	↔ Norddeutschland		↔ Nothern Germany
	↔ Förderung		↔ Funding
	↔ Unsicherheit		↔ Uncertainty
	↔ Notwendigkeit		↔ Necessity

	↔ Rückschritt		↔ Regression
	↔ Jugend		↔ Youth
	↔ Süddeutschland		↔ Southern Germany
	↔ Bürokratie		↔ Bureaucracy
	↔ Westdeutschland		↔ West Germany
	↔ Erfahrung		↔ Experience
	↔ Kooperation		↔ Cooperation
	↔ Eigenverantwortung		↔ Autonomy
	↔ Unruhestifter		↔ Troublemaker
	↔ Ostdeutschland		↔ East Germany
	↔ Karriere		↔ Career
	↔ Möglichkeit		↔ Opportunity
	↔ Nachfrage		↔ Demand
Seite 09		Page 09	
Bitte geben Sie an ob Sie das Wort eher mit Kreativität oder Produktivität in Verbindung bringen. Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht. *Filter: Wenn keine Angaben gemacht wurden, dann Screenout*	↔ Vorbild	Please indicate whether you associate the word more with creativity or productivity. Please move the slider to the position that suits your feeling best. *Filter: In case no answers were recorded, then screenout*	↔ Role Model
	↔ Fortschritt		↔ Progress
	↔ Freiraum		↔ Freedom
	↔ Norddeutschland		↔ Nothern Germany
	↔ Förderung		↔ Funding
	↔ Unsicherheit		↔ Uncertainty
	↔ Notwendigkeit		↔ Necessity

	↔ Rückschritt		↔ Regression
	↔ Jugend		↔ Youth
	↔ Süddeutschland		↔ Southern Germany
	↔ Bürokratie		↔ Bureaucracy
	↔ Westdeutschland		↔ West Germany
	↔ Erfahrung		↔ Experience
	↔ Kooperation		↔ Cooperation
	↔ Eigenverantwortung		↔ Autonomy
	↔ Unruhestifter		↔ Troublemaker
	↔ Ostdeutschland		↔ East Germany
	↔ Karriere		↔ Career
	↔ Möglichkeit		↔ Opportunity
	↔ Nachfrage		↔ Demand
Seite 10		Page 10	
Inwieweit treffen die folgenden Aussagen auf Sie zu? (Skala: sehr unzutreffend – sehr zutreffend)	○○○○○○ Ich schenke anderen Menschen leicht Vertrauen, glaube an das Gute im Menschen.	How well do the following statements describe your personality? (Scale: Disagree strongly – Agree strongly)	○○○○○○ I see myself as someone who is generally trusting.
	○○○○○○ Ich neige dazu, andere zu kritisieren.		○○○○○○ I see myself as someone who tends to find faults with others.
	○○○○○○ Ich habe eine aktive Vorstellungskraft, bin fantasievoll.		○○○○○○ I see myself as someone who has an active imagination.

	○○○○○○ Ich bin entspannt, lasse mich durch Stress nicht aus der Ruhe bringen.		○○○○○○ I see myself as someone who is relaxed, handles stress well.
	○○○○○○ Ich bin bequem, neige zur Faulheit.		○○○○○○ I see myself as someone who tends to be lazy.
	○○○○○○ Ich bin eher zurückhaltend, reserviert.		○○○○○○ I see myself as someone who is reserved.
	○○○○○○ Ich werde leicht nervös und unsicher.		○○○○○○ I see myself as someone who gets nervous easily.
	○○○○○○ Ich erledige Aufgaben gründlich.		○○○○○○ I see myself as someone who does a thorough job.
	○○○○○○ Ich gehe aus mir heraus, bin gesellig.		○○○○○○ I see myself as someone who is outgoing, sociable.
	○○○○○○ Ich habe nur wenig künstlerisches Interesse.		○○○○○○ I see myself as someone who has few artistic interests.
Seite 11		Page 11	
In den nachfolgenden Fragen bezieht sich die Region auf den Ort, in dem Sie aktuell wohnen und wo Sie sich in einem durchschnittlichen Monat normalerweise aufhalten.	!	In the questions below, region refers to where you currently live and where you usually stay in an average month.	!
Denken Sie bitte an eine konkrete Person, die Ihrer Meinung nach ein typischer Vertreter Ihrer aktuellen Wohnregion sein könnte. Inwieweit treffen die folgenden Aussagen Ihrer Meinung nach auf diese Person zu?	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion hat nur wenig künstlerisches Interesse.	Please think of a specific person who, in your opinion, could be a typical representative of your current region of residence. In your opinion, to what extent do the following statements apply to this person?	○○○○○○ The typical person from my current region of residence has few artistic interests.
	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion schenkt		○○○○○○ The typical person from my current region of residence is generally trusting.

(Skala: sehr unzutreffend - sehr zutreffend) *Filter: Wenn auf dieser und der letzten Seite eine Varianz von 0 identifiziert wurde, dann Screenout*	anderen Menschen leicht Vertrauen, glaubt an das Gute im Menschen.	(Scale: Disagree strongly – Agree strongly) *Filter: In case on this and on the last page a variance of zero is detected, then screenout*	
	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion neigt dazu, andere zu kritisieren.		○○○○○○ The typical person from my current region of residence tends to find faults with others.
	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion geht aus sich heraus, ist gesellig.		○○○○○○ The typical person from my current region of residence is outgoing, sociable.
	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion hat eine aktive Vorstellungskraft, ist fantasievoll.		○○○○○○ The typical person from my current region of residence has an active imagination.
	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion ist bequem, neigt zur Faulheit.		○○○○○○ The typical person from my current region of residence tends to be lazy.
	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion ist entspannt, lässt sich durch Stress nicht aus der Ruhe bringen.		○○○○○○ The typical person from my current region of residence is relaxed, handles stress well.
	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion wird leicht nervös und unsicher.		○○○○○○ The typical person from my current region of residence gets nervous easily.
	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion ist eher zurückhaltend, reserviert.		○○○○○○ The typical person from my current region of residence is reserved.

	○○○○○○ Die typische Person aus meiner aktuellen Wohnregion erledigt Aufgaben gründlich.		○○○○○○ The typical person from my current region of residence does a thorough job.
Seite 12		Page 12	
In den nachfolgenden Fragen bezieht sich die Region auf den Ort, in dem Sie aktuell wohnen und wo Sie sich in einem durchschnittlichen Monat normalerweise aufhalten.	!	In the questions below, region refers to where you currently live and where you usually stay in an average month.	!
Wie viele Freunde wohnen in der selben Region in der Sie wohnen?	↔ Keiner / Alle	How many friends live in the same region where you live?	↔ None / All
Wie viele Familienmitglieder wohnen in der selben Region in der Sie wohnen?	↔ Keiner / Alle	How many family members live in the same region where you live?	↔ None / All
Wie viele Kollegen (auch andere regelmäßige Geschäftskontakte) wohnen in der selben Region wie Sie wohnen?	↔ Keiner / Alle	How many colleagues (including other regular business contacts) live in the same region as you live?	↔ None / All
Haben Sie an Veranstaltungen in der Region teilgenommen, bei denen über neu gegründete und unter 5 Jahre alte Unternehmen informiert wurde?	○ Ja ○ Nein ○ Keine Angabe	Have you attended any events in the region that provided information about newly founded firms and businesses under 5 years old?	○ Yes ○ No ○ No specification
Kennen Sie Personen, die ihr eigenes Unternehmen gegründet haben persönlich?	○ Ja → *Seite 13 anzeigen* ○ Nein ○ Keine Angabe	Do you personally know people who have started their own business?	○ Yes → *Show page 13* ○ No ○ No specification
Seite 13		Page 13	
In den folgenden Fragen wird mit innovativen Unternehmen ein	!	In the following questions, innovative company means a company that offers	!

Unternehmen gemeint, das Produkte oder Dienstleistungen anbietet, die vorher in der Form nicht existiert haben.		products or services that did not exist in the form before.	
Wohnt diese Person/diese Personen, die ein Unternehmen gegründet hat/haben, in der gleichen Region, in der Sie wohnen und regelmäßig unterwegs sind, wie Sie?	○ Ja ○ Nein ○ Unterschiedlich ○ Keine Angabe	Does this person/these people who started a business live in the same region where you live and travel regularly as you do?	○ Yes ○ No ○ Different ○ No specification
Bitte schätzen Sie ein, wie innovativ die Produkte oder Dienstleistungen sind, die das Unternehmen der Person/die Unternehmen der Person anbietet.	↔ Gar nicht innovativ / Sehr innovativ	Please rate how innovative the products or services offered by the person's company(s) are.	↔ Not at all innovative / Very innovative
Seite 14		Page 14	
In den nachfolgenden Fragen bezieht sich die Region auf den Ort, in dem Sie aktuell wohnen und wo Sie sich in einem durchschnittlichen Monat normalerweise aufhalten.	!	In the questions below, region refers to where you currently live and where you usually stay in an average month.	!
In den folgenden Fragen wird mit innovativen Unternehmen ein Unternehmen gemeint, das Produkte oder Dienstleistungen anbietet, die vorher in der Form nicht existiert haben.	!	In the following questions, innovative company means a company that offers products or services that did not exist in the form before.	!
Bitte schätzen Sie ein, wie viele Unternehmen in Ihrer aktuellen Wohnregion jünger als 5 Jahre sind.	↔ 0 % / 100 %	Please estimate how many businesses in your current region of residence are less than 5 years old.	↔ 0 % / 100 %

Bitte schätzen Sie die Prozentzahl aus dem Gefühl heraus.		Please estimate the percentage based on your feeling.	
Bitte schätzen Sie ein, wie viele Unternehmen in Ihrer aktuellen Wohnregion innovativ sind. Bitte schätzen Sie die Prozentzahl aus dem Gefühl heraus.	↔ 0 % / 100 %	Please estimate how many companies are innovative in your current region of residence. Please estimate the percentage based on your feeling.	↔ 0 % / 100 %
Bitte schätzen Sie ein, wie viele der jungen Unternehmen (jünger als 5 Jahre) in Ihrer aktuellen Wohnregion innovativ sind. Bitte schätzen Sie die Prozentzahl aus dem Gefühl heraus.	↔ 0 % / 100 %	Please estimate how many of the young companies (younger than 5 years) in your current region of residence are innovative. Please estimate the percentage based on your feeling.	↔ 0 % / 100 %
Seite 15		Page 15	
Inwieweit treffen die folgenden Aussagen Ihrer Meinung nach zu? (Skala: stimme gar nicht zu – stimme voll zu) *Vermerk: Die deutschsprachigen Übersetzungen wurden von Global Entrepreneurship Monitor Team Deutschland bereitgestellt und vertraulich. Die Formulierungen wurden leicht angepasst.*	○○○○○○ [redacted] ○○○○○○ [redacted] ○○○○○○ [redacted]	Do you agree with the following statements? (Scale: strongly disagree – fully agree) *Note: The German translations were provided by the Global Entrepreneurship Monitor Team Germany and underlie confidentiality. The formulations were slightly adapted.*	○○○○○○ In the region where I currently live, those successful at starting a new business have a high level of status and respect. ○○○○○○ In the region where I currently live, most people consider starting a new business a desirable career choice. ○○○○○○ In the region where I currently live, you will often see stories in the public media about successful new businesses.

Seite 16		Page 16	
In den nachfolgenden Fragen bezieht sich die Region auf den Ort, in dem Sie aktuell wohnen und wo Sie sich in einem durchschnittlichen Monat normalerweise aufhalten.	!	In the questions below, region refers to where you currently live and where you usually stay in an average month.	!
In den folgenden Fragen wird mit innovativen Unternehmen ein Unternehmen gemeint, das Produkte oder Dienstleistungen anbietet, die vorher in der Form nicht existiert haben.	!	In the following questions, innovative company means a company that offers products or services that did not exist in the form before.	!
Inwieweit treffen die folgenden Aussagen Ihrer Meinung nach auf Ihre aktuelle Wohnregion zu? (Skala: stimme gar nicht zu – stimme voll zu) *Vermerk: Die deutschsprachigen Übersetzungen wurden von Global Entrepreneurship Monitor Team Deutschland bereitgestellt und vertraulich. Die Formulierungen wurden leicht angepasst.*	○○○○○○ [redacted]	In your opinion, to what extent do the following statements apply to your current region of residence? (Scale: strongly disagree – fully agree) *Note: The German translations were provided by the Global Entrepreneurship Monitor Team Germany and underlie confidentiality. The formulations were slightly adapted.*	○○○○○○ In the next six months, will there be good opportunities for starting a business in the area where you live?
	○○○○○○ [redacted]		○○○○○○ The knowledge, skills, and experience necessary to start a business are available in the marketplace.
	○○○○○○ [redacted]		○○○○○○ In the next six months, will there be good opportunities for starting an innovative business in the area where you live?
	○○○○○○ [redacted]		○○○○○○ The knowledge, skill, and experience necessary to start an innovative business are available in the marketplace.

Inwiefern treffen die folgenden Aussagen Ihrer Meinung nach auf alle anderen Regionen in Deutschland durchschnittlich zu? (Skala: stimme gar nicht zu – stimme voll zu) *Vermerk: Die deutschsprachigen Übersetzungen wurden von Global Entrepreneurship Monitor Team Deutschland bereitgestellt und vertraulich. Die Formulierungen wurden leicht angepasst.* *Filter: Wenn auf dieser und der letzten Seite eine Varianz von 0 identifiziert wurde, dann Screenout*	○○○○○○ [redacted] ○○○○○○ [redacted] ○○○○○○ [redacted] ○○○○○○ [redacted]	In your opinion, to what extent do the following statements apply on average to all other regions in Germany? (Scale: strongly disagree – fully agree) *Note: The German translations were provided by the Global Entrepreneurship Monitor Team Germany and underlie confidentiality. The formulations were slightly adapted.* *Filter: In case on this and on the last page a variance of zero is detected, then screenout*	○○○○○○ In the next six months, will there be good opportunities for starting a business in the area where you live? ○○○○○○ The knowledge, skills, and experience necessary to start a business are available in the marketplace. ○○○○○○ In the next six months, will there be good opportunities for starting an innovative business in the area where you live? ○○○○○○ The knowledge, skill, and experience necessary to start an innovative business are available in the marketplace.
Seite 17		Page 17	
Bitte stellen Sie sich vor, dass Sie ein Unternehmen gründen wollen würden. Wie würden Sie die folgenden Aktivitäten bestreiten? Bitte schieben Sie den Regler auf die Position, die Ihrer Vorstellung am ehesten entspricht.	↔ Ich würde Kunden vor allem durch einzigartige Produkte oder Services überzeugen, bei mir zu kaufen. / Ich würde Kunden vor allem durch Werbung und Marketing überzeugen, bei mir zu kaufen. ↔ Ich würde wollen, dass mein Unternehmen Menschen dabei hilft, alltägliche Routinen einfacher zu machen. / Ich würde wollen, dass mein	Please imagine that you were to start a business. How would you go about the following activities? Please move the slider to the position that most closely matches your imagination.	↔ I would convince customers to buy from me primarily through unique products or services. / I would convince customers to buy from me primarily through advertising and marketing. ↔ I would want my company to help people make everyday routines easier. / I would want my business to make a

	Unternehmen den Alltag von Menschen stark verändert.		big difference to people's everyday routines.
	↔ Ich würde mich in einem Bereich spezialisieren. / Ich würde mein Wissen in benachbarten Bereichen, die ich noch nicht so gut kenne, erweitern		↔ I would specialise in one area. / I would expand my knowledge in neighbouring areas that I don't know so well yet.
	↔ Ich würde mich vor allem von der Verwirklichung meiner Idee motivieren lassen. / Ich würde mich vor allem von der Chance, viel Geld mit dem Unternehmen zu verdienen, motivieren lassen.		↔ I would be motivated primarily by the implementation of my idea. / I would be motivated primarily by the chance to make a lot of money from the business.
	↔ Ich würde erst im laufenden Betrieb Geld und Zeit investieren und eher auf das richtige Timing für den Start meines Unternehmens warten, um das Risiko zu minimieren. / Ich würde gleich zu Beginn sehr viel Zeit und/oder Geld investieren, um meine Geschäftsidee umzusetzen, mit dem Risiko, dass es sich am Ende nicht auszahlt.		↔ I would not invest money and time until the business is up and running, rather waiting for the right timing to start my business to minimise risk. / I would invest a lot of time and/or money right at the beginning to implement my business idea, with the risk that it would not pay off in the end.
	↔ Ich würde einer Vision folgen. / Ich würde mit meinem Unternehmen versuchen, ein spezielles Problem zu lösen.		↔ I would follow a vision. / I would try to solve a specific problem with my business.

Haben Sie in Ihrem Studium Kurse zu Betriebswirtschaftslehre oder Innovationsmanagement vertieft?	○ Ja	Did you take courses on business administration or innovation management in your studies?	○ Yes
	○ Nein		○ No
	○ Keine Angabe		○ No specification
Seite 19		Page 19	
Schauen Sie regelmäßig TV Serien und Shows, die sich mit dem Thema Start-ups beschäftigen an? (Beispielsweise „Höhle der Löwen“)	○ Ja	Do you regularly watch TV series and shows that deal with the topic of start-ups? (For example "Shark Tank")	○ Yes
	○ Gelegentlich		○ Occasionally
	○ Nein		○ No
	○ Keine Angabe		○ No specification
Welche Tätigkeit führen Sie aus?	□ Vollzeiterwerbstätig	What activity do you perform?	□ Full-time employed
	□ Teilzeiterwerbstätig		□ Part-time employed
	□ In einer beruflichen Ausbildung/Lehre		□ In a vocational training/apprenticeship program
	□ Schüler/-in an einer allgemeinbildenden Schule		□ Student at a general education school
	□ Student/-in		□ Student
	□ Rentner/-in, Pensionär/-in, im Vorruhestand		□ Retiree, pensioner, in early retirement
	□ Arbeitslos		□ Unemployed
	□ Dauerhaft erwerbsunfähig		□ Permanently incapacitated for work
	□ Hausfrau/Hausmann		□ Housewife/husband
	□ Sonstiges		□ Other
	□ Selbständig		□ Self-employed
	□ Keine Angabe		□ No specification

Wie viel Arbeitserfahrung haben Sie bereits in kleinen oder neu gegründeten Unternehmen gesammelt?	○ Über 10 Jahre ○ 5-10 Jahre ○ 1-5 Jahre ○ Unter 1 Jahr ○ Keine Erfahrung ○ Keine Angabe	How much work experience have you had in small or newly founded firms?	○ Over 10 years ○ 5-10 years ○ 1-5 years ○ Under 1 year ○ No experience ○ No specification
Haben Sie bereits eigene Erfahrungen mit Unternehmensgründungen gesammelt?	○ Ja ○ Nein ○ Keine Angabe	Have you already gained your own experience with founding a firm?	○ Yes ○ No ○ No specification
[redacted] *Vermerk: Die deutschsprachigen Übersetzungen wurden von Global Entrepreneurship Monitor Team Deutschland bereitgestellt und vertraulich.*	○ [redacted] ○ [redacted] ○ [redacted] ○ [redacted] ○ [redacted]	Are you, alone or with others, expecting to start a new business, including any type of self-employment, within the next three years? *Note: The German translations were provided by the Global Entrepreneurship Monitor Team Germany and underlie confidentiality.*	○ Yes ○ Rather likely ○ Rather unlikely ○ No ○ No specification
Seite 20 – Letzte Seite		Page 20 – Last page	
Vielen Dank für Ihre Teilnahme! Ich möchte mich ganz herzlich für Ihre Mithilfe bedanken. Bei Rückfragen oder Anmerkungen zur Studie kontaktieren Sie gerne jessica.birkholz@uni-bremen.de.	!	Thank you for your participation! I would like to thank you very much for your assistance. If you have any questions or comments about the study, please feel free to contact jessica.birkholz@uni-bremen.de. Your answers have been saved, you can now close the browser window.	!

Ihre Antworten wurden gespeichert, Sie können das Browser-Fenster nun schließen.

2 Questionnaire Chapter 5

Fragentext und Ausfüllanweisungen	**Antwortoptionen** ○ Einfachauswahl ⁞ Drop Down Auswahl […] Offene Frage □ Mehrfachauswahl ↔ Slider ○○○○○○ 5-stufige Likert-Skala + keine Angabe ⏳ Reaktionszeit-Messung ! Information	**Question text and filling instructions**	**Response options** ○ Single selection ⁞ Drop down selection […] Open question □ Multiple selection ↔ Slider ○○○○○○ 5-point Likert scale + no specification ⏳ Reaction time measurement ! Information
Seite 01		Page 01	
Herzlich Willkommen zu unserer kurzen Umfrage über die Wahrnehmung von Unternehmenskulturen. Die Umfrage dauert nur 15 bis 20 Minuten und alle gesammelten Daten werden anonym verarbeitet. Die Ergebnisse der Umfrage lassen keine Rückschlüsse auf Ihre Person zu und werden ausschließlich zu wissenschaftlichen Zwecken ausgewertet. Bereits existierende Regionaldaten werden mit den Ergebnissen der Umfrage verbunden. Es kommt bei der	!	Welcome to our short survey on perceptions of corporate cultures. The survey takes only 15 to 20 minutes and all data collected will be processed anonymously. The results of the survey do not allow any conclusions to be drawn about you personally and will be analysed for scientific purposes only. Existing regional data will be linked to the results of the survey. It is your opinion that counts when answering the questions and there are no right or wrong answers. If you are unsure	!

Beantwortung der Fragen auf Ihre Meinung an und dabei existieren keine richtigen oder falschen Antworten. Wenn Sie sich bei der Beantwortung einer Frage unsicher sind, entscheiden Sie bitte aus Ihrem Gefühl heraus. Vielen Dank für Ihre ehrliche Meinung! Jessica Birkholz & Jarina Kühn		about answering a question, please decide based on your feelings. Thank you for your honest opinion! Jessica Birkholz & Jarina Kühn	
Ich habe die Teilnahmebedingungen verstanden und erkläre mich einverstanden.	○ Ja ○ Nein → *Screenout*	I have understood the conditions of participation and agree to them.	○ Yes ○ No → *Screenout*
Bitte geben Sie das Gerät an, mit dem Sie diesen Fragebogen beantworten.	○ Computer oder Laptop ○ Tablet → *Screenout* ○ Smartphone → *Screenout* ○ Sonstiges	Please indicate the device you are using to answer this questionnaire.	○ Computer or laptop ○ Tablet → *Screenout* ○ Smartphone → *Screenout* ○ Other
Seite 02		Page 02	
Bitte geben Sie an, welchem Geschlecht Sie zugehörig sind.	○ Männlich ○ Weiblich ○ Divers ○ Keine Angabe	Please indicate which gender you belong to.	○ Male ○ Female ○ Divers ○ No specification
In welchem Jahr sind Sie geboren? *Filter: Wenn die Probanden zwischen 1935 und 1973 geboren wurden → Seite 19, 20, 21 anzeigen*	⁞ _1 (2002) _68 (1935) _70 (keine Angabe)	What year were you born? *Filter: In case the respondents are born between 1935 and 1973 → Show page 19, 20, 21*	⁞ _1 (2002) _68 (1935) _70 (no specification)

Wenn die Probanden zwischen 1935 und 1992 geboren wurden → Seite 22, 23, 24 anzeigen *Wenn die Probanden zwischen 1949 und 1990 geboren wurden → Seite 4 anzeigen*		*In case the respondents are born between 1935 and 1992 → Show page 22, 23, 24* *In case the respondents are born between 1949 and 1990 → Show page 4*	
Welchen höchsten Bildungsabschluss haben Sie?	○ Hauptschulabschluss	What is your highest level of education?	○ Certificate of Secondary Education
	○ Mittlere Reife, Realschulabschluss, Fachschulreife		○ General Certificate of Secondary Education (GCSE), Technical college entrance qualification
	○ Fachhochschulreife, Abschluss einer Fachoberschule		○ Advanced technical college entrance qualification, Completion of a specialised secondary school
	○ Abitur, allgemeine oder fachgebundene Hochschulreife		○ Final secondary-school examinations, general or subject-specific higher education entrance qualification
	○ Bachelorabschluss → *Seite 28 anzeigen*		○ Bachelor's degree → *Show page 28*
	○ Masterabschluss, Diplom → *Seite 28 anzeigen*		○ Master's degree, diploma → *Show page 28*
	○ Promotion → *Seite 28 anzeigen*		○ Doctorate → *Show page 28*
	○ Keiner dieser Abschlüsse		○ None of these degrees
	○ Keine Angabe		○ No specification
Ist Deutsch Ihre Muttersprache?	○ Ja	Is German your mother tongue?	○ Yes
	○ Nein		○ No
Sind Sie Rechts- oder Linkshänder?	○ Rechtshänder		○ Right-handed

Falls sie Beidhänder sind, geben Sie bitte an, mit welcher Hand Sie schreiben.	○ Linkshänder ○ Keine Angabe	Are you right-handed or left-handed? If you are ambidextrous, please indicate with which hand you write.	○ Left-handed ○ No specification
Seite 03		Page 03	
Was ist die Postleitzahl des Ortes, in dem Sie derzeit leben? Bitte geben Sie eine fünfstellige Postleitzahl ein.	[…] Offene Frage	What is the zip code of the town where you currently live? Please enter a five-digit zip code.	[…] Open question
Ab wann wohnen Sie bereits an Ihrem aktuellen Wohnort? Beginn	⁞ _01 (2020) _86 (1935) _88 (keine Angabe)	Since when do you live at your current residence? Start	⁞ _01 (2020) _86 (1935) _88 (no specification)
Was ist die Postleitzahl des Ortes, in dem Sie sich in den letzten 5 Tagen hauptsächlich aufgehalten haben? Bitte geben Sie eine fünfstellige Postleitzahl ein. Falls Sie die Postleitzahl nicht wissen, geben Sie bitte den Ortsnamen an.	[…] Offene Frage	What is the zip code of the place where you mainly stayed in the last 5 days? Please enter a five-digit zip code. If you do not know the zip code, please enter the city name.	[…] Open question
Seite 04		Page 04	
Wurden Sie in der DDR geboren?	○ Ja ○ Nein ○ Keine Angabe	Were you born in the GDR?	○ Yes ○ No ○ No specification
Seite 05		Page 05	

Die nachfolgenden Aufgaben dienen der Ermittlung Ihrer Vorstellung von Konzepten wie „Neugründung“, „Mittelstand“, „Kreativität“ und „Produktivität“. Um Ihnen ein Beispiel für die Funktionsweise der Aufgabe zu geben, wird zunächst eine kurze Übung durchgeführt. Die Übung wird ca. 1 Minute und die beiden folgenden Aufgaben werden ca. 3 Minuten in Anspruch nehmen. Da Ihre Reaktionszeiten von entscheidender Bedeutung für die Auswertung sind, bitten wir Sie, Ihre volle Aufmerksamkeit auf die Bearbeitung der Aufgaben zu richten und so schnell wie möglich die Anweisungen auszuführen.	!	The following tasks are designed to determine your conception of concepts such as “newly founded firm”, “mittelstand”, “creativity”, and “productivity”. To give you an example of how the task works, a short exercise will be done first. The exercise will take about 1 minute and the two following tasks will take about 3 minutes. Since your reaction times are of crucial importance for the evaluation, we ask you to give your fill attention to the processing of the tasks and to carry out the instructions as quickly as possible.	!
Seite 06		Page 06	
Bitte drücken Sie mit Ihrem linken Finger auf die Taste „E“, wenn Sie das Wort „Tier“ sehen. Bitte drücken Sie mit Ihrem rechten Finger auf die Taste „I“, wenn Sie das Wort „Person“ sehen. Drücken Sie die Tasten so schnell Sie können und versuchen Sie gleichzeitig,	⧖ Vorbild ⧖ Fortschritt ⧖ Freiraum ⧖ Norddeutschland ⧖ Förderung ⧖ Unsicherheit	Please press the „E“ button with your left finger when you see the world “animal”. Please press the “I” key with you right finger when you see the word “person”. Press the keys as fast as you can while trying to make as less mistakes as possible.	⧖ Role Model ⧖ Progress ⧖ Freedom ⧖ Nothern Germany ⧖ Funding ⧖ Uncertainty

so wenig Fehler wie möglich zu machen. Es werden nie zwei Wörter gleichzeitig erscheinen. Zwischen den Wörtern „Tier“ und „Person“ werden andere Wörter kurz eingeblendet, bei denen Sie keine Taste drücken sollen. Zum Starten drücken Sie „E“. TIER / PERSON	⌛ Notwendigkeit	Two words will never appear at the same time. Between the words “animal” and “person” other words will appear briefly where you should not press any key. To start, press “E”. ANIMAL / PERSON	⌛ Necessity
	⌛ Rückschritt		⌛ Regression
	⌛ Jugend		⌛ Youth
	⌛ Süddeutschland		⌛ Southern Germany
	⌛ Bürokratie		⌛ Bureaucracy
	⌛ Westdeutschland		⌛ West Germany
	⌛ Erfahrung		⌛ Experience
	⌛ Kooperation		⌛ Cooperation
	⌛ Eigenverantwortung		⌛ Autonomy
	⌛ Unruhestifter		⌛ Troublemaker
	⌛ Ostdeutschland		⌛ East Germany
	⌛ Karriere		⌛ Career
	⌛ Möglichkeit		⌛ Opportunity
	⌛ Nachfrage		⌛ Demand
Seite 07		Page 07	
Bitte drücken Sie mit Ihrem linken Finger auf die Taste „E“, wenn Sie das Wort „Neugründung“ sehen. Bitte drücken Sie mit Ihrem rechten Finger auf die Taste „I“, wenn Sie das Wort „Mittelstand“ sehen. Drücken Sie die Tasten so schnell Sie können und	⌛ Vorbild	Please press the “E” button with your left finger when you see the word “newly founded firm”. Please press the “I” key with your right finger when you see the word “mittelstand”. Press the keys as fast as you can while trying to make as	⌛ Role Model
	⌛ Fortschritt		⌛ Progress
	⌛ Freiraum		⌛ Freedom
	⌛ Norddeutschland		⌛ Nothern Germany
	⌛ Förderung		⌛ Funding
	⌛ Unsicherheit		⌛ Uncertainty

versuchen Sie gleichzeitig, so wenig Fehler wie möglich zu machen. Es werden nie zwei Wörter gleichzeitig erscheinen. Zwischen den Wörtern „Neugründung“ und „Mittelstand“ werden andere Wörter kurz eingeblendet, bei denen Sie keine Taste drücken sollen. Zum Starten drücken Sie „E“. NEUGRÜNDUNG / MITTELSTAND	⌛ Notwendigkeit	less mistakes as possible. No two words will ever appear at the same time. Between the words “newly founded firm” and “mittelstand”, other words will appear briefly where you should not press any key. To start, press “E”. NEWLY FOUNDED FIRM / MITTELSTAND	⌛ Necessity
	⌛ Rückschritt		⌛ Regression
	⌛ Jugend		⌛ Youth
	⌛ Süddeutschland		⌛ Southern Germany
	⌛ Bürokratie		⌛ Bureaucracy
	⌛ Westdeutschland		⌛ West Germany
	⌛ Erfahrung		⌛ Experience
	⌛ Kooperation		⌛ Cooperation
	⌛ Eigenverantwortung		⌛ Autonomy
	⌛ Unruhestifter		⌛ Troublemaker
	⌛ Ostdeutschland		⌛ East Germany
	⌛ Karriere		⌛ Career
	⌛ Möglichkeit		⌛ Opportunity
	⌛ Nachfrage		⌛ Demand
Seite 08		Page 08	
Bitte drücken Sie mit Ihrem linken Finger auf die Taste „E“, wenn Sie das Wort „Kreativität“ sehen. Bitte drücken Sie mit Ihrem rechten Finger auf die Taste „I“, wenn Sie das Wort „Produktivität“ sehen. Drücken Sie die Tasten so schnell Sie können und	⌛ Vorbild	Please press the “E” button with your left finger when you see the word “creativity”. Please press the “I” key with your right finger when you see the word “productivity”. Press the keys as fast as you can while trying to make as less	⌛ Role Model
	⌛ Fortschritt		⌛ Progress
	⌛ Freiraum		⌛ Freedom
	⌛ Norddeutschland		⌛ Nothern Germany
	⌛ Förderung		⌛ Funding
	⌛ Unsicherheit		⌛ Uncertainty

versuchen Sie gleichzeitig, so wenig Fehler wie möglich zu machen. Es werden nie zwei Wörter gleichzeitig erscheinen. Zwischen den Wörtern „Kreativität“ und „Produktivität" werden andere Wörter kurz eingeblendet, bei denen Sie keine Taste drücken sollen. Zum Start drücken Sie „E“. KREATIVITÄT / PRODUKTIVITÄT	⌛ Notwendigkeit	mistakes as possible. No two words will ever appear at the same time. Between the words “creativity” and “productivity”, other words will appear briefly where you should not press any key. To start, press “E”. CREATIVITY / PRODUCTIVITY	⌛ Necessity
	⌛ Rückschritt		⌛ Regression
	⌛ Jugend		⌛ Youth
	⌛ Süddeutschland		⌛ Southern Germany
	⌛ Bürokratie		⌛ Bureaucracy
	⌛ Westdeutschland		⌛ West Germany
	⌛ Erfahrung		⌛ Experience
	⌛ Kooperation		⌛ Cooperation
	⌛ Eigenverantwortung		⌛ Autonomy
	⌛ Unruhestifter		⌛ Troublemaker
	⌛ Ostdeutschland		⌛ East Germany
	⌛ Karriere		⌛ Career
	⌛ Möglichkeit		⌛ Opportunity
	⌛ Nachfrage		⌛ Demand
Seite 09		Page 09	
Bitte geben Sie an, ob Sie das Wort eher mit Neugründung oder Mittelstand in Verbindung bringen. Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht.	↔ Vorbild	Please indicate whether you associate the word more with newly founded firm or mittelstand. Please move the slider to the position that suits your feeling best.	↔ Role Model
	↔ Fortschritt		↔ Progress
	↔ Freiraum		↔ Freedom
	↔ Norddeutschland		↔ Nothern Germany
	↔ Förderung		↔ Funding
	↔ Unsicherheit		↔ Uncertainty

	↔ Notwendigkeit		↔ Necessity
	↔ Rückschritt		↔ Regression
	↔ Jugend		↔ Youth
	↔ Süddeutschland		↔ Southern Germany
	↔ Bürokratie		↔ Bureaucracy
	↔ Westdeutschland		↔ West Germany
	↔ Erfahrung		↔ Experience
	↔ Kooperation		↔ Cooperation
	↔ Eigenverantwortung		↔ Autonomy
	↔ Unruhestifter		↔ Troublemaker
	↔ Ostdeutschland		↔ East Germany
	↔ Karriere		↔ Career
	↔ Möglichkeit		↔ Opportunity
	↔ Nachfrage		↔ Demand
Seite 10		Page 10	
Bitte geben Sie an, ob Sie das Wort eher mit Kreativität oder Produktivität in Verbindung bringen. Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht.	↔ Vorbild	Please indicate whether you associate the word more with creativity or productivity. Please move the slider to the position that suits your feeling best.	↔ Role Model
	↔ Fortschritt		↔ Progress
	↔ Freiraum		↔ Freedom
	↔ Norddeutschland		↔ Nothern Germany
	↔ Förderung		↔ Funding
	↔ Unsicherheit		↔ Uncertainty

	↔ Notwendigkeit		↔ Necessity
	↔ Rückschritt		↔ Regression
	↔ Jugend		↔ Youth
	↔ Süddeutschland		↔ Southern Germany
	↔ Bürokratie		↔ Bureaucracy
	↔ Westdeutschland		↔ West Germany
	↔ Erfahrung		↔ Experience
	↔ Kooperation		↔ Cooperation
	↔ Eigenverantwortung		↔ Autonomy
	↔ Unruhestifter		↔ Troublemaker
	↔ Ostdeutschland		↔ East Germany
	↔ Karriere		↔ Career
	↔ Möglichkeit		↔ Opportunity
	↔ Nachfrage		↔ Demand
Seite 11		Page 11	
Inwieweit treffen die folgenden Aussagen auf Sie zu? (Skala: sehr unzutreffend – sehr zutreffend)	○○○○○○ Ich schenke anderen Menschen leicht Vertrauen, glaube an das Gute im Menschen.	How well do the following statements describe your personality? (Scale: Disagree strongly – Agree strongly)	○○○○○○ I see myself as someone who is generally trusting.
	○○○○○○ Ich erledige Aufgaben gründlich.		○○○○○○ I see myself as someone who tends to find faults with others.
	○○○○○○ Ich werde leicht nervös und unsicher.		○○○○○○ I see myself as someone who has an active imagination.

	○○○○○○ Ich habe eine aktive Vorstellungskraft, bin fantasievoll.		○○○○○○ I see myself as someone who is relaxed, handles stress well.
	○○○○○○ Ich gehe aus mir heraus, bin gesellig.		○○○○○○ I see myself as someone who tends to be lazy.
	○○○○○○ Ich neige dazu, andere zu kritisieren.		○○○○○○ I see myself as someone who is reserved.
	○○○○○○ Ich bin eher zurückhaltend, reserviert.		○○○○○○ I see myself as someone who gets nervous easily.
	○○○○○○ Ich bin bequem, neige zur Faulheit.		○○○○○○ I see myself as someone who does a thorough job.
	○○○○○○ Ich habe nur wenig künstlerisches Interesse.		○○○○○○ I see myself as someone who is outgoing, sociable.
	○○○○○○ Ich bin entspannt, lasse mich durch Stress nicht aus der Ruhe bringen.		○○○○○○ I see myself as someone who has few artistic interests.
Seite 12		Page 12	
Bitte geben Sie an, inwieweit Ihre Meinung mit den folgenden Aussagen übereinstimmt. (Skala: trifft überhaupt nicht zu – trifft ausgesprochen zu)	○○○○○○ Auch in ungewissen Zeiten erwarte ich normalerweise das Beste.	Please indicate the extent to which your opinion agrees with the following statements. (Scale: strongly disagree - strongly agree)	○○○○○○ In uncertain times, I usually expect the best.
	○○○○○○ Fast nie entwickeln sich Dinge nach meinen Vorstellungen		○○○○○○ I hardly ever expect things to go my way.
	○○○○○○ Ich zähle selten darauf, dass mir etwas Gutes widerfährt.		○○○○○○ I rarely count on good things happening to me.
	○○○○○○ Meine Zukunft sehe ich immer optimistisch.		○○○○○○ I´m always optimistic about my future.
	○○○○○○ Ich bin allzu leicht aus der Fassung zu bringen.		○○○○○○ I don´t get upset too easily.
	○○○○○○ Es ist wichtig für mich, ständig beschäftigt zu sein.		○○○○○○ It´s important for me to keep busy.

	○○○○○○ In meinem Freundeskreis fühle ich mich wohl.		○○○○○○ I enjoy my friends a lot.
	○○○○○○ Es fällt mir leicht, mich zu entspannen.		○○○○○○ It´s easy for me to relax.
	○○○○○○ Wenn bei mir etwas schief laufen kann, dann tut es das auch.		○○○○○○ If something can go wrong for me, it will.
	○○○○○○ Alles in allem erwarte ich, dass mir mehr gute als schlechte Dinge widerfahren.		○○○○○○ Overall, I expect more good things to happen to me than bad.
Seite 13		Page 13	
Bitte stellen Sie sich vor, dass Sie ein Unternehmen gründen wollen würden. Wie würden Sie die folgenden Aktivitäten bestreiten? Bitte schieben Sie den Regler auf die Position, die Ihrer Vorstellung am ehesten entspricht.	↔ Ich würde Kunden vor allem durch einzigartige Produkte oder Services überzeugen, bei mir zu kaufen. / Ich würde Kunden vor allem durch Werbung und Marketing überzeugen, bei mir zu kaufen.	Please imagine that you were to start a business. How would you go about the following activities? Please move the slider to the position that most closely matches your imagination.	↔ I would convince customers to buy from me primarily through unique products or services. / I would convince customers to buy from me primarily through advertising and marketing.
	↔ Ich würde wollen, dass mein Unternehmen Menschen dabei hilft, alltägliche Routinen einfacher zu machen. / Ich würde wollen, dass mein Unternehmen den Alltag von Menschen stark verändert.		↔ I would want my company to help people make everyday routines easier. / I would want my business to make a big difference to people's everyday routines.
	↔ Ich würde mich in einem Bereich spezialisieren. / Ich würde mein Wissen in benachbarten Bereichen, die ich noch nicht so gut kenne, erweitern		↔ I would specialise in one area. / I would expand my knowledge in neighbouring areas that I don't know so well yet.

	↔ Ich würde mich vor allem von der Verwirklichung meiner Idee motivieren lassen. / Ich würde mich vor allem von der Chance, viel Geld mit dem Unternehmen zu verdienen, motivieren lassen.		↔ I would be motivated primarily by the implementation of my idea. / I would be motivated primarily by the chance to make a lot of money from the business.
	↔ Ich würde erst im laufenden Betrieb Geld und Zeit investieren und eher auf das richtige Timing für den Start meines Unternehmens warten, um das Risiko zu minimieren. / Ich würde gleich zu Beginn sehr viel Zeit und/oder Geld investieren, um meine Geschäftsidee umzusetzen, mit dem Risiko, dass es sich am Ende nicht auszahlt.		↔ I would not invest money and time until the business is up and running, rather waiting for the right timing to start my business to minimise risk. / I would invest a lot of time and/or money right at the beginning to implement my business idea, with the risk that it would not pay off in the end.
	↔ Ich würde einer Vision folgen. / Ich würde mit meinem Unternehmen versuchen, ein spezielles Problem zu lösen.		↔ I would follow a vision. / I would try to solve a specific problem with my business.
Seite 14		Page 14	
Bitte stellen Sie sich vor, dass Sie ein Unternehmen gründen wollen würden.	!	Please imagine that you would like to start a business.	!
Für welche Art von Produkten oder Dienstleistungen können Sie sich am ehesten vorstellen, unternehmerisch tätig zu werden?	○ Gegenstände	For what type of products or services can you most imagine becoming an entrepreneur?	○ Objects
	○ Finanzprodukte		○ Financial products
	○ Geistiges Eigentum		○ Intellectual property
	○ Physische Leistungen		○ Physical services
	○ Keine Angabe		○ No specification

Wie stellen Sie sich Ihre Rolle als Unternehmer vor?	○ Sie produzieren etwas/ schaffen etwas neu	How do you envision your role as an entrepreneur?	○ You produce something/create something new
	○ Sie veredeln und verarbeiten bestehende Produkte		○ You refine and process existing products
	○ Sie verwenden Ihre Fähigkeiten, Ihr Kapital oder Ihren Besitz		○ You use your skills, capital or property
	○ Sie handeln mit Produkten		○ You trade products
	○ Keine Angabe		○ No specification
Stellen Sie sich bitte vor, wie ein jetzt gegründetes, lohnenswertes Unternehmen aussehen würde.	!	Please imagine what a worthwhile business established now would look like.	!
Welche Art von Produkten oder Dienstleistungen betrachten Sie als am meisten lohnenswert, um unternehmerisch tätig zu werden?	○ Gegenstände	What type of products or services do you consider most worthwhile to be entrepreneurial?	○ Objects
	○ Finanzprodukte		○ Financial products
	○ Geistiges Eigentum		○ Intellectual property
	○ Physische Leistungen		○ Physical services
	○ Keine Angabe		○ No specification
Wie stellen Sie sich die Rolle als Unternehmer vor in diesem derzeit lohnenswerten Unternehmensbereich?	○ Der/die Unternehmer*in produziert etwas/ schafft etwas neu	How do you envision your role as an entrepreneur in this currently rewarding area of business?	○ The entrepreneur produces something/creates something new
	○ Der/die Unternehmer*in veredelt und verarbeitet bestehende Produkte		○ The entrepreneur refines and processes existing products.
	○ Der/die Unternehmer*in verwendet seine/ihre Fähigkeiten, sein/ihr Kapital oder sein/ihr Besitz		○ The entrepreneur uses his/her skills, capital, or possessions
	○ Der/die Unternehmer*in handelt mit Produkten		○ The entrepreneur trades in products

	○ Keine Angabe		○ No specification
Seite 15		Page 15	
Wie sehr hat sich Ihr Arbeitsalltag durch die Maßnahmen zur Eindämmung des Corona-Virus verändert? Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht.	↔ gar nicht / sehr viel	How much has your daily work routine changed as a result of the measures taken to contain the Corona virus? Please move the slider to the position that suits your feeling best.	↔ not at all / very much
Sind Sie von Kurzarbeit betroffen?	○ Ja	Are you affected by short-time work?	○ Yes
	○ Nein		○ No
	○ Keine Angabe		○ No specification
Arbeiten Sie derzeit im Homeoffice?	○ Ja	Are you currently working from a home office?	○ Yes
	○ Nein		○ No
	○ Keine Angabe		○ No specification
Haben Sie Kinder?	○ Ja → *Seite 16 anzeigen*	Do you have children?	○ Yes → *Show page 16*
	○ Nein		○ No
	○ Keine Angabe		○ No specification
Seite 16		Page 16	
Hat sich der Arbeitsaufwand durch zusätzliche Kinderbetreuung, bedingt durch die Maßnahmen zur Eindämmung des Corona-virus, für Sie erhöht? Bitte schieben Sie den Regler auf die	↔ gar nicht / sehr stark	Has the workload increased for you due to additional childcare, as a result of the measures taken to contain the Corona virus? Please move the slider to the position that suits your feeling best.	↔ not at all / very much

Position, die Ihrem Gefühl am Besten entspricht.			
Seite 17		Page 17	
Bitte geben Sie an, wie Sie die untenstehenden Ereignisse bewerten. Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht. Ich erwarte positive/negative Auswirkungen in den nächsten 12 Monaten auf… (Skala: sehr negativ – sehr positiv)	↔ meine Gesundheit.	Please indicate how you feel about the events below. Please move the slider to the position that best matches your feeling. I expect positive/negative impact in the next 12 months on.... (Scale: very negative - very positive)	↔ my health.
	↔ die wirtschaftliche Entwicklung Deutschlands.		↔ the economic development of Germany.
	↔ mein Einkommen und meine finanzielle Sicherheit.		↔ my income and financial security.
	↔ meine Arbeitsplatzsicherheit, beziehungsweise meine Arbeitsplatzsuche.		↔ my job security, or my job search.
Wie zufrieden sind Sie mit der Handlungsweise des Staates bezüglich der Eindämmung des Corona-Virus?	○ Sehr zufrieden	How satisfied are you with the state's course of action regarding the containment of the Corona virus?	○ Very satisfied
	○ Eher zufrieden		○ Rather satisfied
	○ Eher unzufrieden		○ Rather dissatisfied
	○ Unzufrieden		○ Dissatisfied
	○ Keine Angabe		○ No specification
Wie sehr verändert sich Ihr Freizeitverhalten durch die Einschränkungen aufgrund der Maßnahmen gegen das Corona-Virus? Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht.	↔ gar nicht / sehr viel	How much does your leisure time behaviour change due to the restrictions resulting from the measures against the Corona virus? Please move the slider to the position that suits to your feeling best.	↔ not at all / very much

Womit verbringen Sie im Vergleich zu der Zeit vor der Einführung der Corona-Virus-dämmenden Maßnahmen jetzt mehr Zeit?	□ Nachrichten verfolgen (TV, Radio, Social Media)	What do you spend more time doing now compared to before the Corona virus-containing measures were introduced?	□ Follow news (TV, radio, social media)
	□ Nach Jobs suchen		□ Search for jobs
	□ Persönliches Netzwerk durch Telefonate oder Ähnliches pflegen		□ Maintain personal network via phone calls or similar activities
	□ Kreative Tätigkeiten		□ Creative activities
	□ Keine Angabe		□ No specification
Wie lange beschäftigen Sie sich durchschnittlich pro Tag mit Nachrichten über das Corona-Virus? Bitte schätzen Sie die Dauer in Stunden ein und geben Sie maximal zwei Nachkommastellen an. Durchschnittliche Dauer pro Tag (in Stunden)	[…] Offene Frage	On average, how long do you spend per day on news about the Corona virus? Please estimate the duration in hours and enter a maximum of two decimal places. Average duration per day (in hours)	[…] Open question
Wie fühlen Sie sich persönlich in der Gesamtsituation? Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht.	↔ frustriert / begeistert	How do you personally feel about the overall situation? Please move the slider to the position that suits to your feeling best.	↔ frustrated / enthusiastic
Bitte beschreiben Sie, wie Sie sich persönlich in der aktuellen Gesamtsituation fühlen.	[…] Offene Frage	Please describe how you personally feel about the current overall situation.	[…] Open question
Seite 18		Page 18	
Stellt die derzeitige Situation eine gute Gelegenheit für Sie dar, sich mit der	○ Stimme zu	Does the current situation represent a good opportunity for you to	○ Agree
	○ Stimme eher zu		○ Somewhat agree

Idee der Selbstständigkeit und Unternehmensgründung aktiv auseinanderzusetzen?	○ Weder noch ○ Stimme eher nicht zu ○ Stimme nicht zu ○ Keine Angabe	actively explore the idea of self-employment and starting a business?	○ Neither ○ Strongly disagree ○ Disagree ○ No specification
Seite 19		Page 19	
Wie sehr erinnert Sie die aktuelle Situation an die während der Zeit der deutschen Wende 1989/1990? Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht.	↔ wenig / sehr	How much does the current situation remind you of the one during the time of the German reunification in 1989/1990? Please move the slider to the position that best suits to your feeling.	↔ little / very
Seite 20		Page 20	
Bitte nennen Sie die größten Unterschiede zwischen der derzeitigen Situation und der während der deutschen Wende 1989/1990. Verwenden Sie bitte nur Schlagworte und nutzen Sie für jeden Unterschied eine neue Zeile. Unterschied 1 Unterschied 2 Unterschied 3	[…] Offene Frage	Please name the biggest differences between the current situation and the situation during the German reunification in 1989/1990. Please use keywords only and use a new line for each difference. Difference 1 Difference 2 Difference 3	[…] Open question
Bitte begründen Sie Ihre Angaben.	[…] Offene Frage	Please give reasons for your statements.	[…] Open question

Seite 21		Page 21	
Bitte nennen Sie die größten Gemeinsamkeiten zwischen der derzeitigen Situation und der während der deutschen Wende 1989/1990. Verwenden Sie bitte nur Schlagworte und nutzen Sie für jede Gemeinsamkeit eine neue Zeile. Gemeinsamkeit 1 Gemeinsamkeit 2 Gemeinsamkeit 3	[…] Offene Frage	Please name the greatest similarities between the current situation and the situation during the German reunification in 1989/1990. Please use keywords only and use a new line for each Similarity. Similarity 1 Similarity 2 Similarity 3	[…] Open question
Bitte begründen Sie Ihre Angabe.	[…] Offene Frage	Please give reasons for your statements.	[…] Open question
Seite 22		Page 22	
Wie sehr erinnert Sie die aktuelle Situation an die während der Zeit der Wirtschaftskrise 2008/2009? Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht.	↔ wenig / sehr	How much does the current situation remind you of the situation during the economic crisis of 2008/2009? Please move the slider to the position that suits to your feeling best.	↔ little / very
Seite 23		Page 23	
Bitte nennen Sie die größten Unterschiede zwischen der derzeitigen Situation und der während der Wirtschaftskrise 2008/2009.	[…] Offene Frage	Please name the biggest differences between the current situation and the situation during the economic crisis of 2008/2009.	[…] Open question

Verwenden Sie bitte nur Schlagworte und nutzen Sie für jeden Unterschied eine neue Zeile. Unterschied 1 Unterschied 2 Unterschied 3		Please use keywords only and use a new line for each difference. Difference 1 Difference 2 Difference 3	
Bitte begründen Sie Ihre Angaben.	[…] Offene Frage	Please give reasons for your statements.	[…] Open question
Seite 24		Page 24	
Bitte nennen Sie die größten Gemeinsamkeiten zwischen der derzeitigen Situation und der während der Wirtschaftskrise 2008/2009. Verwenden Sie bitte nur Schlagworte und nutzen Sie für jede Gemeinsamkeit eine neue Zeile. Gemeinsamkeit 1 Gemeinsamkeit 2 Gemeinsamkeit 3	[…] Offene Frage	Please name the greatest similarities between the current situation and the situation during the economic crisis of 2008/2009. Please use keywords only and use a new line for each similarity. Similarity 1 Similarity 2 Similarity 3	[…] Open question
Bitte begründen Sie Ihre Angaben.	[…] Offene Frage	Please give reasons for your statements.	[…] Open question
Seite 25		Page 25	
Fallen Ihnen andere vergleichbare Ereignisse zu der derzeitigen Situation ein? Bitte nennen Sie diese.	[…] Offene Frage	Can you think of other comparable events to the current situation? Please name them.	[…] Open question

Seite 26		Page 26	
Schauen Sie regelmäßig TV Serien und Shows, die sich mit dem Thema Start-ups beschäftigen an? (Beispielsweise „Höhle der Löwen“)	○ Ja	Do you regularly watch TV series and shows that deal with the topic of start-ups? (For example "Shark Tank")	○ Yes
	○ Gelegentlich		○ Occasionally
	○ Nein		○ No
	○ Keine Angabe		○ No specification
Welche Tätigkeit führen Sie aus?	□ Vollzeiterwerbstätig	What activity do you perform?	□ Full-time employed
	□ Teilzeiterwerbstätig		□ Part-time employed
	□ In einer beruflichen Ausbildung/Lehre		□ In a vocational training/apprenticeship program
	□ Schüler/-in an einer allgemeinbildenden Schule		□ Student at a general education school
	□ Student/-in		□ Student
	□ Rentner/-in, Pensionär/-in, im Vorruhestand		□ Retiree, pensioner, in early retirement
	□ Arbeitslos		□ Unemployed
	□ Dauerhaft erwerbsunfähig		□ Permanently incapacitated for work
	□ Hausfrau/Hausmann		□ Housewife/husband
	□ Sonstiges		□ Other
	□ Selbständig		□ Self-employed
	□ Keine Angabe		□ No specification
	○ Über 10 Jahre		○ Over 10 years
	○ 5-10 Jahre		○ 5-10 years

Wie viel Arbeitserfahrung haben Sie bereits in kleinen oder neu gegründeten Unternehmen gesammelt?	○ 1-5 Jahre ○ Unter 1 Jahr ○ Keine Erfahrung ○ Keine Angabe	How much work experience have you had in small or newly founded firms?	○ 1-5 years ○ Under 1 year ○ No experience ○ No specification
Haben Sie bereits eigene Erfahrungen mit Unternehmensgründungen gesammelt?	○ Ja ○ Nein ○ Keine Angabe	Have you already gained your own experience with founding a firm?	○ Yes ○ No ○ No specification
Können Sie sich vorstellen, sich innerhalb der nächsten drei Jahre selbstständig zu machen, z.B. ein neues Unternehmen zu gründen?	○ Ja ○ Eher wahrscheinlich ○ Eher unwahrscheinlich ○ Nein ○ Keine Angabe	Can you imagine starting your own business within the next three years, e.g. starting a new company?	○ Yes ○ Rather likely ○ Rather unlikely ○ No ○ No specification
Kennen Sie Personen, die Ihr eigenes Unternehmen gegründet haben persönlich?	○ Ja → *Seite 27 anzeigen* ○ Nein ○ Keine Angabe	Do you personally know people who have started their own business?	○ Yes → *Show page 27* ○ No ○ No specification
Seite 27		Page 27	
In den folgenden Fragen wird mit innovativen Unternehmen ein Unternehmen gemeint, das Produkte oder Dienstleistungen anbieten, die vorher in der Form existiert haben.	!	In the following questions, innovative company means a company that offers products or services that have previously existed in the form.	!

Bitte schätzen Sie ein, wie innovativ die Produkte oder Dienstleistungen sind, die das Unternehmen der Person/die Unternehmen der Personen anbietet. Bitte schieben Sie den Regler auf die Position, die Ihrem Gefühl am Besten entspricht.	↔ sehr innovativ / Gar nicht innovativ	Please rate how innovative the products or services offered by the person's company(s) are. Please move the slider to the position that suits your feeling best.	↔ very innovative / not innovative at all
Seite 28		Page 28	
Haben Sie in Ihrem Studium Kurse zu Betriebswirtschaftslehre oder Innovationsmanagement vertieft?	○ Ja ○ Nein ○ Keine Angabe	Did you take courses on business administration or innovation management in your studies?	○ Yes ○ No ○ No specification
Seite 29 - Letzte Seite		Page 29 - Last Page	
Vielen Dank für Ihre Teilnahme! Wir möchten uns ganz herzlich für Ihre Mithilfe bedanken. Bei Rückfragen oder Anmerkungen zur Studie kontaktieren Sie gerne jessica.birkholz@uni-bremen.de. Ihre Antworten wurden gespeichert, Sie können das Browser-Fenster nun schließen.	!	Thank you for your participation! We would like to thank you very much for your assistance. If you have any questions or comments about the study, please feel free to contact jessica.birkholz@uni-bremen.de. Your answers have been saved, you can now close the browser window.	!

Personal contributions to the papers of the cumulative thesis

CHAPTER 1: ENTREPRENEURSHIP AS VEHICLE FOR REGIONAL KNOWLEDGE TRANSFORMATION: THE RELATION BETWEEN THE ENTREPRENEURIAL PROCESS AND REGIONAL KNOWLEDGE DYNAMICS

This chapter is an introductory part of the dissertation. It was written by me as a sole author.

CHAPTER 2: PERSISTENCE OF REGIONAL ENTREPRENEURSHIP PATTERNS: QUANTITY AND QUALITY OF REGIONAL BUSINESS OPPORTUNITY PERCEPTION

This paper was written by me as a sole author. The paper benefited from advice and comments from colleagues as well as participants of the conferences and seminars, where it had been presented.

CHAPTER 3: DO NOT JUDGE A BUSINESS IDEA BY ITS COVER: THE RELATION BETWEEN TOPICS IN BUSINESS IDEAS AND INCORPORATION PROBABILITY

This paper was written by me as a sole author. The paper benefited from advice and comments from colleagues as well as participants of the conferences and seminars, where it had been presented.

CHAPTER 4: TRANSFORMING REGIONAL KNOWLEDGE BASES: A NETWORK AND MACHINE LEARNING APPROACH TO LINK ENTREPRENEURIAL EXPERIMENTATION AND REGIONAL ABSORPTIVE CAPACITY

This paper was written by me as a sole author. The paper benefited from advice and comments from colleagues as well as participants of the conferences, workshops and seminars, where it had been presented.

CHAPTER 5: ANTECEDENTS OF ENTREPRENEURSHIP DURING THE FIRST COVID-19 SHOCK: MENTAL REPRESENTATIONS OF ENTREPRENEURSHIP AND PREFERENCES OF BUSINESS MODELS DURING THE CRISIS

This paper is a joint work with Jarina Kühn. The idea was developed together. A former developed questionnaire by me was adapted and the primary data collection was performed by Jarina Kühn and me. The literature review and the discussion of the results were conducted jointly. The econometric analyses were done by me.

Eidesstattliche Erklärung

ERKLÄRUNG ÜBER DIE ANFERTIGUNG DER DISSERTATION OHNE UNERLAUBTE HILFSMITTEL

Ich erkläre hiermit, dass diese Arbeit ohne unerlaubte Hilfe angefertigt worden ist und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt wurden.

Ich erkläre ferner, dass die den benutzten Werken wörtlich und inhaltlich entnommenen Stellen als solche kenntlich gemacht wurden.

Eine Überprüfung der Dissertation mit qualifizierter Software im Rahmen der Untersuchung von Plagiatsvorwürfen ist gestattet.

Bremen, June 8th, 2022

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Jessica Birkholz

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