

The Contribution of Alumni Spin-off Entrepreneurs
to a
University's Entrepreneurial Support Structure

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Conceptual Arguments, Empirical Evidence, and Recommendations for an
Effective Mobilization

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Abstract

Universities are increasingly expected to adopt a more fundamental and proactive role in economic development by transferring knowledge and technologies into the economy. Start-ups by university students or scientists – so-called university spin-offs – are regarded as the most efficient mechanism of knowledge and technology transfer and can significantly enhance economic progress, structural change and well-being. It is generally acknowledged that universities dedicated to fostering spin-off formation should establish an entrepreneurial support structure which for instance includes entrepreneurship education or consultancy offerings. This dissertation focuses on one particular issue which can significantly determine the successful realization of such a support structure: the contribution of individuals who started a spin-off company out of a particular university at an earlier point in time (in this dissertation referred to as "alumni spin-off entrepreneurs").

The core of this cumulative dissertation consists of three separate research papers on the contributions of alumni spin-off entrepreneurs to a university's entrepreneurial support structure. Each paper addresses one major research gap. Their respective objectives are (1) to present a revised theoretical concept of university spin-off formation which acknowledges a potential contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure, (2) to reveal the relative importance of the contribution of alumni spin-off entrepreneurs for a university's entrepreneurial support structure, and (3) to formulate empirically based recommendations for university actors on how to successfully mobilize alumni spin-off entrepreneurs to become involved.

The empirical investigations are based on a qualitative research design. It includes a survey of semi-structured interviews with key informants on the support structures of two German universities (Leibniz Universität Hannover and Georg-August-Universität Göttingen) and a survey of semi-structured interviews with alumni spin-off entrepreneurs from both universities. All data was collected in the context of a research project named "University spin-offs in Lower Saxony and their regional economic impact: empirical evidence from Hannover and Göttingen". The interview data was analyzed using typical content analysis procedures.

Overall, this dissertation contributes to the discussion on how to establish a university environment which is conducive to spin-off formation. It emphasizes that the contribution of alumni spin-off entrepreneurs is of significant importance and describes how it may occur. Furthermore, this dissertation highlights strategies for a successful mobilization of alumni spin-off entrepreneurs to become involved.

Key words: university spin-offs, academic entrepreneurship, entrepreneurial university, alumni spin-off entrepreneur

Kurzzusammenfassung

Von Universitäten wird zunehmend erwartet, dass sie einen bedeutsameren Beitrag als bisher zur wirtschaftlichen Entwicklung leisten. Dieser beinhaltet einen proaktiven Transfer von an Universitäten generiertem Wissen und entwickelten Technologien in die Wirtschaft. Von Studierenden oder Wissenschaftlern getätigte Unternehmensgründungen – sogenannte Spin-off Gründungen – gelten als effizientester Mechanismus des universitären Wissens- und Technologietransfers und können wesentlich zu wirtschaftlicher Prosperität, zum strukturellen Wandel und zur Schaffung und Sicherung von Wohlstand beitragen. Einigkeit herrscht darüber, dass an der Förderung von Spin-off Gründungen interessierte Universitäten eine gründungsbezogene Unterstützungsinfrastruktur benötigen, die unter anderem Gründungsausbildungs- und Beratungsangebote umfasst. Diese Dissertation befasst sich mit dem Beitrag, den Alumni Spin-off Entrepreneur (Personen, die zu einem früheren Zeitpunkt ein Spin-off Unternehmen an einer Universität gegründet haben) zu einer gründungsbezogenen Unterstützungsinfrastruktur an einer Universität leisten können. Damit thematisiert die vorliegende Arbeit ein Phänomen, welches die Realisierung einer solchen Unterstützungsinfrastruktur nachhaltig positiv beeinflussen kann.

Den Kern der vorliegenden kumulativen Dissertation bilden drei separate Forschungsartikel, die sich mit dem Beitrag von Alumni Spin-off Entrepreneur zu einer universitären gründungsbezogenen Unterstützungsinfrastruktur befassen. Die Ziele der einzelnen Artikel lauten wie folgt: Das erste Ziel ist es, ein überarbeitetes theoretisches Konzept zur Erklärung von Spin-off Aktivitäten zu präsentieren, welches den potenziellen Beitrag von Alumni Spin-off Entrepreneur zu einer universitären gründungsbezogenen Unterstützungsinfrastruktur berücksichtigt. Das zweite Ziel ist es herauszufinden, welche relative Bedeutung der Beitrag von Alumni Spin-off Entrepreneur für die Realisierung einer gründungsbezogenen Unterstützungsinfrastruktur hat. Das dritte Ziel ist die Formulierung von empiriebasierten Empfehlungen, wie Alumni Spin-off Entrepreneur erfolgreich dazu mobilisiert werden können, sich in eine universitäre Unterstützungsinfrastruktur einzubringen.

Die empirischen Untersuchungen basieren auf einem qualitativen Forschungsdesign. Dieses umfasst zwei Primärerhebung: Halbstrukturierte Interviews mit Schlüsselinformanten zu den gründungsbezogenen Unterstützungsinfrastrukturen an zwei deutschen Universitäten (Leibniz Universität Hannover und Georg-August-Universität Göttingen) sowie halbstrukturierte Interviews mit Alumni Spin-off Entrepreneur beider Universitäten. Sämtliche Daten wurden im Rahmen eines Forschungsprojekts mit dem Titel "Universitäre Spin-Off Gründungen in Niedersachsen und ihre regionalwirtschaftlichen Wirkungen: die Beispiele Hannover und Göttingen" erhoben. Das Datenmaterial wurde anhand inhaltsanalytischer Verfahren ausgewertet.

Insgesamt trägt die vorliegende Arbeit zur Diskussion darüber bei, wie ein für Spin-off Gründungen förderliches universitäres Umfeld geschaffen werden kann. Dabei wird deutlich, dass der Beitrag von Alumni Spin-off Entrepreneur eine wichtige Rolle für eine gründungsbezogenen Unterstützungsinfrastruktur spielt. Darüber hinaus zeigt diese Arbeit, wie ein solcher Beitrag aussehen kann und formuliert Strategien für eine erfolgreiche Mobilisierung von Alumni Spin-off Entrepreneur hinsichtlich einer Einbindung.

Schlagerworte: Universitäre Spin-off Gründungen, akademische Gründer, unternehmerische Universität, Alumni Spin-off Entrepreneur

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Abbreviations

BMWI	Bundesministerium für Wirtschaft und Technologie [Federal German Ministry of Economics and Technology]
eds.	Editors
e.g.	exempli gratia (=for example)
et al.	et alii (=and others)
etc.	et cetera (= and so forth)
EU	European Union
GAUG	Georg-August-Universität Göttingen
GUESSS	Global University Entrepreneurial Spirit Students' Survey
i.a.	inter alia (=among others)
KEY INF.	Key informant
LUH	Leibniz Universität Hannover
MINT	Mathematics, informatics, natural sciences and technology
RBV	Resource-based view
TTO	Technology transfer office
USO	Research project “University spin-offs in Lower Saxony and their regional economic impact: empirical evidence from Hannover and Göttingen”

Chapter 1

Introduction

1.1 Background

There is a wide consensus among academics and policymakers that innovation is a key element of economic prosperity at the regional and national level (cf. FAGERBERG 2005: 20, OECD 2009: 3, OECD 2012: 146, ROMER 1986: 1034, VERSPAGEN 2005: 487-509, WONG et al. 2005: 335). By increasing an economy's productivity and competitiveness, innovation generates economic growth and fosters employment security, job creation and well-being (cf. GROSSMAN/HELPMAN 1991: 334, OECD 2013: 13, OUGHTON et al. 2002: 97). As a consequence of the increased competition through accelerating global economic integration, particularly the prosperity of developed economies depends on the ability to generate innovation. In this respect, high income countries and regions are only able to maintain their living standards when they succeed in retaining their international economic competitiveness. In order to achieve a competitive edge, developed economies constantly need to renew their economic basis through the creation (invention) and commercialization (innovation) of new products, production processes and organizational methods (cf. OECD 2007: 7).

Innovation emerges from new knowledge and ideas which arise from formal and informal research and development activity and the resulting scientific, technological as well as organizational progress (cf. BILBAO-OSORIO/RODRÍGUEZ-POSE 2004: 434, OUGHTON et al. 2002: 100). In this regard, an economy's stock of human capital is of critical importance (cf. DAKHLI/DE CLERCQ 2004: 109, OECD 2013: 88). Not only the generation of new knowledge and ideas, but also the successful market implementation of innovative products, processes or organizational methods and the capacity of potential users to adopt these, depend on the know-how, skills and competence of an economy's labor force (cf. FAGERBERG 2005: 5, OECD 2007: 18, SCHWAB et al. 2014: 8).

The modern role of universities for innovation and economic prosperity

Universities play an essential role for an economy's innovative performance and development prospects (cf. FLORIDA/COHEN 1999: 1). They traditionally face two missions: human capital formation in the scope of higher education and teaching as well as new knowledge creation through basic research (cf. BRAMWELL/WOLFE 2008: 1175, 1176, CANIELS/VAN DEN BOSCH 2011: 272, GUNASEKARA 2006: 101). These two missions reflect the traditional linear perspective on the innovation process (cf. CANIELS/VAN DEN BOSCH 2011: 273, FLORIDA/COHEN 1999: 17) which identifies new knowledge created

within the research sector as the source and starting point of innovation. Furthermore, the linear model of innovation describes a straightforward conversion of new knowledge from the research sector into new products, processes or organizational methods developed within the enterprise sector from where it further straightforwardly diffuses into the wider economy through its application by customers and/or competitors (cf. GODIN 2006: 639).

However, extensive academic debate within the past decades has led to a contemporary understanding of the innovation process, which challenges the linear model of innovation (cf. NELSON/ROSENBERG 1998). In addition, wider socio-economic changes within developed economies, such as the intensified global competition, the shift from traditional manufacturing to knowledge-intensive production and services as well as the increasingly specialized nature of production, labor and knowledge creation, has altered the actual means by which innovation is generated (cf. BALCONI et al. 2010, CARAYANNIS/CAMPBELL 2009, DRUCKER/GOLDSTEIN 2007: 20, HARDEMAN et al. 2014: 3). The contemporary view is that successful innovation nowadays emerges within the scope of a non-linear process including feedback loops between the different stages of the innovation process through interaction, cooperation and communication between the involved actors (cf. LUNDVALL 1988). Furthermore, the innovation process is considered to be "...inevitably an iterative process full of trial and error and incremental adaptation at every stage." (CANIELS/VAN DEN BOSCH 2011: 273). In contrast to the linear model of innovation, the non-linear perspective suggests that the creation, diffusion and application of new knowledge within an economy and consequently its innovative capacity do not solely depend on the productivity of the research sector. Instead, new knowledge and commercial innovation is generated within the scope of complex interactions between research organizations (i.a. universities), enterprises and institutions. Thus, economic progress is not the result of innovation efforts of individual isolated actors, but rather consequence of the innovation efforts made by an entire regional or national system of innovation (cf. CANIELS/VAN DEN BOSCH 2011: 273, EDQUIST 2001: 2, FISCHER 2001: 207).

The shift from a linear to a non-linear, interactive conceptualization of innovation necessitates a reconsideration of the role of universities in a society. An influential approach in this respect is the triple helix model of university, industry and government relations (cf. ETZKOWITZ/LEYDESDORFF 2000, ETZKOWITZ 2008), which argues that the hybrid, recursive and cross-institutional interaction between universities, industry and government (cf. GUNASEKARA 2006: 102) "...is the key to innovation and growth in the knowledge-based economy." (ETZKOWITZ 2008: 1). An important view is that in triple helix interaction

"...universities, industry and government each 'take the role of the other' {...} even as they maintain their primary roles and distinct identities" (ETKOWITZ 2008: 1). For universities this implies that they are expected to actively commercialize knowledge and technologies generated within the scope of teaching and research – formally a role attributed to the enterprise sector (cf. GARNSEY 2007: 227) – through interaction with industry and governmental institutions by various mechanisms of knowledge and technology transfer (cf. LAWTON SMITH 2007: 101, LAZZERONI/PICCALUGA 2003: 38). Moreover, not least due to public budgetary limitations, universities are increasingly expected to generate economic returns from their research results in order to finance their scientific activities. Thereby they contribute to a task which is traditionally the responsibility of the government (cf. BERCOVITZ/FELDMAN 2006: 175, BRAMWELL/WOLFE 2008: 1176, DRUCKER/GOLDSTEIN 2007: 21, ETZKOWITZ et al. 2000: 326). Those universities, which face and exploit a high degree of freedom in earning financial resources by commercializing research results and in making profit oriented investments are also commonly referred to as "entrepreneurial universities" (cf. BERCOVITZ/FELDMAN 2006, 175, ETZKOWITZ 2008: 27).

In essence, the contemporary idea is that "entrepreneurial universities" operating within a triple helix nexus adopt a complementary third mission in addition to the traditional missions of education and basic research. This third mission refers to an active and direct role in innovation through "the capitalization of research" within the scope of different knowledge and technology transfer mechanisms, and consequently attributes a more fundamental and proactive role to universities in economic and social development (cf. ETZKOWITZ/LEYDESDORFF 2000: 110, ETZKOWITZ 2008: 27-30, LAZZERONI/PICCALUGA 2003: 38) in a regional, national or even international context (cf. DRUCKER/GOLDSTEIN 2007: 22).

Particularly in developed economies, governments increasingly encourage universities to become "entrepreneurial", because of accelerating international competition and the resulting pressure to successfully and – regarding the problematic situation of public budgets in many countries – efficiently generate innovation in order to remain economically prosperous and secure well-being (cf. BERCOVITZ/FELDMAN 2006: 175, BRAMWELL/WOLFE 2008: 1176, ETZKOWITZ et al. 2000: 314, 326)¹. In this regard, governments in many countries

¹ It should be noted that the envisaged "entrepreneurial" mission of universities is not free of criticism. In this respect, the most frequently phrased concern refers to the expected loss of intellectual freedom and independence. Accordingly, pecuniary interest leads to a focus of scientific activity on research subjects, which

established legislation that gives universities the intellectual property rights of inventions arising from publically funded research, thereby increasing their control over the commercial exploitation of research results (cf. ETZKOWITZ et al. 2000: 319, LAWTON SMITH 2007: 98). While in the United States the Bayh-Dole Patent and Trademark Amendments Act became applicable as early as 1980 (cf. MOWERY/SAMPAT 2005: 237), countries such as France ("Loi Allègre sur l'innovation et la recherche" in 1999) or Germany (reform of the so-called university teachers' privilege (Hochschullehrerprivileg) in 2002) passed similar legislation much later (cf. GRIMALDI et al. 2011: 1046, HÜLSBECK 2011: 23). In addition to the adjustment of the legal framework conditions, policymakers increasingly support university-industry collaborations and encourage universities to establish a knowledge and technology transfer infrastructure, such as technology transfer or industrial liaison offices (cf. ETZKOWITZ et al. 2000: 319-325, LAWTON SMITH 2007: 103).

Spin-off formation as efficient transfer mechanism and regional growth enhancer

The transfer of university knowledge and technology into the regional and/or national context can occur through a variety of different channels, such as research collaborations with industry, the disposal of licenses and patents, consultation offerings for private companies, politicians and policymakers, or labor mobility of graduates and scientists (cf. AGRAWAL 2001: 297, MUELLER 2006: 1501, ROGERS et al. 2001: 254-255). Due to the often tacit nature of university knowledge, it is plausible to assume that the transfer through persons (labor mobility of graduates or scientists) is the most efficient mechanism of knowledge transfer (cf. BEKKERS/FREITAS 2008: 1838, FONTES 2005: 341, 342). This applies especially to start-up firms by university members – so-called university spin-offs – by which university students or scientists commercialize the knowledge obtained and created at a university in a direct manner (cf. FONTES 2005: 346, ROGERS et al. 2001: 259).

Not less important than the relative efficiency of spin-off formation as a knowledge transfer mechanism, is its significant potential as enhancer of structural change, economic development and well-being (cf. BERCOVITZ/FELDMAN 2006: 179). Particularly politicians and policymakers at the regional level increasingly consider university spin-off

promise imminent economic return for the university and/or individual scientist, while research subjects that yield no direct or only long-term or indirect returns for society are neglected (cf. BERCOVITZ/FELDMAN 2006: 186, DÖRRE/NEIS 2010: 164, ETZKOWITZ et al. 2000: 314). Criticism also comes from the enterprise sector. Accordingly, when universities become entrepreneurial, they distort competition because of their public funding (ETZKOWITZ et al. 2000: 314).

formation to be an effective instrument to endogenously foster economic growth (cf. BENNEWORTH/CHARLES 2005: 539). This appreciation of spin-off formation is fueled by two observations.

Firstly, studies suggest that university spin-off companies are above-average performing and innovation oriented companies that generate significant economic value and create many jobs (for a summary of studies see SHANE 2004a: 20). Thereby, they unfold their positive effects primarily at the regional level, because the majority of spin-off companies remain within close proximity to the incubating university (cf. STERNBERG 2014: 138).

Secondly, the literature widely acknowledges that spin-off companies from local "entrepreneurial universities" played a significant role for the genesis and evolution of different high-tech regions around the world (cf. SHANE 2004a: 20, ROGERS et al. 2001: 255). These include for example the Silicon Valley in Northern California (spin-off formation from Stanford University) (cf. BAHRAMI/EVANS 2000: 168, SAXENIAN 1996: 8), the Route 128 area in Massachusetts (Massachusetts Institute of Technology) (cf. ROBERTS/EESLEY 2011: 51), the Cambridge region in the United Kingdom (Cambridge University) (cf. EATWELL 2005: 226, GARNSEY/HEFFERNAN 2005: 1130), the Göteborg region in Sweden (Chalmers University of Technology) (cf. DAHLSTRAND 1997: 671), the Tsukuba Science City in Japan (Tsukuba University) or the Bangalore area in India (Bangalore University) (cf. ROGERS et al. 2001: 255).

Driven by the intention to imitate the success of these dynamic locations, policymakers around the world implement strategies to foster university spin-off formation (cf. SHANE 2004a). The growing policy interest has stimulated an intense scientific discourse on the factors influencing the quantity and quality (in terms of growth, employment creation and survival) of the spin-off companies a university generates. Consequently, a huge body of literature has emerged that focuses on different determinants of university spin-off formation, such as the individual founders' personality, the characteristics of the start-up project respectively the firm, national and regional conditions as well as the university context (for an overview of the state of research on the determinants of university spin-off formation see for example ASTEBRO et al. 2012, DI GREGORIO/SHANE 2003, HELM/MAURONER 2007, O'SHEA et al. 2008, ROTHÄRMEL et al. 2007, SHANE 2004a).

The state of research on the context determinants of university spin-off formation suggests that while the national and regional context (e.g. size of economy, economic performance, industry-structure (cf. GUPTE 2007, HEMER et al. 2007), entrepreneurial regime and culture

(cf. BELENZON/SCHANKERMAN 2009), existence and quality of support programs and infrastructure (cf. FINI et al. 2011), availability of financial capital (cf. DI GREGORIO/SHANE 2003)) undoubtedly also plays an important role, it is in particular the university context, which determines the dynamics of spin-off formation and the performance of respective start-ups (cf. LOCKETT et al. 2003). In this respect, a university's characteristics such as its size and tradition, its nature and quality of research and teaching, its ability to attract financial resources and forms of collaboration with industry partners, mirror a university's stock of commercialized knowledge and technology and therefore determine the frequency and quality of spin-off activities (cf. DI GREGORIO/SHANE 2003, LANDRY et al. 2006, LOCKETT/WRIGHT 2005, O'SHEA et al. 2005a, O'SHEA et al. 2008, POWERS/MCDOUGALL 2005, SHANE 2004b, WRIGHT et al. 2004).

A key notion within the literature is that the existence of a capable university entrepreneurial support structure is crucial for the quantity and quality of spin-off formation. Studies suggest that in order to facilitate spin-off formation, a university must implement and maintain specific cultural attributes, practical routines as well as measures and facilities of support (cf. O'SHEA et al. 2005a, ROTHÄRMEL et al. 2007). Based on these scientific results as well as on practical experience, universities around the world that are dedicated to fostering regional development by transferring knowledge and technology in the form of spin-off formation, try to develop a positive entrepreneurial climate, introduce specific policies on spin-off formation, realize start-up support measures – consisting for instance of training, coaching and consultation programs – and establish particular infrastructural facilities, such as business incubators or venture capital funds (cf. ASTEBRO et al. 2012, GUERRERO/URBANO 2012, WRIGHT et al. 2007).

1.2 Concretization of research topic

The research topic of this dissertation is broadly situated within the research stream on the characteristics of a university's entrepreneurial support structures as a determinant of spin-off formation. Its focus is on one particular issue, which can significantly determine a support structure's successful configuration: the contribution of individuals who started a spin-off company out of a particular university at an earlier point in time (in the following referred to as “alumni spin-off entrepreneurs”).

While there is agreement on the importance of a capable entrepreneurial support structure for a university's spin-off dynamics and for the performance of the respective start-ups (e.g.

growth, employment creation, survival), empirical evidence on how exactly such a support structure emerges and evolves and who the key actors in this process are, is still scarce. Recent studies suggest that alumni spin-off entrepreneurs play an important role in this respect (cf. LLOYD-REASON et al. 2009, NATHUSIUS 2013). Accordingly, due to traditional negative attitudes towards commercialization and spin-off activities at many universities as well as a lack of practical experience in starting up a business, the actors in charge of organizing an entrepreneurial support structure at most universities lack the necessary resources and capabilities to build up and sustain a capable support structure. Thus, they rely on external assistance. Alumni spin-off entrepreneurs are a promising source for these lacking but important resources and capabilities, as they have gone through the distinctive process of research commercialization and business start-up out of a university. Through this experience they obtained specific know-how and information, which is of particular value for the university's actors in charge (cf. HSU 2007, NATHUSIUS 2013: 2). Consequently, a university's entrepreneurial support structure may profit from an involvement of alumni spin-off entrepreneurs, by which they induce important resources and capabilities that a university may lack.

In recent years, several studies have made suggestions on the role of alumni spin-off entrepreneurs for a university's entrepreneurial support structure. These studies for instance propose that a respective involvement can positively influence the realization of existing support measures, and thus supports the daily business and consequently the overall reinforcement of a university's entrepreneurial support structure. In this respect it is for instance argued that entrepreneurship sensitization measures improve effectiveness when alumni spin-off entrepreneurs are involved as role-models (cf. KULICKE et al. 2011: 250, WILSON 2008: 6). Moreover, it has been illustrated for universities in different geographical locations that university entrepreneurship education and training events, as well as its consultancy and coaching offerings profit when alumni spin-off entrepreneurs engage as educators, lecturers, coaches or mentors (cf. ROBERT/EESLEY 2009: 6 for MIT in the United States, KULICKE et al. 2011: 239 for German universities, LLOYD-REASON et al. 2009: 609 for universities in the United Kingdom, KURATKO 2005: 589, NATHUSIUS 2013: 161, WILSON 2008: 6).

Furthermore, the literature considers the contribution of alumni spin-off entrepreneurs to be valuable within the scope of the initial establishment and later evolvement of a university's entrepreneurial support structure. In this respect, alumni spin-off entrepreneurs can provide important guidance regarding the idea generation, the initial conceptualization or the later

refinement of particular support structure elements (cf. KAILER 2010: 260, LLOYD-REASON et al. 2009: 603, NATHUSIUS 2013: 76, 166). However, the empirical evidence for this dimension remains superficial and foremost anecdotal. For instance, KAILER (2010) recognizes that in German-speaking countries, "it turned out to be effective to integrate alumni-entrepreneurs into the universities' working groups, focusing on both future strategic positioning, and university and faculty development plans or curriculum designs." (KAILER 2010: 260). In this respect, NATHUSIUS (2013: 76, 166) and LLOYD-REASON et al. (2009: 603) emphasize that experienced alumni spin-off entrepreneurs can provide important advice regarding the development of specific entrepreneurship support offerings and the overall entrepreneurship education curriculum. More precisely, the literature suggests that alumni spin-off entrepreneurs may either formally be a member of the respective conceptualization team or may share their advice and experience rather sporadically and informally with the respective actors in charge (cf. KAILER 2010, LLOYD-REASON et al. 2009, NATHUSIUS 2013).

In general, the literature indicates that the phenomenon of alumni spin-off entrepreneurs' involvement in and contribution to a university's entrepreneurial support structure is more common in Anglo-American countries than in continental Europe (cf. KAILER 2010: 256, WILSON 2008: 6). Nevertheless, also in continental Europe, its potential is being increasingly acknowledged by policymakers and practitioners. In Germany for instance, the mode and extent of a university's cooperation with alumni spin-off entrepreneurs within the scope of its entrepreneurship support measures, is used as a selection criterion for funding by "EXIST-Gründungskultur", a federal program designed to help universities establish an integrated entrepreneurial support structure (cf. BMWI 2010: 6, BMWI 2011: 20). Furthermore, the inclusion of successful alumni spin-off entrepreneurs is taken as a quality criterion in a study comparing the conditions for entrepreneurial activity of students at German universities (cf. SCHMUDE et al. 2011: 15).

By addressing the research topic of the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure, this dissertation does not only contribute in a broader sense to the literature on the determinants of university spin-off formation, but implicitly also refers to the research stream on its effects. Most studies in this respect analyze the immediate real-economic effects of spin-off formation, using indicators such as turn-over or employment creation (cf. e.g. LAWTON SMITH et al. 2006 for Oxfordshire (UK), OSKARSSON/SCHLÄPFER 2008 for the ETH Zurich (Switzerland), ROBERTS/EESLEY

2009 for MIT). However, the rather indirect and systemic effects of spin-off formation that affect a regional economy in the long-run remain underresearched.

According to PATTON and KENNEY's (2010) concept of "University research-centric-based clusters", the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure can lead to such a long-term systemic effect. Similar to the genesis of clusters in general (see e.g. FELDMAN/FRANCIS 2004, ROMANELLI/FELDMAN 2006), PATTON and KENNEY (2010) describe the formation of a university research-centric-based cluster as a three-stage pattern evolutionary process. The emergence of university research-based new knowledge and technologies is considered to be a "triggering event" and initializes the first stage of cluster genesis, as economic opportunities are created that are partly exploited by university affiliates in the form of spin-off activities (cf. PATTON/KENNEY 2010). Critical to the development of the cluster and the associated regional economic effects is the second stage that ROMANELLI and FELDMAN (2006) refer to as "Hallmark of Vibrant Clusters". According to PATTON and KENNEY (2010), the evolution of a university-internal (and also regional) environment supportive to university entrepreneurship and eventually the development prospects of the cluster, substantially depend on the behavior and engagement of the university's alumni spin-off entrepreneurs. Optimally, they act as "social actors" by sustainably coining the configuration of the university (and also regional) spin-off support infrastructure through interacting with various stakeholders as well as actively co-designing, expressing opinions or sharing experience.

Although PATTON and KENNEY's concept refers to the evolution of clusters in particular, their basic idea of a positive effect of an involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure can plausibly be transferred to university regions which do not have the characteristics of a cluster and/or do not have significant potential to become a cluster. Following PATTON and KENNEY's concept, it is plausible to assume that in case the contribution of a university's alumni spin-off entrepreneurs is substantial enough, it induces a self-amplifying process by which the university's entrepreneurial support structure is continuously modified and upgraded. The rationale of this self-amplifying process is illustrated in Figure 1. An improved entrepreneurial support structure with a high probability leads to more spin-off activity and consequently to more spin-off entrepreneurs at a university (arrow a in Figure 1). As a consequence, also the number of alumni spin-off entrepreneurs increases in the medium term, as spin-off entrepreneurs become established (arrow b). Thus, there are also more alumni spin-off entrepreneurs who can potentially contribute to a university's entrepreneurial support structure (arrow c), which thereby in turn experiences

another improvement (arrow d). The dynamization of spin-off activity as a consequence of an improved entrepreneurial support structure does not only initiate the next cycle of self-amplification (arrows e, f, g and h), but in the long term also increases the potential for sustainable knowledge-driven regional development (arrow i) (cf. PATTON/KENNEY 2010).

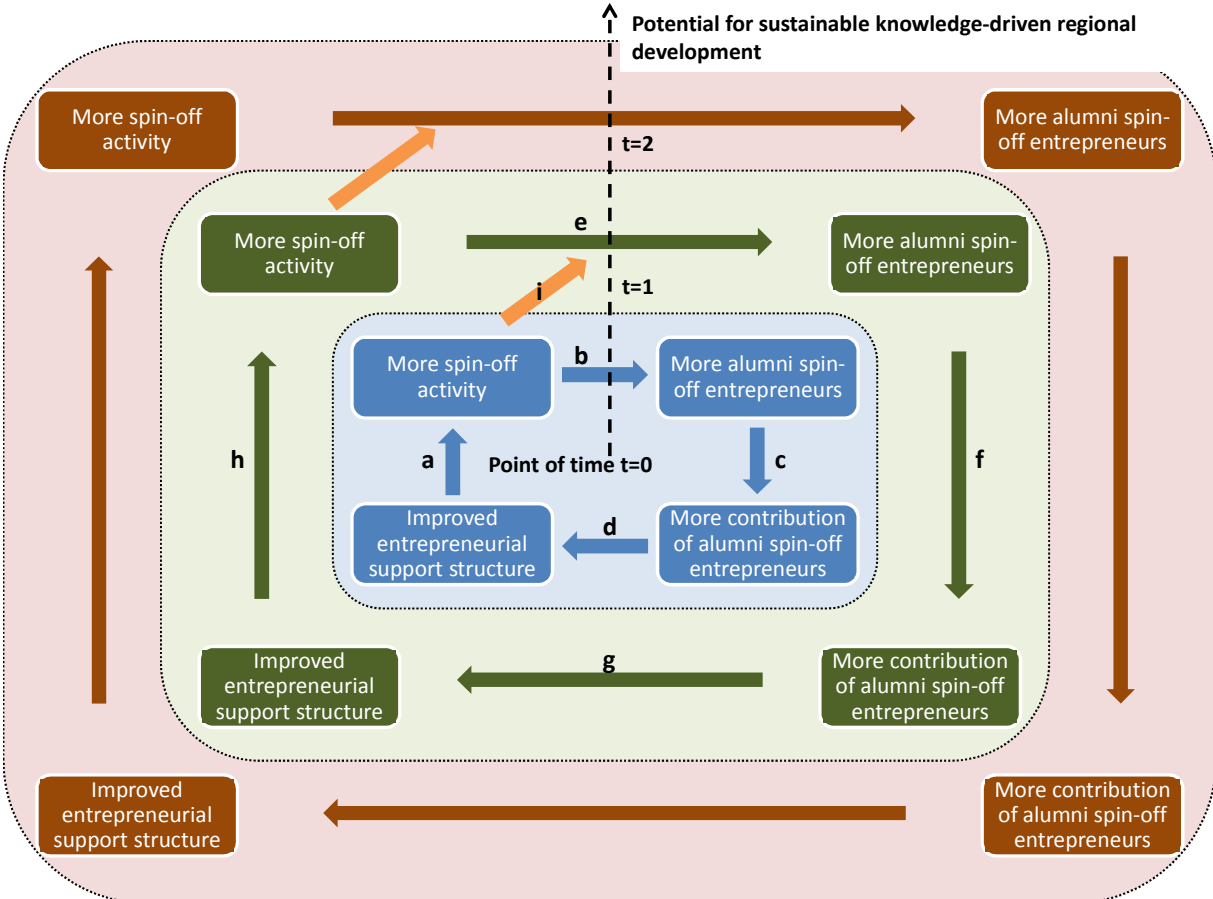


Figure 1: The self-amplifying process of the upgrade of a university's entrepreneurial support structure through the contribution of alumni spin-off entrepreneurs
 Source: Own illustration

1.3 Research gaps addressed in this dissertation

A review of the literature on the contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure reveals several research gaps, which are not least consequence of the fact that the above presented stream of literature is poorly developed. In this regard, the elucidated suggestion that an involvement of alumni spin-off entrepreneurs is a valuable contribution to a university's entrepreneurial support structure is actually acknowledged only by a small number of studies. Moreover, the majority of the above presented studies address such an involvement only marginally, while primarily concentrating on other aspects of spin-off formation (cf. e.g. KAILER 2010, KULICKE et al. 2011, KURATKO 2005, ROBERT/EESLEY 2009, WILSON 2008). In-depth analyses, which focus exclusively on how alumni spin-off entrepreneurs influence a university's entrepreneurial support structure by their involvement are even more scarce. Important exceptions are the studies conducted by NATHUSIUS (2013) and LLOYD-REASON et al. (2009).

This dissertation addresses three major research gaps in the existing literature. The *first research gap* relates to a conceptual shortcoming emerging from the suggestion that alumni spin-off entrepreneurs contribute to a university's entrepreneurial support structure. Plausibly, from a conceptual point of view, such a contribution implies an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs: The individual spin-off entrepreneur is not only influenced by a university's entrepreneurial support structure regarding the decision to become self-employed, the start-up process and the early development of the spin-off company, but can in turn also shape a university's entrepreneurial support structure. However, the literature lacks a conceptual foundation of university spin-off formation that accounts for such an interdependent relationship. In fact, contemporary concepts of university spin-off formation so far focus only on one direction of effect, namely the role of a university's entrepreneurial support structure for spin-off formation, while the influence of spin-off entrepreneurs on the support structure remains disregarded (cf. e.g. O'SHEA et al. 2005a, ROTHAERMEL et al. 2007).

The *second research gap* relates to an empirical shortcoming in the literature. While the above cited studies in general acknowledge the positive effects of an involvement of alumni spin-off entrepreneurs for the reinforcement and development of a university's entrepreneurial support structure (cf. e.g. KAILER 2010, KULICKE et al. 2011, KURATKO 2005, LLOYD-REASON et al. 2009, NATHUSIUS 2013, ROBERT/EESLEY 2009, WILSON 2008), its

importance relative to other sources of know-how, experience and information remains unknown.

The *third research gap* relates to potential strategies for a successful mobilization of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure. Regarding the potential that an involvement of alumni spin-off entrepreneurs inheres for the reinforcement and development of a university's entrepreneurial support structure (cf. LLOYD-REASON et al. 2009, NATHUSIUS 2013), as well as the increasing expectations of policymakers in this respect (cf. BMWI 2010: 6, BMWI 2011: 20), these strategies are plausibly of great interest. However, surprisingly the literature hitherto lacks a discussion of respective strategies and does not make recommendations for a successful mobilization of alumni spin-off entrepreneurs.

1.4 Objectives of dissertation

The aim of this dissertation is to narrow the above identified theoretical, empirical and strategy-related research gaps (see Section 1.3).

The *first objective* is to address the conceptual shortcoming in the literature by presenting a revised theoretical concept of university spin-off formation that takes into account an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. The concept is not only supposed to emphasize the existence of this phenomenon, but also attempts to define how (its nature) and under which conditions alumni spin-off entrepreneurs contribute to a university's entrepreneurial support structure.

The *second objective* of this dissertation is to narrow the empirical research gap regarding the importance of the contribution of alumni spin-off entrepreneurs relative to other sources of know-how, experience and information. In other words, the aim is to show whether the contribution of alumni spin-off entrepreneurs is an essential ingredient or just a decorative accessory to a university's entrepreneurial support structure. In case the contribution of alumni spin-off entrepreneurs turns out to be an important ingredient, another aim of this dissertation is to reveal, in which way and for which particular elements of a university's entrepreneurial support structure it is of importance. At a glance, the three research questions on this second objective are:

- *Which relative role does the contribution of alumni spin-off entrepreneurs play for a university's entrepreneurial support structure?*

- *In which way does the contribution of alumni spin-off entrepreneurs play an important role for a university's entrepreneurial support structure?*
- *For which elements of a university's entrepreneurial support structure does the contribution of alumni spin-off entrepreneurs play an important role?*

This dissertation's *third objective* is to address the research gap on potential strategies for a successful mobilization of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure. Thereby, the central aim is to formulate empirically based recommendations for university actors, on how to successfully mobilize alumni spin-off entrepreneurs to become involved. Plausibly, a successful mobilization of alumni spin-off entrepreneurs depends on whether they can be motivated to become involved. Thus, knowledge about the motives that influence the decision of alumni spin-off entrepreneurs to become involved or not is of particular value. The aim is to empirically reveal these motives, as they have hitherto not been empirically investigated. Furthermore, it is obvious that in order to formulate recommendations on how university actors can successfully mobilize alumni spin-off entrepreneurs, knowledge on how the university context affects the motives addressed above is crucial. At a glance, the research questions on this third objective are:

- *What are the motives that influence the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure?*
- *How does the university context affect the motives that influence the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure?*
- *How can a university successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure?*

1.5 Structure of dissertation

This dissertation follows a cumulative approach. It is a compilation of three research papers (in the present form integrated into chapters), of which each independently from each other addresses one of the above presented research gaps and objectives. Earlier versions of each

paper were presented at national and international conferences, workshops and colloquia². Slightly revised versions of the papers were and will be submitted to peer-reviewed journals.

The cumulative nature of this dissertation implies that each chapter comprises an introduction and approach to the research subject, a theoretical background section, an explanation of the methodology (when applicable) as well as a conclusion. Because of the coherent and independent nature of the chapters, they can be read separately from each other. Thus, when reading this dissertation in chronological order, repetitions – especially between the theory and methodology parts of the main chapters as well as between the conclusions of the main chapters and the overall summary and conclusion in Chapter 6 – cannot be excluded. However, in order to facilitate a chronological reading, the original papers were slightly modified in the present form of this dissertation. Where it was possible without sacrificing the coherence and comprehension of each paper, repetitions were removed and substituted by references to previous chapters.

Table 1 provides an overview of the chapters and illustrates the structure of this dissertation. It furthermore sketches the research design, the used data and the applied empirical analyses of each chapter, which are described in more detail below (see Section 1.6). Before Chapters 3, 4 and 5 address the above introduced subject of investigation, content- and context-related background information for the subsequent chapters is provided. In the scope of a literature review, **Chapter 2** illustrates which elements a capable university entrepreneurial support structure should be comprised of. Furthermore, the chapter describes and compares the entrepreneurial support structures and the entrepreneurial potential of the two German universities (Leibniz Universität Hannover (LUH) and Georg-August-Universität Göttingen (GAUG)) that serve as the research context for the empirical investigations in the following chapters (see Section 1.6.2 for the reasons for selecting LUH and GAUG as the research context). The information stems from official university sources, from interviews with key informants as well as from quantitative survey data on the entrepreneurial spirit of students

² These include the Workshop “Universitäre Spin-off Gründungen und ihre Förderung“ [“University spin-offs and their support”] in Hannover in February 2014, the “Arbeitsgruppe Gründung der Georg-August-Universität Göttingen” [“Working group 'business start-ups at Georg-August-Universität Göttingen'”] in Göttingen in November 2013, the 3rd ERSA International Workshop in Mönchengladbach in October 2013, the “Abend für Gründer und Unternehmer aus der Leibniz Universität Hannover“ [“Networking evening for founders and entrepreneurs from Leibniz Universität Hannover”] in Hannover in September 2013, the 53rd European Regional Science Association Congress in Palermo in August 2013, the 11th Annual Interdisciplinary European Conference on Entrepreneurship Research (IECER) in Brescia in March 2013, the “Lenkungsausschuss starting business der Leibniz Universität Hannover“ [“steering board 'starting business' of Leibniz Universität Hannover”] in Hannover in December 2012, the “Jahrestreffen des Arbeitskreis Industriegeographie“ [“Annual meeting of working group 'industrial geography'”] in Naurod-Niedernhausen in October 2011, as well as different meetings of the research colloquium of the Institute of Economic and Cultural Geography at Leibniz Universität Hannover.

Chapters	Aims/Research Questions	Research design	Data	Empirical analyses
Chapter 1: Introduction				
Chapter 2: The elements of a capable university entrepreneurial support structure: How supportive to spin-off formation are Leibniz Universität Hannover and Georg-August-Universität Göttingen?	<p>Illustration of the elements of which a capable university entrepreneurial support structure consists</p> <p>Comparison of the entrepreneurial support structures and entrepreneurial potential at LUH and GAUG</p>	<p>Literature review</p> <p>Qualitative and quantitative research design</p>	<ul style="list-style-type: none"> • Official university sources • USO Alumni spin-off entrepreneur survey • USO Key informant survey • GUESSS student survey • Research context: LUH and GAUG 	<p>USO: Qualitative content analysis</p> <p>GUESSS: Descriptive analyses</p>
Chapter 3: A theoretical approach to explain the interdependencies between a university's entrepreneurial support structure and its spin-off entrepreneurs	<p>Presentation of a concept of university spin-off formation that takes into account an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs</p>	<p>Literature review</p>		
Chapter 4: The contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure: Essential ingredient or just a decorative accessory?	<ul style="list-style-type: none"> • Which relative role does the contribution of alumni spin-off entrepreneurs play for a university's entrepreneurial support structure? • In which way does the contribution of alumni spin-off entrepreneurs play an important role for a university's entrepreneurial support structure? • For which elements of a university's entrepreneurial support structure does the contribution of alumni spin-off entrepreneurs play an important role? 	<p>Qualitative research design</p>	<ul style="list-style-type: none"> • USO Key informant survey • Research context: LUH 	<p>Qualitative content analysis</p>
Chapter 5: How to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure	<ul style="list-style-type: none"> • What are the motives that influence the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure? • How does the university context affect the motives that influence the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure? • How can a university successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure? 	<p>Qualitative research design</p>	<ul style="list-style-type: none"> • USO Alumni spin-off entrepreneur survey • USO Key informant survey • Research context: LUH and GAUG 	<p>Qualitative content analysis</p>
Chapter 6: Conclusion (Major results and contributions to the literature, implications for further research, policy implications)				

Table 1: Structure of dissertation

from both universities. All information and data was collected in the scope of two separate research projects (see Section 1.6 for information on the research projects, research designs, survey methodologies and data analysis procedures).

Chapter 3, 4 and 5 constitute the core of this dissertation and address the three research gaps and objectives outlined above. **Chapter 3** is titled "A theoretical approach to explain the interdependencies between a university's entrepreneurial support structure and its spin-off entrepreneurs". The respective paper deals with the first objective of this dissertation and presents a revised theoretical concept of university spin-off formation that takes into account an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. The theoretical foundation for the suggestion that spin-off entrepreneurs are not only influenced by a university's entrepreneurial support structure but also shape it – and thus for an interdependent relationship – is based on the theory of structuration (cf. GIDDENS 1984), on approaches in regional science and economic geography (cf. BATHELT/GLUECKLER 2011), as well as on a literature review regarding the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure (cf. BOSCHMA/FRENKEN 2006). Furthermore, the revised theoretical concept illustrates under which conditions alumni spin-off entrepreneurs influence a university's entrepreneurial support structure. It is argued that it is necessary to describe these on the micro-level of the involved individual actors, namely the individual alumni spin-off entrepreneurs as well as the individual actors in charge of a university's entrepreneurial support structure. By relating to the theory of planned behavior (cf. AJZEN 1991), the chapter derives under which conditions an individual actor in charge of a university's entrepreneurial support structure decides to include alumni spin-off entrepreneurs in his/her efforts to organize a capable support structure as well as under which conditions an alumni spin-off entrepreneur decides to become involved.

Chapter 4 is titled "The contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure: Essential ingredient or just a decorative accessory?" and addresses the second objective of this dissertation. In the scope of a qualitative case study design with the entrepreneurial support structure of Leibniz Universität Hannover (LUH) as the subject of investigation, the respective paper investigates the relative importance of the contribution of alumni spin-off entrepreneurs for the evolution and reinforcement of a support structure. Therefore, in a first step, background information is provided on how LUH's entrepreneurial support structure evolved since its initial establishment. Furthermore, the paper investigates in which way and for which particular elements of a support structure it is

of importance. The paper's theoretical background section discusses why it is plausible to assume that the contribution of alumni spin-off entrepreneurs plays an important role. Furthermore, it derives from the literature a contribution's potential nature and the elements, which could potentially be affected. These serve as categories, which guide the empirical data collection and analysis (cf. STRAUSS/CORBIN 1998). The primary data collection includes a survey of semi-structured face-to-face interviews of key informants of LUH's entrepreneurial support structure. This data is supplemented with archival material and official documents. The data is analyzed by typical content analysis procedures (cf. GLÄSER/LAUDEL 2009, MAYRING 2010) (see Section 1.6 for information on the survey methodology and data analysis procedures).

Chapter 5 is titled "How to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure?". The respective paper addresses the third objective of this dissertation, which is to formulate empirically based recommendations for university actors regarding a successful mobilization of alumni spin-off entrepreneurs. A successful mobilization plausibly depends on whether alumni spin-off entrepreneurs can be motivated to become involved. Thus, the paper empirically surveys the motives that influence the decision of alumni spin-off entrepreneurs between becoming and not becoming involved in a university's entrepreneurial support structure. Furthermore, the paper shows how the university context affects the respective decision motives. The paper applies a qualitative research design. The primary data collection includes two surveys consisting of semi-structured face-to-face interviews with a) alumni spin-off entrepreneurs and with b) key informants. Context of investigation are Leibniz Universität Hannover and Georg-August-Universität Göttingen. The data is analyzed by typical content analysis procedures (cf. GLÄSER/LAUDEL 2009, MAYRING 2010). The data collection and analysis is structured according to potential decision motives derived from theoretical considerations (cf. STRAUSS/CORBIN 1998). Regarding the lack of conceptual work and empirical findings on the exact subject of investigation, the paper thereby refers to the literature on prosocial behavior in general and alumni university engagement in particular (see Section 1.6 for information on the survey methodologies and data analysis procedures).

Chapter 6 provides a conclusion, summarizes the results of the core chapters and shows how these contribute to the literature. Furthermore, implications for future research and policy making are identified.

1.6 Data and methods

1.6.1 Research design

The empirical investigations in the core Chapters 4 and 5 as well as in the background Chapter 2 of this dissertation are based on a qualitative research design (see Table 1). It was preferred to a quantitative approach for the following reasons:

First, the empirical investigations at least partially have an exploratory character. Regarding the scarceness of empirical studies, knowledge about how alumni spin-off entrepreneurs contribute to a university's entrepreneurial support structure and about the elements that are affected is still superficial. Furthermore, the decision motives for the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure as a particular case of prosocial behavior have hitherto not been subject of empirical investigation. Although the literature review in Chapter 4 reveals the potential nature of a contribution (dimensions and modes) and the possibly affected elements of a university's entrepreneurial support structure, it can be assumed that the categorization of dimensions, modes and elements at least partially deviates in this study. The same applies to the decision motives examined in Chapter 5. Although the chapter's conceptual framework suggests potential decision motives regarding prosocial behavior in general and alumni university engagement in particular, it is plausible to assume that the categorization of motives at least partially deviates in the specific case of prosocial behavior considered. Furthermore additional interesting and relevant aspects may plausible exist for the nature of an involvement, for the affected elements of a university's entrepreneurial support structure as well as for each decision motive, which have not been considered in the literature. Regarding the latter, it is for instance probable that the role of the university context is very specific for the decision of alumni spin-off entrepreneurs to become involved or not in a university's entrepreneurial support structure. In essence, it can be argued that a quantitative approach including an operationalization of potential dimensions, modes, affected elements and decision motives into quantifiable variables in order to test deductively derived hypotheses would lead to a reduction of information and consequently to limited insight into the specific subject of investigation.

Secondly, a qualitative research design is usually applied when the subject of investigation is of high complexity, which cannot be completely captured by quantitative procedures of data collection and analysis (cf. YIN 2003). This is the case for several aspects addressed in this dissertation: the evaluation and comparison of the entrepreneurial support structures at LUH and GAUG in Chapter 2, the illustration of the evolution of LUH's support structure in

Chapter 4, as well as the examination of the existence and nature of a contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure in Chapter 4. Furthermore, it especially applies to research on individual-related issues, such as "...people's attitudes, behaviours, value systems, concerns, motivations, aspirations,..." (JOUBISH et al. 2011: 2082) that explain why people make decisions and/or act in a certain way (cf. JOUBISH et al. 2011). Correspondingly, the social psychology literature acknowledges that due to the high degree of complexity and comprehensiveness as well as the intensity of interactions between different motives, qualitative approaches are considered to be more effective than quantitative techniques when exploring an individual's motive for or against a particular type of prosocial behavior (cf. LOCHNER et al. 2012). This should also be the case for the exploration of the decision motives of alumni spin-off entrepreneurs between becoming or not becoming involved, as described in Chapter 5.

Thirdly, one of the objectives of this dissertation is to define recommendations on how to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure (see Chapter 5). In this respect, it is meaningful to support the derivation of recommendations from the findings on motives with the opinion of experienced key informants on university entrepreneurial support structures (for a definition of key informants see Section 1.6.3). Regarding the intention to consider potential recommendations in depth and in detail, a qualitative approach with open-ended questions is preferred to a quantitative approach with predefined variables.

While the core of this dissertation applies a qualitative research design, the provision of background information on LUH's and GAUG's entrepreneurial conditions and potential in Chapter 2 is supplemented with quantitative data from the research project "Global University Entrepreneurial Spirit Students' Survey" (GUESSS) (see Table 1). GUESSS is an international annual online survey, which evaluates entrepreneurial attitudes, intentions and activities of Bachelor, Master and PhD students and also examines their awareness and attendance of university entrepreneurship support offerings. The project's central objective is to compare these issues both internationally between different countries as well as between the participating universities within each country (cf. BERGMANN et al. 2012: 4, SIEGER et al. 2014: 6). In Chapter 2, GUESSS-data is used to evaluate and compare the level of awareness of LUH's and GAUG's entrepreneurial support programs among their students and to assess the entrepreneurial climate and potential measured as students' entrepreneurial intentions. Data is used from the 2011 GUESSS-survey. For both universities a total of 3,151

interviews with students were conducted (LUH: 1,585; GAUG: 1,567). The data analysis in Chapter 2 was conducted descriptively.

1.6.2 Context of investigation

It is plausible to assume that the degree and nature of the contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure as well as their motives regarding the decision to become or not to become involved are strongly influenced and shaped by the surrounding conditions, especially of the university itself. Thus, in terms of comparability, the context of investigation should include universities that are similar regarding entrepreneurial conditions (e.g. characteristics of the entrepreneurial support structure and the entrepreneurial climate) and entrepreneurial potential (e.g. structure of scientific disciplines). Furthermore, in order to be able to at least carefully and partially generalize, the selected universities should exemplify the regular case, and therefore be middle-range, standard universities regarding entrepreneurial conditions and spin-off activities.

The research context for the empirical investigations in this dissertation are the German universities Leibniz Universität Hannover (LUH) and Georg-August-Universität Göttingen³ in the year 2011⁴. These two universities were chosen because they meet the requirements regarding comparability. LUH and GAUG are similar in size with regard to the total number of students. In October 2011, 21,530 students (including PhD students) were enrolled at LUH and 25,459 students (including PhD students) studied at GAUG (including its medical center) (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2014a, LEIBNIZ UNIVERSITÄT HANNOVER 2012). Furthermore, both universities have a similar entrepreneurial potential concerning the total number of students in subjects that are common for spin-off formation. In general, the so-called MINT subjects (mathematics, computer science, natural science, medical science and engineering) as well as management and economics are considered to have a higher spin-off potential than humanities or social sciences (O'SHEA et al. 2005a). In October 2011, the number of students enrolled in MINT subjects was 12,447 at LUH and 12,787 at GAUG. The number of students enrolled in management and economics was 3,050

³ While both LUH and GAUG are used as context of investigation in Chapter 5, Chapter 4 is limited to data from LUH (see Table 1). Although initially intended, the quality of information that could be drawn from interviews with key informants and from archival material of GAUG did not allow for a comparison of LUH and GAUG in Chapter 4.

⁴ All data and information presented in this dissertation relate to the year 2011. Thus, also the presented characteristics of LUH's and GAUG's entrepreneurial support structures describe the situation in 2011.

at LUH and 3,264 at GAUG (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2014a, LEIBNIZ UNIVERSITÄT HANNOVER 2012). Furthermore, LUH and GAUG are comparable with respect to spin-off activities and entrepreneurial conditions (cf. SCHMUDE et al. 2011). Both have established an entrepreneurial support structure for more than a decade, which is of similar quality today (see Chapter 2 for a detailed illustration of LUH's and GAUG's entrepreneurial support structures). In addition, both universities are located in Lower Saxony and therefore are subject to the same higher education policies, which are responsibility of the federal states in Germany (cf. POWELL/SOLGA 2011: 64).

Furthermore LUH and GAUG are suitable examples of the German standard. As a study, which compares entrepreneurial conditions among 63 German universities reveals, LUH and GAUG both are middle-range universities regarding their entrepreneurship education and coaching offerings, their mobilization activities, their general policies on spin-off formation, as well as their spin-off dynamics (cf. SCHMUDE et al. 2011).

1.6.3 Survey methodologies

The primary data collection was conducted within the framework of a broader research project called "University spin-offs in Lower Saxony and their regional economic impact: empirical evidence from Hannover and Göttingen" (USO). It was funded from 2010 to 2013 by the Ministry for Science and Culture of Lower Saxony, grant no. AZ. 76202-17-5/09. The research project's broad aims were to give an overview on the quantity and characteristics of spin-off activity at LUH and GAUG, to examine the evolution and status quo of LUH's and GAUG's entrepreneurial support structure and to analyze which individual- and university-related factors determine the emergence of spin-off companies and their development. The primary data collection included two surveys: Semi-structured face-to-face interviews with a) key informants on LUH's and GAUG's entrepreneurial support structures and with b) alumni spin-off entrepreneurs of both universities. Table 1 shows from which of the two qualitative surveys the used data stems for each chapter of this dissertation.

In the scope of the **key informant survey**, semi-structured interviews with 25 (LUH: 13, GAUG: 12) persons were conducted. Key informants were considered to be persons that either worked in the past in or still are affiliated with an organization and position in which they directly deal with LUH's or GAUG's entrepreneurial support structure, such as the universities' technology transfer offices, the universities' management and administration, Hanover's and Göttingen's economic development agencies or Lower Saxony's Ministry of

Economics, Employment and Traffic as well as its Ministry of Science, Education and Culture.

During the interviews, the key informants were confronted with questions on several different issues. First, they were asked to assess the status quo and to explain the evolution of their respective university's entrepreneurial support structure. Secondly, they were requested to consider the sources of know-how and information during the conceptualization and reconceptualization of particular support structure elements and for the realization of existing support measures. Thirdly, the key informants were asked to state if and how alumni spin-off entrepreneurs contributed to the conceptualization, reconceptualization or realization (and thus reinforcement) of the support structure. Fourth, they were supposed to assess the motives of alumni spin-off entrepreneurs to become or not to become involved in the university's entrepreneurial support structure. Fifth, they were requested to consider potential strategies to improve the mobilization of alumni spin-off entrepreneurs to become involved (see Appendix 1 for the interview manual of the key informant survey). In order to clarify and verify certain aspects, the respective key informants were contacted several times during data collection and analysis. Especially in case of content-related discrepancies (concerning e.g. the evolution of LUH's entrepreneurial support structure, the sources of know-how and information during the conceptualization of particular elements at a particular stage of evolution and alumni spin-off entrepreneurs' contribution at a particular point in time), they were approached again for clarification. Thus, the interviews ranged in length from a few minutes for short supplementary queries to one and a half hours.

In addition to the interviews with key informants, information on the evolution of LUH's and GAUG's entrepreneurial support structure was collected from archival sources, such as the annual activity reports of the universities' technology transfer offices, studies, presentations, brochures and strategy documents.

The **alumni spin-off entrepreneur survey** included semi-structured face-to-face and telephone interviews with 77 alumni spin-off entrepreneurs, who originated from LUH (43) or GAUG (34) and whose businesses were still located in the respective region. Alumni spin-off entrepreneurs were defined as scientists or students who exploited the knowledge and/or skills acquired while working or studying at the respective university by starting up a company within the time period of 1980 to 2011. At the time the business was officially founded, the entrepreneur was either affiliated with the university or had left it for a maximum of three years. The definition of alumni spin-off entrepreneurs was not restricted to certain scientific

disciplines. Thus, the sample includes both spin-offs offering technology-oriented products as well as spin-offs offering knowledge-intensive services.

LUH's and GAUG's official data on their spin-offs is far from accurate and complete. Therefore as many alumni spin-off entrepreneurs as possible were identified as follows: in a first step informal discussions were conducted with key informants of those institutions dealing with LUH's and GAUG's spin-offs, such as the universities' technology transfer offices or the local economic development agencies. In order to avoid a bias for the benefit of alumni spin-off founders, which were supported by the respective organization, the heads of all of the universities' academic institutes were asked for information about university spin-offs via mail. Furthermore, a search operation was conducted through the business network Xing in order to capture alumni spin-off founders, who neither had contact with the current faculty staff nor with the organizations offering start-up support. In a second step all contacts were validated via e-mail, internet search and phone calls. In total a list of 334 alumni spin-off entrepreneurs (LUH: 191, GAUG: 143) was obtained. From this a sample of 152 founders (LUH: 71, GAUG: 81) were contacted via e-mail, telephone or Xing. A sampling grid was chosen that considered two variables – industry sector and company age – to ensure a heterogenic sample structure (cf. BERNARD/RYAN 2009, SCHREIER 2012). Of the 152 founders, 65 (LUH: 27, GAUG: 38) were unresponsive or declined to do an interview. Another 10 (LUH: 1, GAUG: 9) were not located in the respective region and were therefore excluded from analysis.

The face-to-face interviews usually took place in the respective company and ranged from 45 minutes to two and a half hours in length. During each interview the respective alumni spin-off entrepreneur was asked whether he/she either at the time of the interview or in the past had become involved in any manner in the entrepreneurial support structure of his/her university. A total of 18 alumni spin-off entrepreneurs were identified for whom this was the case (LUH: 8, GAUG: 10). These 18 entrepreneurs were asked questions regarding the extent and particular nature of their involvement and their motives for their decision to contribute to their university's entrepreneurial support structure. Furthermore the 59 alumni spin-off entrepreneurs who reported to never have become involved, were asked to describe the reasons and motives of their decision not to become involved. For all 77 alumni spin-off entrepreneurs in the sample, additional information on the start-up process and support from the university, regional or national organizations and/or programs as well as on the previous and further expected development of the company was collected (see Appendix 2 for the

interview manual as well as Appendix 3 for the post-interview questionnaire of the alumni spin-off entrepreneur survey).

During the interviews with both key informants and alumni spin-off entrepreneurs, the interviewer was able to take advantage of the qualitative survey methodology. First, it was possible to explain and exemplify to the interviewees what was meant by an involvement in a university's entrepreneurial support structure and by the motives behind such behavior. Secondly, the methodology ensured that the interview partners were able to consider each possible manner of involvement (e.g. contribution to the conceptualization of new or assistance in the realization of existing support structure elements) (cf. MAYRING 2010, PATTON 1990, YIN 2003). Thirdly, the face-to-face interview situation with alumni spin-off entrepreneurs allowed to pose the questions regarding the motives of the decision to become or not to become involved in a "...truly open-ended fashion..." (cf. PATTON 1990: 295) without predetermining theoretically drawn decision motives. Thus, the interviewees' answer behavior was not influenced by potential answer categories (cf. PATTON 1990: 295). Furthermore, by provoking spontaneous, unconstrained answers, the probability of alumni spin-off entrepreneurs responding strategically or in a manner, that could be desired or expected by society or by the interviewer, decreases (cf. KVALE 1996: 145, OPDENAKKER 2006: 9). Fourth, the methodology allowed to further delve into interesting issues that emerged during the interviews and to identify new and important aspects (cf. MAYRING 2000, PATTON 1990, YIN 2003).

Both components of primary data collection were conducted during the period of September 2011 to December 2012. All interviews were tape-recorded unless the informant rejected this and directly transcribed. During and after each interview, the interviewer took field notes. All interviews were anonymized for data privacy reasons. Consequently, the interview partners of both the key informant survey as well as the alumni spin-off entrepreneur survey are not listed in the annex.

1.6.4 Data coding and analysis

In all empirical papers of this dissertation the transcribed interviews were analyzed using typical content analysis procedures (cf. GLÄSER/LAUDEL 2009, MAYRING 2010), supported by the qualitative data analysis software NVivo (see Table 1). As commonly implemented in qualitative research (cf. KELLE/KLUGE 2010, KUCKARTZ 2012, SCHREIER 2012: 89), two central procedures of systematic, rule guided, category based

analysis were integrated: deductive category application and inductive category development. For themes with theoretically pre-defined categories (e.g. nature of alumni spin-off entrepreneurs' contribution, affected elements of a university's entrepreneurial support structure, decision motives of alumni spin-off entrepreneurs) the procedure of deductive category application was employed. Thereby the categories that were derived in the conceptual frameworks from theoretical considerations were used as basis to structure the transcript material. In order to ensure a distinct attribution of text passages to categories, a consistent coding procedure as well as the auditability of data analysis and interpretation, a coding agenda was developed, which included explicit definitions, examples and coding rules for each deductive category.

Inductive category development was applied for two occasions. Firstly, the deductively derived categories were refined, modified and specified by extracting new information that had not been anticipated by theoretical considerations directly from the transcript material. Furthermore, data was sorted into new categories that emerged from examining the material. In case that quotes fit into existing categories but were in its nature more specific, subcategories were created. Secondly, inductive category development was applied in the case of themes for which a theoretical derivation of categories before data collection was not feasible (e.g. evolution of LUH's entrepreneurial support structure; sources of know-how, information and experience concerning spin-off formation during different stages of evolution). In order to ensure a consistent procedure of inductive category development and modification, the technique of paraphrasing summarization was applied (cf. KUCKARTZ 2012). Thereby the researcher worked through the transcript material, reduced the material by paraphrasing and generalized it by allocating these to existing (sub-)categories or creating new (sub-)categories. The whole process included several feedback loops by which the categories were revised carefully within the process of analysis (cf. MAYRING 2000). The final coding frames that emerged from deductive category application and inductive category development of the interview material with key informants and alumni spin-off entrepreneurs are presented in Appendices 4 and 5.

Compliance with quality criteria of qualitative research (cf. STEINKE 2004) was ensured as follows: the process of data analysis was methodologically controlled by consistently applying rule guided procedures (see above). Consistency of structuring and coding of transcripts throughout the process of analysis was ensured through the application of several cycles of text retrieval (intracoder reliability). In order to monitor objectivity and reliability of

data analysis and interpretation, two members of the research team independently coded the material and discussed certain issues in the case of discrepancies (intercoder reliability).

Chapter 2

The elements of a capable university entrepreneurial support structure:

How supportive to spin-off formation are Leibniz Universität Hannover and Georg-August-Universität Göttingen?⁵

Abstract

The levels of university spin-off activity vary considerably across universities and regions. An important factor influencing a university's ability to generate successful spin-off companies is the existence of a capable entrepreneurial support structure consisting for instance of particular support measures and infrastructural facilities. This paper has two objectives. The first objective is to illustrate in the scope of a literature review which particular elements a capable university entrepreneurial support structure should comprise. The second objective is to evaluate and compare the entrepreneurial support structures of Leibniz Universität Hannover (LUH) and Georg-August-Universität Göttingen (GAUG). The data and information stems from official university sources, from qualitative interviews with key informants as well as from a quantitative survey among students of both universities. The results suggest that the entrepreneurial support structures of both universities still have a considerable upward potential⁶. Thereby both universities have similar strength and weaknesses. While their support measures are well developed, they lack important infrastructural facilities, in particular an entrepreneurship professorship and an incubator. Furthermore, the entrepreneurial climate and the universities' general commitment for spin-off formation are relatively unsophisticated. In general, LUH's entrepreneurial support structure is slightly better developed than GAUG's.

⁵ This paper was written together with Dr. Nora Hesse, Institute of Economic and Cultural Geography, Leibniz Universität Hannover. Both authors contributed equally to the paper.

⁶ The year of reference is 2011.

2.1 Introduction

Universities are increasingly seen as engines for regional innovation and economic growth (cf. ETZKOWITZ 2008, LAWTON SMITH 2007, MUSTAR et al. 2008). While they are traditionally understood as sites for basic research and higher education, the contemporary view is that they increasingly integrate with the regional economy via different channels of knowledge and technology transfer. Some famous high-tech regions have developed on the basis of universities, for example Silicon Valley in California, Greater Boston in Massachusetts, or the Research Triangle in North Carolina (cf. SAXENIAN 1983, STERNBERG 2010). In these regions, university spin-offs are regarded as one important vehicle of knowledge transfer and commercialization from university to industry.

Universities and regions dedicated to the facilitation of spin-off activities need a supportive environment. Important in this respect are the general characteristics of the university (e.g. size, structure of scientific disciplines and quality of research and teaching) and the regional context (e.g. economic performance, industry-structure, entrepreneurial regime). Particularly crucial is the existence of a capable university entrepreneurial support structure. Studies suggest that in order to facilitate spin-off formation, a university must implement and maintain specific cultural attributes, practical routines as well as measures and facilities of support (e.g. business incubators or training, coaching and consultation programs) (cf. O'SHEA et al. 2005a, ROTHÄRMEL et al. 2007).

This paper has two objectives. The first objective is to illustrate in the scope of a literature review which particular elements a capable university entrepreneurial support structure should comprise. The second objective is to evaluate and compare the entrepreneurial support structures of Leibniz Universität Hannover (LUH) and Georg-August-Universität Göttingen (GAUG). Thereby, important content- and context-related background information for this dissertation's core Chapters 3, 4 and 5 is provided.

The empirical analysis is based on two research projects: one targets a qualitative, the other a quantitative approach. The qualitative research project "University spin-offs in Lower Saxony and their regional economic impact: empirical evidence from Hannover and Göttingen" (USO) provides data from semi-structured face-to-face interviews with 25 key informants from university and regional organizations in Hannover and Göttingen. The quantitative research project "Global University Entrepreneurial Spirit Students' Survey" (GUESSS) provides data on the entrepreneurial attitude, competence and activity of 3,151 students at LUH and GAUG and their perception their university's entrepreneurial programs and climate.

The subsequent analytical process relies on a content analysis of the qualitative data and a descriptive analysis of the quantitative data.

In summary, the literature review reveals that a capable university entrepreneurial support structure should comprise three major elements: a positive entrepreneurial climate, specific support measures (sensitization, capability supply, information supply and resource supply measures) and affiliated infrastructural facilities as well as conducive university policies on spin-off formation.

The empirical results suggest that at both LUH and GAUG the entrepreneurial support structure still has a considerable upward potential⁷. Both universities face similar strengths and weaknesses. While their support measures are well developed, they lack important infrastructural facilities, in particular an entrepreneurship professorship and an incubator. Furthermore, their entrepreneurial climate and the universities' general commitment for spin-off formation are not very sophisticated. In general, the entrepreneurial support structure of LUH is slightly better developed than GAUG's.

This paper is structured as followed: First, Section 2.2 in the scope of a literature review discusses the importance of the university environment in general and of a university entrepreneurial support structure in specific. Furthermore, Section 2.2 explains which elements a university's entrepreneurial support structure should comprise. Based on the literature review, Section 2.3 formulates precise research questions that structure the empirical analyses. The subsequent Section 2.4 describes the data and methods used for the empirical analyses. The following chapters compare LUH and GAUG with regard to their entrepreneurial potential (Section 2.5) and their entrepreneurial support structures (Section 2.6). Finally, the paper concludes with a summary of the results, policy implications and indications for further research (Section 2.7).

⁷ The year of reference 2011.

2.2 The importance of the university environment for spin-off formation and the elements of a capable university entrepreneurial support structure

While factors like founder personality, firm characteristics, broader (national) legal conditions (cf. DI GREGORIO/SHANE 2003) and the regional surrounding of a university (cf. GUPTE 2007, HEMER et al. 2007, LANDRY et al. 2006, O'SHEA et al. 2008, SHANE 2004a, STERNBERG 2009: 273) certainly also play a significant role, the state of research suggests that it is mainly the characteristics of a university itself, that determine the dynamics of spin-off formation and the performance of the respective start-ups (cf. LOCKETT et al. 2003).

A university spin-off's business idea usually originates from technological and knowledge-resources, which the founder obtains while studying or researching at a university (cf. DRUILHE/GARNSEY 2004). Consequently, the basis for spin-off activity resides in a university's stock of knowledge and technology (cf. GRAS et al. 2008, SHANE/STUART 2002). A university's characteristics such as its size and tradition, its nature and quality of research and teaching, its ability to attract financial resources and its frequency of collaboration with industry partners, mirror a university's stock of commercializable knowledge and technology and therefore determine the frequency and quality of spin-off activities (cf. DI GREGORIO/SHANE 2003, GRAS et al. 2008, LANDRY et al. 2006, LOCKETT/WRIGHT 2005, O'SHEA et al. 2005a, O'SHEA et al. 2005b, O'SHEA et al. 2008, POWERS/MCDOUGALL 2005, SHANE 2004a, WRIGHT et al. 2004, ZUCKER et al. 1998). For instance, as not all subjects are equally well-suited for commercialization, universities focusing on technical and natural sciences subjects as well as on economics and business administration are rather more inclined towards spin-off formation than those with a tradition in social sciences and humanities (cf. O'SHEA et al. 2005a). Furthermore, the more a university applies industry-funded than public-funded research, the higher the probability of generating spin-off companies will be (cf. BLUMENTHAL et al. 1996).

The singularity and exclusivity of the knowledge and technology a spin-off company receives from a university holds a competitive advantage over other business entrepreneurs (cf. DRUILHE/GARNSEY 2004). In spite of this competitive advantage, academic entrepreneurs usually face a shortage of other necessary resources, capabilities and information during the process of spinoff formation – such as entrepreneurial skills and thinking, market information and financial resources – to develop the business idea and the associated product towards market maturity, and to manage the start-up process (cf. DRUILHE/GARNSEY 2004, POWERS/MCDOUGALL 2005). Furthermore, scientific staff and students often lack the

motivation to become self-employed (cf. SHANE 2004a). A university has the potential to provide these lacking resources, capabilities and information as well as to resolve the limited entrepreneurial motivation of students and scientists by establishing a supportive environment consisting of an organizational and institutional infrastructure as well as specific measures of support (cf. DEGROOF/ROBERTS 2004, POWERS/MCDOUGALL 2005, RASMUSSEN/BORCH 2010).

Summarizing the literature, a capable university entrepreneurial support structure comprises three elements (see Figure 2). Firstly, for a university dedicated to fostering spin-off activities a positive entrepreneurial climate (in the literature sometimes also referred to as entrepreneurial culture) is crucial. In a nutshell, when faculty and students encounter a climate which advocates commercialization and entrepreneurship, they are more likely to develop and realize start-up ideas (cf. GUERRERO/URBANO 2012, NDONZUAU et al. 2007, SHANE 2004a, SIEGEL et al. 2003). Furthermore, the start-up is more likely to perform successfully (cf. GUPTE 2007).

Secondly, practical experience and academic research suggest that a university intending to increase the number and quality of spin-offs needs to establish several support measures and associated infrastructural facilities. In general four important support measures can be

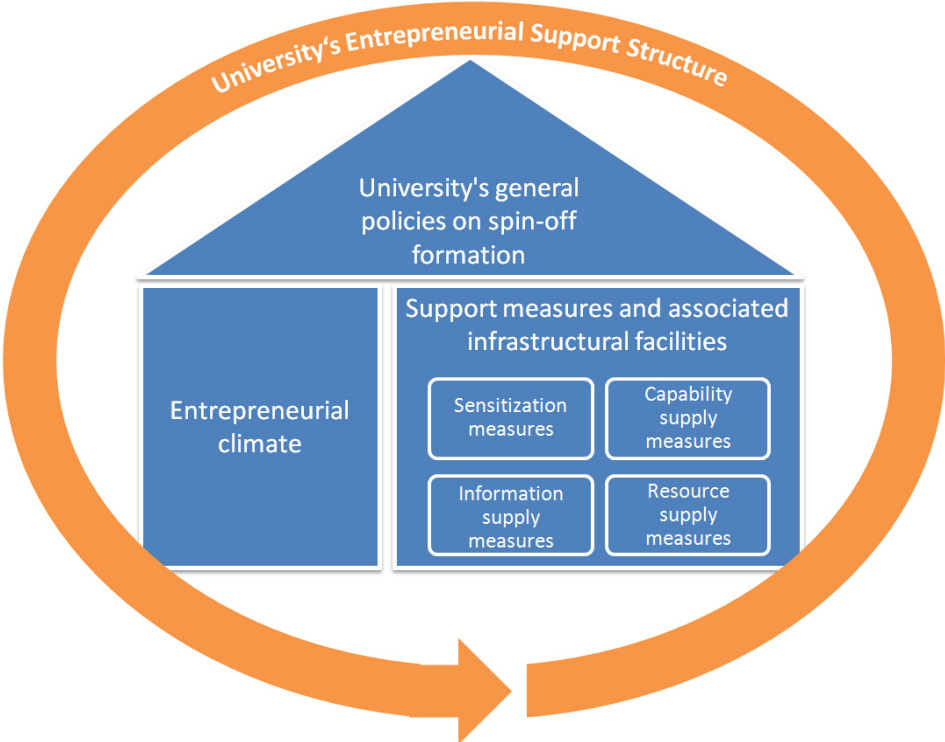


Figure 2: Elements of a capable university entrepreneurial support structure
 Source: Own illustration

differentiated. Sensitization measures target at fostering motivation and attitudes towards entrepreneurship among faculty and staff by increasing the awareness of entrepreneurship as a possible and desirable career choice. Thereby these measures indirectly also improve a university's entrepreneurial climate (cf. FINI et al. 2011, KULICKE et al. 2011). Information supply measures in the form of advisory and consultation offerings can equip (potential) spin-off entrepreneurs with expertise and assistance in areas such as the identification of business ideas, the assessment of their commercial and technological market potential, the definition of the most suitable way to exploit the idea, legal protection and ownership rights of the business idea, and the development of a sophisticated business plan (cf. NDONZUAU et al. 2002, O'SHEA et al. 2005a, SHANE 2004a, VOHORA et al. 2004). Furthermore, a university can also set up (potential) spin-off entrepreneurs with the necessary skills and capabilities in the areas mentioned above. These capability supply measures may include an entrepreneurship education program within a university's curricula or training and qualification programs for those students or scientists in the process of setting up a business. As a side effect, capability supply measures also foster a university's entrepreneurial climate by supporting entrepreneurial thinking and attitudes among its students and staff (cf. ASTEBRO/BAZZAZIAN 2011, GUERRERO/URBANO 2012, KULICKE et al. 2011). Studies suggest that for an efficient implementation and realization of sensitization activities as well as information supply, and capability supply measures, a university should establish certain infrastructural facilities, such as a technology transfer office, an entrepreneurship office or an entrepreneurship professorship (cf. DJOKOVIC/SOUITARIS 2008, GUERRERO/URBANO 2012, WRIGHT et al. 2007). Finally, resource supply measures target at supplying (potential) spin-off entrepreneurs with scarce but necessary financial or material resources. Regarding the former, a university can support its spin-off entrepreneurs financially by simple cost absorption, by taking equity in a spin-off firm or by the more sophisticated establishment of a venture capital fund (cf. DI GREGORIO/SHANE 2003, WRIGHT et al. 2007, WRIGHT et al. 2002). As for material resources, a university should establish specific rules and flexible arrangements to allow (potential) spin-off entrepreneurs to access university resources such as laboratories, scientific equipment and office space (FINI et al. 2011, HELM/MAURONER 2007, SHANE 2004a). More sophisticated infrastructural facilities for making material resources more accessible to early spin-off firms could be a university-affiliated business incubator or a science and technology park (cf. DI GREGORIO/SHANE 2003, DJOKOVIC/SOUITARIS 2008).

The entrepreneurship expertise within the regional context (in the form of e.g. investors, consultants, chambers of commerce, agencies of economic development or business incubators) can serve as an additional source of information, capabilities and resources for (potential) spin-off entrepreneurs. A university should assist in connecting (potential) spin-off entrepreneurs with these actors by establishing and cultivating networks (cf. O'SHEA et al. 2005a, SHANE 2004a).

Thirdly, a university's climate regarding entrepreneurship as well as its entrepreneurship support measures and associated infrastructural elements can only be developed and can only function effectively when they are backed by a university's general policies on spin-off formation. Most important in this respect is the general commitment of a university and its administration to the commercialization of university knowledge and technology via spin-off formation (cf. ASTEBRO et al. 2012). In addition, the literature identifies a set of specific rules, arrangements and unwritten norms which a university should establish in order to encourage its scientific staff and students to exploit intellectual property and engage in spin-off activities (cf. ASTEBRO et al. 2012, DI GREGORIO/SHANE 2003, FINI et al. 2011, SHANE 2004a). In addition to the aforementioned procedures to support spin-offs by taking equity or by allowing them to access university infrastructure (cf. HELM/MAURONER 2007, LOCKETT et al. 2003), a university should facilitate the exploitation of university-assigned knowledge and technologies by offering exclusive licenses and patent rights to spin-off founders, should introduce specific contractual arrangements with scientific staff starting up a business (e.g. leave of absence or part-time employment) (cf. FINI et al. 2011, MUSTAR et al. 2008) and should introduce incentive structures that reward entrepreneurial activity (cf. O'SHEA et al. 2005a).

It is important that the three elements of a university's entrepreneurial support structure should not be considered separately, but that they interact. There is for example a nexus between a university's climate and the other two support structure elements, in that an entrepreneurial climate is also reflected by a university's general commitment towards commercialization and entrepreneurial activities. This in turn constitutes if and to what extent support measures, associated organizations as well as specific policies on spin-off formation are implemented. On the other hand, a strong commitment of a university towards entrepreneurship and effective rules, arrangements and unwritten norms positively influence faculties' and students' attitudes towards spin-off formation and improves a university's entrepreneurial climate. Furthermore, sensitization measures as well as capability supply measures (particularly an entrepreneurship education program and an entrepreneurship

professorship) support entrepreneurial thinking and attitudes among students and staff and thereby foster a positive entrepreneurial climate.

2.3 Research questions structuring the empirical analyses

The results of the literature review regarding the importance of the university environment for spin-off formation and the elements of a capable university entrepreneurial support structure allow to pose more specific research questions for comparing the support structures of Leibniz Universität Hannover (LUH) and Georg-August-Universität Göttingen (GAUG). These are used to structure the subsequent empirical analyses.

An important suggestion is that not only the existence and quality of a university's entrepreneurial support structure determines spin-off activity, but that universities significantly differ with regard to their entrepreneurial potential. Consequently it makes sense to compare LUH's and GAUG's prerequisites regarding spin-off formation before evaluating their entrepreneurial support structures. The literature proposes that a university's general characteristics, such as its size, its tradition and nature of research and teaching, its frequency of collaboration with industry partners, as well as the amount of industry-funded research significantly determine the spin-off dynamics of a university. Thus the first research question addressed in the following is:

*(1) Which **entrepreneurial potential** do LUH and GAUG have regarding their general university characteristics in comparison?*

General university characteristics only indirectly mirror the potential for spin-off activity. Furthermore, it is plausible to assume that a university's entrepreneurial potential is determined by additional aspects (e.g. entrepreneurial culture and tradition, support efforts, etc.). Eventually, a university's potential for spin-off activity resides in the entrepreneurial intentions of its students and staff. The more these regard self-employment as a desirable career choice and the more concrete their conceptual considerations with and thoughts about starting up a business, the higher the probability that a university generates spin-off companies. Thus, it makes sense to use entrepreneurial intentions as an indicator for a university's spin-off potential:

(2) *How prevalent are **entrepreneurial intentions among the students at LUH and GAUG in comparison?***

The literature review on the elements of a capable university entrepreneurial support structure revealed that a respective support structure should be comprised of three important elements: a positive entrepreneurial climate, specific support measures (sensitization, capability supply, information supply and resource supply measures) and affiliated infrastructural facilities as well as conducive university policies on spin-off formation. The following research questions structure the comparison of LUH's and GAUG's entrepreneurial support structure. Each research question relates to one element of a capable support structure.

(3) *How can the **entrepreneurial support measures and infrastructural facilities** be characterized at LUH and GAUG in comparison?*

(4) *How can the **university policies on spin-off formation** be characterized at LUH and GAUG in comparison?*

(5) *How can the **entrepreneurial climate** be characterized at LUH and GAUG in comparison?*

2.4 Data

In this paper, the entrepreneurial potential and the entrepreneurial support structures of Leibniz Universität Hannover (LUH) and Georg-August-Universität Göttingen (GAUG) are compared. Thereby, three kinds of data are used. First, the comparison of the general university characteristics of LUH and GAUG as indicators for their entrepreneurial potential (Research Question 1) relies on official data provided by the two universities. However, official information is insufficient for the evaluation of actual entrepreneurial potential among the universities' students as well as for the evaluation of the universities' entrepreneurial support structures. Thus, the official information was supplemented with (2) qualitative data from semi-structured interviews with key informants on both universities' entrepreneurial support structures as well as with (3) quantitative data from a students' survey. In the following, these two data sources are explained in detail.

2.4.1 Interviews with key informants⁸

The interviews with key informants provide information on the characteristics of LUH's and GAUG's entrepreneurial support measures and associated infrastructural facilities (Research Question 3) as well as on both universities' general policies on spin-off formation (Research Question 4). The primary data collection included semi structured face-to-face interviews with 25 (LUH: 13, GAUG: 12) key informants. As key informants persons were considered that either worked in the past in or still are affiliated with an organization and position in which they directly deal with LUH's or GAUG's entrepreneurial support structure (for more detailed information on who qualifies as key informant see Section 1.6.3). The transcribed interviews were examined using typical content analysis procedures (cf. GLÄSER/LAUDEL 2009, MAYRING 2008a, 2008b), supported by the qualitative data analysis software NVivo. As the relevant categories of a university's entrepreneurial support structure were already theoretically pre-defined (see Figure 2), the procedure of deductive category application was employed (cf. KELLE/KLUGE 1999, KUCKARTZ 2012, SCHREIER 2012). Thereby categories derived from theoretical considerations were used as a basis to structure the transcript material (see Section 1.6.4 for more information). In addition to the interviews with key informants, information from archival sources, such as the annual activity reports of the universities' technology transfer and entrepreneurship offices, studies, presentations, brochures and strategy documents were collected and analyzed.

2.4.2 Quantitative data from students survey

In order to analyze the students' perceptions of the entrepreneurial support measures and associated infrastructural facilities (Research Question 3) and entrepreneurial climate (Research Question 5) as well as the entrepreneurial potential among the students (Research Question 2) at the two universities, a quantitative research design was chosen. The data was collected within the framework of the research project "Global University Entrepreneurial Spirit Students' Survey" (GUESSS). GUESSS is an international annual online survey, which evaluates the entrepreneurial competence and activity of Bachelor, Master and PhD students (cf. BERGMANN et al. 2012). For the current study, we use the data which was collected in

⁸ Detailed information on data and methods are already provided in the introduction of this dissertation (see Section 1.6). In order to avoid repetitions, this version of the paper includes only the most relevant information on the research design, the survey methodology as well as the data coding and analysis. For more information please refer to Section 1.6.

2011 at LUH and GAUG. In that year, both universities had the greatest number of cases in the German GUESSS with a total of 3,151 interviewed students. The response rate for LUH was 7,9 % and for GAUG 6,5 % (cf. BERGMANN et al. 2012). Compared to other online surveys addressing students (e.g. JOSTEN et al. 2008) the response rate is quite satisfactory.

In order to evaluate the entrepreneurial support measures and infrastructural facilities (Research Question 3), the students were asked whether they know and attended entrepreneurial programs at the university. According to the assessment of the entrepreneurial climate (Research Question 5), the students were asked how much they agree with the statement, that there is a favorable climate and premises for becoming an entrepreneur at their university. For the rating of the entrepreneurial climate a seven point Likert scale from 1 = “strongly disagree” to 7 = “strongly agree” was used. Regarding the entrepreneurial potential (second research question), the students were asked to indicate if and how seriously they have been thinking about founding a business. Here, a nine point Likert scale from 1 = “never” to 9 = “I have already founded more than one company” was used.

In the analyses the students of the two universities are differentiated according to their fields of studies. The fields of studies comprise three broad categories: business and economics, natural sciences, and social sciences. The field of business and economics comprise economics, management and business administration. The field of natural science include medicine, health science, mathematics, natural sciences, engineering sciences, architecture, computer sciences and informatics. Thus, the category of natural sciences includes the so-called MINT subjects, which are considered to have a high entrepreneurial potential. The category of social sciences comprise linguistics, religion, philosophy, psychology, education, pedagogy, sociology, political science and other social sciences.

Furthermore, it should be noted that the students’ entrepreneurial intentions might also influence the field of study a student chooses, the perception of the entrepreneurial climate and the perception of the entrepreneurial support measures. The students are therefore also differentiated according to their entrepreneurial intentions. They are divided into three types: students without entrepreneurial intentions, students with entrepreneurial intentions and active founders. Students without entrepreneurial intentions never or only sketchily thought about founding a company. Students with entrepreneurial intentions have at least repeatedly thought about starting a business or have already started to found a company. Active founders are students, who are already self-employed in one or more companies.

2.5 The entrepreneurial potential of LUH and GAUG in comparison

As mentioned above, universities significantly differ with regard to their entrepreneurial potential as a consequence of their general university characteristics. Section 2.5.1 compares LUH and GAUG with regard to the general characteristics that influence entrepreneurial potential. The following Section 2.5.2 directly addresses the entrepreneurial intentions of both universities' students as indicator for entrepreneurial potential.

2.5.1 General university characteristics

This section compares LUH's and GAUG's general characteristics regarding size, tradition and nature of research and teaching as well as the role of industry-funded research. All three characteristics significantly determine the spin-off dynamics of a university and can thus be used as indicators for entrepreneurial potential (cf. DI GREGORIO/SHANE 2003, LANDRY et al. 2006, LOCKETT/WRIGHT 2005, O'SHEA et al. 2005a, O'SHEA et al. 2008, POWERS/MCDOUGALL 2005, SHANE 2004a, WRIGHT et al. 2004, ZUCKER et al. 1998).

Regarding enrolment rates as an indicator for size, LUH and GAUG are the two biggest universities in the German Bundesland Lower Saxony. In October 2011, 25,459 students (including PhD students) were enrolled at GAUG (including its medical center) (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2014a) and 21,530 students (including PhD students) studied at LUH (cf. LEIBNIZ UNIVERSITÄT HANNOVER 2012). Both universities belong to the larger German universities, while GAUG ranks 22nd and LUH 31st among the 110 universities in Germany⁹ (cf. FEDERAL BUREAU OF STATISTICS 2014). In regards to scientific staff, GAUG has 3,972 scientists¹⁰ and is considerably larger than LUH with 2,509 (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2014b, LEIBNIZ UNIVERSITÄT HANNOVER 2012).

⁹ The list includes private universities but no universities of applied sciences, theological colleges, art colleges, universities of public administration and universities of education.

¹⁰ It has to be taken into account that the number for GAUG includes 1,545 employees at its medical center.

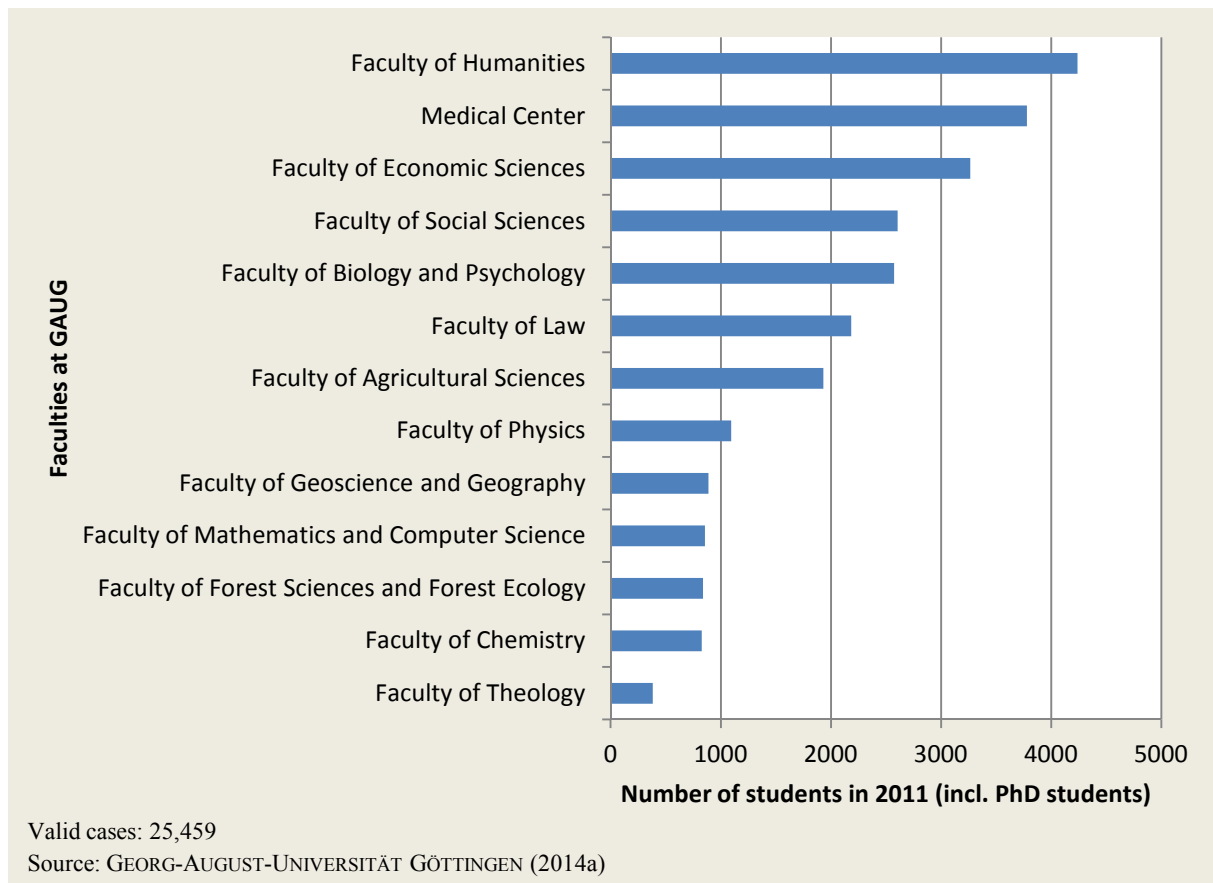


Figure 3: Number of students at GAUG according to faculties

There are considerable differences in the tradition of research and teaching between the two universities, which are still mirrored in faculty structure, education programs and research focus. While GAUG also offers natural sciences, it traditionally has a stronger focus on humanities, social sciences, economic sciences and law. These faculties belong to the six largest among GAUG's 13 faculties, when considering the number of students (see Figure 3). A specialty of GAUG is that it includes a medical center, which is the second largest faculty. However, GAUG has no research or teaching program in technical subjects (e.g. mechanical, civil or electrical engineering) (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2014a).

On the other hand, LUH traditionally has a focus on technical subjects, while also offering programs in natural sciences, social sciences, humanities, law, economics and management. In fact, one third of all students are enrolled in the Faculties of Mechanical Engineering, Electrical Engineering and Computer Science, Civil Engineering and Geodetic Science or Architecture and Landscape Sciences (see Figure 4). In contrast to GAUG, LUH does not have a medical center (cf. LEIBNIZ UNIVERSITÄT HANNOVER 2012).

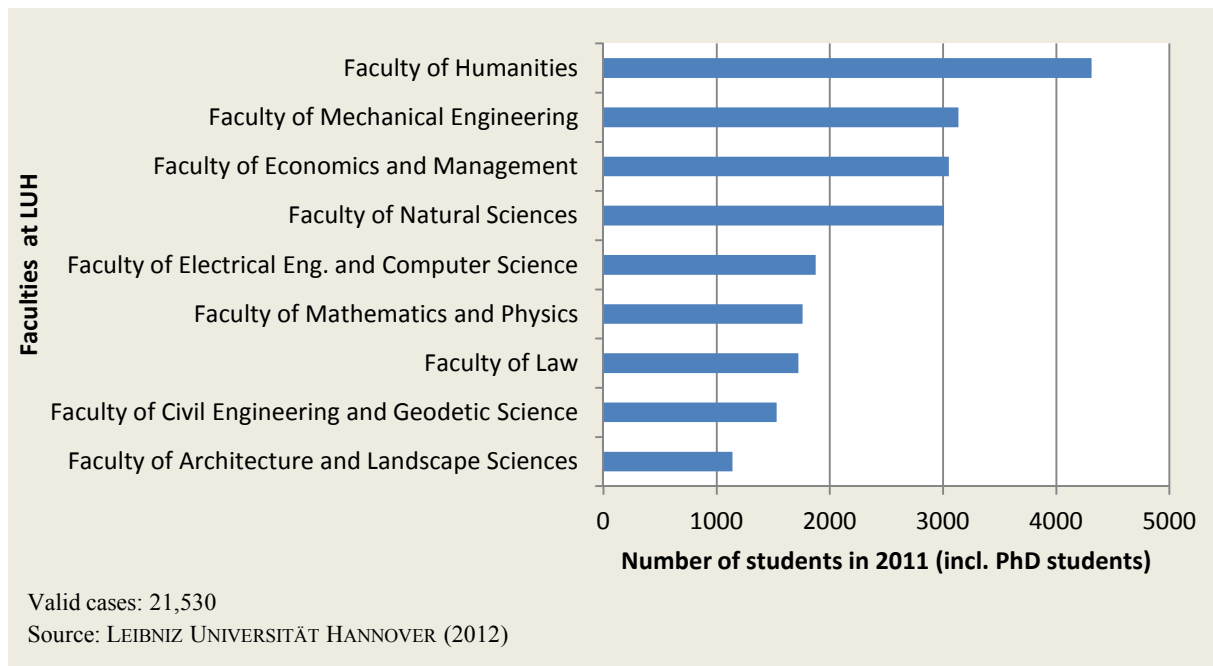


Figure 4: Number of students at LUH according to faculties

As already mentioned above, not all scientific disciplines are equally inclined towards commercialization and spin-off formation. In general, technical sciences (e.g. mechanical, civic and electrical engineering, architecture), natural sciences (e.g. chemistry, biology, physics), medical sciences, economics and management are considered to have a higher spin-off potential than humanities or social sciences (cf. O'SHEA et al. 2005a). When aggregating the number of students in the different faculties into these broad scientific disciplines, the universities' structural differences are revealed (see Figure 5). While LUH's strengths in comparison to GAUG are the technical sciences, GAUG has more students in natural and medical sciences as well as in the aggregated category of humanities, law, social sciences and theology (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2014a, LEIBNIZ UNIVERSITÄT HANNOVER 2012).

In spite of these structural differences, LUH and GAUG have a similar spin-off potential when considering the total number of students in technical, natural and medical sciences (so-called MINT subjects¹¹) as well as economics and management. The number of students enrolled in MINT subjects is 12,447 at LUH and 12,787 at GAUG. The respective numbers for students enrolled in economics and management are 3,050 at LUH and 3,264 at GAUG. The share of students enrolled in MINT subjects is higher at LUH than at GAUG. This is due to the fact that a considerable higher number of students is enrolled in humanities, law, social

¹¹ MINT subjects include mathematics, computer science, natural science and engineering. They are comparable to the STEM fields used in English. These comprise science, technology, engineering and mathematics. In the following also medical sciences is included.

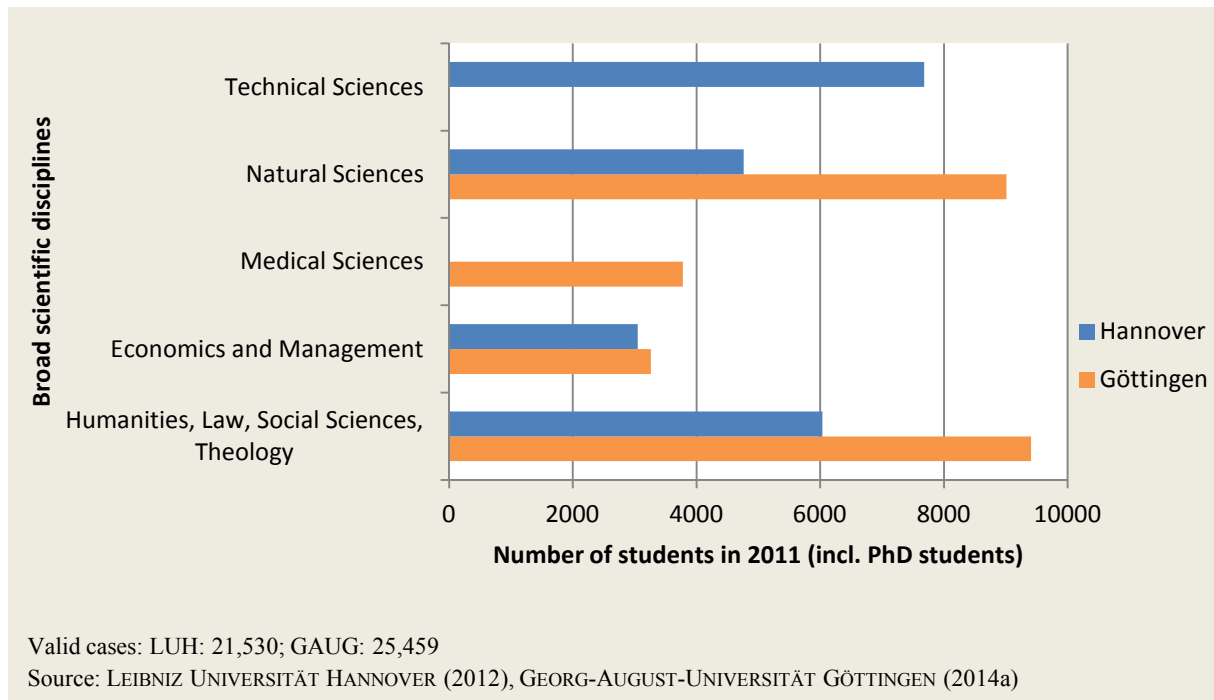


Figure 5: Number of students at LUH and GAUG according to broad scientific disciplines

sciences and theology at GAUG (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2014a, LEIBNIZ UNIVERSITÄT HANNOVER 2012).

The differences between the two universities regarding their scientific disciplines also apply for their scientific staff (see Figure 6). While LUH has a comparative advantage in technical sciences, GAUG employs more scientists in the areas natural sciences, medical sciences, humanities and law (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2014b, LEIBNIZ UNIVERSITÄT HANNOVER 2012).

As mentioned above, studies suggest that a university's ability to successfully attract external third party research funding, especially industry funding will increase the probability of generating spin-off companies. The rationale is that results from industry funded research are in general more commercially usable than those that are publicly funded (cf. BLUMENTHAL et al. 1996). Regarding this issues LUH performs better than GAUG. In 2011 LUH raised industry-funds in the amount to 13.1 Mio. Euro, which constitutes 3.3% of its overall revenues (cf. LEIBNIZ UNIVERSITÄT HANNOVER 2012). The industry funds at GAUG are considerably lower at 8.8 Mio. Euro. The share of industry funds of GAUG's overall revenues is 0.8%. This low share is due to the high amount of public funding for its medical center. However, when excluding the medical center from the calculations the share is still only at 1.6% (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2012).

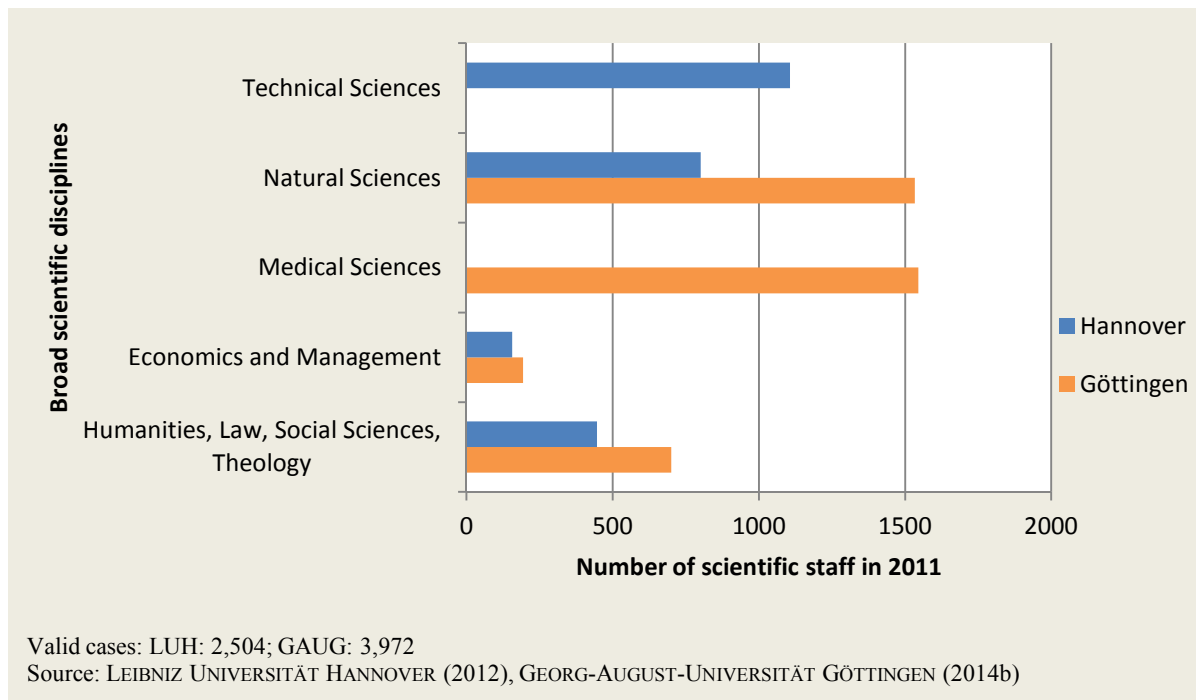


Figure 6: Number of scientific staff at LUH and GAUG according to broad scientific disciplines

2.5.2 The entrepreneurial intentions among LUH's and GAUG's students

As explained above, a university's potential for spin-off activity eventually resides in the entrepreneurial intentions of its students and staff. The more these regard self-employment as a desirable career choice and the more concrete their conceptual considerations with and thoughts about starting up a business, the higher the probability that a university generates spin-off companies. Thus, it makes sense to use entrepreneurial intentions as an indicator for the comparison of LUH's and GAUG's spin-off potential.

In the scope of the quantitative students survey GUESSS, students at both universities were asked if and how seriously they had been thinking about founding a company. The results indicate that at both universities there is quite an entrepreneurial potential, which could be further mobilized (see Figure 7).

On the one hand, a large share of students has never or only sketchily thought about founding a company (colored orange). The share of these students, who have no entrepreneurial intention, is 70 % at GAUG and 60 % at LUH. With this rate LUH corresponds roughly to the average of all German universities (55 %), while GAUG is above average (cf. BERGMANN et al. 2012). The reason for the lack of entrepreneurial intention can be twofold. Some of these students may have already thought about being self-employed but came to the conclusion that owning a company is not an option for them. Other students may have never thought about

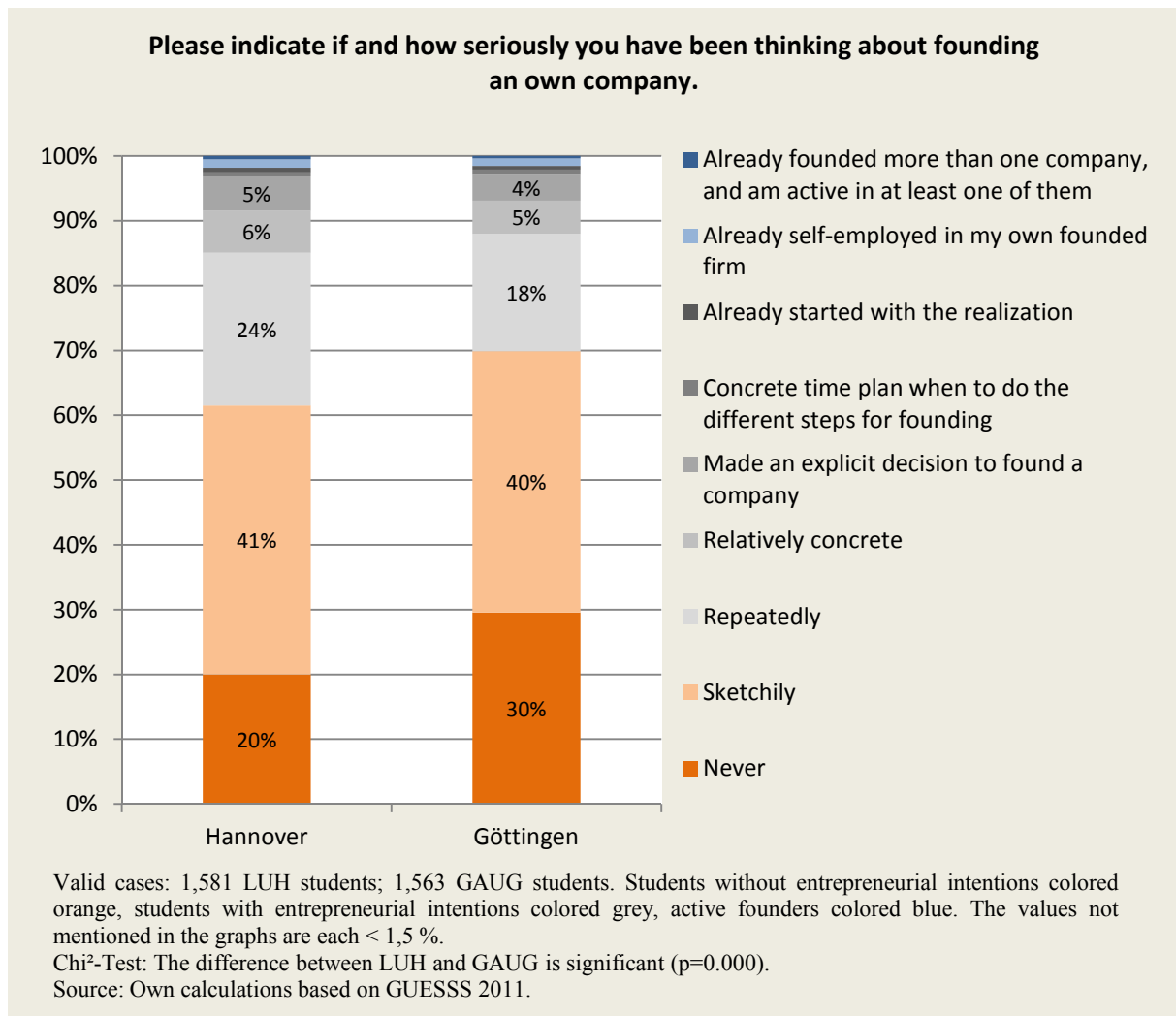


Figure 7: Entrepreneurial intentions of students at LUH and GAUG

being self-employed because they are not aware of self-employment as an equal alternative to dependent employment. Especially the second group of students may therefore be susceptible to entrepreneurial sensitization measures. When taking into account only the students who have at least sketchily thought about founding a company (around 40 %) it is quite an indication for entrepreneurial potential. On the other hand there are many students at both universities (around 29 % at GAUG and 37 % at LUH) who have already repeatedly or even more concretely thought about founding a company (colored grey). These students with entrepreneurial intentions may profit from entrepreneurial programs at the university, especially from information and capability supply measures. At the same time, only a very small minority of students of only 2 % at both universities is already involved in starting up a business (colored blue). For this group of students, capability and resource supply measures would be helpful.

In order to evaluate to what extent entrepreneurial potential exists within different fields of studies the question of how seriously the students have been thinking about founding a company is crossed with the three fields of subjects: business and economics, natural sciences and social sciences (see Figure 8). Regarding the three broad fields of studies, the share of students, who have never thought about starting up a business, is generally higher in the field of social sciences at both universities. Students of business and economics have the lowest share of individuals, who have never thought about founding a company and the largest share of individuals, who have thought about founding a company, at least sketchily to relatively concretely. This is, by definition, not surprising and fits with the dominant culture of the respective fields of studies. In the field of natural sciences the pattern of the students' entrepreneurial intentions differs between LUH and GAUG. At GAUG the natural sciences

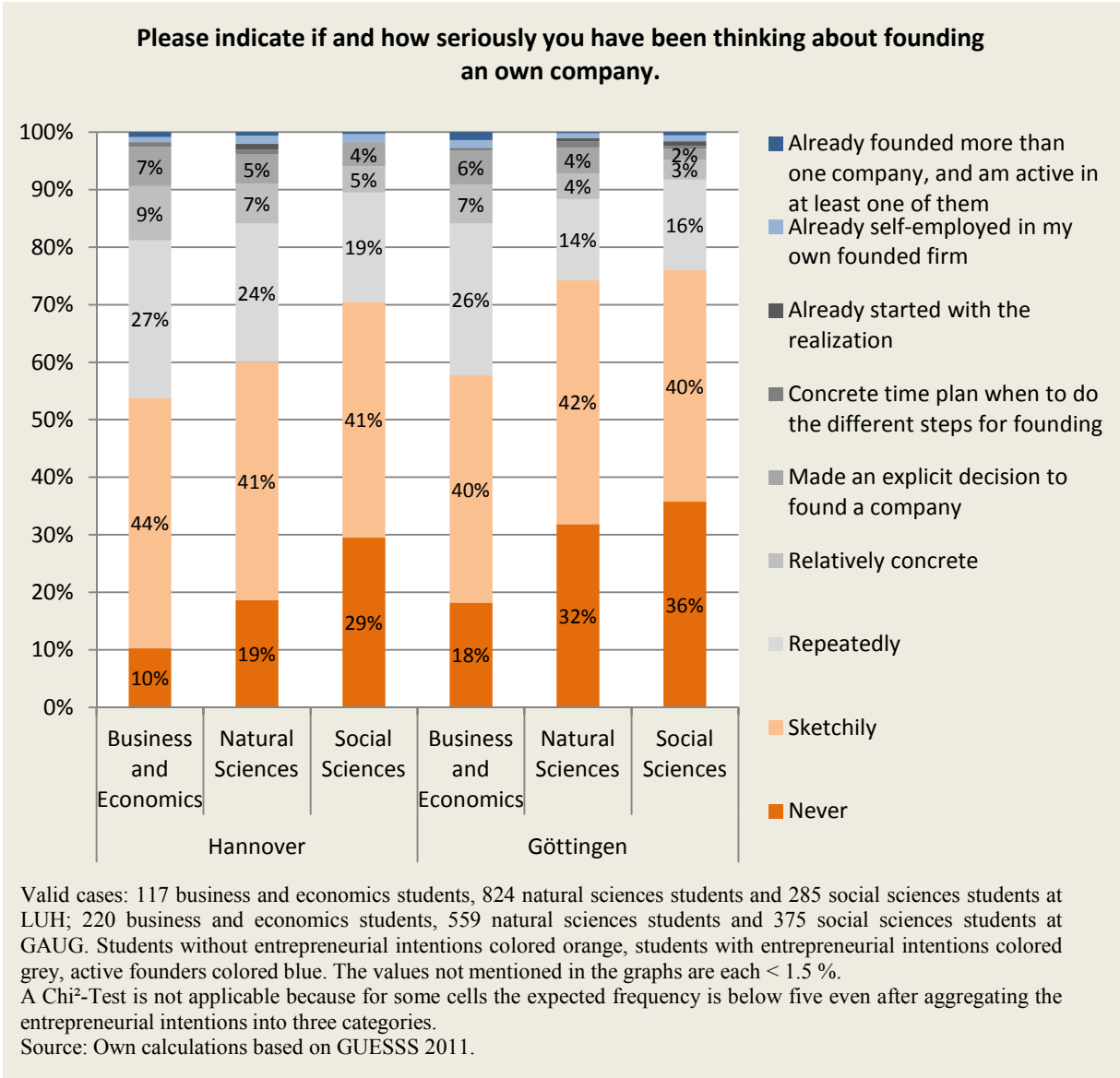


Figure 8: Entrepreneurial intentions of students at LUH and GAUG according to fields of study

students have similarly low entrepreneurial intentions as the social sciences students, while at LUH the natural sciences students have on average higher entrepreneurial intentions. This may have different reasons. LUH offers technical study programs which are summarized in the field of natural sciences in this study. In national comparison the rate of technical science students at LUH with entrepreneurial intentions ranks among the top three (cf. BERGMANN et al. 2012). However, GAUG contains medicine, which is also predestinated for becoming self-employed.

Summarizing the comparison of entrepreneurial potential at LUH and GAUG, the results regarding general university characteristics suggest that both universities have similar prerequisites for spin-off activity when regarding the number of students in subjects common for entrepreneurial activity (MINT-subjects as well as economics and business administration). However, when considering industry funded research as an indicator, LUH performs considerably better than GAUG. Furthermore, the analysis of entrepreneurial intentions of students suggest that the majority of students at both universities have at least sketchily thought about starting up a business. Thus, there seems to be a large entrepreneurial potential at both LUH and GAUG which is still unused and probably not yet well addressed by entrepreneurial support measures. This entrepreneurial potential is slightly larger at LUH than at GAUG.

2.6 The entrepreneurial support structures at LUH and GAUG in comparison

This chapter describes the entrepreneurial support structures at LUH and GAUG in the year 2011. As illustrated in Section 2.2, a capable university entrepreneurial support structure should be comprised of three elements: a positive entrepreneurial climate, entrepreneurship related support measures and affiliated infrastructural facilities, as well as conducive university policies on spin-off formation. In the following these three elements are characterized. Section 2.6.1 compares LUH's and GAUG's entrepreneurship support measures and associated infrastructural facilities. Section 2.6.2 describes both universities' general policies on spin-off formation. Section 2.6.3 evaluates the entrepreneurial climate at both universities.

2.6.1 Support measures and associated infrastructural facilities

As explained in Section 2.2, one important element of a capable university entrepreneurial support structure are its entrepreneurship support measures and associated infrastructural facilities. These can help to increase the entrepreneurial activity at a university and the quality of its spin-offs (cf. FINI et al. 2011, KULICKE et al. 2011). Section 2.6.1.1 shows how these can be described at LUH and GAUG. However, not only the existence and quality of support measures per se are important. Instead, it is the perception of the support measures by a university's students and scientists which translates into spin-off activity. Thus, Section 2.6.1.2 analyzes, how aware both universities' students are about the existence of entrepreneurship support measures and whether they have made use of them.

2.6.1.1 Description of the status quo

At both universities various spin-off support measures and associated infrastructural facilities have existed for more than ten years. Thereby, the central and most important infrastructural facility at both universities are their entrepreneurship offices. The entrepreneurship offices' general aim is to increase the number of innovative and marketable spin-off companies (cf. TTO Presentation at Executive Committee Meeting 2012, KEY INFORMANT (KEY INF.) 13, KEY INF. 14). The entrepreneurship offices of both universities are affiliated with the universities' technology transfer offices (cf. KEY INF. 2, KEY INF. 9, KEY INF. 14). The entrepreneurship office at LUH comprises two employees (equivalent to 1.5 full-time positions) and is financed by a German federal spin-off support program (EXIST) as well as a

support program of the federal state Lower Saxony (Gründercampus plus). The entrepreneurship office at GAUG also has two employees (equivalent to 1 full-time position), financed by the university budget as well as the European Regional Development Fund (ERDF).

At both universities the entrepreneurship offices are in charge of organizing the universities' entrepreneurial support measures. Overall, these are well developed. All of the important support measures listed in Section 2.2 exist: sensitization, information supply, capability supply as well as resource supply measures.

The entrepreneurship sensitization measures at both universities have three intentions. Firstly, as sensitization measures are those support measures that are most visible and therefore most easily perceived by students, scientists and external individuals, they aim at "...putting the topic on the agenda of the university." (cf. KEY INF. 2), according to one employee of the entrepreneurship office at LUH. The second aim is to increase the awareness of self-employment as a possible and desirable career choice among the students and staff and thus to mobilize as many of them to start-up a company. The idea is that as a side effect the motivation and attitudes towards entrepreneurship are improved, with the intention to establish a positive entrepreneurial climate at the universities. Thirdly, the sensitization efforts aim at making the information supply, capability supply and resource supply measures of the entrepreneurship offices known among the students and staff. In order to reach these aims, the entrepreneurship offices at both universities implement various activities, such as maintaining information desks within the university buildings, the distribution of information flyers and posters, the presentation of its programs and of successful spin-off entrepreneurs in lectures, seminars and at different university events (e.g. the orientation week in the beginning of each semester, events regarding career planning and job fairs), as well as intensive public relations (cf. KEY INF. 2, KEY INF. 14, KEY INF. 20).

A comparative advantage of LUH's entrepreneurial sensitization measures is the employment of four professional start-up scouts (Gründungsscouts) within the faculties of natural sciences, mechanical engineering, electrical engineering and computer sciences, as well as mathematics and physics. In addition to the above mentioned centralized sensitization and mobilization activities, the start-up scouts' task is to implement the topic of spin-off formation and self-employment within the faculties. Therefore they actively visit lectures and seminars, organize faculty specific events and stay in close personal contact with students and scientists (cf. KEY INF. 9, TTO Presentation at Executive Committee Meeting 2012). As several key informants

state, the employment of the start-up scouts turns out to be a very successful and effective sensitization measure (cf. KEY INF. 2, KEY INF. 9, KEY INF. 23). In contrast, GAUG has no such professional scouts on faculty level.

The spin-off support measures of both universities have very well developed information supply measures. By offering personal advisory and consultation programs, (potential) spin-off entrepreneurs are equipped with expertise and assistance in the following areas: assessment of the technological and commercial market potential of the business idea, customer acquisition, support and financing opportunities, application to support programs, legal protection and ownership rights, as well as business plan development. In general, the spectrum of the entrepreneurship offices' activities ranges from a first consulting session to a longer term supporting accompaniment. However, in practice, the focus usually is on initial advice, while for more in-depth assistance in particular fields, (potential) academic entrepreneurs are sent to regional partners (see below) (cf. KEY INF 2, KEY INF 9, KEY INF 14, KEY INF 20, TTO Presentation at Executive Committee Meeting 2012). GAUG's information supply measures are furthermore upgraded by the existence of a university affiliated organization (MBM ScienceBridge), which is specialized in issues such as legal protection, ownership rights as well as patenting of university knowledge and technologies (cf. KEY INF. 14, KEY INF. 20).

As explained in Section 2.2, a university may not only provide information but also set up (potential) spin-off entrepreneurs with the necessary skills and capabilities within the framework of capability supply measures. These may consist of an entrepreneurship education program within a university's curricula or training and qualification programs for those students or scientists in the process of setting up a business. The entrepreneurship office at LUH organizes quite a range of trainings and qualification programs, including workshops in areas such as business plan development or legal protection (cf. KEY INF. 2). In contrast, the entrepreneurship office at GAUG offers qualification and training programs only at a very small scale. Instead, (potential) spin-off entrepreneurs who demand qualification are usually sent to regional partners, such as the local chamber of industry and commerce (see below) (cf. KEY INF. 14). Regarding curricular entrepreneurship education both universities do not have a conclusive entrepreneurship program. However, their curricula includes seminars on entrepreneurship related topics that are optional for students. In this respect, a major shortcoming of the entrepreneurial support structures at both universities is that they do not have an entrepreneurship professorship as an infrastructural facility (cf. KEY INF 2, KEY INF. 9, KEY INF. 14).

As explained in Section 2.2, universities can supply (potential) spin-off entrepreneurs directly with scarce but necessary financial or material resources. In the case of LUH and GAUG, these resource supply measures are the less developed within the four measures of support. Regarding financial resources, GAUG together with industry partners established a university venture capital fund (Innovations-Capital Göttingen GmbH) in 2001, as the first university in Germany. Its focus is on pre-seed, seed and start-up capital for academic entrepreneurs from the areas of life sciences, physics and other natural sciences. However, the funds' impact can be considered to be rather limited, as it has invested only in a very small number of companies since its establishment. As a consequence of financial losses, the venture capital fund has been inactive for several years (cf. KEY INF. 14, KEY INF. 16, KEY INF. 19, KEY INF. 20). LUH has never established a venture capital funding or invested equity into a spin-off company, partly due to financial constraints and different priorities of investments (e.g. research personnel or facility infrastructure) (cf. KEY INF. 1, KEY INF. 7, KEY INF. 12).

In addition to the inadequacies regarding financial resource supply capabilities, the material resource supply capabilities are also underdeveloped at both universities. In particular, they both lack a business incubator with office space on the campus. In order to compensate for this infrastructural gap, the entrepreneurship offices support the use of office space and scientific equipment within the universities' institutes and departments (cf. KEY INF. 7, KEY INF. 9, KEY INF. 20). In addition, several business incubators and technology parks exist in both university regions, to which academic entrepreneurs have access and are sent to by the universities' entrepreneurship offices (cf. KEY INF. 1, KEY INF. 2, KEY INF. 7, KEY INF. 8, KEY INF. 9, KEY INF. 13, KEY INF. 20). LUH's material resource supply capability especially profits from two university affiliated institutes. The Hannover Centre for Production Technology (PZH) and the Laser Center Hannover (LZH) provide office space and access to laboratories and scientific equipment for start-ups in the sectors of production and laser technology (cf. KEY INF. 1, KEY INF. 2, KEY INF. 8, KEY INF. 9, KEY INF. 13). GAUG's material resource supply capability profits from an incubator of another higher education institution in the direct neighborhood of the campus, to which also university spin-off entrepreneurs have access, provided the incubator has capacities (cf. KEY INF. 14, KEY INF. 15, KEY INF. 20).

As laid out in Section 2.2, the entrepreneurship expertise and infrastructure within the regional context can serve as an additional source of information, skills and resources for (potential) spin-off entrepreneurs. Thus, a university should assist (potential) spin-off entrepreneurs in connecting with the respective actors by establishing and cultivating

networks (cf. O'SHEA et al. 2005a, SHANE 2004a). In fact, such a network approach is an important aspect of the entrepreneurial support structures at LUH and GAUG. In this respect, many information and capability supply measures are organized and realized in close cooperation with regional partners, such as Hannover's and Göttingen's economic development agencies, local banks or the chamber of industry and commerce (cf. KEY INF. 2, KEY INF. 6, KEY INF. 9, KEY INF. 10, KEY INF. 12, KEY INF. 13, KEY INF. 14, KEY INF. 15, KEY INF. 20). Further cooperation occurs as the universities' entrepreneurship offices send (potential) spin-off entrepreneurs to regional partners for in-depth consultation and advisory (cf. KEY INF. 2, KEY INF. 9, KEY INF. 14, KEY INF. 20, TTO Presentation at Executive Committee Meeting 2012). Also, as already indicated above, regional organizations serve as a substitute for the universities' inadequacies regarding resource supply facilities, especially a university incubator (cf. KEY INF. 1, KEY INF. 2, KEY INF. 7, KEY INF. 8, KEY INF. 9, KEY INF. 13, KEY INF. 14, KEY INF. 15, KEY INF. 20). In the case of GAUG, regional partners are particularly important regarding its limited entrepreneurship qualification programs. In this respect, (potential) spin-off entrepreneurs demanding qualification programs are sent to regional partners, such as the chamber of industry and commerce (cf. KEY INF. 14, KEY INF. 15, KEY INF. 20).

In summary, the characteristics of the universities' entrepreneurial support measures as well as the affiliated infrastructural facilities are quite similar (see Table 2). At both universities the support measures are well developed and a number of sensitization, information supply, capability supply and resource supply measures are offered. In regards to the start-up scouts within the faculties, the sensitization efforts are more sophisticated at LUH than at GAUG. Furthermore, the programs regarding qualification and training are broader at LUH. While the support measures can be considered an asset of the support structure at both universities, the affiliated infrastructural facilities represent a serious inadequacy. While both universities have technology transfer offices and entrepreneurship offices, they lack an entrepreneurship professorship as well as an incubator. This shortcoming can at least partially be compensated by the well developed regional network. The cooperation with regional partners plays therefore an important role for the realization of the different support programs.

Table 2: Overview on the entrepreneurial support measures and infrastructural facilities at LUH and GAUG

		LUH	GAUG
Support measures	Sensitization measures	(+) Start-up scouts within faculties	
	Information supply measures	(+) Regional network	(+) Regional network
	Capability supply measures	(+) Wide range of programs	(-) Only few qualification programs
		(+) Optional seminars on entrepreneurship related topics	(+) Optional seminars on entrepreneurship related topics
		(+) Regional network	(+) Regional network
	(-) No conclusive curricular entrepreneurship education	(-) No conclusive curricular entrepreneurship education	
Resource supply measures	(+) Use of university infrastructure possible	(+) Use of university infrastructure possible	
	(+) Regional network	(+) Regional network	
	(-) Least developed support measure	(-) Least developed support measure	
	(-) Infrastructural facilities underdeveloped	(-) Infrastructural facilities underdeveloped	
Infrastructural facilities	Technology Transfer Office		
	Entrepreneurship Office		
	Entrepreneurship Professorship		
	University incubator		
	Venture Capital Funds		(-) Fund is inactive

Grey: Support measure/infrastructural facility exists at respective university.

White: Support measure/infrastructural facility does not exist at respective university.

(+) Particularly positive feature

(-) Particularly negative feature

Source: Results of the interviews with key informants from LUH and GAUG in 2011.

2.6.1.2 The perception of the support measures by LUH's and GAUG's students

As explained above, the entrepreneurial support measures at LUH and GAUG are well developed. However, the best support measures are worthless if they are not perceived by the students. Thus, in the following it is analyzed to which degree the students at LUH and GAUG are aware of the existence of entrepreneurial support programs at their university and to what extent they attend these. Respective questions were asked in the scope of GUESSS. The categories of entrepreneurial programs in GUESSS comprise entrepreneurial lectures and seminars on entrepreneurship in general, business planning, innovation and idea generation, financing entrepreneurial ventures, technology entrepreneurship, entrepreneurial marketing, social entrepreneurship or family firms as well as entrepreneurial networks and coachings including workshops and networking with experienced entrepreneurs, a contact point for entrepreneurial issues, business plan contests and workshops, mentoring and coaching programs for entrepreneurs and contact platforms with potential investors. For the sake of clarity, the entrepreneurial programs are aggregated in the following figures.

When comparing the total awareness of and participation in the entrepreneurial programs at LUH and GAUG it becomes clear that LUH performs slightly but significantly better than GAUG (see Figure 9). At LUH three quarters of the students know about the entrepreneurial programs and one third of the students have attended at least in one of the entrepreneurial programs. At GAUG the shares are lower: only 63 % of the students have heard about the entrepreneurial programs and 22 % have taken part. A conceivable explanation for this result

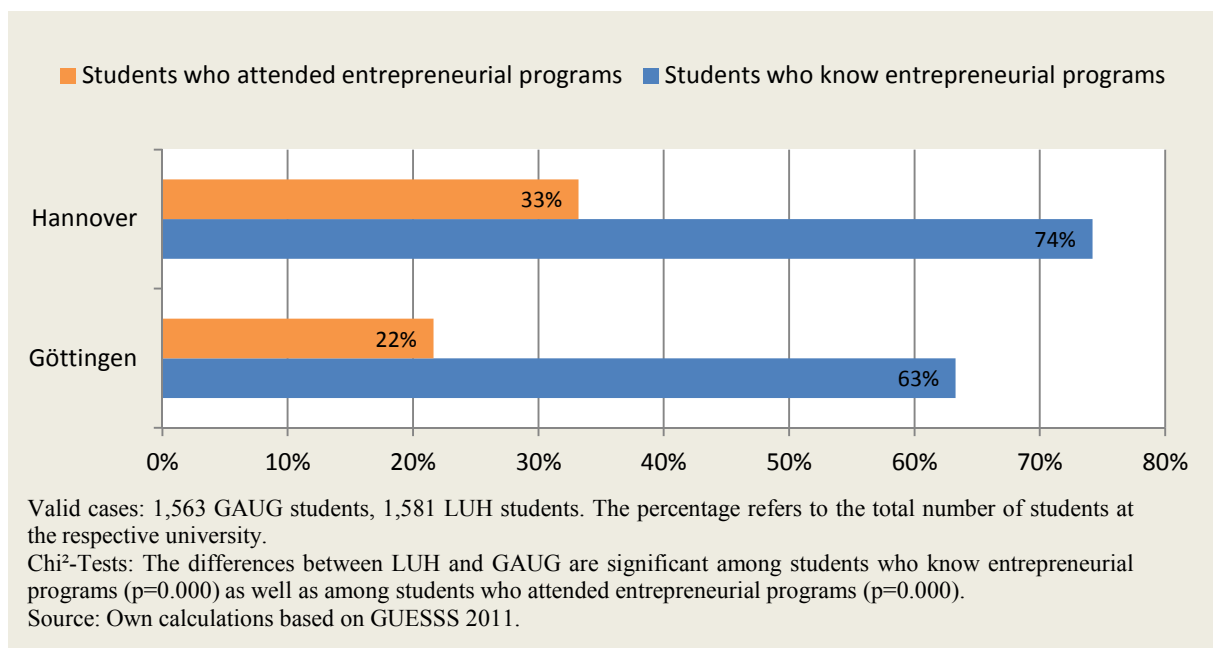


Figure 9: Awareness of and participation in entrepreneurial programs at LUH and GAUG

is that the advertisement of the entrepreneurial programs at LUH is better than at GAUG. However, if only the awareness of each single entrepreneurial programs at the two universities is selected, GAUG and LUH remain below the German average (cf. BERGMANN et al. 2012).

In the following analyses not only the two universities are compared but the results are also distinguished for three different fields of studies (social sciences, business and economics, natural sciences) and three forms of entrepreneurial intentions (students without entrepreneurial intention, students with entrepreneurial intentions and active founders). The reason for this is that a correlation is expected between the students' perceptions of the entrepreneurship support offerings and their field of study or entrepreneurial intention.

Figure 10 shows the awareness of and participation in entrepreneurial programs at LUH and GAUG distinguishing between three different fields of studies: social sciences, natural sciences as well as business and economics. A closer look at the different fields of studies reveals large disparities. As it is to be expected, the business and economics students are best informed in the entrepreneurial programs at both universities. Their curriculum comprises lectures and seminars on entrepreneurship, at least as an optional subject. This is why the vast majority of around 90 % of the business and economics students know about the entrepreneurial programs at university. However, the share of students who then took part in one of these programs is substantially lower with 45 % at GAUG and 61 % at LUH. This difference is statistically significant.

For the other two fields of studies the situation is different. At LUH the social science students know and use the programs the least. The disparity between knowing (70 %) and attending (21 %) is also highest. In the field of natural sciences three quarters of the students have heard about the programs, while one third have used them. In contrast, at GAUG the field of natural sciences scores rather poorly. Only the half of the students knows about the entrepreneurial programs and only one in ten has attended. Although the field of social sciences performs slightly better, the result can be improved. 63 % of the social sciences students know about the programs but only 16 % have made use of them. Here the disparity between knowing and attending is remarkably high.

The results indicate that there is further upward potential at both universities for raising the awareness of and participation in the entrepreneurial programs. At GAUG improvements are required in the fields of natural and social sciences. Especially natural science students, which include in this case medicine, have naturally a high entrepreneurial potential, so that a better

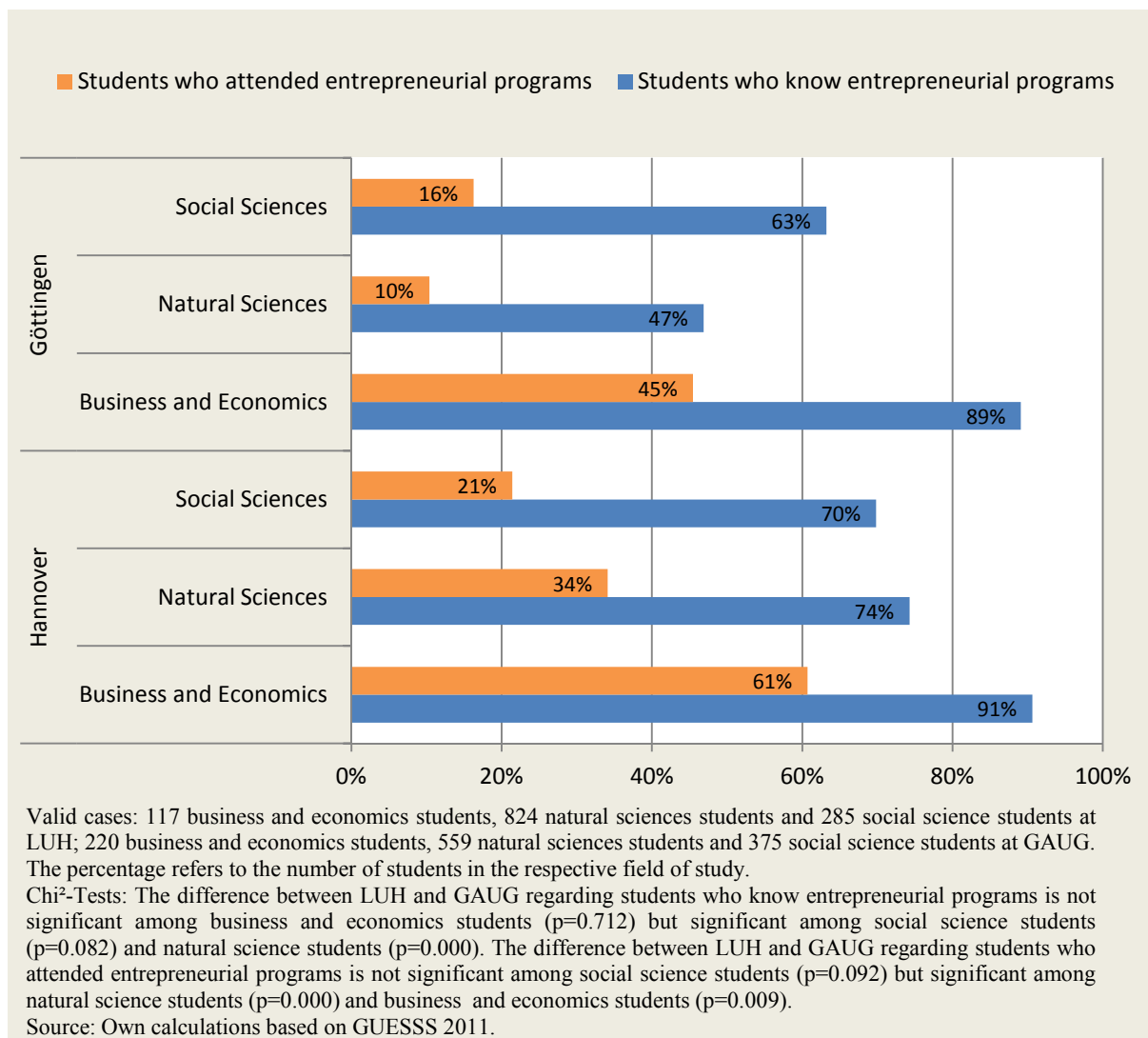


Figure 10: Awareness of and participation in entrepreneurial programs at LUH and GAUG according to fields of study

perception of the entrepreneurial programs may have a significant impact on the entrepreneurial activity at the university. While LUH fares better overall, it does still have upward potential in the fields of social sciences.

A correlation is also expected to exist between the students' perceptions of the entrepreneurial programs and their entrepreneurial intentions. Students who are not interested in the topic of entrepreneurship may not pay much attention to these programs. Therefore, Figure 11 shows the awareness of and participation in entrepreneurial programs distinguishing students' entrepreneurial intentions: students without entrepreneurial intentions, students with entrepreneurial intentions and students who are already involved in starting up a business.

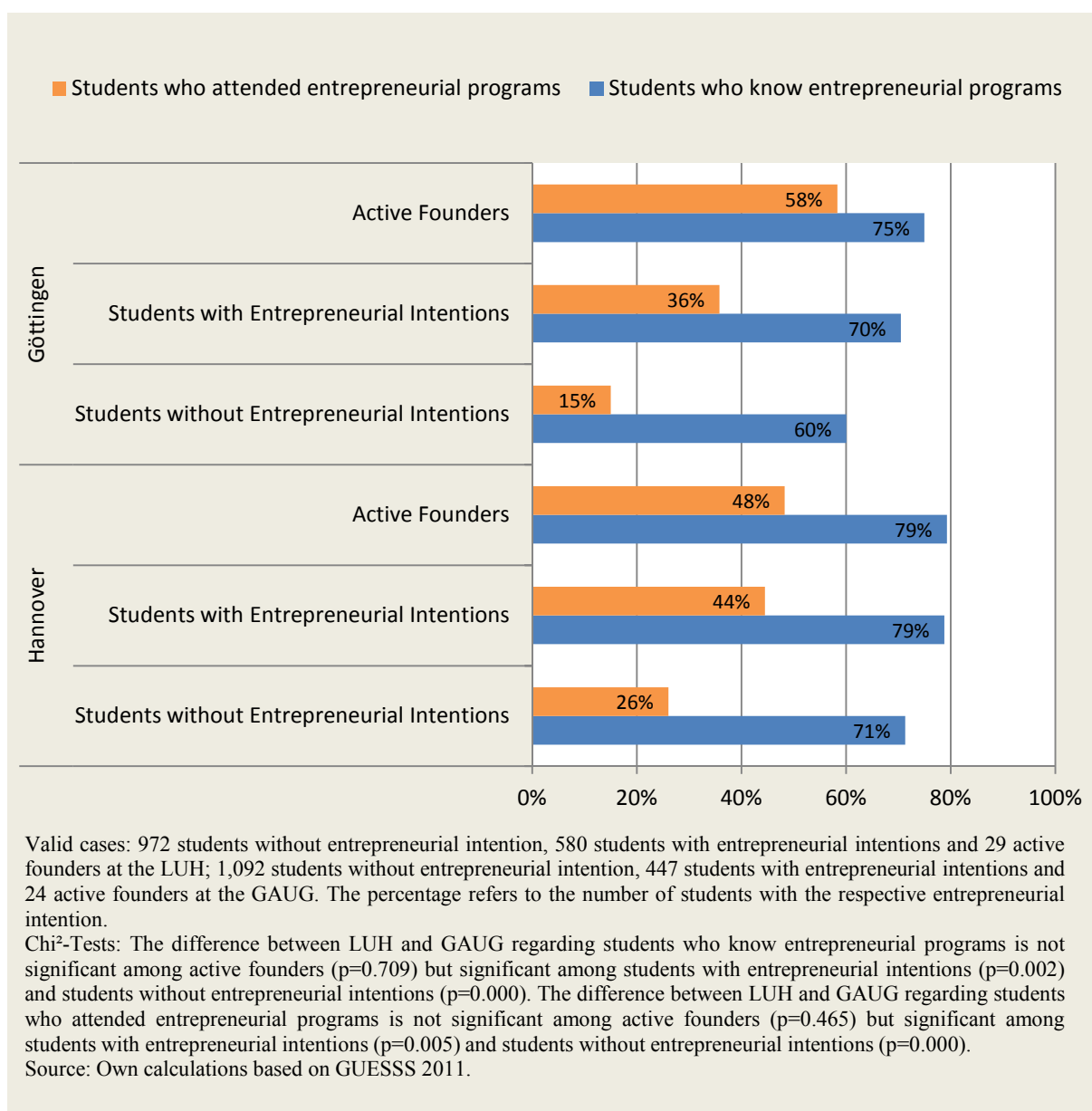


Figure 11: Awareness of and participation in entrepreneurial programs at LUH and GAUG according to the entrepreneurial intentions of students

Principally, it can be concluded that the share of students knowing or attending entrepreneurial programs increases with rising entrepreneurial intention. However, there is a small exception for LUH. Here, the share of students with entrepreneurial intentions knowing about the entrepreneurial programs is same as that of active founders (79 %).

Furthermore, the variance of the share of students knowing is not as large as the variance of the share of students attending the entrepreneurial programs. At LUH the share of students knowing the programs is between 71 % and 79 %. At GAUG the share lies between 60 % and 75 %. The share of students attending the entrepreneurial programs increases with rising entrepreneurial intention from 15 % to 58 % at GAUG and 26 % to 48 % at LUH.

Also, the gap between the awareness and participation becomes smaller with increasing entrepreneurial intention. In the case of GAUG, 60 % of the students without entrepreneurial intentions know about the programs while only 15 % take part in such programs. In utmost contrast, 75 % of the active founders are aware of the programs while 58 % make use of them. The pattern is similar but weaker for LUH.

In summary, the total awareness of and participation in the entrepreneurial programs is quite satisfactory at LUH. The situation at GAUG is slightly but significantly less favorable. However, it is important to bear in mind that although the entrepreneurial measures and infrastructural facilities normally focus on the business and economics as well as MINT subjects (e.g. the results of the accompanying research of EXIST III by KULICKE et al. 2011), the business and economics students are the ones who raise the average. This is especially true for GAUG. Furthermore, it can be summarized that students with a higher entrepreneurial intentions are more interested in the entrepreneurial programs.

In the long term the universities should aim to obtain the awareness of all students. Each student should be aware of the entrepreneurial programs and should be aware that self-employment is an equal alternative to dependent employment, whatever the student's career choice is at the end.

2.6.2 General policies on spin-off formation

As mentioned in Section 2.2, a university's climate regarding entrepreneurship as well as its entrepreneurship support measures and associated infrastructural elements can only be developed and can only function effectively when they are backed by a university's general policies on spin-off formation. These include both the general commitment of the university to the commercialization of university knowledge and technology via spin-off formation, as well as a set of specific rules, arrangements and unwritten norms that a university should establish in order to encourage its scientific staff and students to exploit intellectual property and engage in spin-off activities (cf. ASTEBRO et al. 2012, DI GREGORIO/SHANE 2003, FINI et al. 2011, SHANE 2004a).

The interviews with key informants suggest that the general commitment of the university administration for the support of spin-off formation is rather inadequate at LUH and GAUG. In the case of LUH however, the commitment supposedly had improved in the years before 2011. In this respect, the university increasingly acknowledges its role in regional

development and the relevance of commercializing university technology and knowledge (cf. KEY INF. 1, KEY INF. 2, KEY INF. 9). In fact, the topic was included to LUH's mission statement: *“We support transfer of technology, start-ups and continuing academic education.”* (cf. LEIBNIZ UNIVERSITÄT HANNOVER 2013a). In spite of this official commitment, the topic of spin-off formation still has little priority in comparison to other issues, such as assuring high quality research and teaching. In addition, other channels of knowledge and technology transfer (e.g. industry-cooperation or licensing) seem to be prioritized (cf. KEY INF. 1, KEY INF. 2, KEY INF. 9).

The subordinate role of spin-off formation for the administration at LUH finds expression in the low commitment to concrete action and/or investments. In spite of the entrepreneurship office's staff's continuous efforts to convince the administration of the necessity to install an entrepreneurship professorship, a business incubator with office space on the campus and/or a university venture capital funds, none existed at LUH until the year 2011 (cf. KEY INF. 2, KEY INF. 7, KEY INF. 9). The insufficient conclusiveness of the universities' spin-off concept as well as the underdeveloped entrepreneurship-related infrastructure (no entrepreneurship professorship, business incubator or venture capital funds) will also have long-term consequences: The federal support program funds (EXIST), which financed the start-up scouts within the four faculties, terminated in 2011, and the university's application for the follow-up program failed, mainly due to the illustrated shortcomings. Thus, it is questionable if and to what extent the intensive sensitization and mobilization efforts will be continued (cf. KEY INF. 13).

Also at GAUG, knowledge and technology transfer supposedly plays a minor role for the university's administration compared to issues like assuring high quality education and research. One of the reasons for this is probably the university's successful application for the Excellence Initiative of the German Federal Ministry of Education and Research and the German Research Foundation in 2006/2007. The university was honored for its future concept in research. Because of the Excellence Initiative and a change in presidency the university put the focus on basic research and German Research Foundation (DFG) projects. Consequently, industrial projects, technology transfer and entrepreneurial support only play a minor role and receive little financial support by the university budget (e.g. the 0.5 full-time equivalent position at the entrepreneurship office) (cf. KEY INF. 14, KEY INF. 15, KEY INF. 16, KEY INF. 20). Not surprisingly, in contrast to LUH, GAUG's mission statement mentions its role in regional development and the commercialization of university technology and knowledge only implicitly: *“Georg-August-Universität Göttingen perceives itself as a font of innovation*

to enrich all spheres of life, regarding it as its task [...] to publicise its research findings and promote their utilisation and to contribute to the responsible development of its regional environment.” (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2013a).

Regarding spin-off related rules, arrangements and unwritten norms, both universities established some general guidelines. In this respect, they officially allow academic entrepreneurs to use laboratory equipment and office space (cf. KEY INF. 13). Furthermore, contractual arrangements for scientific staff starting-up a business (e.g. leave of absence or part-time employment) are generally feasible. However, the concrete application of such procedures depends on the specific institute in which infrastructure is supposed to be used or in which the scientist is employed. While some institutes are very constructive in finding respective solutions, others are not inclined to allow the commercial use of their infrastructure and to find specific contractual arrangements (cf. KEY INF. 2, KEY INF. 9, KEY INF. 13, KEY INF. 14, KEY INF. 20).

In summary, both universities acknowledge the topic of knowledge and technology transfer in their mission statements, at least implicitly in the case of GAUG. However, the interviews with key informants suggest that when it comes to making the necessary investments the administrations' commitment is rather inadequate. Nevertheless, both universities established arrangements for the use of their infrastructure.

2.6.3 The perception of the entrepreneurial climate by LUH's and GAUG's students

As explained in Section 2.2, an important element of a capable university entrepreneurial support structure is a positive entrepreneurial climate. When students and faculty perceive a favorable entrepreneurial climate, they are more likely to develop and realize start-up ideas (cf. GUERRERO/URBANO 2012, NDONZUAU et al. 2002, SHANE 2004a, SIEGEL et al. 2003) and the start-up is more likely to perform successfully (cf. GUPTE 2007).

In order to evaluate the entrepreneurial climate at LUH and GAUG, the students were asked in the scope of GUESSS, how much they agree with the statement that there is a favorable climate and premises for becoming an entrepreneur at their university. The results reveal that the students assess the entrepreneurial climate and premises quite similarly (see Figure 12). About one fifth of the students at both universities agree with that statement, while one third is indifferent and about 45 % disagree. Beside this general tendency there is a slight

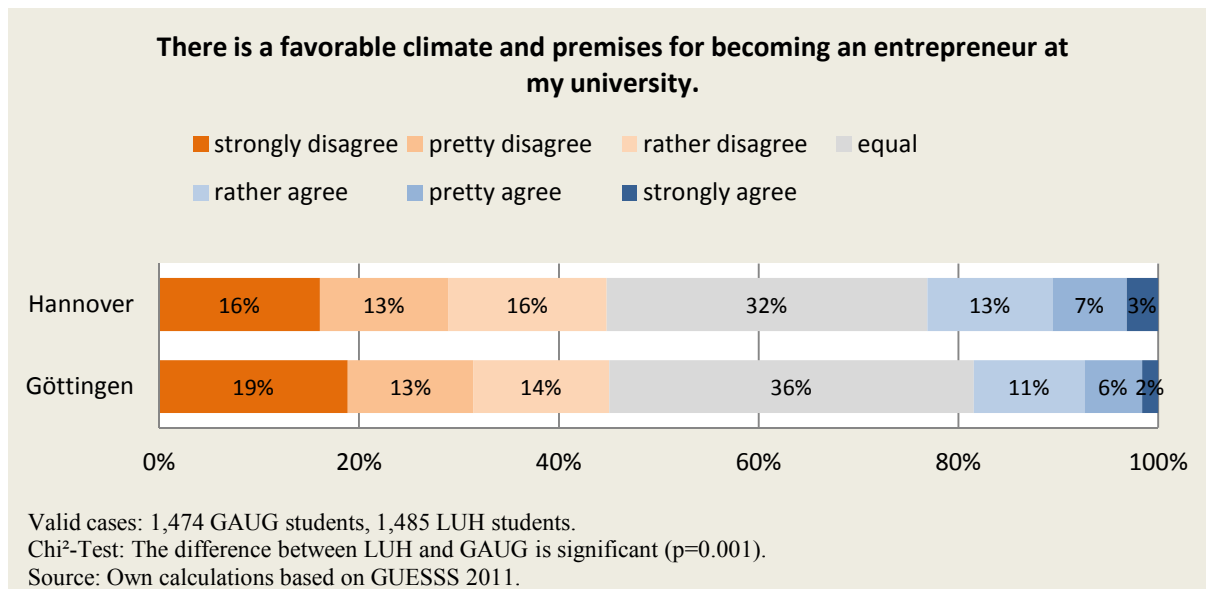


Figure 12: Perception of the entrepreneurial climate by students at LUH and GAUG

difference between LUH and GAUG. Students at GAUG are more frequently indifferent or more inclined to disagree to the statement. The overall assessment of the entrepreneurial climate is therefore slightly but significantly better at LUH. However, in comparison to other German universities LUH and GAUG are both among the lowest ranked in regard to their entrepreneurial climate (cf. BERGMANN et al. 2012).

Due to the expected correlation between the students' perceptions of the entrepreneurial climate and their field of study, Figure 13 distinguishes the entrepreneurial climate also between three different fields of studies: social sciences, natural sciences as well as business and economics. There are significant differences between the two universities regarding the fields of studies. At GAUG the entrepreneurial climate is evaluated the worst in the field of the natural sciences and best in the field of business and economics. In contrast, at LUH the natural science students evaluated the entrepreneurial climate best and the social science students worst. In summary, however, it can be concluded that the entrepreneurial climate at both universities and in all fields of studies can be improved. Even in those fields, where the students' ratings are best, the shares of students, who are dissatisfied with the entrepreneurial climate, are still over 35 % at both universities. In contrast to this, only about 30 % of the students state that they are satisfied.

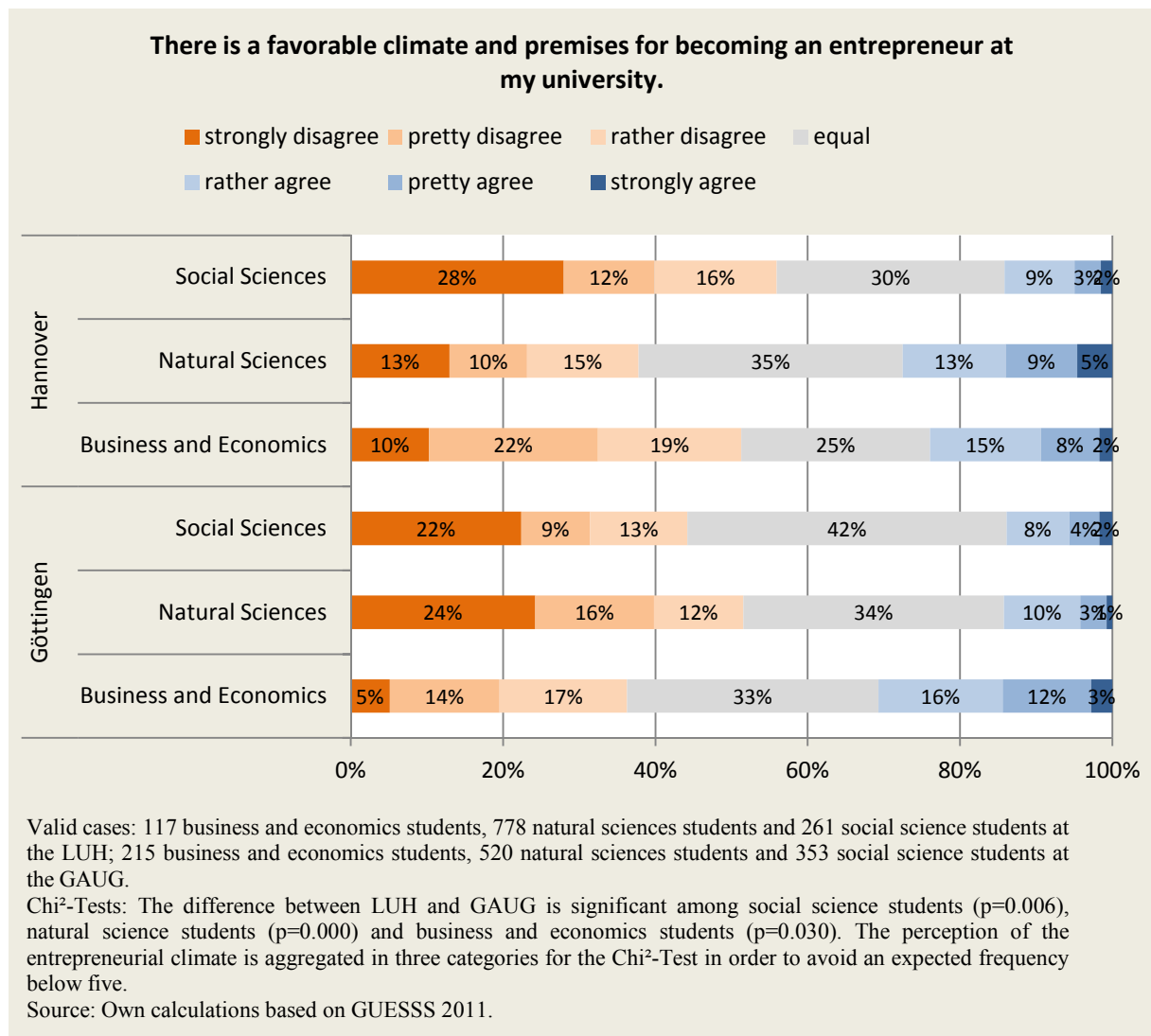


Figure 13: Perception of the entrepreneurial climate by students at LUH and GAUG according to fields of study

A correlation between the students' perceptions of the entrepreneurial climate and their entrepreneurial intentions is also expected to exist. Students who are not interested in the topic of entrepreneurship may not pay much attention to the entrepreneurial climate. Therefore, Figure 14 shows the perception of the entrepreneurial climate distinguishing students' entrepreneurial intentions: students without entrepreneurial intentions, students with entrepreneurial intentions and students who are already involved in starting up a business.

It can be concluded that active founders evaluate the entrepreneurial climate at both universities worst, even if they are only a few in number. At GAUG almost 60 % of the active founders evaluate the entrepreneurial climate as rather unfavorable to strongly unfavorable. At LUH the share is even at almost 70 %. The marked difference between the students with and without entrepreneurial intentions is that students without entrepreneurial intentions evaluate the entrepreneurial climate more often as strongly unfavorable, have more often no

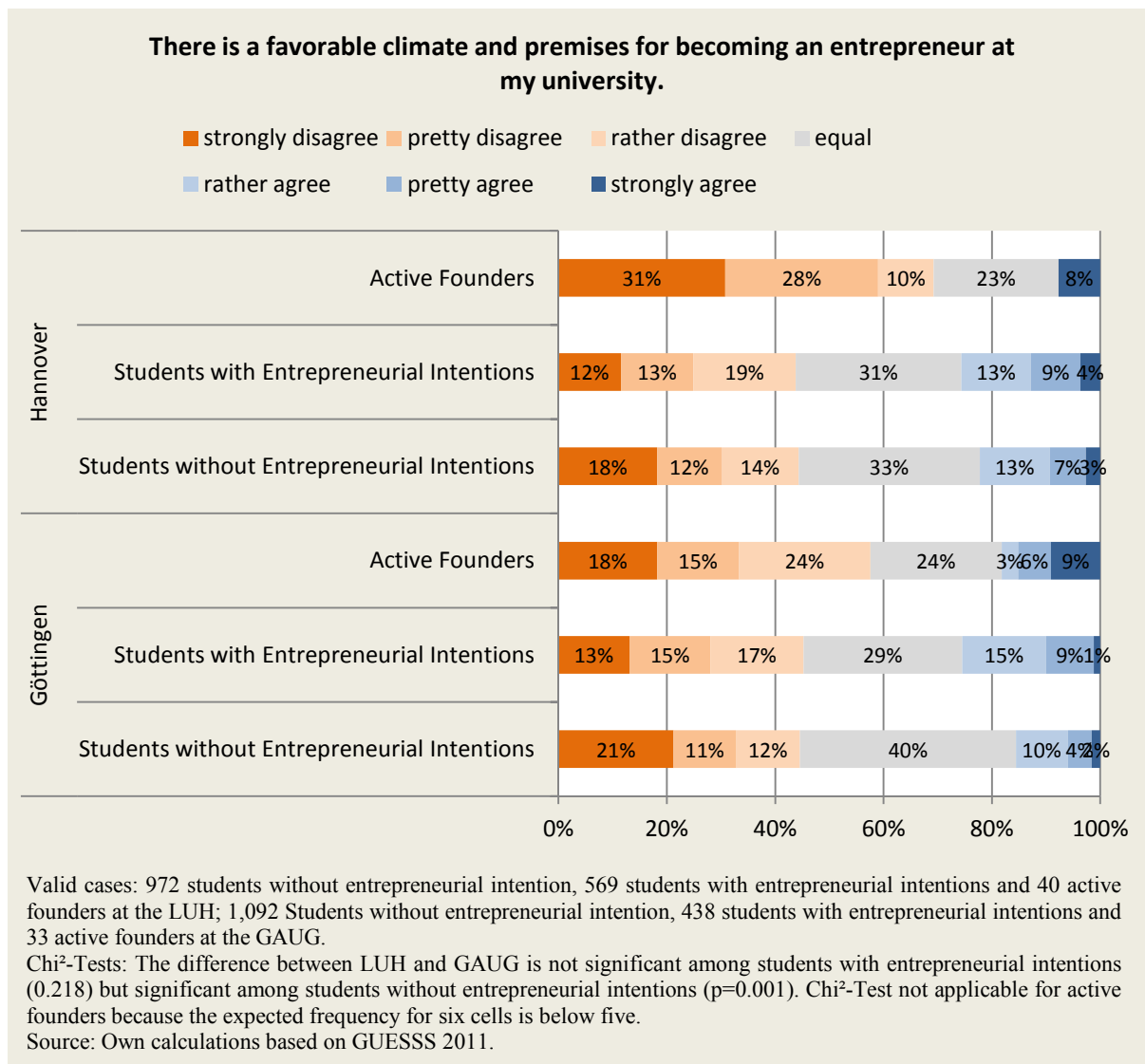


Figure 14: Perception of the entrepreneurial climate by students of LUH and GAUG according to entrepreneurial intentions

opinion and find the entrepreneurial climate less often favorable. This is true for both universities, whereby the pattern is more distinctive for GAUG. However, the share of students who find the entrepreneurial climate rather unfavorable to strongly unfavorable is for students with and without entrepreneurial intentions at both universities similar at a share of about 45 %.

In summary, the results reveal that the entrepreneurial climate could be improved at both universities in all fields of studies. Even if different degrees of students' entrepreneurial intentions are considered, it does not explain the poor results. Nevertheless there are certain fields of studies, where the students evaluate the entrepreneurial climate even worse. At the LUH it is in the field of social sciences and at GAUG it is in the field of natural sciences.

Here, more than the half of students find the entrepreneurial climate rather unfavorable to strongly unfavorable.

2.7 Conclusions

2.7.1 Major results

The first objective of this paper was to illustrate in the scope of a literature review, of which elements a capable entrepreneurial support structure consists. In summary, the literature review revealed that a capable university entrepreneurial support structure should comprise three major elements: a positive entrepreneurial climate, specific support measures (sensitization, capability supply, information supply and resource supply measures) and affiliated infrastructural facilities as well as conducive general university policies on spin-off formation.

Another important suggestion of the literature is that not only the existence and quality of a university's entrepreneurial support structure determines spin-off activity, but that universities significantly differ with regard to their entrepreneurial potential. In this respect, a university's general characteristics such as its size and tradition, its nature and quality of research and teaching, its ability to attract financial resources and its frequency of collaboration with industry partners mirror a university's stock of commercializable knowledge and thus can be regarded indicators of entrepreneurial potential (cf. e.g. DI GREGORIO/SHANE 2003, GRAS et al. 2008).

Consequently, before comparing the entrepreneurial support structures of Leibniz Universität Hannover (LUH) and Georg-August-Universität Göttingen (GAUG) (the second objective of this paper), LUH's and GAUG's entrepreneurial potential with regard to their general characteristics was evaluated. The results suggest that although LUH and GAUG differ in the tradition and in the structure of teaching and research fields, they have similar prerequisites for spin-off formation when considering the total number of students and scientists in subjects that are common for spin-off formation (technical, natural and medical sciences as well as economics and management). However, when considering industry funded research as an indicator, LUH performs considerably better than GAUG.

As explained above, general university characteristics only indirectly mirror the potential for spin-off activity. Furthermore, it is plausible to assume that a university's entrepreneurial potential is determined by additional aspects (e.g. entrepreneurial culture and tradition,

support efforts, etc.). Eventually, a university's potential for spin-off activity resides in the entrepreneurial intentions of its students and staff. The more these regard self-employment as a desirable career choice and the more concrete their conceptual considerations with and thoughts about starting up a business, the higher the probability that a university generates spin-off companies. Thus, the entrepreneurial intentions of LUH's and GAUG's students were analyzed. The results suggest that the majority of students at both universities have at least sketchily thought about starting up a business. Thus, there seems to be a large entrepreneurial potential at both LUH and GAUG which is still unused and probably not yet well addressed by entrepreneurial support measures. This entrepreneurial potential is slightly larger at LUH than at GAUG.

The second aim of this paper was to compare the entrepreneurial support structures at LUH and GAUG. The universities' entrepreneurial support structures were characterized and compared with each other by the different elements identified in the literature review. Overall, the empirical results suggest that the entrepreneurial support structures at both universities still have a considerable upward potential. The comparison of both universities shows that LUH's entrepreneurial support structure is slightly more sophisticated than GAUG's.

The entrepreneurial support measures and infrastructural facilities can be characterized as follows. On the one hand the well developed entrepreneurial support measures are an asset of both universities and the majority of students is aware of them. Especially, at LUH the sensitization measures are well developed due in part to the start-up scouts in the natural science faculties. As a consequence, a higher share of students is aware of the entrepreneurial support measures. On the other hand the infrastructural facilities can be considered to be inadequate at both universities as there is neither an entrepreneurship professorship nor an incubator on either campus.

The universities' general policies on spin-off formation are rather impeding the dynamic of spin-off activities. Although both universities' mission statements mention the transfer of knowledge and technology via spin-off formation, at least implicitly in the case of GAUG, their administrations' commitment is rather small when it comes to making financial investments. It is however positive that specific arrangements regarding for example the use of university infrastructure by academic entrepreneurs were established.

Another major inadequacy of the universities' entrepreneurial support structures is their insufficiently developed entrepreneurial climate. In fact, around 45 % of the students at both universities assess the entrepreneurial climate to be unfavorable for starting up a business. At

both universities, this share is above the average of all German universities. For the fields of social sciences as well as business and economics at LUH and natural sciences at GAUG the results are even worse. In these fields more than the half of students finds the entrepreneurial climate to be unfavorable. Also, active founders at both universities evaluate the entrepreneurial climate to be particularly bad.

Overall, this paper provides interesting content-related background information for this dissertation's core Chapters 3, 4 and 5 because it illustrates, of which elements a capable university entrepreneurial support structure consists. Moreover, this paper presented important context-related background information as the entrepreneurial potential and entrepreneurial support structures of the two universities which serve as context of investigation in Chapters 4 and 5 of this dissertation are evaluated.

2.7.2 Limitations and further research

Although the present empirical study gives an initial and comprehensive view on the entrepreneurial potential and support structures of LUH and GAUG, some limitations and resulting need for further research should be considered.

In regard to survey methodology related issues, although many different key informants were consulted and the interview material was supplemented by archival material, the data collection by interviews with key informants could suffer from subjectivity. This especially applies to the quality of different support structure elements and infrastructural facilities, while the information on their existence and characteristics is probably less biased.

Regarding the quantitative student survey (GUESSS), a sampling bias cannot be excluded. Students who are interested in self-employment and entrepreneurship may be overrepresented as they are more prone to participate in such surveys.

Due to the fact that this study only includes data of the year 2011, the results are hardly transferable to other time periods. Furthermore, cross-sectional studies often have problems with endogeneity. Thus, the students' entrepreneurial intentions, for example, might influence their perception of the support structure and at the same time the support structure might influence the students' entrepreneurial intentions. In order to consider this aspect at least to a certain extent in this study, the students were differentiated regarding their entrepreneurial intentions in the calculations. In the future, a panel study could help to remedy this

endogeneity problem. A first step in this direction could be projects such as the German National Educational Panel Study (NEPS) (cf. SCHAEFER 2013).

As for content related issues, the following limitations must be considered. The focus of this paper is the entrepreneurial support structure at the universities. However, as the literature review as well as the results indicate, the regional context also plays an important role (cf. GUPTE 2007, HEMER et al. 2007, LANDRY et al. 2006, O'SHEA et al. 2008, SHANE 2004a). In this respect, a central aspect of a university's entrepreneurial support structure is its linkage to a regional network of different actors (e.g. economic development agencies, banks, consultants, etc.). Although such a network approach is considered to be an asset of both universities' entrepreneurial support structures, and different regional cooperation partners were mentioned in this respect, the scope of this investigation did not allow for an in-depth evaluation of their characteristics and qualities.

Furthermore, this investigation characterized the entrepreneurial support structure at an aggregated university level. However, recent studies also highlight the importance of the local work environment in connection with individual university spin-off activity (cf. BERCOVITZ/FELDMAN 2008, DÖRRE/NEIS 2010, KENNEY/GOE 2004, NANDA/SORENSEN 2010, STUART/DING 2006). Therefore, there might be a difference in the entrepreneurial support structure between the different faculties and institutes of a university, especially regarding the entrepreneurial climate. In order to consider this aspect at least to a certain extent in this study, three broad fields of studies were differentiated. Further investigation of the micro work environment's influence could provide an interesting approach for further research.

2.7.3 Policy implications

The entrepreneurial support measures at LUH and GAUG are actually quite sufficient. Although the awareness among the students is satisfactory it could be improved, especially in the field of natural sciences at GAUG. The start-up scouts at the technical and natural science faculties at LUH seem to have been a good approach, expressed by a comparatively better evaluated entrepreneurial climate and perception of the entrepreneurial programs. However, the business and economics students at both universities have the highest shares of awareness and participation regarding the entrepreneurial programs. Actually, the universities should aim to improve the awareness of every student – also in the fields of social sciences – that entrepreneurial programs are available and that self-employment can be an equally valid

alternative to dependent employment. This vision is an ambitious target but the empirical results indicate that there still is a large entrepreneurial potential which can be mobilized and which is probably not yet well-addressed by entrepreneurial support measures. In this regard, it would be a great step forward if the infrastructural facilities could be improved as they currently are one of the weak links in the entrepreneurial support structures of both universities. An entrepreneurship professorship or an incubator on campus would positively influence the entrepreneurial climate as well as the perceptions of students and outsiders. To achieve this, however, it would be necessary that the universities' managements reconsider their priorities and increase their entrepreneurial commitment.

Acknowledgements

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Chapter 3

A theoretical approach to explain the interdependencies between a university's entrepreneurial support structure and its spin-off entrepreneurs

Abstract

As universities are increasingly expected to contribute to a region's economic development through the formation of spin-off companies, they need to establish and reinforce an entrepreneurial support structure including e.g. qualification, education and consultation measures. It is plausible to assume that such a support structure can strongly profit from an involvement of alumni spin-off entrepreneurs, who can provide important resources and capabilities that a university may lack, such as practical start-up experience, know-how and information. From a conceptual point of view, this implies that the relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs is interdependent: The individual spin-off entrepreneur is not only influenced by a university's entrepreneurial support structure regarding the decision to become self-employed, the start-up process and the early development of the spin-off company, but in turn also shapes the support structure. Regarding the lack of a conceptual foundation, this paper presents a theoretical concept of university spin-off formation that takes into account an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. The concept not only emphasizes the existence of this phenomenon, but also defines how and under which conditions it occurs.

3.1 Introduction

Universities are important for regional economic growth and wealth creation. In this respect, they are traditionally recognized as a site for basic research and higher education (cf. CANIELS/VAN DEN BOSCH 2011). However, in the past decades the self-conception and expectations of universities have changed. Besides the traditional functions, universities are increasingly perceived as so-called "entrepreneurial universities" with strong links to the regional economy and governmental institutions. In this function they are supposed to play an active role in the transfer and commercialization of publicly funded research into the regional economy (cf. ETZKOWITZ/LEYDESDORFF 1997, GARNSEY 2007). This knowledge transfer occurs through different channels (e.g. collaboration with industry partners or licensing) (cf. BEKKERS/FREITAS 2008). Due to the often tacit nature of university knowledge, it can be assumed that the transfer through persons (e. g. labor mobility of graduates or scientists) is the most efficient mechanism of knowledge transfer (cf. BEKKERS/FREITAS 2008). This applies especially to start-up firms by university members – so-called university spin-offs – by which university students or scientists commercialize the knowledge obtained and created at a university in a direct manner (cf. FONTES 2005).

In the past decades, there has been a growing interest among researchers, policymakers and politicians on the influence that university spin-offs have in a university region. This interest is particularly fueled by the observation that university spin-offs played a significant role in the genesis and evolution of different prominent high-tech regions, such as the Route 128 area in Massachusetts, the Silicon Valley in California, or the Cambridge region in the United Kingdom (cf. SHANE 2004a: 20). In his summary of studies from different geographical contexts, SHANE (2004a: 20) comes to the conclusion that university spin-offs can encourage economic development because they are above-average performing and innovation oriented companies that generate significant economic value and create many jobs. Moreover, university spin-off formation is attributed endogenous development potential, because most spin-off companies remain in the university region and therefore unfold their positive effects primarily locally (cf. STERNBERG 2014: 138).

Remarkably, most studies concentrate on the immediate real economic effects of spin-off formation, using indicators such as turn-over or employment creation (e.g. LAWTON SMITH et al. 2006 for Oxfordshire (UK), OSKARSSON/SCHLÄPFER 2008 for the ETH Zurich (Switzerland), ROBERTS/EESLEY 2009 for MIT). The rather indirect and systemic effects of spin-off formation that affect a regional economy in the long run remain underresearched.

This also applies to the potential long-term modification and upgrade of a university's entrepreneurial support structure by the engagement and contribution of individuals who started a spin-off company out of a particular university at an earlier point in time (in the following referred to as “alumni spin-off entrepreneurs”). So far this potential effect of university spin-off formation has only been rarely and superficially discussed in academia (see e.g. LLOYD-REASON et al. 2009, NATHUSIUS 2013, PATTON/KENNEY 2010, ROBERTS/EESLEY 2009). This is the case although it is plausible that in case the contribution of alumni spin-off entrepreneurs is substantial enough, it can induce a self-amplifying process by which the entrepreneurial support structure is continuously modified and upgraded. This in turn causes a dynamization of spin-off activity, which increases the potential for sustainable knowledge-driven regional development (cf. PATTON/KENNEY 2010).

From a conceptual point of view it is obvious that such a mechanism implies that an interdependent relationship exists between a university's entrepreneurial support structure and its spin-off entrepreneurs: the individual spin-off entrepreneur is not only influenced by a university's entrepreneurial support structure regarding the decision to become self-employed, the start-up process and the early development of the spin-off company, but can in turn also shape a university's entrepreneurial support structure. However, the literature lacks a conceptual foundation on the topic of university spin-off formation that accounts for such an interdependent relationship. In fact, contemporary concepts of university spin-off formation so far focus only on one direction of effect, namely the role of a university's entrepreneurial support structure for spin-off formation, while the influence of spin-off entrepreneurs on the support structure is disregarded (cf. O'SHEA et al. 2005a, ROTHÄRMEL et al. 2007).

The aim of this paper is to address the conceptual shortcomings in the literature by presenting a theoretical concept of university spin-off formation that takes into account an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. The concept is not only supposed to emphasize the existence of this phenomenon, but also attempts to define how and under which conditions alumni spin-off entrepreneurs contribute to a university's entrepreneurial support structure.

The paper applies the following approach: Based on a literature review, Section 3.2 provides the theoretical foundation for the suggestion that spin-off entrepreneurs are not only influenced by a university's entrepreneurial support structure but also shape it and consequently for the idea of an interdependent relationship between a university's

entrepreneurial support structure and its spin-off entrepreneurs. The literature review furthermore elaborates on the nature of a potential influence of alumni spin-off entrepreneurs on a university's entrepreneurial support structure by describing, how it occurs.

Section 3.3 addresses the conditions under which this phenomenon occurs. Plausibly, this issue must be elaborated on a micro-level of the involved individual actors, namely the individual alumni spin-off entrepreneurs and the individual actors in charge of a university's entrepreneurial support structure. Thereby, the aim is to illustrate under which conditions an individual actor in charge of a university's entrepreneurial support structure decides to include alumni spin-off entrepreneurs in his efforts to establish, develop and realize the support structure as well as under which conditions an individual alumni spin-off entrepreneur decides to become involved in this respect.

Section 3.4 summarizes the theoretical arguments from the previous chapters and derives a revised theoretical concept of university spin-off formation that abstains from the contemporary view of a unidirectional relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs and instead endorses an interdependent relationship.

Section 3.5 provides a conclusion.

3.2 Existence and nature of interdependencies between a university's entrepreneurial support structure and its spin-off entrepreneurs: A literature review

It is well established in contemporary social sciences, regional science and economic geography that individual actors and the contextual conditions influence each other and that their relationship can consequently be described as interdependent (cf. GIDDENS 1984, NUSSMUELLER et al. 2009: 2). Section 3.2.1 briefly summarizes the respective literature and thereby provides the theoretical rationale that also the relationship between a university's entrepreneurial support structure (as contextual condition) and its spin-off entrepreneurs (as individual actors) is interdependent. The subsequent section 3.2.2 focuses particularly on the relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs and presents the state of research on both directions of effects. This section also describes how a university's entrepreneurial support structure potentially affects individual

spin-off entrepreneurs and how these potentially exert an influence on a university's entrepreneurial support structure.

3.2.1 The relationship between individual actors and contextual conditions

For a long time, basic social theory has attempted to explain the relationship between individual actors and the societal context (cf. STONES 2005). In this respect, traditional approaches ignore the possibility of an interdependent relationship. Instead, social sciences are traditionally characterized by a strong divide between objectivist and subjectivist theories. Theoretical approaches from the objectivistic tradition (e.g. functionalism or structuralism) suggest that while individual actors are influenced by contextual conditions, they are unable to control or comprehend these conditions. Contrarily, subjectivistic concepts (e.g. the hermeneutic tradition of thought) argue that individual actors have power over their environment and shape it. However, these concepts ignore the possibility that individual actors are in turn also influenced by the contextual conditions (cf. PARKER 2000: 8).

A social theory that combines objectivistic and subjectivistic arguments as two interrelated dimensions and that has become a strong pillar in contemporary social science is GIDDENS' (1984) theory of structuration (cf. THORNTON 1999). The so-called "duality of structure", which constitutes the theory's core, proposes that contextual conditions (structure) influences individual actors, but are also shaped by individual actors. Thus, contextual conditions are both the medium and the result of individual behavior (cf. GIDDENS 1984: 25-27). This argument implies that an interdependent relationship exists between contextual conditions and individual actors. Regarding the intentions of individual actors, the theory of structuration suggests that individual actors may directly modify the contextual conditions by intended and purposeful action. However, the influence on contextual conditions may also be an unintended by-product of an otherwise motivated action (cf. HUNDT 2012: 50, STONES 2005: 24-27).

Regarding the relationship between economic actors and their regional and institutional environment, it is important to consider the economic geography and regional sciences literature. Similar to traditional social theory, traditional approaches in economic geography and regional sciences (e.g. the neoclassical theory of regional growth, the endogenous theory of regional growth or the different theories of polarization) also presume that contextual conditions externally determine the action and behavior of individual economic actors (cf. SCHÄTZL 2003: 135-199). The suggestion that economic actors in turn also influence the

regional and institutional context is traditionally not acknowledged (cf. BATHELT/GLUECKLER 2011: 25, NUSSMUELLER et al. 2009: 1). However, in the past decades the idea of an interdependent relationship between economic actors and the contextual conditions has found its way into contemporary theoretical approaches. For instance, the relational approach to economic geography is conceptualized in close correspondence to the theory of structuration by looking beyond the objectivism-subjectivism divide (cf. BATHELT/GLUECKLER 2011: 31). It emphasizes the contextual dependency of economic action but in addition "...suggests that economic actors are actively involved in the production of their own regional environments." (BATHELT/GLUECKLER 2011: 26). Under the term "co-evolution", this phenomenon is also acknowledged by the evolutionary approach to economic geography (cf. BOSCHMA/FRENKEN 2006, 2009). Accordingly, locations emerge from the actions of individual economic actors rather than that contextual conditions only determine the actors' behavior. Consequently, "...institutions coevolve with the development of industries" (BOSCHMA/FRENKEN 2009: 154). In a nutshell, the evolutionary approach to economic geography suggests that "...it is the dynamic interplay between structure and agency that produce the evolution of real places." (BOSCHMA/FRENKEN 2006: 292). Therefore, "...the path dependent and self-reinforcing nature of locational dynamics is at the core of a systematic explanation." (BOSCHMA/FRENKEN 2006: 289). Furthermore, the phenomenon that the action of economic actors is not only contextually dependent but also shapes contextual conditions is a crucial aspect for the explanation of regional prospect within the literature on industrial districts (cf. ASHEIM 1996), industrial clusters (cf. PORTER 1998), innovative milieus (cf. CAMAGNI 1991) and high-tech regions (cf. KEEBLE/WILKINSON 2000) (cf. NUSSMUELLER et al. 2009: 2).

3.2.2 The relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs

In the literature on university spin-off formation, a vast amount of publications address the relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. However, among the studies conducted so far, there is a clear focus on the influence of a university's entrepreneurial support structure on spin-off entrepreneurs and on their decision to become self-employed, the start-up process and the early development of their spin-off company (for an overview see for example ASTEBRO et al. 2012, DI

GREGORIO/SHANE 2003, HELM/MAURONER 2007, O'SHEA et al. 2008, ROTHAEEMEL et al. 2007, SHANE 2004a). The opposite effect, namely the influence that spin-off entrepreneurs have on a university's entrepreneurial support structure remains underresearched.

The current state of research is that besides factors like founder personality, firm characteristics, broader national legal conditions (cf. DI GREGORIO/SHANE 2003) and the regional surroundings of a university (cf. GUPTA 2007, HEMER et al. 2007, LANDRY et al. 2006, O'SHEA et al. 2008, SHANE 2004, STERNBERG 2009: 273) especially the characteristics of a university itself determine the dynamics of spin-off formation and the performance of the respective start-ups (cf. LOCKETT et al. 2003). In particular, the literature suggests that a university can foster spin-off formation by establishing a capable entrepreneurial support structure consisting for instance of specific support measures and infrastructural facilities (cf. O'SHEA et al. 2005a, ROTHAEEMEL et al. 2007). The rationale for the suggestion that an entrepreneurial support structure exerts a significant influence on potential and actual individual spin-off entrepreneurs regarding their decision to become self-employed, the start-up process and the early development of their spin-off company is as follows.

While the singularity and exclusivity of the knowledge and technology a spin-off company receives from a university holds a competitive advantage over other business entrepreneurs (cf. DRUILHE/GARNSEY 2004), academic entrepreneurs usually face a shortage of other necessary resources, capabilities and information during the process of spin-off formation – such as entrepreneurial skills, market information and financial resources – to develop the business idea and the associated product, to gain market maturity, and to manage the start-up process (cf. DRUILHE/GARNSEY 2004, POWERS/MCDOUGALL 2005). Furthermore, scientific staff and students often lack the motivation to become self-employed (cf. SHANE 2004a). By establishing a capable entrepreneurial support structure, a university can provide these missing resources, capabilities and information as well as intensify the entrepreneurial motivation of students and scientists (cf. DEGROOF/ROBERTS 2004, POWERS/MCDOUGALL 2005, RASMUSSEN/BORCH 2010).

The core of a university's entrepreneurial support structure is its support measures and associated infrastructural facilities, which directly affect spin-off entrepreneurs by providing resources, capabilities, information as well as motivation. Briefly summarizing the relevant literature, a university's entrepreneurial support structure can affect spin-off entrepreneurs and

their decision to become self-employed, the founding process and the early development of their spin-off company by four different support measures. Firstly, sensitization measures that target at fostering motivation and attitudes towards entrepreneurship among faculty and staff (cf. FINI et al. 2011, KULICKE et al. 2011). Secondly, information supply measures in the form of advisory and consultation offerings that provide know-how and information in areas such as the assessment of market potential, legal protection or business plan development (cf. NDONZUAU et al. 2002, O'SHEA et al. 2005a, SHANE 2004a, VOHORA et al. 2004). Thirdly, capability supply measures, such as an entrepreneurship education program within a university's curricula or training and qualification measures, which teach (potential) spin-off entrepreneurs necessary skills (cf. ASTEBRO/BAZZAZIAN 2011, GUERRERO/URBANO 2012, KULICKE et al. 2011). Fourthly, resource supply measures, aiming at supplying spin-off entrepreneurs with scarce but necessary financial and material resources (e.g. taking equity, allowing the use of university infrastructure) (cf. DI GREGORIO/SHANE 2003, WRIGHT et al. 2002, WRIGHT et al. 2007). Studies also suggest that certain infrastructural facilities, such as a technology transfer office, an entrepreneurship office, an entrepreneurship professorship, a venture capital fund or a business incubator are crucial for an efficient implementation and realization of support measures and consequently for a strong impact on spin-off entrepreneurs (cf. DI GREGORIO/SHANE 2003, DJOKOVIC/SOUITARIS 2008, GUERRERO/URBANO 2012, WRIGHT et al. 2002, WRIGHT et al. 2007).

The literature suggests that a capable university entrepreneurial support structure should furthermore incorporate two elements. Firstly, a positive entrepreneurial climate (in the literature sometimes also referred to as entrepreneurial culture), which advocates the commercialization of university knowledge and technology via spin-off formation (cf. GUERRERO/URBANO 2012, GUPTE 2007, NDONZUAU et al. 2002, SHANE 2004a, SIEGEL et al. 2003,). Secondly, a university's general commitment to the commercialization of university knowledge and technology via spin-off formation (cf. ASTEBRO et al. 2012) and respective policies including rules, arrangements and unwritten norms regarding for example the use of the university infrastructure (cf. HELM/MAURONER 2007), the provision of licenses and patent rights, the introduction of specific contractual arrangements (cf. FINI et al. 2011, MUSTAR et al. 2008) or the establishment of incentive structures that reward entrepreneurial activity (cf. O'SHEA et al. 2005a) (for a more detailed explanation of the elements of a capable university entrepreneurial support structure see Chapter 2 of this dissertation).

While the literature summary shows that there is plenty of empirical evidence for the suggestion that a university's entrepreneurial support structure exerts a significant influence on spin-off entrepreneurs, knowledge about the opposite effect is scarce. Currently, only a few studies acknowledge the positive effects of an engagement and contribution of alumni spin-off entrepreneurs on a university's entrepreneurial support structure. Moreover, these studies usually address such an involvement only marginally, while primarily concentrating on other aspects of spin-off formation (cf. e.g. KAILER 2010, KULICKE et al. 2011, KURATKO 2005, ROBERT/EESLEY 2009, WILSON 2008). In-depth analyses which focus exclusively on how actively involved alumni spin-off entrepreneurs influence a university's entrepreneurial support structure are even more scarce. Important exceptions are the studies conducted by NATHUSIUS (2013) and LLOYD-REASON et al. (2009).

From the above cited literature, two potential dimensions of how alumni spin-off entrepreneurs affect a university's entrepreneurial support structure can be derived. Regarding the first dimension, it can be assumed that alumni spin-off entrepreneurs may contribute to the reinforcement of a university's entrepreneurial support structure. This suggestion can be drawn from the assumption in the literature that an involvement of alumni spin-off entrepreneurs positively influences the realization of specific existing support measures. It is for instance argued that sensitization measures are improved when alumni spin-off entrepreneurs are involved as role-models (cf. KULICKE et al. 2011: 250, WILSON 2008: 6). Moreover, studies from different geographical contexts show that a university's entrepreneurship education and training events, as well as its consultancy and coaching offerings profit when alumni spin-off entrepreneurs engage as educators, lecturers, coaches or mentors (cf. ROBERT/EESLEY 2009: 6 for MIT in the United States, KULICKE et al. 2011: 239 for German universities, LLOYD-REASON et al. 2009: 609 for universities in the UK, NATHUSIUS 2013: 161, WILSON 2008: 6, KURATKO 2005: 589).

As for the second dimension, alumni spin-off entrepreneurs assumingly may contribute to the idea generation, the initial conceptualization or the later refinement of particular elements of a university's entrepreneurial support structure, and thus to its overall initial establishment and evolution. However, the empirical evidence for this dimension remains superficial and mostly anecdotal. For instance, KAILER (2010) recognizes that in German-speaking countries, "it turned out to be effective to integrate alumni-entrepreneurs into the universities' working groups, focusing on both future strategic positioning, and university and faculty development plans or curriculum designs." (KAILER 2010: 260). In this respect, NATHUSIUS (2013: 76, 166) and LLOYD-REASON et al. (2009: 603) emphasize that

experienced alumni spin-off entrepreneurs can provide important guidance regarding the development of specific entrepreneurship support offerings and the overall entrepreneurship education curriculum. More precisely, the literature suggests that alumni spin-off entrepreneurs may either be a legitimate member of the respective conceptualization team or may contribute advice and experience rather sporadically and informally to the respective actors in charge (cf. KAILER 2010, LLOYD-REASON et al. 2009, NATHUSIUS 2013).

In general, the literature states that the phenomenon of engagement and contribution of alumni spin-off entrepreneurs for a university's entrepreneurial support structure is more common in the Anglo-American region than in Europe (cf. KAILER 2010: 256, WILSON 2008: 6). Nevertheless, also in Europe, this potential is being increasingly acknowledged by policymakers and practitioners. In Germany for instance, the mode and extent of a university's cooperation with alumni spin-off entrepreneurs within the scope of its entrepreneurship support measures, is considered a selection criterion for funding by "EXIST-Gründungskultur", a federal program designed to help universities develop an integrated entrepreneurial support structure (cf. BMWI 2010: 6, BMWI 2011: 20). Furthermore, the inclusion of successful alumni spin-off entrepreneurs is considered a quality criterion in a study comparing the conditions for entrepreneurial activity of students at German universities (cf. SCHMUDE et al. 2011: 15).

Even less attention than the question of if and how alumni spin-off entrepreneurs exert an influence on a university's entrepreneurial support structure receive its effects at an aggregated regional level. Currently, the only approach that links regional development (in particular cluster formation) to the influence of alumni spin-off entrepreneurs on entrepreneurial conditions at a university and within a region is PATTON and KENNEY's (2010) concept of "University research-centric-based Clusters". Similar to the genesis of clusters in general (see e.g. FELDMAN/FRANCIS 2004, ROMANELLI/FELDMAN 2006), PATTON and KENNEY (2010) describe the formation of a university research-centric-based cluster as a three-stage pattern evolutionary process. The emergence of university research-based new knowledge and technologies is considered as "triggering event" and initializes the first stage of cluster genesis, as economic opportunities are created that are partly exploited by university affiliates in the form of spin-off activities (cf. PATTON/KENNEY 2010). Critical to the development of the cluster and the associated regional economic effects is the second stage that ROMANELLI and FELDMAN (2006) refer to as "Hallmark of Vibrant Clusters". According to PATTON and KENNEY (2010), the evolution of a university-internal (and also

regional) environment that is supportive to university entrepreneurship and eventually to the development prospects of the cluster, substantially depends on the behavior and engagement of the university's alumni spin-off entrepreneurs. Optimally, they act as "social actors" by sustainably coining the configuration of the university and regional spin-off support infrastructure, through interaction with various stakeholders as well as active co-designing, expression of opinion or exchange of experience.

Although PATTON and KENNEY's concept refers to the evolution of clusters in particular, their basic idea of a positive effect through the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure can plausibly be transferred to university regions that do not have the characteristics of a cluster and/or do not have the potential to become a cluster. Regarding PATTON and KENNEY's concept, it can be assumed that in case the contribution of a university's alumni spin-off entrepreneurs is substantial enough, it can induce a self-amplifying process by which the university's entrepreneurial support structure is continuously modified and upgraded. This in turn causes a dynamization of spin-off activity, which increases the potential for sustainable knowledge-driven regional development (cf. PATTON/KENNEY 2010).

In summary, contemporary theoretical approaches in social science, regional science and economic geography, as well as the evidence from more specific studies, support the argument of an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. While there is plenty of empirical evidence on how a university's entrepreneurial support structure affects its spin-off entrepreneurs, the literature on the influence of spin-off entrepreneurs on a university's entrepreneurial support structure is rudimentary. Concerning the question of how spin-off entrepreneurs affect a university's entrepreneurial support structure, this literature suggests that they can either contribute to the realization of existing support structure elements or to its initial establishment and further evolution.

3.3 The conditions of an interdependent relationship

This section addresses the conditions under which alumni spin-off entrepreneurs contribute to a university's entrepreneurial support structure and consequently the conditions under which the relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs is interdependent. Plausibly, it is necessary to elaborate this issue on a micro-

level of the involved individual actors, namely the individual alumni spin-off entrepreneurs as well as the individual actors in charge of a university's entrepreneurial support structure. Thereby, the aim is to illustrate under which conditions an individual actor in charge of a university's entrepreneurial support structure decides to include alumni spin-off entrepreneurs in his efforts of establishing, developing and realizing the support structure as well as under which conditions an individual alumni spin-off entrepreneur decides to become involved.

Before these particular issues are addressed in Sections 3.3.2 and 3.3.3, Section 3.3.1 presents a conceptual framework, which is based on AJZEN's (1991) theory of planned behavior. Section 3.4 summarizes the theoretical arguments described in Sections 3.3.2 and 3.3.3 and aggregates them to a revised theoretical concept of university spin-off formation that abstains from the contemporary view of a unidirectional relationship between a university's entrepreneurial support structure and spin-off entrepreneurs and instead endorses an interdependent relationship.

3.3.1 Conceptual framework

The starting point is a fictitious case of a university which has established different elements of a university entrepreneurial support structure, such as general policies on spin-off formation, support measures and associated infrastructural facilities. Responsible for establishing, evolving and realizing this entrepreneurial support structure and its offerings are particular actors in charge within the university, which usually are employees of the university's entrepreneurship office or technology transfer office. If we assume that this university has already been successful in generating spin-offs then a number of alumni spin-off entrepreneurs would already exist. Therefore, the entrepreneurial support structure could potentially be improved by the engagement of these entrepreneurs. However, in this particular fictitious case, this potential has not been exploited.

It can be assumed that the ultimate reason for this can be found in the behavior of the individual actors involved. Neither do those persons in charge of the university's entrepreneurial support structure include alumni spin-off entrepreneurs in their efforts, nor do the alumni spin-off entrepreneurs make a proactive contribution. Ergo, the question is, under which conditions the individuals involved change their behavior – in the respect that they performs an alternative behavior – and decide to include alumni spin-off entrepreneurs in his efforts regarding the entrepreneurial support structure (actors in charge of the university's

entrepreneurial support structure), respectively decides to become involved with the university's entrepreneurial support structure (alumni spin-off entrepreneurs).

AJZEN's (1991) theory of planned behavior provides the adequate theoretical basis to explain such a change in behavior. His theory "...is designed to predict and explain human behavior in specific contexts." (AJZEN 1991: 181) and postulates that a given individual's behavior is a direct consequence of the individual's intention to perform it (cf. AJZEN 1991: 181). Intentions "...are indicators of how hard people are willing to try, of how much an effort they are planning to exert, in order to perform the behavior." (AJZEN 1991: 181). In principle, the likelihood that a given behavior is performed increases the stronger an individual's intention is (cf. AJZEN 1991: 181). According to AJZEN (1991: 206), intentions in turn are the results of three motivational factors – *attitudes towards the behavior, subjective norm and perceived behavioral control* –, which are based on an underlying foundation of beliefs about the intended behavior (cf. AJZEN 1991: 206). These motivational factors and underlying beliefs help to understand why one person decides to engage in a given behavior while another refrains from it. Furthermore they indicate, under which conditions individuals change their behavior and serve as potential target point when prevailing on another person to change a certain behavior (cf. AJZEN 1991: 206).

A person's *attitude towards the behavior* reflects the degree to which a person values the performance of the respective behavior, either positively or negatively (cf. AJZEN 1991: 188). While the affective component of attitude refers to the emotion of performing a behavior (e.g. is the behavior enjoyable or not?), the instrumental component considers how advantageous the performance's consequences are (cf. FRENCH et al. 2005: 1825). The attitudes towards a behavior develop from the subjective beliefs a person has regarding the behavior per se as well as its likely consequences (also called "behavioral beliefs"), which can either be beneficial or disadvantageous (e.g. financially costly) (cf. AJZEN 1991: 191). In general, the more positive a person's assessment of the behavior and its consequences is, the stronger is a person's intention to perform the considered behavior (cf. AJZEN 1991: 188).

Subjective norm refers to a person's perceived social pressure to engage in a behavior or to refrain from it (cf. AJZEN 1991: 188). The subjective norm results from the beliefs about the normative expectations of important referent individuals or groups (also called "normative beliefs") and the motivation to comply with these expectations (cf. AJZEN 1991: 195). From the perspective of a person considering a given behavior, subjective norms can be further differentiated. Injunctive norms consider whether others encourage or not encourage a person

to perform a behavior, while descriptive norms relate to the fact that others do or do not perform the behavior under consideration as well (cf. FISHBEIN/AJZEN 1975). The stronger the assessment of a person that it is likely that a given behavior is approved by others, the stronger is a person's intention to perform the given behavior (cf. AJZEN 1991: 188).

Perceived behavioral control ascribes the perception of and confidence in one's own capability to perform a given behavior. The underlying control beliefs refer to a person's assessment of the presence of factors facilitating or impeding the considered behavior (cf. AJZEN 1991: 183). This assessment may for example be based on one's own experience with the behavior or on the experience of other persons (cf. AJZEN 1991: 196). "The more resources and opportunities individuals believe they possess, and the fewer obstacles or impediments they anticipate, the greater should be their perceived control over the behavior." (AJZEN 1991: 196). Notably, a successful performance of a behavior does not only depend on a person's perceived behavior control and the resulted intention, but also on an adequate amount of actual behavior control, meaning the extent to which a person not only believes but actually also has the capabilities and resources that are necessary to exert a given behavior (cf. AJZEN 1991).

In sum, "...the more favorable the attitude and subjective norm with respect to a behavior, and the greater the perceived behavioral control, the stronger should be an individual's intention to perform the behavior under consideration." (AJZEN 1991: 188). The relative importance of these three motivational factors differs between the considered behavior as well as the particular situation (AJZEN 1991: 188).

While originally developed in social psychology, the theory of planned behavior has in the past decades been applied to the analysis of individual behavior in different research fields, such as management (cf. e.g. MORRIS et al. 2005), education (cf. e.g. HANEY et al. 1996), medicine and health (cf. e.g. GODIN/KOK 1996). The theory has in particular gained recognition in entrepreneurship research, where it is used to theoretically predict start-up intentions (cf. e.g. BERGMANN 2002, CARR/SEQUEIRA 2007, KRUEGER/CARSRUD 1993, VAN GELDEREN et al. 2008).

3.3.2 Conditions under which an actor in charge of a university's entrepreneurial support structure seeks the involvement of alumni spin-off entrepreneurs

The rationale of AJZEN's (1991) theory of planned behavior can be applied to an individual actor in charge of a university's entrepreneurial support structure and his behavior regarding the inclusion of alumni spin-off entrepreneurs in his efforts to establish, develop and realize the entrepreneurial support structure. Accordingly, the more positive an actor's in charge attitude is towards a contribution of alumni spin-off entrepreneurs and the greater his perceived social pressure is to include alumni spin-off entrepreneurs, the stronger is his intention to realize an inclusion. The likelihood that an actor in charge decides to include alumni spin-off entrepreneurs furthermore increases when his confidence in his capabilities to mobilize alumni spin-off entrepreneurs is large and the more sophisticated his actual capabilities in this respect are (cf. AJZEN 1991: 188).

An actor's in charge attitude towards contributing to a university's entrepreneurial support structure results from subjective beliefs about the behavior per se (affective component) as well as from the expected consequences of the performance (instrumental component). As for the affective component of attitude, the more an actor in charge of a university's entrepreneurial support structure perceives the cooperation with alumni spin-off entrepreneurs to be potentially enjoyable, the stronger his intention to translate it into action (cf. FRENCH et al. 2005: 1825). The instrumental component of attitude suggests that it is plausible to assume that an individual actor in charge of the establishment, development and realization of a university's entrepreneurial support structure positively assesses everything that helps to execute his job. In this regard, the inclusion of alumni spin-off entrepreneurs is an important aspect for the following rationale: an actor's in charge capacity to establish, develop and realize a university entrepreneurial support structure is oftentimes at least partially limited. Particularly when an actor in charge does not have practical start-up experience himself, he does not possess all resources, capabilities and information necessary to efficiently support the formation of university spin-offs. Thus, an actor in charge usually relies on external assistance when configuring and reinforcing an environment supportive to spin-off formation. It is plausible to assume that alumni spin-off entrepreneurs are a promising source of these missing resources, capabilities and information, as they have gone through the distinctive process of research commercialization and business start-up out of a university. Through this experience they have obtained specific know-how that is of particular value for the university's actors in charge (cf. HSU 2007, NATHUSIUS 2013: 2). The more an actor in

charge of a university's entrepreneurial support structure is aware of the fact that he lacks certain important experiences, information and resources and that the inclusion of alumni spin-off entrepreneurs is a feasible way to compensate it, the more positive his attitude will be towards including alumni spin-off entrepreneurs and the stronger his intention will be to actually do so.

Regarding subjective norm, an actor in charge of a university's entrepreneurial support structure will consider the opinion of certain relevant individuals or groups regarding the inclusion of alumni spin-off entrepreneurs in the scope of his efforts to establish, develop and realize a support structure. The more an actor in charge perceives social pressure in this respect and the more he is willing to comply with these expectations, the stronger his intention will be to actually include alumni spin-off entrepreneurs (cf. AJZEN 1991: 195). More precisely, an actor in charge of a university's entrepreneurial support structure usually faces a general social pressure to establish, develop and realize a capable support structure from those individuals and institutions who develop the superior strategies on the commercialization of university knowledge and technology as well as on spin-off formation and that finance the support structure and an actor's in charge position. Usually, these are the university's administration, politicians or project coordinators within political institutions (e.g. ministries). The more an actor in charge is aware of the fact that an inclusion of alumni spin-off entrepreneurs will help to meet the expectations to organize a capable university entrepreneurial support structure, the more positive is his attitude will be towards it and the more likely he will decide to mobilize alumni spin-off entrepreneurs.

However, an actor's in charge decision to include alumni spin-off entrepreneurs may not only be consequence of the perceived social pressure to generally organize a capable university entrepreneurial support structure and his acknowledgement that an inclusion is an important aspect. Instead, the idea to include alumni spin-off entrepreneurs may directly originate from the spin-off formation strategies of the university's administration, politicians or project coordinators within political institutions. Their expectations and incentives to build networks and cooperate with alumni spin-off entrepreneurs may exert the respective social pressure (cf. BMWI 2010, NATHUSIUS 2013: 148).

The important role of expectations and social pressure strongly suggests that the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure is not only a question of the decisions made by and behavior of the individual actors in charge and individual alumni spin-off entrepreneurs. Instead, also those actors and institutions that either

directly or indirectly exert social pressure on the actors in charge to include alumni spin-off entrepreneurs – e.g. the university administration, politicians or project coordinators within political institutions – play an important role. The higher the expectations are and the more these expectations are communicated, the stronger an actor's in charge perceived social pressure will be to include alumni spin-off entrepreneurs in his efforts to organize a university's entrepreneurial support structure and the more likely he will decide to do so. The expectations of a university's administration, politicians or project coordinators are in turn a consequence of their superior strategies on the commercialization of university knowledge and technology and are also influenced by their ideas of fostering university spin-off formation and the possible role of alumni spin-off entrepreneurs in this regard.

In addition to the effect of expectations and encouragements by others (injunctive norms), an actor in charge of a university entrepreneurial support structure is influenced by descriptive norms, which refer to the impact of others performing a similar behavior (cf. FISHBEIN/AJZEN 1975). In this respect, an actor's in charge intention to include alumni spin-off entrepreneurs in his efforts increases, the more he perceives the actors in charge of other universities' entrepreneurial support structures to act similarly.

As illustrated in Section 3.3.1, the theory of planned behavior suggests that a person's behavioral intention in addition to attitudes towards the behavior and subjective norm depends on that person's perceived behavioral control (cf. AJZEN 1991: 183). In regard to the specific behavior discussed here, perceived behavioral control ascribes an actor's in charge perception of and confidence in his own capability to mobilize alumni spin-off entrepreneurs to contribute to his efforts in establishing, developing and realizing the university's entrepreneurial support structure. His underlying control beliefs refer to his assessment of the presence of factors facilitating or impeding the mobilization of alumni spin-off entrepreneurs. It is plausible to assume that the more positive an actor in charge of a university's entrepreneurial support structure assesses his capabilities to mobilize alumni spin-off entrepreneurs, the stronger his intention will be to actually do so.

However, not only perceived but also actual behavior control plays a role. In this respect, it is important that an actor in charge does not only believe to, but also actually possesses the capabilities necessary to mobilize alumni spin-off entrepreneurs (cf. AJZEN 1991). These include for instance that he has well-developed personal contacts to alumni spin-off entrepreneurs. Consequently, an actor's in charge networking capacity and competence in maintaining contacts play an important role. Furthermore, personality characteristics such as

persuasiveness and enthusiasm as well as motivational skills are important for the successful mobilization of alumni spin-off entrepreneurs. Also, the likelihood that alumni spin-off entrepreneurs will agree to contribute to a university's entrepreneurial support structure increases, when they evaluate the work of the actors in charge positively and take it seriously. Therefore, it is imperative that an actor in charge of a university's entrepreneurial support structure has the competence and the eloquence in business management and entrepreneurship issues.

3.3.3 Conditions under which an alumni spin-off entrepreneur decides to contribute to a university's entrepreneurial support structure

The theory of planned behavior is not only conducive to understand, under which conditions the actors in charge of a university's entrepreneurial support structure seek the involvement of alumni spin-off entrepreneurs in their efforts to organize a capable support structure. The theory's motivational factors can also explain the other side, namely the conditions under which alumni spin-off entrepreneurs decide to contribute to a university's entrepreneurial support structure.

According to the theory's argumentation, it is plausible to assume that the more favorable an individual alumni spin-off entrepreneur's attitude and subjective norm is regarding a contribution to a university's entrepreneurial support structure, and the greater his perceived and actual behavioral control is in this respect, the stronger will be his intention and the likelihood he actually becomes engaged (cf. AJZEN 1991: 188).

Nevertheless, the final choice of an alumni spin-off entrepreneur between becoming or not becoming involved in a university's entrepreneurial support structure is based on different decision motives. Knowledge about these decision motives helps to understand the motivational factors from the theory of planned behavior in more detail and as a consequence improves the comprehension of the conditions under which an alumni spin-off entrepreneur decides to contribute to a university's entrepreneurial support structure. In this respect, the literature on individuals' prosocial behavior and their decision motives offers interesting insights. Plausibly, its arguments can be transferred to the decision motives of an alumni spin-off entrepreneur, because eventually, an alumni spin-off entrepreneur's contribution to a university's entrepreneurial support structure can be regarded as an act of prosocial behavior, which is defined as an individual's action voluntarily performed with the expectation and intention that it benefits other persons, groups, organizations or the overall society (cf.

AYDINLI et al. 2013, BRIEF/MOTOWIDLO 1986: 711, RUYTER/WETZELS 2000: 389, TWENGE et al. 2007: 56), "...such as helping, sharing, donating, co-operating, and volunteering..." (cf. BRIEF/MOTOWIDLO 1986: 710).

In the following, each motivational factor derived from the theory of planned behavior – attitudes towards the behavior, subjective norm and behavioral control – is applied to the conditions under which an individual alumni spin-off entrepreneur decides to contribute to a university's entrepreneurial support structure, and is also supplemented with concepts from the literature on prosocial behavior.

An alumni spin-off entrepreneur's attitude towards contributing to a university's entrepreneurial support structure results from subjective beliefs about the behavior per se (affective component) as well as from the expected consequences of the performance (instrumental component). As for the affective component of attitude, the more an alumni spin-off entrepreneur believes that a contribution will be enjoyable, the stronger his intention will be to become engaged. The instrumental component of attitude is a consequence of how beneficial or unfavorable an alumni spin-off entrepreneur considers an involvement in a university's entrepreneurial support structure (cf. FRENCH et al. 2005: 1825). According to the literature on the decision motives of prosocial behavior, it is plausible that the more the perceived benefits for an alumni spin-off entrepreneur and/or his company – e.g. reputation, money, access to networks – exceed its costs – e.g. money, time, resources – the higher the likelihood that he decides to become engaged (cf. LEVINE/MANNING 2012: 328, MEIER 2006: 4). It is likely that an alumni spin-off entrepreneur does not only consider the rewards and costs of becoming involved, but also those of remaining uninvolved, such as saving time and money (rewards) or a loss of reputation (costs) (cf. BATSON et al. 1981: 290, LEVINE/MANNING 2012: 328).

In addition to these self-referential considerations, an alumni spin-off entrepreneur plausibly also considers societal consequences of a potential contribution to a university's entrepreneurial support structure. The more positive an alumni spin-off entrepreneur's opinion is about the commercialization of university knowledge and technology as well as about spin-off formation, the stronger his willingness will be to help foster it by assisting the organization and realization of a university's entrepreneurial support structure. The same applies to an alumni spin-off entrepreneur's opinion about the necessity and advantageousness of establishing a university-affiliated support structure and respective support measures. It is plausible to assume that an alumni spin-off entrepreneur who disapproves the benefits of a

university's entrepreneurial support structure – for instance because of a negative experience – will be less willing to become involved. An alumni spin-off entrepreneur's assessment of the competence of the actors in charge of a university's entrepreneurial support structure is crucial in this respect. When the university's entrepreneurial support structure is perceived negatively because the actors in charge are believed to be inadequately competent to support the start-ups of students and research staff, an alumni spin-off entrepreneur will not be motivated to become involved.

The literature on prosocial behavior suggests that an alumni spin-off entrepreneur's attitude towards contributing to a university's entrepreneurial support structure is furthermore influenced by the nature of his relationship to the university as a whole as well as to its entrepreneurial support structure in particular. Emotional attachment is acknowledged to be an important motive influencing an individual's decision between acting prosocially or not (cf. BALDASSARI/GROSSMAN 2013: 1, BIERHOFF 2008, TIDWELL 2005: 450). Relating this to the prosocial behavior considered here, it can be assumed that the stronger an alumni spin-off entrepreneur's feelings of emotional attachment are to a university as a whole or its entrepreneurial support structure in particular, the more positive his attitude will be towards an involvement and the more likely a decision will be in favor of it (cf. DIAMOND/KASHYAP 1997: 917, MEIER 2006: 16, RUYTER/WETZELS 2000: 392).

The intensity of an attachment is influenced by the nature of the personal relationship between the involved actors. The more stable and close the personal relationship is between an alumni spin-off entrepreneur and the actors in charge of a university's entrepreneurial support structure and the more it is based on sympathy and trust, the more likely the decision of an alumni spin-off entrepreneur will become in favor of an involvement (cf. BALDASSARI/GROSSMAN 2013: 1, BIERHOFF 2008: 323, REGAN 1971: 629). Attachment is also shaped by the so-called degree of "we-ness". In addition to the closeness of a relationship, it considers the similarity between individuals and their perception to belong to one group. "We-ness" leads to common attitudes, values, opinion and beliefs on specific issues and fosters the identification with one another (cf. BALDASSARI/GROSSMAN 2013: 2, BIERHOFF 2008: 329, BRIEF/MOTOWIDLO 1986, DIAMOND/KASHYAP 1997: 917, LEVINE et al. 2005: 444, MEIER 2006: 16). This implies that the stronger an alumni spin-off entrepreneur's identification is with the university as a whole, its entrepreneurial support structure, or even the region, and the more they share common attitudes, values, opinion and beliefs in respect to the commercialization of university knowledge and

technology via spin-off formation and conducive measures to support it, the more beneficial his attitude will be towards it and the more likely the decision in favor of an involvement.

Another aspect of an alumni spin-off entrepreneur's relationship to a university as a whole or its entrepreneurial support structure in particular, which affects his attitude towards contributing to a university's entrepreneurial support structure, is his feeling of obligation to reciprocate. In this respect, the literature on prosocial behavior states that people oftentimes "...help those who have helped them..." (cf. BRIEF/MOTOWIDLO 1986: 718) because they feel that they have an obligation to give back something in return for what they have previously received (cf. DIAMOND/KASHYAP 1997: 919, FEHR/GÄCHTER 2006: 161, REGAN 1971: 635). This argumentation implies that the more an alumni spin-off entrepreneur assesses the university education or the start-up support of the university to have been beneficial for himself, the more positive his attitude will be towards contributing to the university and its entrepreneurial support structure and the higher the likelihood will be that he decides to actually become involved.

According to the theory of planned behavior, the likelihood that an alumni spin-off entrepreneur decides to contribute to a university's entrepreneurial support structure is additionally determined by his subjective norm concerning such an engagement. In this respect, an alumni spin-off entrepreneur considers whether certain referent individuals or groups do or do not encourage and approve a contribution (injunctive norm). The greater the expectations of these referent individuals or groups regarding an engagement actually are, the more an alumni spin-off entrepreneur perceives these expectations and the more he is willing to comply with these expectations, the stronger the intention of an alumni spin-off entrepreneur will be to actually contribute to a university's entrepreneurial support structure (cf. AJZEN 1991: 195). The social pressure to contribute to a university's entrepreneurial support structure can either originate from certain individuals – e.g. the actors in charge of a university's entrepreneurial support structure, a university administration or regional stakeholders – or can be consequence of the expectations the society has on business owners in general or on a university's spin-off entrepreneurs in particular. As similarly discussed in Section 3.3.2, this suggests that the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure is not only a question of the decisions made by and behavior of the individual actors in charge and of individual alumni spin-off entrepreneurs. Instead, also culture and tradition regarding e.g. the social responsibility of entrepreneurs, alumni giving back and reciprocity, determine the expectations of society as well as of regional stakeholders that alumni spin-off entrepreneurs are faced with.

In addition to the effect of expectations and encouragement by others (injunctive norms), an alumni spin-off entrepreneur is influenced by descriptive norms, which refer to the impact of others performing the respective behavior as well (cf. FISHBEIN/AJZEN 1975). An alumni spin-off entrepreneur's intention to become involved in a university's entrepreneurial support structure increases, the more he observes other alumni spin-off entrepreneurs doing the same.

The theory of planned behavior furthermore suggests that an alumni spin-off entrepreneur's decision regarding an involvement in a university's entrepreneurial support structure depends additionally on his perceived behavioral control. This describes an alumni spin-off entrepreneur's perception of and confidence in his own capability to make a valuable contribution to the establishment, evolution and/or realization of a university's entrepreneurial support structure. Thereby, an alumni spin-off entrepreneur's control beliefs regarding the presence of factors that facilitate or impede a valuable contribution – e.g. his know-how, information, aptitude and experience – play an important role. Taking into account the literature on the decision motives of prosocial behavior, it can be assumed that the more positive an alumni spin-off entrepreneur assesses his capabilities to be for a useful contribution to a university's entrepreneurial support structure, the stronger his intention will be to become involved and the higher the likelihood will be of an actual involvement (cf. MIDLARSKY 1971: 133, 146, SCHWARTZ/DAVID 1976: 407). As already mentioned above, not only perceived but also actual behavior control plays a role. Accordingly, it is important that an alumni spin-off entrepreneur does not only believe to but also actually has the necessary capabilities to make a valuable contribution to a university's entrepreneurial support structure (cf. AJZEN 1991).

3.4 Aggregation of the presented arguments to a revised theoretical concept of university spin-off formation

By summarizing and aggregating the theoretical arguments from the previous sections, a revised theoretical concept of university spin-off formation which acknowledges an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs is presented in the following. The revised concept is illustrated in Figure 15. The arrows a, b, c, and d represent the direction of effect which contemporary concepts of university spin-off formation are confined to. Summarizing the respective literature, a university's entrepreneurial support structure can influence spin-off entrepreneurs and their decision to become self-employed, the start-up process as well as the development of the spin-off company by fostering their entrepreneurial motivation (arrow a) as well as by providing necessary information (arrow b), capabilities (arrow c) as well as material and financial resources (arrow d). The core of a university's entrepreneurial support structure are its support measures (sensitization measures, information-, capability- and resource supply measures (e.g. consultation, an entrepreneurship education program or training and coaching offerings)) and associated infrastructural facilities (e.g. a technology transfer office, an entrepreneurship office, an entrepreneurship professorship or a business incubator), which directly affect spin-off entrepreneurs (cf. ASTEBRO/BAZZAZIAN 2011, FINI et al. 2011, GREGORIO/SHANE 2003, O'SHEA et al. 2005a, WRIGHT et al. 2007). The literature furthermore suggests that a university's support measures and associated infrastructural facilities are optimally complemented by a positive entrepreneurial climate as well as a strong commitment of the university administration towards spin-off formation and respective policies (cf. ASTEBRO et al. 2012, GUERRERO/URBANO 2012, HELM/MAURONER 2007, NDONZUAU et al. 2002). Accordingly, while the national and regional environment as well as a university's characteristics (e.g. its subject structure) also exert an influence, it is especially the entrepreneurial support structure which affects a (potential) spin-off entrepreneur (cf. O'SHEA et al. 2005a, ROTHÄRMEL et al. 2007).

However, as illustrated in Section 3.2.1, contemporary theoretical approaches and evidence from the social sciences, regional sciences, economic geography and those very few studies that actually focus on the subject of interest suggest that spin-off entrepreneurs are not only influenced by a university's entrepreneurial support structure but can also influence it (e.g. cf. BATHELT/GLUECKLER 2011, BOSCHMA/FRENKEN 2006, GIDDENS 1984, KAILER 2010, LLOYD-REASON et al. 2006, NATHUSIUS 2013, NUSSMUELLER et al. 2006).

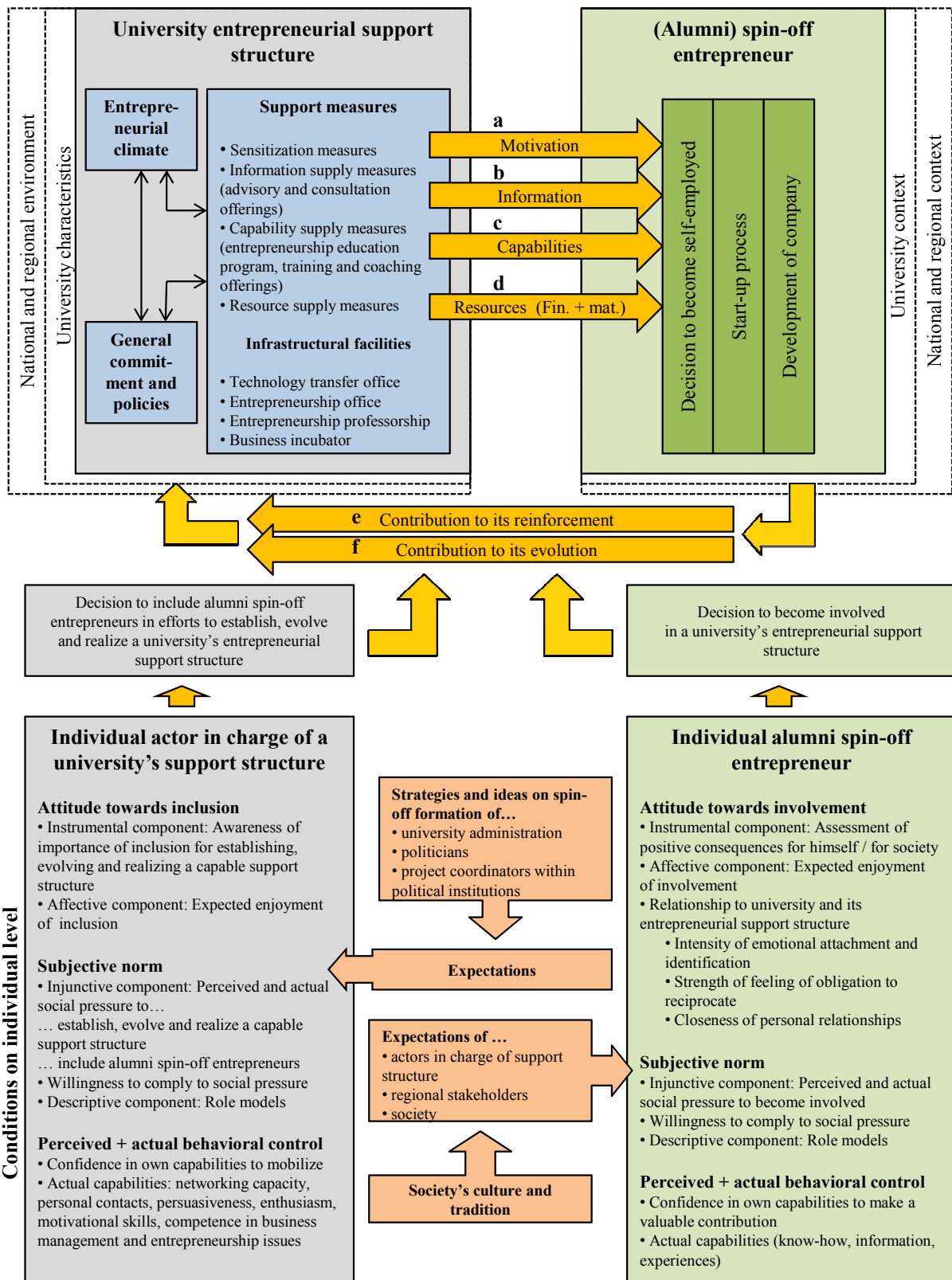


Figure 15: Revised theoretical concept of university spin-off formation

Source: Own illustration

Regarding this phenomenon's nature, two different potential dimensions of how alumni spin-off entrepreneurs affect a university's entrepreneurial support structure can be derived from the respective literature. These are illustrated by arrows e and f in Figure 15. Firstly, alumni spin-off entrepreneurs may contribute to the reinforcement of existing elements of a university's entrepreneurial support structure as they help to realize specific support measures (arrow e). In this respect, they may act as role models in the scope of sensitization measures or be involved as educators, lectures, coaches or mentors at education and training events as well as consultancy and coaching offerings (cf. KULICKE et al 2011: 239, 250, LLOYD-REASON et al. 2009: 609, ROBERT/EESLEY 2009: 6, WILSON 2008: 6).

Secondly, alumni spin-off entrepreneurs may contribute to the idea generation, the initial conceptualization or the later refinement of particular elements of a university's entrepreneurial support structure, and thus to its overall initial establishment and evolution (arrow f). They may provide important advice from their own start-up experience to the actors in charge, by either being a formal member of the respective conceptualization team or by informal and sporadic information exchange (cf. KAILER 2010: 260, LLOYD-REASON et al. 2009: 603, NATHUSIUS 2013: 76, 166).

A theoretical concept of university spin-off formation, which emphasizes that alumni spin-off entrepreneurs exert an influence on a university's entrepreneurial support structure and thus acknowledges an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs, should also explain, under which conditions this phenomenon occurs. The theoretical concept illustrated in Figure 15 describes these circumstances on a micro-level of the involved individual actors, namely the individual alumni spin-off entrepreneurs as well as the individual actors in charge of a university's entrepreneurial support structure. More precisely it explains, under which conditions an individual actor in charge decides to include alumni spin-off entrepreneurs in his efforts to establish, develop and realize the support structure as well as under which conditions an individual alumni spin-off entrepreneur decides to become involved in this respect.

Referring to AJZEN's (1991) theory of planned behavior, both an individual actor in charge of a university's entrepreneurial support structure as well as an individual alumni spin-off entrepreneur will decide in favor of an inclusion/involvement the more positive their attitude towards it, the stronger their subjective norm as well as the larger their perceived and actual behavioral control (see Figure 15). By summarizing Sections 3.3.2 and 3.3.3 the theoretical

concept in Figure 15 explains these motivational factors and the underlying beliefs more precisely.

Accordingly, an individual actor's in charge attitude towards an involvement of alumni spin-off entrepreneurs improves with the awareness that it is important for his success in establishing, evolving and realizing a capable entrepreneurial support structure (instrumental component) and with its expected enjoyment (affective component). Subjective norm refers to the perceived and actual social pressure of organizing a capable entrepreneurial support structure and to include alumni spin-off entrepreneurs (injunctive component). In this respect, the extent of expectations by the university administration, politicians or project coordinators within political institutions as well as the willingness of an actor's in charge to comply to these are of particular importance. Subjective norm is also affected by potential role models of the actors of other universities who are in charge of entrepreneurial support structures and their inclusion of alumni spin-off entrepreneurs (descriptive component). Regarding perceived and actual behavioral control, the likelihood that an actor in charge will include alumni spin-off entrepreneurs increases with his confidence in and his actual capabilities to mobilize alumni spin-off entrepreneurs to become involved, such as networking capacity, persuasiveness, motivational skills and competences in business management and entrepreneurship issues (see Figure 15).

The theoretical concept in Figure 15 also describes the precise motivational factors and underlying beliefs which determine the conditions under which an individual alumni spin-off entrepreneur decides to become involved in a university's entrepreneurial support structure. Accordingly, an alumni spin-off entrepreneur's attitude towards becoming involved increases, the stronger his assessment is that an engagement will have positive consequences for himself (e.g. financially or for his reputation), his business or for the overall society (instrumental component) and the more enjoyable he expects an engagement will be (affective component). In addition, an alumni spin-off entrepreneur's attitude towards an involvement is strongly influenced by his relationship to the university as a whole as well as to its entrepreneurial support structure. In this respect, the more intense his emotional attachment to and identification with these institutions are, the stronger his feeling of obligation to reciprocate and the closer the personal relationships to its actors are, the more positive an alumni spin-off entrepreneur's attitude will be towards an involvement. Regarding subjective norm, the stronger the perceived and actual social pressure to become involved is, the more likely an alumni spin-off entrepreneur decides in favor of an involvement (injunctive component). Of importance are also the extent of expectations by the actors in charge of the support structure,

regional stakeholders or the society as well as the willingness of an alumni spin-off entrepreneur to comply to these expectations. An alumni spin-off entrepreneur's subjective norm is furthermore affected by his perception of role-models, who exemplify an involvement for a university's entrepreneurial support structure (descriptive component). As for perceived and actual behavioral control, the likelihood that an alumni spin-off entrepreneur decides to become involved in a university's entrepreneurial support structure increases with his confidence in his capabilities and with the extent of his actual capabilities (know-how, information, aptitude, experiences) to make a valuable contribution (see Figure 15).

The theoretical concept illustrated in Figure 15 emphasizes that the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure is not only a question of the decisions made by and behavior of the individual actors in charge and individual alumni spin-off entrepreneurs. Instead, it indirectly also depends on those individuals and institutions that develop the superior strategies on the commercialization of university knowledge and technology as well as on spin-off formation. These are usually the university's administration, politicians or project coordinators within political institutions (e.g. ministries). Their strategies and ideas shape the expectations regarding a capable entrepreneurial support structure and the inclusion of alumni spin-off entrepreneurs, which in turn affect the actors in charge of establishing, developing and realizing a university's entrepreneurial support structure. Furthermore, culture and tradition regarding, e.g., social responsibility of entrepreneurs, alumni giving back and reciprocity determine the expectations of the society as well as by regional stakeholders that alumni spin-off entrepreneurs are faced with.

3.5 Conclusions

The aim of this paper was to present a revised theoretical concept of university spin-off formation, which takes into account an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. Thereby, this paper contributes in several ways to the literature on university spin-off formation and reveals interesting issues for further research.

3.5.1 Contributions to the literature

As already explained in the outset, the literature on university spin-off formation provides studies (e.g. LLOYD-REASON et al. 2009, NATHUSIUS 2013), from which one can surmise that the relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs can be considered to be interdependent. In this respect, the idea is that an individual spin-off entrepreneur is not only influenced by a university's entrepreneurial support structure regarding the decision to become self-employed, the start-up process and the early development of the company, but in turn also shapes a university's entrepreneurial support structure. However, from a conceptual point of view, the literature lacks a theoretical foundation of university spin-off formation that accounts for such an interdependent relationship. In fact, contemporary concepts of university spin-off formation so far focus only on one direction of effect, namely the role of a university's entrepreneurial support structure for spin-off formation (cf. for example O'SHEA et al. 2005a, ROTHARMEL et al. 2007), while the influence of spin-off entrepreneurs on the support structure has been largely ignored so far. This paper's contribution to the literature is that it addresses this conceptual shortcoming by presenting a revised theoretical concept of university spin-off formation that takes into account an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. Based on theoretical approaches from social science, regional science and economic geography and a summary of the literature on the relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs, the theoretical concept proposes the existence of an interdependent relationship. Furthermore, the concept explains how spin-off entrepreneurs potentially shape a university's entrepreneurial support structure. Thereby it suggests that they influence the structure by their involvement and contribution, either to the initial establishment and evolution of a university's entrepreneurial support structure or to the realization of existing elements. Finally, the revised theoretical concept reveals, under which conditions the

phenomenon occurs. More precisely, based on AJZEN's (1991) theory of planned behavior, it shows under which conditions an individual actor in charge of a university's entrepreneurial support structure decides to include alumni spin-off entrepreneurs in his efforts to establish, develop and realize the support structure as well as under which conditions an individual alumni spin-off entrepreneur decides to become involved in this respect.

Eventually, through the presented revised theoretical concept of university spin-off formation, this paper contributes to the advancement of the current state of research on the context determinants of spin-off formation by emphasizing the importance of the involvement of alumni spin-off entrepreneurs in establishing and reinforcing a capable university's entrepreneurial support structure.

By arguing for an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs, this paper furthermore contributes to the literature on the effects of university spin-off formation. So far the literature concentrates on the immediate real-economic effects (cf. LAWTON SMITH et al. 2006, OSKARSSON/SCHLÄPFER 2008, ROBERT/EESLEY 2009, SHANE 2004), while the rather indirect and systemic effects that affect a regional economy in the long-run are underresearched. This paper theoretically addresses and through the theoretical concept proposes, one so far in academia rarely and superficially discussed (e.g. LLOYD-REASON et al. 2009, NATHUSIUS 2013) indirect-systemic effect: the potential long-term modification and upgrade of a university's entrepreneurial support structure through the involvement and contribution of alumni spin-off entrepreneurs. As already stated, this phenomenon is expected to induce a self-amplifying process by which the entrepreneurial support structure is continuously modified and upgraded, in turn causing a dynamization of spin-off activity, which increases the potential for sustainable knowledge-driven regional development (cf. PATTON/KENNEY 2010).

More broadly, this paper contributes to the literature in economic geography and regional sciences, as it theoretically elaborates on the relationship between regional or institutional contextual conditions (a university's entrepreneurial support structure in this case) and individual actors (individual spin-off entrepreneurs in this case). Thereby, the revised theoretical concept strongly proposes that contextual conditions and individual actors influence each other, an argument that is in line with contemporary theoretical approaches in economic geography and regional sciences (cf. BATHELT/GLUECKLER 2011: 25, BOSCHMA/FRENKEN 2006, NUSSMUELLER et al. 2009).

3.5.2 Research implications

This paper only addresses the conceptual shortcomings of an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. However, empirical evidence in this respect is also scarce. As mentioned in the beginning, while there is plenty of empirical evidence on how a university's entrepreneurial support structure influences spin-off entrepreneurs (cf. for example O'SHEA et al. 2005a, ROTHÄRMEL et al. 2007), only a few studies address the other side by acknowledging the positive effects of an engagement and contribution of alumni spin-off entrepreneurs on the capability of a university's entrepreneurial support structure. Moreover, these studies usually address such an involvement only marginally, while primarily concentrating on other aspects (cf. e.g. KAILER 2010, KULICKE et al. 2011, KURATKO 2005, ROBERT/EESLEY 2009, WILSON 2008). In-depth analyses which focus exclusively on how actively involved alumni spin-off entrepreneurs influence a university's entrepreneurial support structure are even more scarce. The studies conducted by NATHUSIUS (2013) and LLOYD-REASON et al. (2009) are important exceptions. Consequently, future research should aim at finding empirical evidence for the existence and nature of the influence of spin-off entrepreneurs on a university's entrepreneurial support structure. This paper makes suggestions that can be used to guide further empirical analyses.

In addition, future studies should focus on the effects of the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure. In this respect, one issue is whether their involvement really has significant influence on the reinforcement and/or evolution of a capable entrepreneurial support structure and thus on the dynamization of spin-off activity, or whether their engagement is only an add-on for the realization of certain support offerings. It would be interesting to analyze whether particular university characteristics and/or regional conditions foster or hamper the effects that the involvement of alumni spin-off entrepreneurs could have.

No studies exist on the determinants of the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure. Future research should investigate the conditions at a university and regional level that support such an involvement. Particularly critical is the question on how a university can successfully mobilize alumni spin-off entrepreneurs to become involved. As a successful mobilization of alumni spin-off entrepreneurs depends on whether they can be motivated to become involved, knowledge about the motives that influence the decision of alumni spin-off entrepreneurs to become

involved or not is of particular value. Thus, future research should empirically address these motivations. The respective insights should be used to formulate empirically based recommendations for university actors on how to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure.

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Chapter 4

The contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure: Essential ingredient or just a decorative accessory?

Abstract

As universities are increasingly expected to contribute to a region's economic development through the formation of spin-off companies, they need to establish and reinforce an entrepreneurial support structure including e.g. qualification, education and consultation measures. In this respect, the literature suggests that a university's entrepreneurial support structure can strongly profit from the contribution of alumni spin-off entrepreneurs, who provide important resources and capabilities that a university may lack, such as practical start-up experience, know-how and information. However, such a contribution's importance, relative to other sources of know-how, experience and information remains unknown. This paper aims at narrowing this research gap by investigating on the relative role of the contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure. Furthermore, it intends to reveal in which way and for which particular elements of a support structure it is of importance. In a nutshell, the results from a qualitative case study suggest that while the contribution of alumni spin-off entrepreneurs is an essential ingredient for the realization of particular support measures and thus for the overall reinforcement of existing elements of a university's entrepreneurial support structure, it should rather be considered a decorative accessory when it comes to its overall evolution.

4.1 Introduction

Universities are important for regional economic growth and wealth creation. In this respect, they are traditionally recognized as a site for basic research and higher education (cf. CANIELS/VAN DEN BOSCH 2011). However, in the past decades self-conception and expectations of universities have changed. Besides the traditional functions, universities are increasingly perceived as so-called "entrepreneurial universities" with a strong link to the regional economy and governmental institutions. In this function they are supposed to play an active role in the transfer and commercialization of publicly funded research into the regional economy (cf. ETZKOWITZ/LEYDESDORFF 1997, GARNSEY 2007). This knowledge transfer occurs via different channels (e.g. collaboration with industry partners or licensing) (cf. BEKKERS/FREITAS 2008). Due to the often tacit nature of university knowledge, it is plausible to assume that the transfer through persons (e. g. labor mobility of graduates or scientists) is the most efficient mechanism of knowledge transfer (cf. BEKKERS/FREITAS 2008). This applies especially to start-up firms by university members – so-called university spin-offs – by which university students or scientists commercialize the knowledge obtained and created at a university in a direct manner (cf. FONTES 2005).

Universities and regions dedicated to the facilitation of spin-off activities need a supportive environment. Important in this respect are the general characteristics of the university (e.g. size, structure of scientific disciplines and quality of research and teaching) and the regional context (e.g. economic performance, industry-structure, entrepreneurial regime). Particularly crucial is the existence of a capable university entrepreneurial support structure. Studies suggest that in order to facilitate spin-off formation, a university must implement and maintain specific cultural attributes, practical routines as well as measures and facilities of support (e.g. business incubators or training, coaching and consultation programs) (cf. O'SHEA et al. 2005a, ROTHARMEL et al. 2007).

However, empirical evidence is still scarce on how exactly a university's entrepreneurial support structure emerges and evolves and who the key actors in this process. Among the existing literature, recent studies suggest that individuals who started a spin-off company out of a particular university at an earlier point in time (in the following referred to as "alumni spin-off entrepreneurs") play an important role in this respect (cf. LLOYD-REASON et al. 2009, NATHUSIUS 2013). Accordingly, a university's entrepreneurial support structure may significantly profit from an involvement and contribution of its alumni spin-off entrepreneurs, who provide important resources like experience, know-how or information they gained

during their own start-up process (cf. KAILER 2010, KURATKO 2005, NATHUSIUS 2013). However, hitherto, the respective stream of literature is little developed. Only few studies on the university context conditions of spin-off formation acknowledge that an involvement of alumni spin-off entrepreneurs is a valuable contribution to a university' entrepreneurial support structure. Moreover, these studies usually address such an involvement only marginally, while primarily concentrating on other aspects of spin-off formation (cf. e.g. KAILER 2010, KULICKE et al. 2011, KURATKO 2005, ROBERT/EESLEY 2009, WILSON 2008). Even more scarce are in-depth analyses which focus exclusively on how alumni spin-off entrepreneurs influence a university's entrepreneurial support structure by their engagement. In this respect, important exceptions are the studies conducted by NATHUSIUS (2013) and LLOYD-REASON et al. (2009).

While the above literature in general acknowledges the positive effects of an involvement of alumni spin-off entrepreneurs, its importance for a university's entrepreneurial support structure, relative to other sources of know-how, experience and information remains unknown. In other words, the question is, whether the contribution of alumni spin-off entrepreneurs is an essential ingredient or just a decorative accessory to a university's entrepreneurial support structure. This paper aims at narrowing this research gap by answering the following central research question:

(1) Which relative role does the contribution of alumni spin-off entrepreneurs play for a university's entrepreneurial support structure?

In this respect, in case the contribution of alumni spin-off entrepreneurs is an important ingredient, this paper's further aim is to reveal, in which way and for which particular elements of a university's entrepreneurial support structure it is of importance. The corresponding research questions are:

(2) In which way does the contribution of alumni spin-off entrepreneurs play an important role for a university's entrepreneurial support structure?

(3) For which elements of a university's entrepreneurial support structure does the contribution of alumni spin-off entrepreneurs play an important role?

Regarding the intention to understand the investigated phenomena holistically and in its complex details, while taking into account its context-dependency and process character, I

apply a qualitative case study design, as recommended by YIN (2003). As the subject of investigation I choose the entrepreneurial support structure of Leibniz Universität Hannover (LUH) in Germany. The primary data collection includes a survey of semi-structured face-to-face interviews with key informants of LUH's entrepreneurial support structure. This data is supplemented with archival material and official documents. I analyze the data using typical content analysis procedures (cf. GLÄSER/LAUDEL 2009, MAYRING 2010).

In a nutshell, the results suggest that the contribution of alumni spin-off entrepreneurs plays an important role for a university's entrepreneurial support structure – at least in the case of LUH. However, this finding needs to be regarded in a differentiated way. While the contribution of alumni spin-off entrepreneurs is obviously an essential ingredient for the realization of particular support measures and thus for the overall reinforcement of existing elements of a university's support structure, it should rather be considered a decorative accessory when it comes to the overall evolution of a university's entrepreneurial support structure.

The results contribute to the literature on university spin-off formation in two ways. Firstly, they advance the current state of research on the context determinants of spin-off formation by emphasizing the importance of alumni spin-off entrepreneurs' involvement for a university's entrepreneurial support structure. Secondly, they contribute to the literature on the effects of university spin-off formation by pointing towards one of in academia so far rarely discussed indirect, long-term and systemic effects of spin-off formation. In this respect, this paper's results lead to the careful conclusion that the contribution of alumni spin-off entrepreneurs induces a self-amplifying process by which LUH's entrepreneurial support structure is continuously modified and upgraded. It is plausible to assume that this in turn causes a dynamization of spin-off activity, which increases the potential for sustainable knowledge-driven regional development (cf. PATTON/KENNEY 2010).

The paper is structured as follows: The next section lays out the theoretical background and deduces relevant categories which guide the empirical analysis. Section 4.3 introduces the research design, survey methodology and data analysis procedures. The results are presented and discussed in Section 4.4. Section 4.5 concludes the paper.

4.2 Theoretical background

Section 4.2.1 discusses the relevance of alumni spin-off entrepreneurs' contribution to a university's entrepreneurial support structure and thus why it is plausible to assume that it plays an important role. Furthermore, Section 4.2.1 derives from the literature the potential nature of a respective contribution, in order to identify in which way it theoretically is of importance. Section 4.2.2 presents a framework of a university's entrepreneurial support structure elements by briefly summarizing the respective literature. Section 4.2.3 summarizes the theoretical considerations and illustrates a conceptual framework, including the theoretically derived relevant categories which will guide the data analysis.

4.2.1 The relevance and nature of the contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure

A suitable approach to understand the relevance of alumni spin-off entrepreneurs' contribution for the evolution and reinforcement of a university's entrepreneurial support structure is the application of the resource-based view (RBV) (for similar applications of RBV see GRAS et al. 2008, PAZOS et al. 2011, POWERS/MCDOUGALL 2005). RBV defines an organization as a bundle of resources, capabilities and information and argues that their existence as well as quality and features exert significant influence on the organization's success in accomplishing its tasks (cf. ALTHOLZ 2010, BARNEY et al. 2001, GRAS et al. 2008, LEE et al. 2001, PAZOS et al. 2011, PENROSE 1959, POWERS/MCDOUGALL 2005). However, RBV argues that most organizations do not possess and are not able to generate all necessary resources, capabilities and information internally. Instead, their success additionally significantly depends on the assets an organization is able to source from the external context (cf. ALTHOLZ 2010, FRĄCZKIEWICZ-WRONKA/SZYMANIEC 2012, NEMATİ et al. 2010, PENROSE 1959).

By applying the rationale of the RBV on a university's entrepreneurial support structure as an organization, it is plausible to assume that its actors in charge do not possess all resources, capabilities and information necessary to efficiently support the formation of university spin-offs. Conceivably, traditional negative attitudes towards commercialization and spin-off activities as well as a lack of practical experience in starting-up businesses inhibit university actors to efficiently support the formation of spin-off companies. Therefore – as RBV

suggests – these actors rely on external assistance when configuring and reinforcing an environment supportive to spin-off formation.

Several arguments support the central hypothesis of this paper that alumni spin-off entrepreneurs are a promising source of these lacking resources, capabilities and information. Firstly, alumni spin-off entrepreneurs have gone through the distinctive process of research commercialization and business start-up out of a university. Through this experience they have obtained specific know-how that is of particular value for the university's actors in charge (cf. HSU 2007). Furthermore, alumni spin-off entrepreneurs are relatively easy to mobilize to engage, as they usually locate their business in the university region and therefore share a regional identity and interest (cf. STEFFENSEN et al. 2000). In addition, they often retain close personal relationships with university actors (cf. GÜBELI/DOLOREUX 2005). Mobilization of alumni spin-off entrepreneurs may also be facilitated because spin-off founders often feel obligated to their university and its regional environment, which might support their business or have done so in the earlier stages of business development. Last but not least, alumni spin-off founders share with the supporting actors the positive attitude towards knowledge and technology transfer and the commercialization of research via spin-off formation – as opposed to many university and regional stakeholders.

Although the literature on the positive effects of the contribution of alumni spin-off entrepreneurs for a university's entrepreneurial support structure is little developed, it is possible to draw assumption on the question, in which way it plays an important role. In this respect, two potential dimensions can be differentiated: Alumni spin-off entrepreneurs' contribution to the reinforcement and their contribution to the overall evolution of a university's entrepreneurial support structure. As for the former dimension, the literature proposes that an involvement of alumni spin-off entrepreneurs positively influences the realization of specific existing support measures. In this respect, their assistance is considered a helpful contribution to the daily business of a university's entrepreneurial support structure. Regarding the specific mode of such an involvement, it is for instance argued that sensitization measures improve effectiveness when alumni spin-off entrepreneurs are involved as role-models (cf. KULICKE et al. 2011: 250, WILSON 2008: 6). Moreover, studies from different geographical contexts show that a university's entrepreneurship education and training events, as well as its consultancy and coaching offerings profit when alumni spin-off entrepreneurs engage as educators, lecturers, coaches or mentors (cf. ROBERT/EESLEY 2009: 6 for MIT in the United States, KULICKE et al. 2011: 239 for German universities,

LLOYD-REASON et al. 2009: 609 for universities in the UK, NATHUSIUS 2013: 161, WILSON 2008: 6, KURATKO 2005: 589).

As for the second dimension, alumni spin-off entrepreneurs assumingly may contribute to different stages of a university's entrepreneurial support structure's evolution, such as the idea generation, the configuration and conceptualization of initial support structure elements or its later refinement in the form of reconfiguration efforts (cf. KAILER 2010, LLOYD-REASON et al. 2009, NATHUSIUS 2013). However, the empirical evidence for this dimension remains superficial and foremost anecdotal. For instance, KAILER (2010) recognizes that in German-speaking countries, "it turned out to be effective to integrate alumni-entrepreneurs into the universities' working groups, focusing on both future strategic positioning, and university and faculty development plans or curriculum designs." (KAILER 2010: 260). In this respect, NATHUSIUS (2013: 76, 166) and LLOYD-REASON et al. (2009: 603) emphasize that experienced alumni spin-off entrepreneurs can provide important advice regarding the development of specific entrepreneurship support offerings and the overall entrepreneurship education curriculum. As for the mode of alumni spin-off entrepreneurs' contribution to the evolution of a university's entrepreneurial support structure, the literature on individual's community involvement suggests that "...the social process of taking part (voluntarily) in {...} activities, programs and/or discussions to bring about a planned change or improvement in community life, services and/or resources {...}" (BRACHT/TSOUROUS 1990: 201) may vary in its degree of formality (cf. BRACHT/TSOUROUS 1990). Accordingly, alumni spin-off entrepreneurs may play an active and formal role in the conceptualization of new and reconceptualization of existing initiatives whereas they provide knowledge and experience by being part of the conceptualization team. Their knowledge and experience may also enter the conceptualization and reconceptualization by passive assistance, for example in the form of informal and sporadic knowledge-exchange whereas alumni spin-off entrepreneurs give advice but are not officially part of the conceptualization team (cf. KAILER 2010, LLOYD-REASON et al. 2009, NATHUSIUS 2013).

For both dimensions of alumni spin-off entrepreneurs' contribution to a university's entrepreneurial support structure, the form of activation with respect to the level of proactivity is a crucial issue. The literature on community engagement elaborates on "A specification of the philosophy of response..." (CARROLL 1979: 499) suggesting that it can range on a continuum from proactive to reactive behavior (cf. BATEMAN/CRANT 1993, CARROLL 1979). Accordingly, it is plausible to assume that some alumni spin-off entrepreneurs' impulses and desires to become involved stems from themselves as they anticipate the

necessity to change and improve a university's entrepreneurial support structure (proactive behavior). On the other hand, other alumni spin-off entrepreneurs need to be mobilized by the actors in charge of a university's support structure and only become involved after they are asked (reactive behavior).

4.2.2 The elements of a university's entrepreneurial support structure¹²

As already explained in Chapter 2 of this dissertation, a literature summary suggests that a capable university entrepreneurial support structure should comprise three elements. First, the core of a university's entrepreneurial support structure is its support measures and associated infrastructural facilities, which directly affect spin-off entrepreneurs by providing resources, capabilities, information as well as motivation. Briefly summarizing the relevant literature, a university's entrepreneurial support structure can affect spin-off entrepreneurs and their decision to become self-employed, the founding process and the early development of their spin-off company by four different support measures. Firstly, sensitization measures that target at fostering motivation and attitudes towards entrepreneurship among faculty and staff (cf. FINI et al. 2011, KULICKE et al. 2011). Secondly, information supply measures in the form of advisory and consultation offerings that provide know-how and information in areas such as the assessment of market potential, legal protection or business plan development (cf. NDONZUAU et al. 2002, O'SHEA et al. 2005a, SHANE 2004a, VOHORA et al. 2004). Thirdly, capability supply measures, such as an entrepreneurship education program within a university's curricula or training and qualification measures, which teach (potential) spin-off entrepreneurs necessary skills (cf. ASTEBRO/BAZZAZIAN 2011, GUERRERO/URBANO 2012, KULICKE et al. 2011). Fourthly, resource supply measures, aiming at supplying spin-off entrepreneurs with scarce but necessary financial and material resources (e.g. taking equity, allowing the use of university infrastructure) (cf. DI GREGORIO/SHANE 2003, WRIGHT et al. 2002, WRIGHT et al. 2007). Studies also suggest that certain infrastructural facilities, such as a technology transfer office, an entrepreneurship office, an entrepreneurship professorship, a venture capital fund or a business incubator are crucial for an efficient implementation and realization of support measures and consequently for a strong impact on

¹² An explanation of why a university entrepreneurial support structure is of importance as well as a detailed elaboration of the three elements of a capable university entrepreneurial support structure is provided in Chapter 2 of this dissertation. In order to avoid repetitions, this version of the paper includes only the most relevant information. For details refer to Section 2.2.

spin-off entrepreneurs (cf. DI GREGORIO/SHANE 2003, DJOKOVIC/SOUITARIS 2008, GUERRERO/URBANO 2012, WRIGHT et al. 2002, WRIGHT et al. 2007).

The literature suggests that a capable university entrepreneurial support structure should furthermore incorporate two elements. Firstly, a positive entrepreneurial climate (in the literature sometimes also referred to as entrepreneurial culture), which advocates the commercialization of university knowledge and technology via spin-off formation (cf. GUERRERO/URBANO 2012, GUPTE 2007, NDOZUAU et al. 2002, SHANE 2004a, SIEGEL et al. 2003). Secondly, a university's general commitment to the commercialization of university knowledge and technology via spin-off formation (cf. ASTEBRO et al. 2012) and respective policies including rules, arrangements and unwritten norms regarding for example the use of the university infrastructure (cf. HELM/MAURONER 2007), the provision of licenses and patent rights, the introduction of specific contractual arrangements (cf. FINI et al. 2011, MUSTAR et al. 2008) or the establishment of incentive structures that reward entrepreneurial activity (cf. O'SHEA et al. 2005a) (for a more detailed explanation of the elements of a capable university entrepreneurial support structure see Chapter 2 of this dissertation).

As explained in Chapter 2 of this dissertation, it is important that the three elements of a university's entrepreneurial support structure should not be considered separately, but that they interact. There is for example a nexus between a university's climate and the other two support structure elements, in that an entrepreneurial climate is also reflected by a university's general commitment towards commercialization and entrepreneurial activities. This in turn constitutes if and to what extent measures of support, associated organizations as well as specific policies on spin-off formation are implemented. On the other hand, a strong commitment of a university towards entrepreneurship and effective rules, arrangements and unwritten norms influences a faculty's and a student's attitude towards spin-off formation and improves a university's entrepreneurial culture. Furthermore, sensitization measures as well as capability supply measures (particularly an entrepreneurship education program and an entrepreneurship professorship) support entrepreneurial thinking and attitudes among students and staff and thereby foster an entrepreneurial culture.

4.2.3 Conceptual framework

Figure 16 integrates the research questions addressed and the theoretically derived categories into a conceptual framework, which guides the empirical analysis. Firstly, I will investigate on the relative role of the contribution of alumni spin-off entrepreneurs for a university's entrepreneurial support structure (Research Question 1). The aim is to show whether this is an essential ingredient to a support structure or just a decorative accessory. Secondly, I will elaborate, in which way the contribution of alumni spin-off entrepreneurs is of importance (Research Question 2). In this respect, Section 3.2.1 discusses two potential dimensions: Alumni spin-off entrepreneurs' contribution to the evolution of a university's entrepreneurial support structure including configuration and re-configuration efforts, as well as their engagement to the reinforcement by contributing to existing support measures. Regarding the mode of contribution to the evolution of a university's entrepreneurial support structure, a differentiation regarding the degree of formality (formal vs. informal engagement) is plausible. For both dimensions, I will furthermore identify the modes of activation, which

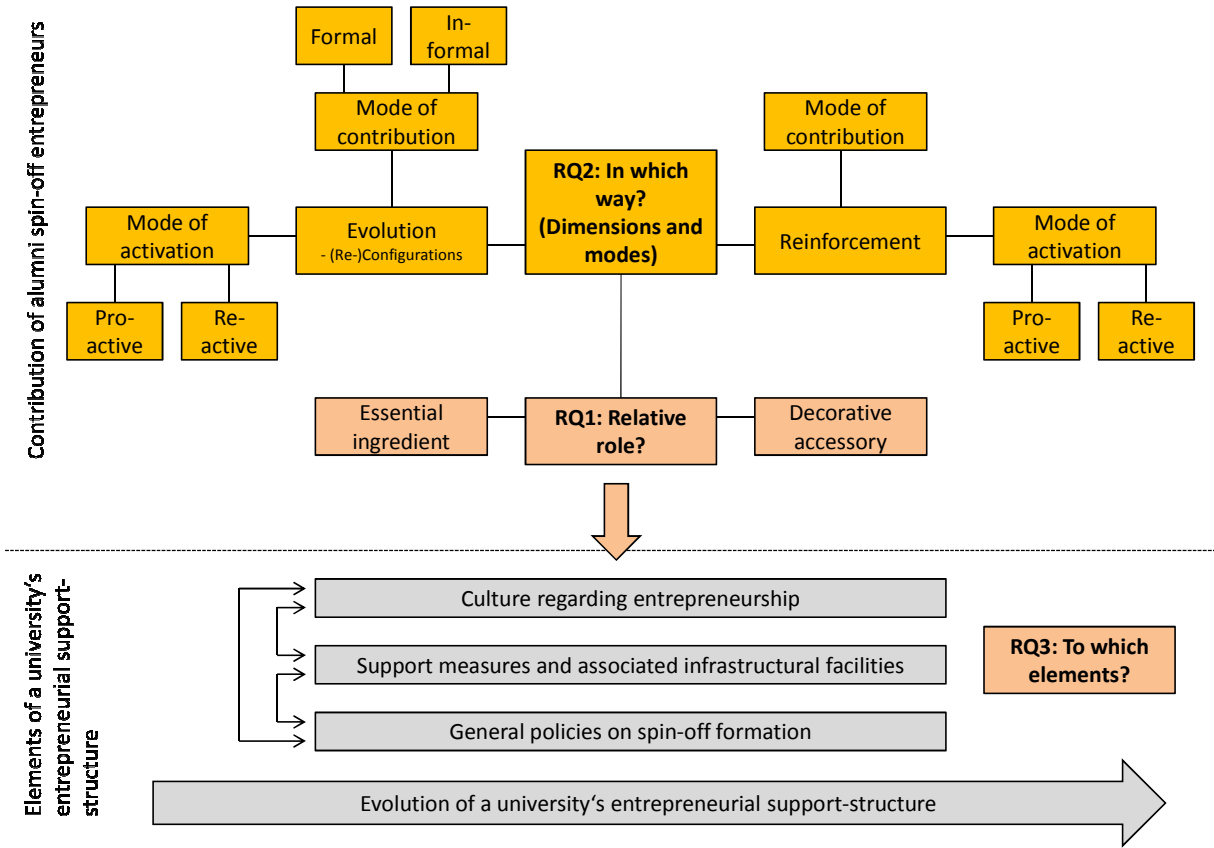


Figure 16: Conceptual framework
Source: Own illustration

may vary between proactive and reactive behavior (see Section 3.2.1). Thirdly, I will consider, for which elements of a university's entrepreneurial support structure the contribution of alumni spin-off entrepreneurs plays an important role (Research Question 3). Section 3.2.2 identifies three elements of a university's entrepreneurial support structure: A university's culture regarding entrepreneurship, particular support measures (including sensitization, information supply, capability supply and resource supply measures) and associated infrastructural facilities, as well as a university's general policies on spin-off formation.

A university's entrepreneurial support structure is of course not stable but gradually evolves over time in a highly path-dependent process, including different phases of configuration, conceptualization and refinements. Regarding the evolution of a university's entrepreneurial support structure, the three elements should not be considered separately. Instead, there are interactions between the different elements.

4.3 Data and methods¹³

4.3.1 Research design and case selection

Regarding the intention to understand the investigated phenomena holistically and in its complex details, while taking into account its context dependency and process character, I apply a case study design, as recommended by YIN (2003) (see Section 1.6.1 for a more detailed explication of why a qualitative research design is chosen). As subject of investigation I choose the entrepreneurial support structure of Leibniz Universität Hannover (LUH). As explained in the introduction of this dissertation, I choose LUH, because it exemplifies a German middle-range university regarding entrepreneurial conditions and spin-off activities (cf. SCHMUDE et al. 2011) (see Section 1.6.2). Furthermore, LUH is located in a region outside a high-tech cluster with a rather weak entrepreneurial culture. It is hence a particularly suitable example for displaying the German normality.

4.3.2 Survey methodology

The primary data collection included semi structured face-to-face interviews with 13 key informants. As key informants I considered persons that either worked in the past in or still are affiliated with an organization and position in which they directly deal with LUH's entrepreneurial support structure (for more detailed information on who qualifies as key informant see Section 1.6.3).

Throughout the interviews, I asked the key informants questions regarding the evolution of LUH's entrepreneurial support-structure, the sources of know-how and information during the conceptualization and configuration of its particular elements as well as alumni spin-off entrepreneurs' contribution to the conceptualization, configuration and reinforcement of these elements (see Appendix 1 for the interview manual of the key informant survey). In the case of content-related discrepancies, I approached the key informants once more to reconcile discrepancies. The qualitative survey methodology enabled several advantages during the interviews (cf. MAYRING 2000, PATTON 1990, YIN 2003) (see Section 1.6.3).

¹³ Detailed information on data and methods are already provided in the introduction of this dissertation (see Section 1.6). In order to avoid repetitions, this version of the paper includes only the most relevant information on the research design, the case selection, the survey methodology as well as the data coding and analysis. For more information please refer to Section 1.6..

I supplemented the information from the interviews with key informants with information from archival sources, such as the annual activity reports of LUH's technology transfer office, studies, presentation, brochures and strategy documents.

4.3.3 Data coding and analysis

I examined the transcribed interviews using typical content analysis procedures (cf. GLÄSER/LAUDEL 2009, MAYRING 2010), supported by the qualitative data analysis software NVivo. As commonly implemented in qualitative research (cf. KELLE/KLUGE 2010, KUCKARTZ 2012, SCHREIER 2012: 89), I applied two central procedures of systematic, rule guided, category based analysis. Firstly, I applied deductive category application for themes with theoretically pre-defined categories (e.g. dimensions, degree of formality and mode of activation of alumni spin-off founders' contribution). Thereby I used the in the conceptual framework from theoretical considerations derived categories as basis to structure the transcript material. Furthermore, I applied inductive category development. The scopes and approaches of both procedures are explained in detail in the introduction of this dissertation (see Section 1.6.4). The final coding frames that emerged from deductive category application and inductive category development of the interview material with key informants are presented in Appendix 4.

I ensured compliance with quality criteria of qualitative research (cf. STEINKE 2004) by applying rule guided procedures as well as by establishing intra- and intercoder reliability in the scope of data analysis (see Section 1.6.4).

4.4 Empirical results

The following presentation of results is structured based on the two assumed dimensions of alumni spin-off entrepreneurs' contribution to a university's entrepreneurial support structure: Their engagement regarding its evolution (Section 4.4.2) which is introduced by the illustration of the evolution of LUH's entrepreneurial support structure (Section 4.4.1), and their commitment regarding the reinforcement of existing support structure elements (Section 4.4.3).

4.4.1 The evolution of LUH's entrepreneurial support structure¹⁴

Archival material analysis and interviews with key informants suggest that the evolution of LUH's entrepreneurial support structure can broadly be divided into three different stages: The initial stage included the generation of the general idea to establish an entrepreneurial support structure at LUH, the first impetus as well as an evaluation of demand. It was followed by a stage of conceptualization and configuration of the initial support structure elements. The third stage, which is still in progress, incorporates the sustainment and gradual reconfiguration, which shaped the further evolution of LUH's entrepreneurial support structure. The following briefly outlines each stage.

Stage 1: Idea generation, first impetus and evaluation of demand for an entrepreneurial support structure

While in the United States public policy and universities actively supported university spin-off formation since the 1970s (cf. SHANE 2004a: 65), most universities in Germany, as in other European countries, did not implement initiatives for students and scientists who intend to commercialize university knowledge and technology by starting up businesses before the 1990s (cf. WRIGHT et al. 2007). This is also the case for Leibniz Universität Hannover (LUH), where no centralized, organized and structured support measures existed until 1996. Although a technology transfer office (TTO) was established in 1987, its initiatives and programs within the first ten years of its existence focused on different channels of technology and knowledge transfer. Its primary aim was the intermediation between university science and the private economy by offering information and consultation for university affiliates who intended to commercialize scientific knowledge, and for companies that wanted to access university knowledge and technology. In order to promote an intense relationship between science and research at LUH, the private economy and public actors, the TTO conceptualized, organized and implemented various events of public relations (cf. TTO Annual Activity Reports 1993, 1994, 1995).

While there was no institutionalized university-internal entrepreneurial support structure at LUH until 1996, regional initiatives aiming to support start-ups by young scientists already existed before. As early as 1984, the so-called "Hannover-Modell der Förderung von technisch orientierten Existenzgründungen" ("Hannover-Modell for the support of technical

¹⁴ Encompasses the evolution of LUH's entrepreneurial support structure until the year 2011.

oriented start-ups") was established as an affiliation of representatives of Hanover's municipal, Lower Saxony's Ministry for Economics and Traffic, a regional bank, LUH as well as the "Hannoversche Hochschulgemeinschaft" (Hanover University Association). According to STERNBERG (1984: 112) the "Hannover-Modell" can be described as an attempt to support LUH's young scientists in the fields of natural sciences and engineering in their intention to start a business by mediating financial aid, providing appropriate and inexpensive premises and consulting in case of legal or business problems (cf. STERNBERG 1984: 112-113).

The initial impetus to establish a university-internal entrepreneurial support structure at LUH was induced by Hanover's economic development agency during the mid 1990s. At that time it strongly pursued a strategy to induce knowledge and innovation based regional development by fostering knowledge and technology intensive entrepreneurship. In this respect, several key persons acknowledged the potential to commercialize the knowledge and technology generated at LUH through start-ups by students and scientists. As a former employee of the TTO remembers:

"We had some very active folk in the economic development agency at that time, who acknowledged the potential of university spin-offs for regional development and who were also willing to push forward certain initiatives" (KEY INF. 12).

As the economic development agency required access to LUH in order to exploit the university's entrepreneurial potential, it actively addressed the LUH's TTO as its cooperation partner. After the TTO was convinced by the potential of establishing an entrepreneurial support structure at LUH, a brainstorming process was initiated to which staff from LUH's TTO as well as staff from several economic development agencies contributed. This brainstorming aimed at identifying important elements of a university's entrepreneurial support structure and at creating strategies for its implementation.

In between fall 1995 and summer 1996 the TTO conducted two municipally financed studies, in order to evaluate the potential demand and the conditions for the implementation of an entrepreneurial support structure at LUH. Firstly, interviews with LUH institute directors and scientific staff revealed that there already was some spin-off activity from certain institutes and that the university's staff indeed desired centralized initiatives to support the formation of spin-off companies. Secondly, a student survey showed that quite a strong demand and interest in entrepreneurship support measures existed among LUH students (cf. TTO Annual

Activity Reports 1995 and 1996, different Key Informants (KEY INF.), TTO Study 1997a, TTO Study 1997b).

Stage 2: Conceptualization and configuration of initial support structure elements

Based on the results of these studies, the LUH's TTO was entrusted by the municipal government to develop a concept of an entrepreneurial support structure at LUH. Subsequently, the TTO conceptualized an initial entrepreneurial training program, which started in 1996. It was financed by Hanover's economic development agency as well as the region's administration. The objective was to provide business and management know-how to students and research staff who had an innovative business idea. It focused on technical engineering and natural sciences and included a series of lectures, weekend seminars and standard curricular courses. During the first year of its existence LUH's entrepreneurial support structure supported three spin-off companies (cf. TTO Annual Activity Report 1996 and different KEY INF.).

Within the scope of a pilot project called "Unternehmensgründungen aus Hochschulen" ("Firm start-ups from universities"), the initial training program was continued and further developed. The pilot project was financed by Lower Saxony's Ministry of Economics, Employment and Traffic as well as its Ministry of Science, Education and Culture and lasted until the year 2000. Similar to the initial training program, the pilot project's aim was to provide business and management know-how to interested students, graduates and research staff as well as to support (potential) entrepreneurs before, during and after a start-up. The project's comprehensive offerings consisted of three pillars: consultation and coaching offerings, education and training events, as well as access to LUH's infrastructure. The access to LUH's infrastructure was one of the first aspects considered in the context of conceptualization. An agreement was arranged with LUH that allowed spin-off founders to utilize university facilities and equipment (e.g. leasing of facilities for business activities, utilization of laboratory equipment) for the development of innovative products, processes or services in agreement with the respective institute (cf. TTO Annual Activity Reports 1997, 1998, 1999, 2000, TTO Final Report Pilotprojekt "Unternehmensgründungen aus Hochschulen" 2001). In addition, a general guide line for contractual arrangements allowing part-time engagement of LUH staff in their start-ups was established (cf. KEY INF. 10). The pilot projects' target group was not only LUH members, but members from all higher education institutions in Hanover. In this respect, LUH's TTO served as central contact point

by centrally coordinating and organizing consultation, coaching, education and training measures (cf. TTO Annual Activity Reports 1997, 1998, 1999, 2000, TTO Final Report Pilotprojekt "Unternehmensgründungen aus Hochschulen" 2001).

A central objective of the pilot project was to establish an entrepreneurial culture at LUH (cf. KEY INF. 10). A former TTO employee remembers that even though it didn't include explicit sensitization activities (cf. KEY INF. 6), the project's coaching, consultation, education as well as training offerings increased the awareness of self-employment as a career choice among LUH students and staff and hence at least indirectly influenced the entrepreneurial culture at LUH (cf. KEY INF. 10).

In addition to the initial training program and the pilot project, the TTO acknowledged the potential of an international partnership with TTOs at different European universities as early as 1996 and decided to contribute to a project, financed by the European Union (Leonardo da Vinci, European Program for Occupational Training). The project started in 1996 and LUH's TTO was coordinator and contracting partner. Cooperation partners were the TTOs of the universities in Twente (Netherlands), Salford (England) and Galway (Ireland). The aim was the joint development of a training program by exchanging know-how and experience in supporting university spin-offs. In 1996 the support activities at the four universities were surveyed and particular contents compared. Based on this, in 1997 a training program was conceptualized and its realization tested. The project ended in 1999 in the context of a conference (cf. TTO Annual Activity Reports 1996, 1997, 1998, KEY INF. 6, KEY INF. 10, KEY INF. 12).

Right from the start, events and measures such as financing workshops, presentations about legal aspects or consultation by tax advisors and lawyers were organized in close cooperation with regional partners like local banks, economic development agencies, technology centers and chambers of commerce. Therefore, in collaboration with the municipal economic development agency and the chamber of commerce, the TTO established a pool of start-up experts, which included 14 different organizations. Over the following years, a close regional network developed that was constantly augmented (cf. TTO Annual Activity Reports 1996, 1997, 1998, 1999, KEY INF. 6, KEY INF. 10, KEY INF. 12, TTO Final Report Pilotprojekt "Unternehmensgründungen aus Hochschulen" 2001).

As several key informants state, the general university's commitment for the support of spin-off formation during the initial projects was rather moderate. Even though the TTO's efforts in this respect were acknowledged and appreciated, the issue was not of higher priority

compared to other tasks of a university (cf. KEY INF. 10, KEY INF. 12). The limited commitment also didn't allow for the establishment of a sophisticated entrepreneurial support infrastructure at LUH, such as a business incubator or an entrepreneurship professorship, which was considered by the TTO's staff. Alternatively, spin-off founders were offered office space and equipment at university or were directed to the municipal's or region's business incubators (cf. KEY INF. 6, KEY INF. 10, KEY INF. 12).

Stage 3: Sustainment and re-configuration during the further evolution of LUH's entrepreneurial support structure

After the end of the pilot project "Unternehmensgründungen aus Hochschulen" in 2000, LUH's TTO's aim was to consolidate and continue the established elements of the entrepreneurial support structure at LUH. Therefore, a new financial base became necessary. At the same time, Lower Saxony's Ministry of Economics, Employment and Traffic initialized a public support program called "Die gründerfreundliche Hochschule" ("The start-up friendly University"), by which universities could receive financial resources in order to support students and staff with start-up intentions (in 2004 it was renamed "Gründercampus plus"). By launching this program, the ministry reacted to the fact that no university in Lower Saxony was included in EXIST I, a German federal program designed to support entrepreneurship at universities (cf. KEY INF. 7, KEY INF. 12). Resources of "Die gründerfreundliche Hochschule" were distributed through a contest of the universities' concepts. One of the most important evaluated aspects was the existence of a network of regional universities and partners. Both existed at LUH as a consequence of the pilot project. LUH won the contest for the region Central Lower Saxony (cf. TTO Annual Activity Report 2000). "Die gründerfreundliche Hochschule" started in 2001 and LUH's TTO became the contact point for Central Lower Saxony and its eight universities. The project included financial support for external consultation, subsidies for the use of university infrastructure as well as a grant for working capital (cf. TTO Annual Activity Reports 2000, 2001, 2002, 2003, 2004, TTO Summary of History 2012, KEY INF. 12). LUH's TTO was central information point for students and staff of the eight universities and, in cooperation with its regional partners, offered a comprehensive offering, including coaching, qualification, consultation and the coordination of financial support resources (cf. TTO Summary of History 2012). The TTO also for the first time started sensitization and mobilization measures, targeted at

improving LUH's entrepreneurial culture. However, as a former TTO employee remarks, these were still very limited due to financial and personnel constraints (cf. KEY INF. 12).

In between 2008 and 2011 LUH's TTO was able to significantly expand its offerings, due to new financial sources from the European Regional Development Funds (ERDF) and EXIST III. In addition to the aforementioned offering, LUH's TTO was now able to substantially intensify its sensitization and mobilization efforts, aiming at promoting the entrepreneurial attitude and culture among LUH students and staff. With the financial support of ERDF and EXIST III, the TTO was able to employ personnel, who worked as coordinators within LUH faculties (cf. TTO Summary of History 2012, TTO Presentation at Executive Committee Meeting 2012, KEY INF. 2, KEY INF. 9).

After the termination of EXIST III in 2011, once again a new financial base was required for the continuation and sustainment of LUH's entrepreneurial support structure. Therefore, LUH applied for the follow-up program EXIST IV. However, LUH's application failed (cf. KEY INF. 2, KEY INF. 9). Several of the key informants explain the reason for this failure: The non-existence of an entrepreneurship professorship and a university incubator, the limited commitment of LUH's management, and a concept with little conclusiveness (cf. KEY INF. 2, KEY INF. 7, KEY INF. 9, KEY INF. 13). As a consequence, the TTO's start-up support faced a severe funding gap resulting in a reduction of its support measures and efforts. This affected especially the sensitization and mobilization efforts that were mainly financed by EXIST (cf. KEY INF. 2, KEY INF. 9). Nevertheless, the TTO's comprehensive offerings, including coaching, qualification, consultation and the coordination of financial support resources, were continued with financing by two ERDF-projects (cf. KEY INF. 2, KEY INF. 9, TTO Summary of History 2012).

Since the conceptualization of the pilot project in 1996, LUH's TTO constantly intensified the collaboration with its regional partners. Since that time, Hanover's entrepreneurship support landscape has gone through several phases of re-organization. Before 2000, regional actors' offerings concerning start-up support were not well coordinated. The "Existenzgründungsinitiative Hannover" (EIH) ("Start-up initiative Hanover" (EIH)), established in 2000 under the membership of LUH's TTO, for the first time coordinated the different offerings in Hanover and served as a central contact and information point. In 2003 the city's and region's economic development agencies were merged into one agency, called HannoverImpuls. HannoverImpuls from then on took over the task as central coordinator of start-up support from the EIH and united various organizations and institutions under its roof.

Since its establishment in 2003, HannoverImpuls has collaborated intensively with LUH's TTO in offering spin-off support; within the first three years informally and since 2006 formally (cf. KEY INF. 2, KEY INF. 9, KEY INF. 12).

In spite of the TTO staff's continuous efforts to convince LUH's administration of the necessity to install an entrepreneurship professorship, a business incubator with office space on the campus and/or a university venture capital funds, none existed at LUH until the year 2011 (cf. KEY INF. 2, KEY INF. 7, KEY INF. 9). In order to compensate for this infrastructural gap, the TTO supports the use of office space within LUH departments and institutes (cf. KEY INF. 7, KEY INF.9). In addition, several business incubators and technology parks exist within the region, to which LUH spin-offs have access. Most suitable in this respect are the LUH affiliated institutes "Hanover Centre for Production Technology" and "Laser Zentrum Hannover". Both provide office space and access to laboratories and scientific equipment for start-ups in the sectors of production and laser technology (cf. KEY INF. 1, KEY INF. 2, KEY INF. 8, KEY INF. 9, KEY INF. 13).

Several interviewed key informants emphasize that LUH's administration's general commitment concerning spin-off formation and support has improved within the last decade. Although the topic still has little priority in comparison to other issues, LUH increasingly acknowledges its role in regional development and the relevance of commercializing university technology and knowledge (cf. KEY INF. 1, KEY INF. 2, KEY INF. 9). Consequently, the issue of knowledge- and technology transfer in the form of spin-off formation was added to the LUH mission statement: "*{...} By working closely with industry we play our part in the development of region and state. We support transfer of technology, start-ups and continuing academic education. {...}*". (LEIBNIZ UNIVERSITÄT HANNOVER 2013a: 8).

With the intention to help universities to relieve the financial constraints of spin-off founders, Lower Saxony's Higher Education Act (Hochschulgesetz) was adjusted in 2002 to allow universities to take equity in private companies. Although the legal framework has been established, until today LUH actually never invested equity capital into a spin-off company, partly due to financial constraints and different priorities of investments (e.g. research personnel or facility infrastructure) (cf. KEY INF. 1, KEY INF. 7, KEY INF. 12).

Regarding the sequence of different phases illustrated above, the evolution of LUH's entrepreneurial support structure appears quite inconsistent. However, as the interviews with key informants suggest, this inconsistency is the case only for the projects' names and their

financial basis. While the availability of financial resources of course influences the feasibility of certain measures (e.g. sensitization and mobilization), the contents of TTOs qualification, coaching and consultation measures were quite stable. The contents rather evolved gradually over time in a highly path-dependent process. Most important was the conceptualization of the pilot-project in the mid 1990s, which created a solid base for its further evolution. One former TTO employee summarizes this as follows:

"Well, in the beginning we developed the first instruments. And then we learned what worked and what did not work. That was the process, in which our measures evolved gradually in the following years, always based on the experiences we had made before and on further input from extern {...}. And the basis was the studies we conducted. Then we conceptualized the pilot project. And everything from then on was built on that {...}. I'm sure if we hadn't conceptualized this pilot project {...}, we wouldn't have the system we have today at LUH {...}. We had created a broad basis and this was constantly refined later, taking into account the experience that was made. Certain elements had to be accommodated later on." (KEY INF. 6)

4.4.2 The contribution of alumni spin-off entrepreneurs to the evolution of LUH's entrepreneurial support structure

Stage 1: Idea generation, first impetus and evaluation of demand for an entrepreneurial support structure

As illustrated above, the first impetus to establish an entrepreneurial support structure at LUH was induced by Hanover's economic development agency that approached LUH's TTO for a joint brainstorming on important elements of such a support structure and strategies for its implementation.

The evaluations of demand conducted by the TTO revealed that at certain LUH institutes, spin-off activity existed already before the implementation of specific support measures in 1996. The interviews with former TTO employees furthermore confirm that the TTO was aware of these activities as the TTO received a few inquiries from students or staff with start-up intentions, who were then directed to regional actors for assistance.

Regarding the existence of spin-off activities before 1996, it would have been generally feasible that the founders of these established LUH spin-offs contributed to the idea generation, e.g. by launching initiatives, in order to convince decision makers to establish certain entrepreneurial support structure elements at LUH. However, as a former TTO employee emphasizes, this was clearly not the case:

"No, before 1996 I do not remember such an initiative by a former spin-off founder." (KEY INF. 12).

The same key informant identifies two simple reasons. Firstly, to assist spin-off founders and to sensitize students and university staff to become self-employed was obviously not perceived as a university's function at this time by those that started up businesses out of the university context. Secondly, there were no personal relationships between the TTO staff and alumni spin-off entrepreneurs.

"At this time it wasn't really en vogue that universities offer assistance to spin-off founders or that they offered any measures of sensitization. Furthermore, I have to say that we weren't in touch with anybody who had started a business out of the university. Usually we sent them directly to a regional partner when they asked for start-up assistance and afterwards we never heard of them again. There was simply no connection between us – the technology transfer office – and the start-up founder" (KEY INF. 12).

Although the same key informant acknowledges that alumni spin-off entrepreneurs would have been an interesting source of know-how and information during the initial brainstorming process and the conceptualization of the evaluation of demand, he states that for similar reasons as for the idea generation, there was no input of ideas, desires, know-how or information by LUH's alumni spin-off entrepreneurs (cf. KEY INF. 12).

Stage 2: Conceptualization and configuration of initial support structure elements

As explained above, the key actors in charge of the process of conceptualizing and configuring the initial support structure elements in the form of the initial training program and the pilot project were LUH's TTO's staff:

"Well, the general idea for certain measures originated at the economic development agency, and it was politically desired from the municipal government – the city – and the region. However, the particular package of measures originated here at LUH, more specifically within the TTO, where they were developed and installed." (KEY INF. 6).

Following the theoretical consideration that university actors usually have limited practical know-how and information regarding the start-up of technology and knowledge intensive businesses (see Section 4.2.1), I asked those TTO employees, who were involved in the conceptualization and the configuration of the initial support structure elements, about the channels from which they obtained the necessary know-how and information needed for the implementation of support measures.

Although, from a theoretical point of view, alumni spin-off entrepreneurs are a promising source in this respect (see Section 4.2.1), they obviously played a minor role in the conceptualization and configuration of LUH's initial support structure elements in comparison to other channels of know-how and information. While none of the interviewed former TTO employees, spontaneously mentioned alumni spin-off entrepreneurs when asked for important know-how and information sources, several other channels were mentioned quite frequently.

Firstly, LUH's own stock of business and management knowledge was considered a key-source (cf. KEY INF. 6, KEY INF. 12):

"Of course, you are right. We didn't know too much about the topic. However, we had the advantage to be located at a university, which inherited certain knowledge we could tap into. {...} We therefore first searched for LUH knowledge that we could use. We then contacted the

department of economics, more specifically the department of marketing, which supported us a lot in the following years" (KEY INF. 6).

Both, the initial training program in 1996 and the pilot project started in 1997, were conceptualized in close cooperation with the LUH department of marketing (cf. TTO Annual Activity Reports 1996, 1997, 1998). More specifically, the LUH marketing department's role during conceptualization was rather in the development of topics that pertain to entrepreneurs, than in the design of particular contents. The reason is – as a former TTO employee specifies – that LUH's stock of knowledge was too academic and theoretical in its nature for a spin-off founder who starts operatively (cf. KEY INF. 6).

Secondly, important know-how for the conceptualization was induced externally by regional partners who were active in the field of start-up support, such as banks, economic development agencies, technology centers or chambers of commerce. The involved TTO staff contacted these actors in order to learn from their experience and to tap into their know-how (cf. TTO Annual Activity Reports 1996, 1997, 1998, KEY INF. 6, KEY INF. 10, KEY INF. 12).

"We were sitting together with regional partners a lot. We heard what they did exactly. It was a close network, we were constantly brainstorming. That is how it developed." (KEY INF. 6)

Regional partners played especially an important role in the content related realization of the program, as a former TTO employee explains:

"We organized the program and approached our regional partners for the realization. We looked for these partners in order to procure the contents, for example by giving lectures and seminars or by acting as coach. {...}. Because we didn't want to have ourselves be trained and then do it. I still believe that it doesn't work that a newcomer like us coaches young entrepreneurs." (KEY INF. 6).

Therefore, as mentioned above, the TTO organized events and measures, such as financing workshops, presentations about legal aspects or consultation by tax advisers and lawyers in close cooperation with regional partners. Consequently a close regional network developed over the years (cf. TTO Annual Activity Reports 1996, 1997, 1998, KEY INF. 6, KEY INF. 12).

Thirdly, the TTO's staff obtained skills and know-how from other university TTOs and incubators, both within Germany as well as internationally. Some universities had already implemented and realized an entrepreneurial support structure in the mid 1990s and had therefore already gone through phases of conceptualization. LUH's TTO actively approached the respective key persons in order to draw on their experience and know-how (cf. KEY INF. 10, KEY INF. 12). Of particular importance was the above illustrated partnership with the TTOs of three European universities within the scope of a European Union project (Leonardo da Vinci). A former TTO employee, who was affiliated with this project explains the rationale for the project as follows:

"We saw that these TTOs had know-how and experience. We acknowledged that we needed to access this knowledge and that we needed to get in touch with the respective persons. We then asked ourselves how to do that and decided to establish a Leonardo-project." (KEY INF. 6)

Recapitulating this four-year long project, a former LUH TTO employee states that the project enabled many important synergy effects and that the collaboration with the European partners was very fruitful. LUH's TTO could especially profit from the universities Twente and Salford where models existed already for a longer time (cf. TTO Annual Activity Reports 1996, 1997, 1998, 1999, KEY INF. 6, KEY INF. 10, KEY INF. 12).

A fourth important information source was the large amount of literature and printed material on entrepreneurial support measures that already existed in the mid 1990s, which the TTO staff frequently sifted through in order to obtain state-of-the-art information and with the objective to copy certain things. Examples are grey literature, such as public materials and brochures about other TTOs and university entrepreneurial support structures, but also scientific studies and evaluations of existing programs and measures (cf. KEY INF. 10, KEY INF. 12). One former TTO employee in the phase of conception was working on a dissertation about the topic of entrepreneurship support, which was also helpful:

"In the context of my dissertation I was of course dealing with state-of-the-art entrepreneurial support very intensively and I read many studies and so on. On this basis I was of course able to see where something works and how and which statistically evident effects certain measures had." (KEY INF. 10)

Fifth, the TTO frequently tried to connect to the scientific community dealing with entrepreneurship research in general and university spin-off support specifically by visiting conferences and by becoming members of associations (cf. KEY INF. 10).

Summarizing, my interviews with former TTO employees, who worked for LUH's TTO when initial entrepreneurial support structure elements were conceptualized and configured, revealed five different channels through which know-how, information and experiences were sourced. A former TTO employee brought these to a point, emphasizing that the mixture of different sources was important:

"Well, to summarize it: The first step was really to look internally at the know-how that existed within our university, in order to tap into the relevant topics from a theoretical point of view. Then we projected these topics to an operative, practical level, as we looked at regional actors and institutions that were already engaged in supporting start-ups, for example the chamber of commerce. {...} However, the chamber of commerce was not specialized in knowledge- and technology-intensive start-ups, originating from a university. Therefore we drew on experiences that were already made at other universities and sifted through a lot of documents, materials and literature and also visited many conferences. Eventually this mixture of know-how sources had knit together the concept by showing us what we had to cover and where we had to set priorities." (KEY INF. 6)

None of the interviewed former TTO employees, who were involved in the conceptualization and the configuration of the initial support structure elements, spontaneously mentioned alumni spin-off entrepreneurs when asked for important know-how and information sources. This at first sight suggests that alumni spin-off entrepreneurs played no role in the conceptualization phase of the initial support structure elements. In order to verify this result and to examine the phenomenon more deeply, I conducted a second round of interviews with the former TTO staff, in which I targeted the questions more specifically to the influence of alumni spin-off entrepreneurs on the establishment of LUH's entrepreneurial support structure. These interviews led to more informative and differentiated results.

As all the interviewed former TTO employees emphasize, alumni spin-off entrepreneurs were indeed not formally engaged in the conceptualization and configuration of the initial entrepreneurial support structure elements at LUH (cf. KEY INF. 6, KEY INF. 10, KEY INF. 12).

"At that time, we didn't see the point of having them included in the conceptualization of our programs. {...} They weren't formally sitting with us at the table saying these are the important instruments and these issues are of importance." (KEY INF. 6)

"Well, I can't say that they actively contributed to the design of the curriculum. {...} I mean of course we could have established a kind of expert advisory board including experienced spin-off founders. But actually we did not do that". (KEY INF. 12)

One former TTO employee very precisely explains the reason for this, relating to the time constraints entrepreneurs usually face:

"Well, first of all, you have to see that it is very difficult, because they simply have too much different stuff to do. {...} You simply cannot expect it from them, because they are usually too busy with their company and its daily business. It wouldn't work. These founders have high opportunity costs and I don't even want to know what we would have to pay to formally engage them in the conceptualization of measures." (KEY INF. 6)

Secondly, according to one former TTO employee, the key persons of conceptualization in the mid 1990s didn't see the added value of a formal engagement:

"As I said, we didn't see the point of including alumni spin-off entrepreneurs. The reason is that we believed that their experiences were only helpful in a very limited way. You have to see, every start-up is very specific and each entrepreneur therefore has a very narrow view on how support measures should work. I believe therefore that it is of more value to work with real experts from regional organizations or other experienced TTOs, who have a wider perspective on the issue". (KEY INF. 6)

The interviews reveal however that while there was no formal engagement of alumni spin-off entrepreneurs in the conceptualization and configuration of the initial entrepreneurial support structure at LUH, they actually influenced it in a rather indirect, informal way. All interviewed persons state that they knew about established spin-offs and that they indeed contacted their founders for specific information on how to exactly conceptualize particular measures.

"In the beginning, we actually surveyed how many spin-offs there had been at the LUH institutes before 1996. And we contacted these persons in order to conceptualize a demand- and needs-oriented program. What did they miss? What would have been desirable?" (KEY INF. 10)

"I knew some spin-off founders from other occasions and I saw them at different events once in a while. And when I saw them I of course talked to them informally and asked them, where they in retrospect would see their needs for qualification or consultation measures. And some of the suggestions surely influenced our conceptualization work" (KEY INF. 12)

One former TTO employee brings the differentiation between the non-existence of a formal engagement and the informal influence of alumni spin-off entrepreneurs on the conceptualization and configuration of LUH's entrepreneurial support structure to a point:

"As mentioned, at that time we didn't say: We have to include them formally in our conceptualization work. But of course we took up suggestions from them. We listened to them when they gave feedback and we also always tried to implement it {...}. However, they didn't sit down formally with us at a table and said, these are the necessary instruments and these are the important aspects. It happened rather during the process that the founders said, look you have to pay attention to this and that. And these tips and ideas we integrated in our conceptualization." (KEY INF. 6)

The same person remembers a good example of such an indirect and informal influence of alumni spin-off entrepreneurs:

"A classic example is, and I still remember this very well, that alumni spin-off entrepreneurs drew our attention to the importance of founders of young spin-offs connection to the university and the need to stay in contact with it. We therefore implied that it would be best to keep young spin-offs within the university and give them a home. The close relationships to companies that many institutes have, might potentially ease the market entry for spin-offs. Consequently we tried to convince the university to allow founders access to its infrastructure. We got such and other similar suggestions and tips from alumni spin-off entrepreneurs." (KEY INF. 6)

This example illustrates that the informal and indirect influence that alumni spin-off entrepreneurs exerted on LUH's entrepreneurial support structure was not limited to the support measures and the associated infrastructure facilities but included at least indirectly another element: LUH's general policies regarding entrepreneurship in the form of rules and arrangements for the spin-off founders' use of LUH infrastructure.

In addition to the mode of contribution and the differentiation between formal and informal engagement, the interviewed former TTO staff made statements concerning the mode of activation of alumni spin-off entrepreneurs' informal engagement. All interviewed persons agreed on the fact that no alumni spin-off entrepreneur approached the TTO personnel

directly to make suggestions on the conceptualization and configuration of LUH's entrepreneurial support structure, but that the initiative always originated at the TTO. Asked whether there was any proactive behavior of alumni spin-off entrepreneurs, one former TTO employee states:

"Well, I don't remember it. It was us approaching the founders and we established the contacts in order to listen to their opinion. I guess most alumni spin-off entrepreneurs don't actually have an interest in an entrepreneurial support structure. Furthermore, they didn't know about our initiatives." (KEY INF. 10)

As alumni spin-off entrepreneurs' informal contribution to the conceptualization and configuration of LUH's entrepreneurial support structure was only mentioned by the interviewed former TTO employees upon request, it is plausible to assume that established founders only played a minor role as source of entrepreneurial know-how and information in comparison to the other channels. One former TTO employee confirms this suggestion:

"I would say that these tips were not more than an add-on. I believe that the other sources, like the marketing department at LUH, our contacts to regional actors and the experiences made by TTOs at other universities were much more important" (KEY INF. 12)

Stage 3: Sustainment and re-configuration during the further evolution of LUH's entrepreneurial support structure

Since the end of the pilot project in 2000 until today, the created support structure elements at LUH were sustained in the context of a sequence of different projects with fluctuating names and financial support, as illustrated above. However, the specific contents of LUH's TTO's qualification, coaching and consultation measures remained quite stable and evolved only gradually over time in a highly path-dependent process. This gradual evolvement was of course moderated by the TTO's staff's efforts to constantly refine and re-configure the existing support structure elements. As it was the case for the configuration of the initial support structure elements, it is plausible to assume that also during the stage of sustainment and re-configuration, the TTO's personnel relied on external know-how and information sources.

The key-informants' answers to my corresponding questions suggest that the contribution of alumni spin-off entrepreneurs in the stage of sustainment and re-configuration is very similar to their contribution during the stage of conceptualization and configuration of initial support

structure elements. Alumni spin-off entrepreneurs were not mentioned spontaneously as a source of know-how and information by the key informants. Instead, they referred to the same five sources as during the stage of conceptualization and configuration: the university itself, regional partners, other university TTOs, literature and material as well as affiliations to the scientific community of entrepreneurship research (cf. KEY INF. 2, KEY INF. 7, KEY INF. 9, KEY INF. 13).

An important difference to earlier stages is however that the know-how and experience of the TTO itself was mentioned, which emphasized the path-dependency of the evolution of LUH's entrepreneurial support structure:

"When I started working for the TTO trying to introduce and re-organize certain things, I have to say that I surely profited from what my predecessors had initialized. From the experience they made and therefore from the know-how that the TTO already inherited" (KEY INF. 7)

I therefore also conducted a second round of interviews with TTO employees working for the TTO during later phases in order to directly ask about the role of alumni spin-off entrepreneurs in the gradual re-conceptualization and re-configuration of certain elements. The results are very similar: Alumni spin-off entrepreneurs play a minor role as a know-how and information source compared to the other channels mentioned above. Regarding the mode of contribution, I found no evidence for a formal engagement of alumni spin-off entrepreneurs, but that they bring in know-how and information informally. In contrast to the contribution of alumni spin-off entrepreneurs to the conceptualization and configuration of the initial elements of LUH's entrepreneurial support structure, their informal behavior in later stages is not only reactive but also proactive:

"Sometimes they bring in new insights and know-how. There are some spin-off founders that contact us once in a while and give updates. They give us hints on how they did certain things, as for venture capital or networks or so. And we can play that back into our offerings" (KEY INF. 2).

Summarizing this section, the interviews with key informants suggest that the contribution of alumni spin-off entrepreneurs to the evolution of LUH's entrepreneurial support structure seems to be limited to informal involvement.

Regarding the three phases of evolution, their contributions can be characterized as follows: Alumni spin-off entrepreneurs played no role regarding the first stage of idea generation. As for the second stage of conceptualization and configuration of initial support structure elements, they only played a minor role in comparison to other important know-how and information sources like the university itself, regional partners, other university TTOs, research literature and printed material as well as the scientific community of entrepreneurship research. However, alumni spin-off entrepreneurs should not be neglected completely as source of entrepreneurial know-how and information. While they were not formally involved in the conceptualization and configuration of the initial elements of LUH's entrepreneurial support structure, they played at least an indirect role, as they informally exchanged ideas with the key-actors.

Concerning the mode of activation, the informal contribution was rather reactive as they only reacted to questions by the key persons and did not proactively approach them with suggestions. As for the different elements of LUH's entrepreneurial support structure, I could reveal that the informal contribution of alumni spin-off entrepreneurs was not limited to support measures and associated organizational infrastructure elements but included LUH's general policies on spin-off formation. The role of alumni spin-off entrepreneurs in the third stage of sustainment and re-configurations is also rather small compared to the other channels of know-how and information and occurred solely informally. Different from the second stage, the mode of activation is not only reactive, but some alumni spin-off entrepreneurs behave proactively.

4.4.3 The contribution of alumni spin-off entrepreneurs to the reinforcement of LUH's entrepreneurial support structure

In addition to the influence on the evolution of LUH's entrepreneurial support structure, alumni spin-off entrepreneurs may play an important role in the reinforcement of its existing elements. This may occur through their engagement to the realization of particular support measures. As the actors in charge often lack own start-up experiences, alumni spin-off entrepreneurs may assist by introducing praxis-relevant know-how to a university's entrepreneurship support program (see Section 4.2.1).

My interviews reveal that the contribution of alumni spin-off entrepreneurs to the realization of support measures indeed has been an important component of LUH's TTO's entrepreneurial

support program since the beginning of the initial training program and pilot project in the mid 1990s. As a former TTO employee explains:

"We actually moderated and coordinated our program. {...} But for the realization of it, we deliberately drew on more experienced people from extern, such as our regional partners and also established founders. It would not have been good if we had done everything by ourselves.{...} It was really important to have a practical orientation" (KEY INF. 6)

The same key informant remembers the initial conceptualization and puts the envisaged role of alumni spin-off entrepreneurs into concrete terms:

"In the first conceptualization phases we thought about what we needed. {...} And very early we realized that we needed a strong praxis orientation. Where and how could we get this? Who can tell us things about practical side to things? And we acknowledged that this practical orientation could only be provided by the founders that had experienced the whole process themselves. So we decided to get this practical knowledge from the alumni spin-off entrepreneurs " (KEY INF. 6)

The interviews with key informants reveal four modes of contribution of alumni spin-off entrepreneurs' to the realization of entrepreneurial support measures at LUH. Firstly, all interviewed key informants confirm that alumni spin-off entrepreneurs are frequently present at capability supply measures, such as entrepreneurial education, training, qualification and coaching measures, where they talk about their experiences with issues like financing, networking or legal aspects. In this respect, they act as best-practice examples and affect the motivation of new spin-off entrepreneurs (cf. KEY INF. 2, KEY INF. 6, KEY INF. 9, KEY INF. 10, KEY INF. 12).

"We of course know many established founders. And we brought them into our program to get their know-how. I mean, they originated from LUH and had experienced this. And we purposely have them as an important component in our events and seminars. They have practical experience and act as best-practice examples. {...}. That always functioned very well" (KEY INF. 6).

"They are present at many different events. If it is about trade mark rights or financing issues. And the participants also demand this practical orientation." (KEY INF. 9)

Secondly, some alumni spin-off entrepreneurs are involved in information supply measures, such as advisory and consultation. This occurs either formally, as they play an active part in

the TTO's coaching program or informally, by being available for inquiries from students or staff who are planning to start a company (cf. KEY INF. 2, KEY INF. 10).

Thirdly, LUH's TTO initialized network meetings in order to foster the know-how and experience exchange between alumni spin-off entrepreneurs and new founders. Through this exchange, alumni spin-off entrepreneurs reinforced LUH's entrepreneurial support structure:

"What we do quite frequently is, we host a founder barbeque. Our motive for that is that we want to bring together alumni spin-off entrepreneurs and young spin-off founders. And I believe that this is an important mechanism of how alumni spin-off entrepreneurs can give something back to the system." (KEY INF. 7)

Fourth, the interviewed key informants emphasize that the input of alumni spin-off entrepreneurs is of particular value for the reinforcement of an entrepreneurial culture among LUH students and staff. They are an important component at sensitization and mobilization events, where they present their start-up company and talk about their career paths. By acting as role model, they substantially influence the attitude of LUH students and staff towards self-employment as a career choice.

"...there we always had an initial event named "Paths into Self-Employment". At this event I always invited spin-off entrepreneurs who talked about their start-up experience. These were persons, who started-up from one of Hanover's universities. And that of course was an effective way to sensitize and motivate students and staff for self-employment." (KEY INF. 10)

"We also organized low-threshold offerings in the framework of career orientation. This was accepted very well. We didn't only inform about self-employment but included different career options as well. And at these events we always had some alumni spin-off entrepreneurs presenting themselves and their career paths." (KEY INF. 7)

An employee of the TTO lists the various activities undertaken to sensitize and mobilize LUH students and staff to consider starting-up a business as a career choice. It is striking that the involvement of alumni spin-off entrepreneurs is prominently mentioned:

"We always start into the new semester with a booth in the university cafeteria, where we distribute information material {...}. Then we are present at events organized by other LUH organizations, for example the career dates and the career service {...} as well as the graduate academy. Self-employment is always a topic at these events where we not only present funding and support possibilities but where we also present spin-off entrepreneurs {...}. Then there are additionally events concerning career perspectives within the faculties

and institutes {...} to which we invite subject-specific spin-off founders. Then we send newsletters and write press releases when we have new spin-offs or when we fund-raised new financial sources for certain spin-offs." (KEY INF. 2)

Regarding the mode of activation of alumni spin-off entrepreneurs' contribution to the reinforcement of LUH's entrepreneurial support structure, the data suggest that the vast majority of founders need to be addressed by the TTO in order to become involved. As one of my key informants explains, this mainly reactive behavior results from the limited resources (especially concerning time) that alumni spin-off entrepreneurs are confronted with and the associated prioritization:

"See, when you have a business yourself that somehow needs the next round of financing {...}, which is not reliable and the firm is in a critical phase, then you firstly face the responsibility to promote your firm. And what partly happens is that the founders were criticized by their financiers, who said: It is pointless what you do. We need purchase orders, we need cash. You should not be running around and do whatever. That has nothing to do with your added value." (KEY INF. 10)

Another two interviewed TTO personnel state that the mobilization of alumni spin-off entrepreneurs to become involved indeed works, but that it takes great effort. They usually do not approach the TTO by themselves, but one has to address them (cf. KEY INF. 2, KEY INF. 9).

"Well, they assist us. But usually we have to approach and ask them if they have time and if they want to be present at certain events to talk about their business." (KEY INF. 9)

Summarizing this section, my interviews with key informants reveal that alumni spin-off entrepreneurs are an important component of LUH's TTO's entrepreneurial support measures. Consequently, these founders play an important role in reinforcing LUH's entrepreneurial support structure. I was able to identify four modes of contribution in this respect: presence at training, qualification and coaching events (capability supply measures), engagement in training and consultation measures (information supply measures), participation in networking events as well as role-modeling in the context of sensitization and mobilization efforts.

4.5 Conclusions

4.5.1 Summary of results

This paper's aim was to investigate on the relative importance of the contribution of alumni spin-off entrepreneurs for a university's entrepreneurial support structure. Applying a qualitative case study design on the entrepreneurial support structure of Leibniz Universität Hannover (LUH), I was able to find answers to the following research questions:

(1) *Which relative role does the contribution of alumni spin-off entrepreneurs play for a university's entrepreneurial support structure?*

The results suggest that the contribution of alumni spin-off entrepreneurs plays an important role for a university's entrepreneurial support structure – at least in the case of LUH. However, this finding has to be regarded in a differentiated way with respect to the nature of such a contribution:

(2) *In which way does the contribution of alumni spin-off entrepreneurs play an important role for a university's entrepreneurial support structure?*

Based on a literature review, I distinguished two potential dimensions of alumni spin-off entrepreneurs' contribution to a university's entrepreneurial support structure: Their contribution to the support structure's overall evolution as well as their contribution to the reinforcement of existing support structure elements. As for its evolution in the case of LUH, I found that the contribution made by alumni spin-off entrepreneurs is rather limited. However, in this respect I determined differentiated results regarding the three stages (see Table 3). Alumni spin-off entrepreneurs played no role in the stage of idea generation – it was coined by Hanover's economic development agency – and only a minor role as know-how and information source in the second stage of conceptualization and configuration of initial support structure elements – other sources like regional partners and other university's TTOs were more important. Regarding the mode of contribution during this second stage, alumni spin-off entrepreneurs were not engaged formally but solely informally by sporadically giving advice and suggestions to LUH's TTO's staff as the actors in charge. As for the mode of activation, this informal integration did not occur proactively on their own initiative, but only reactively, as the responsible actors had to approach them in order to get their opinion and

advice. In principle, the same applies to the third stage of evolution, the sustainment and re-configuration during the further evolution of LUH's entrepreneurial support structure: A minor and informal role of alumni spin-off entrepreneurs, mainly – but not only – by reactive behavior (see Table 3).

In contrast to the rather limited contribution of alumni spin-off entrepreneurs to the evolution of LUH's entrepreneurial support structure, I was able to show that they exert decisive and important influence on the reinforcement of existing elements. Alumni spin-off entrepreneurs are an important component of LUH's entrepreneurial support structure as they provide important know-how, information and practical experience by four different modes: presence at capability supply measures (entrepreneurship education, training, qualification and coaching events), engagement in information supply measures (advisory and consultation measures), participation in networking events as well as role-modeling in the context of sensitization and mobilization efforts. Similar to their mode of activation regarding their influence on the evolution of LUH's entrepreneurial support structure, the contribution of alumni spin-off entrepreneurs to its reinforcement is rather reactive and depends strongly on personal relationships between the TTO staff as the actors in charge and the respective founders (see Table 3).

In summary, the results suggest that while the contribution of alumni spin-off entrepreneurs is obviously an essential ingredient for the realization of particular support measures and thus for the overall reinforcement of existing elements of a university's entrepreneurial support structure, it should rather be considered a decorative accessory when it comes to the overall evolution of a university's entrepreneurial support structure.

Table 3: Summary of results regarding the contribution of alumni spin-off entrepreneurs to LUH's entrepreneurial support structure

Dimension 1: Evolution of LUH's entrepreneurial support structure						
Stage of development	Role of contribution of alumni spin-off entrepreneurs	Contribution of alumni spin-off entrepreneurs – Modes	Contribution of alumni spin-off entrepreneurs – Mode of activation	Elements of LUH's entrepreneurial support structure influenced	Key role / Actors in charge	Important sources of know-how and information
Stage 1: Idea generation, first impetus and evaluation of demand for an entrepreneurial support structure	No contribution/role	-----	-----	-----	- Idea generation / first impetus: economic development agency - Evaluation of demand: TTO staff, economic development agency	-----
Stage 2: Conceptualization and configuration of initial support structure elements	Minor contribution/role	Informal know-how and information exchange	Solely reactive	- University measures of support and associated infrastructural facilities - General university policies on spin-off formation	TTO staff	- University itself - Partners within the region - Other university TTOs - Literature/material - Scientific community
Stage 3: Sustainment and re-configurations during the further evolution of the entrepreneurial support structure	Minor contribution/role	Informal know-how and information exchange	Mainly reactive but also proactive	- University measures of support and associated infrastructural facilities - General university policies on spin-off formation	TTO staff	- University itself - Partners within the region - Other university TTOs - Literature/material - Scientific community - TTO itself

Dimension 2: Reinforcement of LUH's entrepreneurial support structure						
	Role of contribution of alumni spin-off entrepreneurs	Contribution of alumni spin-off entrepreneurs – Modes	Contribution of alumni spin-off entrepreneurs – Mode of activation	Elements of LUH's entrepreneurial support structure influenced	Key role / Actors in charge	
	Decisive, important contribution/role	Formal engagement - presence at training, qualification and coaching events (capability supply measures) - engagement in advisory and consultation measures (information supply measures) - participation in networking events - role-modeling in the context of sensitization efforts	Solely reactive	- University measures of support and associated organizations - Indirectly: University culture regarding entrepreneurship	TTO staff	

(3) For which elements of a university's entrepreneurial support structure does the contribution of alumni spin-off entrepreneurs play an important role?

My interviews with key informants suggest that the contribution of alumni spin-off entrepreneurs plays an important role for all three in the literature identified elements of a university's entrepreneurial support structure. Their minor, informal contribution to its evolution concerns LUH's support measures and the associated infrastructural facilities as well as LUH's general policies on spin-off formation. The decisive and important contribution of alumni spin-off entrepreneurs to the reinforcement of existing elements also mainly targets the support measures – particularly the above mentioned sensitization, information supply and capability supply measures – and the associated infrastructural facilities. Through their engagement regarding sensitization and capability supply measures, alumni spin-off entrepreneurs furthermore significantly affect another element: LUH's culture towards entrepreneurship in the form of students and faculties attitudes towards entrepreneurship.

4.5.2 Contributions to the literature

This paper contributes to the literature on university spin-off formation in two ways. Firstly, it advances the state of research on the determinants of spin-off formation (cf. DJOKOVIC/SOUITARIS 2008, O'SHEA et al. 2008). Thereby it particularly focuses on the university context and the role of alumni spin-off entrepreneurs for the organization of a capable entrepreneurial support structure. As mentioned in the outset, the respective stream of literature is hitherto small and little developed. Nevertheless, it proposes that the involvement of alumni spin-off entrepreneurs positively influences the realization of existing support measures (cf. KAILER 2010: 260, KULICKE et al. 2011: 239, 250, KURATKO 2005: 589, LLOYD-REASON et al. 2009: 609, NATHUSIUS 2013: 161, ROBERT/EESLEY 2009: 6, WILSON 2008: 6), and considers it to be valuable in the scope of the initial establishment and later evolution of a university's entrepreneurial support structure (cf. LLOYD-REASON et al. 2009: 603, NATHUSIUS 2013: 76, 166). In this respect, it is argued that a university's entrepreneurial support structure profits from an involvement of alumni spin-off entrepreneurs, who provide important resources like experiences, know-how or information they gained during their own start-up process (cf. KAILER 2010, KURATKO 2005, NATHUSIUS 2013). However, while the literature in general acknowledges the positive effects of an involvement of alumni spin-off entrepreneurs, its importance for a university's

entrepreneurial support structure relative to other sources of know-how, experience and information has not been subject of empirical investigation before. This paper narrows this research gap not only by revealing the relative importance of the contribution of alumni spin-off entrepreneurs for a university's entrepreneurial support structure, but also by showing in which way and for which particular elements of a support structure it plays an important role.

Secondly, by emphasizing the important role of the contribution of alumni spin-off entrepreneurs for a university's entrepreneurial support structure, this paper contributes to the literature on the effects of university spin-off formation. In this respect, the literature so far concentrates on the immediate real-economic effects (cf. LAWTON SMITH et al. 2006, OSKARSSON/SCHLÄPFER 2008, ROBERT/EESLEY 2009, SHANE 2004a), while the rather indirect and systemic effects that affect a regional economy in the long-run are underresearched. The results of this paper point towards one in academia so far rarely and superficially discussed indirect-systemic effect: The potential long-term modification and upgrade of a university's entrepreneurial support structure by the engagement and contribution of alumni spin-off entrepreneurs. According to PATTON/KENNEY (2010), this phenomenon is expected to induce a self-amplifying process by which the entrepreneurial support structure is continuously modified and upgraded, in turn causing a dynamization of spin-off activity, which increases the potential for sustainable knowledge-driven regional development.

4.5.3 Policy implications

Universities are increasingly expected to contribute to regional economic prosperity through the formation of spin-off companies. Thus, strategies and measures aiming at augmenting the number and quality of a university's spin-offs gain importance and are intensively discussed among researchers, practitioners and politicians (cf. ETZKOWITZ/LEYDESDORFF 1997, ETZKOWITZ et al. 2000, GARNSEY 2007). Thereby, there is a general consensus that spin-off formation can be fostered significantly when a capable entrepreneurial support structure consisting of support measures, associated infrastructural facilities (e.g. an entrepreneurship office, an entrepreneurship professorship, an incubator), effective policies on spin-off formation and a positive entrepreneurial climate, is established and reinforced at a university (cf. O'SHEA et al. 2005a, ROTHÄERMEL et al. 2007). The conceptualization and realization of a university's entrepreneurial support structure is a major challenge for the respective actors in charge and place high demands on their entrepreneurial know-how and capabilities. This paper's result regarding the relative importance of a contribution of alumni spin-off

entrepreneurs suggests that the actors in charge of establishing, developing and realizing a university's entrepreneurial support structure should seriously consider an involvement of alumni spin-off entrepreneurs in the scope of their respective efforts and activities. This especially applies to the realization of existing support measures. Alumni spin-off entrepreneurs can provide important know-how, information and practical experience when they act as role models in the scope of sensitization measures and when they are involved as educators, lecturers, coaches or mentors at education and training events as well as consultancy and coaching offerings. However, also for the initial establishment and later evolution of a university's entrepreneurial support structure, advice from experienced alumni spin-off entrepreneurs is of high value. Thus, the actors in charge of a university's entrepreneurial support structure should at least consult or optimally even formally involve alumni spin-off entrepreneurs when conceptualizing new or refining existing elements of a support structure.

This paper's finding that alumni spin-off entrepreneurs typically do not become involved with a university's entrepreneurial support structure proactively on their own initiative, but mostly reactively upon request, suggests that the mobilization of alumni spin-off entrepreneurs to become involved should be considered an important task of the actors in charge of a university's entrepreneurial support structure.

4.5.4 Limitations and further research

The limitations of this paper relate to the confined generalizability of qualitative case study research. With LUH's entrepreneurial support structure, this paper's data basis stems from only one single case. As it is plausible to assume that the analyzed phenomenon strongly depends on individual persons involved as well as on context specifications, further research on the entrepreneurial support structures of other universities in different geographical contexts is recommended.

Because the contribution of alumni spin-off entrepreneurs is obviously an essential ingredient of a university's entrepreneurial support structure, politicians and practitioners are likely to be interested in factors that support or foster the involvement of alumni spin-off entrepreneurs. Thus, from a content-related perspective, future research should investigate on its respective determinants. In this respect, it would be interesting to find out, whether particular

characteristics of or conditions within universities or regions favor an involvement of alumni spin-off entrepreneurs with a university's entrepreneurial support structure.

This paper suggests that the contribution of alumni spin-off entrepreneurs occurs primarily reactively upon request. Consequently, a successful mobilization of alumni spin-off entrepreneurs is plausibly of central importance. As a successful mobilization of alumni spin-off entrepreneurs depends on whether they can be motivated to become involved, knowledge about the motives that influence alumni spin-off entrepreneurs' decision between entering an involvement and refraining from an involvement is of particular value. Thus, future research should empirically address these motivations. The respective insights should be used to formulate empirical based recommendations for university actors on how to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure.

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Chapter 5

How to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure

Abstract

As universities are increasingly expected to contribute to a region's economic development through the formation of spin-off companies, they need to establish and reinforce an entrepreneurial support structure that include e.g. qualification, education and consultation measures. Recent empirical studies suggest that the involvement of alumni spin-off entrepreneurs plays an important role in this respect. Regarding this potential, the central objective of this paper is to formulate empirically based recommendations for university actors on how to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure. In a first step, the motives of alumni spin-off entrepreneurs influencing the decision between becoming and not becoming involved as well as the role of the university context are evaluated. The results suggest that the motives self-interest, emotional attachment, reciprocity, perceived need, perceived efficacy and altruism play a role as decision motives. Furthermore, all of these motives – except for altruism – depend on and are influenced by the respective university context. More precisely, it is not only the characteristics of a university as a whole on which decision motives depend and are influenced by. Instead, particularly specific support structure facilities and its staff on a subordinate level within a university play a key role. Based on these insights, this paper formulates eight recommendations on how university actors can successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure.

5.1 Introduction

The transfer of university knowledge and technology into the regional economy contributes significantly to regional prosperity (cf. ETZKOWITZ/LEYDESDORFF 1997, GARNSEY 2007). An efficient mechanism of this transfer are start-ups by university members – so-called university spin-offs – by which university students or scientists commercialize the knowledge obtained and created at a university in a direct manner (cf. FONTES 2005).

Universities and regions dedicated to the facilitation of spin-off activities need a supportive environment. Important in this respect are the general characteristics of the university (e.g. size, nature and quality of research and teaching) and the regional context (e.g. economic performance, industry-structure, entrepreneurial regime). Particularly crucial is the existence of a capable university entrepreneurial support structure. Studies suggest that in order to facilitate spin-off formation, a university must implement and maintain specific cultural attributes, practical routines as well as measures and facilities of support (e.g. business incubators or training, coaching and consultancy offerings) (cf. O'SHEA et al. 2005a, ROTHÄRMEL et al. 2007).

However, empirical evidence is still scarce on how exactly a university's entrepreneurial support structure emerges and evolves and who the key actors in this process. Recent studies suggest that individuals who started a spin-off company out of a particular university at an earlier point in time (in the following referred to as “alumni spin-off entrepreneurs”) play an important role in this respect (cf. LLOYD-REASON et al. 2009, NATHUSIUS 2013). Accordingly, due to traditional negative attitudes towards commercialization and spin-off activities at universities as well as a lack of practical experiences in starting-up a business, the actors in charge of organizing an entrepreneurial support structure at most universities lack the necessary resources and capabilities to build up and sustain a capable support structure. Thus, they rely on external assistance. Alumni spin-off entrepreneurs are a promising source for these lacking but important resources and capabilities, as they have gone through the distinctive process of research commercialization and business start-up out of a university. Through this experience they obtained specific know-how and information, which is of particular value for the university's actors in charge (cf. HSU 2007, NATHUSIUS 2013: 2).

Consequently, a university's entrepreneurial support structure may profit from an involvement of alumni spin-off entrepreneurs, by which they induce important resources and capabilities that a university may lack. Studies suggest that such an involvement is particularly important for the realization of existing support measures, and thus for the overall reinforcement of a

university's entrepreneurial support structure. Accordingly, alumni spin-off entrepreneurs can significantly contribute as role models within the scope of sensitization measures or as educators, lecturers, coaches or mentors at education and training events as well as consultancy and coaching offerings (cf. KULICKE et al. 2011: 239, 250, KURATKO 2005: 589, LLOYD-REASON et al. 2009: 609, NATHUSIUS 2013: 161, ROBERT/EESLEY 2009: 6, WILSON 2008: 6). Furthermore, the literature considers the contribution of alumni spin-off entrepreneurs to be valuable within the scope of the initial establishment and later evolvement of a university's entrepreneurial support structure. In this respect alumni spin-off entrepreneurs can provide important guidance regarding the idea generation, the initial conceptualization or the later refinement of for instance specific entrepreneurship support offerings or the entrepreneurship education curriculum (cf. KAILER 2010: 260, LLOYD-REASON et al. 2009: 603, NATHUSIUS 2013: 76, 166).

The potential that the involvement of alumni spin-off entrepreneurs can provide for organizing a capable university entrepreneurial support structure is also increasingly acknowledged by policymakers and practitioners. In Germany for instance, a university's cooperation with alumni spin-off entrepreneurs within the scope of its entrepreneurship support measures, is considered a selection criterion for funding by "EXIST-Gründungskultur", a federal program designed to help universities establish an integrated entrepreneurial support structure (cf. BMWI 2010: 6, BMWI 2011: 20).

Regarding the potential that an involvement of alumni spin-off entrepreneurs inheres for the development and reinforcement of a university's entrepreneurial support structure as well as the increasing expectations of policymakers in this respect, strategies for a successful mobilization of alumni spin-off entrepreneurs are of great interest. It is therefore surprising that the literature so far lacks a discussion of respective strategies. This paper's aim is to narrow this gap in the literature. Its central objective is to formulate empirically based recommendations for university actors on how to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure.

A successful mobilization of alumni spin-off entrepreneurs depends on whether they can be motivated to become involved. Thus, knowledge about the motives that influence the decision of alumni spin-off entrepreneurs to become involved – or not – is of particular value. As this has hitherto not been empirically investigated, the first research question of this paper is:

(1) What are the motives that influence the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure?

In order to formulate recommendations on how university actors can successfully mobilize alumni spin-off entrepreneurs, knowledge on how the university context affects the motives addressed above is crucial. Therefore, the second research question of this paper is as follows:

(2) How does the university context affect the motives that influence the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure?

The third research questions directly relates to the central objective of this paper and will be answered by combining the results on Research Questions 1 and 2:

(3) How can a university successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure?

Due to the exploratory character of the study and the complexity of the phenomenon under investigation, I apply a qualitative research design as recommended by YIN (2003). Following STRAUSS/CORBIN's (1998) procedure of qualitative research, I structure the data collection and analyses according to potential decision motives derived from theoretical considerations. Regarding the lack of conceptual work and empirical findings on the exact subject of investigation, I thereby refer to the literature on prosocial behavior in general and alumni university engagement in particular (see Section 5.2: conceptual framework). The primary data collection includes two surveys consisting of semi-structured face-to-face interviews with a) alumni spin-off entrepreneurs and b) key informants from two Germany universities. I analyze the data using typical content analysis procedures (cf. GLÄSER/LAUDEL 2009, MAYRING 2010).

In a nutshell, the results suggest that the following motives influence the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure: the consideration of benefits and costs of a potential involvement (self-interest), the degree of emotional attachment with the university as a whole and with its entrepreneurial support structure facilities and specifically its staff, the willingness to reciprocate with them, the degree to which the involvement is perceived to be

necessary (perceived need) and efficient (perceived efficacy) as well as altruism. Furthermore, this paper shows that all of these motives – except for altruism – depend on and are influenced by the respective university context. More precisely it is not only the characteristics of a university as a whole on which decision motives depend and are influenced by. Instead, particular support structure facilities and their staff on a subordinate level within the university play a key role.

Based on these insights, I formulate eight recommendations on how a university and specifically its actors in charge of its entrepreneurial support structure can successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure.

The paper is structured as follows. The next section develops a conceptual framework of the motives influencing the decision of an alumni spin-off entrepreneur to become or not become involved in a university's entrepreneurial support structure. Section 5.3 introduces the research design, context of investigation, survey methodology and data analysis procedures. The results are presented and discussed in Section 5.4 (motives) and 5.5 (recommendations). Section 5.6 concludes the paper.

5.2 Conceptual framework: Decision motives for prosocial behavior and university alumni involvement

An alumni spin-off entrepreneur who considers to become involved in a university's entrepreneurial support structure goes through a decision making process, which eventually results in the choice to either become involved or not. The final choice of an alumni spin-off entrepreneur – despite the outcome of the decision – is based on different decision motives. The conceptual framework developed in this section presents the motives that potentially influence an alumni spin-off entrepreneur's decision between becoming involved or not. The different motives derived will guide the empirical analysis in Section 5.4 (cf. STRAUSS/CORBIN 1998).

Due to the lack of theoretical work and empirical evidence on the particular subject of investigation, the conceptual framework is based on theoretical considerations and empirical findings on the decision motives of individuals regarding a prosocial engagement in general (for a similar approach see DIAMOND and KASHYAP 1997) and on university alumni decision motives concerning an involvement in their university in particular.

Plausibly, the arguments of both streams of literature can be transferred to the decision motives of alumni spin-off entrepreneurs. In this respect, the involvement and contribution of alumni spin-off entrepreneurs in a university's entrepreneurial support structure can be regarded as an act of prosocial behavior, which is defined as an individual's action voluntarily performed with the expectation and intention that it benefits other persons, groups, organizations or the overall society (cf. AYDINLI et al. 2013, BRIEF/MOTOWIDLO 1986: 711, RUYTER/WETZELS 2000: 389, TWENGE et al. 2007: 56), "...such as helping, sharing, donating, co-operating, and volunteering..." (cf. BRIEF/MOTOWIDLO 1986: 710). Furthermore, the alumni spin-off entrepreneurs from a specific university are by definition alumni of that university, as they have previously studied, researched, taught and/or worked at that specific university.

Referring to the respective literature, it is important to acknowledge that the motives influencing an individual's decision between a prosocial involvement or its refrainment are oftentimes complex and multifaceted. In fact, many of the theoretical approaches are complementary. Thus, I concur with BIERHOFF (2008: 194) who recommends to simultaneously draw on different approaches when aiming for a comprehensive explanation of the relevant motives in a specific case of prosocial behavior: "The theories developed to explain prosocial behaviour complement each other and may be applied simultaneously to reach a full understanding of the determinants of a specific episode of help or passivity." (BIERHOFF 2008: 194).

The review of theoretical approaches and empirical evidence suggests that a person's decision for or against prosocial action in general and a university alumnus' decision between becoming or not becoming involved in a university in particular arises from one or a mixture of five motives: (1) *the perception of need and efficacy*, (2) *expected self-interest*, (3) *reciprocity*, (4) *emotional attachment* and (5) *altruism* (cf. BIERHOFF 2008, EISENBERG et al. 2006, LEVINE/MANNING 2012).

First, the decision whether or not to engage prosocially depends on a person's *perception of need*. On the one hand, a person's willingness for prosocial involvement increases, when he/she considers his/her potential activity as needed and appropriate (cf. DIAMOND/KASHYAP 1997: 917, EISENBERG et al. 2006: 655) – an argument, which several studies suggest to be alienable with the involvement of alumni in their university (e.g. TAYLOR/MARTIN 1995, WEERTS/RONCA 2007: 32). On the other hand, someone who

assesses his/her engagement not to be necessary is more likely to decide to remain uninvolved.

Furthermore, a person considering to act prosocially assesses his/her *potential efficacy*. In this respect, empirical evidence on the motives for prosocial action in general (cf. EKLUND et al. 2012: 31, KERR/KAUFMAN-GILLILAND 1997: 211) and for university alumni support specifically (cf. WEERTS/RONCA 2007: 23) suggests that individuals are oftentimes motivated to act prosocially due to their belief that their activity really has significant consequences on the subject of support and makes a difference in comparison to other people's engagement (cf. EKLUND et al. 2012: 31, KERR/KAUFMAN-GILLILAND 1997: 211). Efficacy is moderated by a prospective helper's perceived competence regarding a prosocial activity. When a person believes to have the necessary specific knowledge to support another individual, an organization or society in a certain aspect, the probability of a decision in favor of prosocial involvement increases (cf. MIDLARSKY 1971: 133, 146, SCHWARTZ/DAVID 1976: 407). In this respect, not only the competence, but also its efficient use by those who receive support are considered (cf. RUYTER/WETZELS 2000: 393). In turn, when a person assesses the efficacy of a potential prosocial involvement to be low, he/she will more likely decide to remain uninvolved.

Secondly, an important motive that influences a person's decision between becoming prosocially involved or not, is the *self-interest* the person expects to obtain from it. An individual considers the costs (e.g. money, time, resources) and rewards (e.g. reputation, money, praise) of a potential prosocial action (cf. LEVINE/MANNING 2012: 328, MEIER 2006: 4). Experimental and empirical research on this aspect of pro-social behavior has led to the derivation of the so-called arousal: cost-reward model. It posits that the likelihood that a person decides in favor of a prosocial behavior increases when the rewards and benefits are perceived to exceed the costs (cf. BIERHOFF 2008: 178, LEVINE/MANNING 2012: 328). Thereby a prospective helper does not only consider the costs and rewards of becoming prosocially active, but also those when refraining from prosocial behavior, such as saving time and money (rewards) or unpleasant feelings, self-blame, guilt, social castigation and loss of potential rewards (costs) (cf. BATSON et al. 1981: 290, LEVINE/MANNING 2012: 328). A contrario, when a person expects the costs of a prosocial involvement to exceed its benefits, he/she will more likely decide not to become active. Studies reveal that the arguments for self-interest as an important motivational determinant also apply to a university alumnus' decision to volunteer for a university (cf. DIAMOND/KASHYAP 1997: 918, WEERTS/RONCA 2007: 24, WEERTS/RONCA 2009). The self-interest hypothesis of

prosocial behavior is based on the standard traditional rational-choice conception of economic behavior, which views agents as egoistically inclined towards the maximization of profits and exclusively motivated by their material self-interest (cf. AYDINIL et al. 2013: 4, FEHR/GÄCHTER 2000: 159, FREY/MEIER 2004: 65, MEIER 2006: 2).

Arguably, while self-interest is an important motive influencing a person's decision between becoming prosocially active or remaining inactive, it is not the only one (BATSON 1994: 604). Experimental and empirical evidence suggests that decision motives regarding a prosocial engagement cannot solely be reduced to cost-reward considerations and the self-interest of rational-choice agents. Instead, people for example oftentimes accept unnecessary costs of prosocial behavior, which definitely exceed the benefits (cf. FREY/MEIER 2004: 6, LEÓN et al. 2012: 390.). The literature on the motives of prosocial behavior suggests that a person's possible deviation from pure self-interest rests on reciprocity, emotional attachment as well as on altruism.

The norm of reciprocity suggests that people "...help those who have helped them..." (cf. BRIEF/MOTOWIDLO 1986: 718) because they perceive an obligation to give back something in return to what they have previously received (cf. DIAMOND/KASHYAP 1997: 919, FEHR/GÄCHTER 2006: 161, REGAN 1971: 635). Through reciprocation recipients of a positive experience can reduce their perceived indebtedness to their benefactor (cf. RUYTER/WETWELS 2000: 390). Individuals are inclined towards reciprocal prosocial activity "...even if it is costly for them and yields neither present nor future material rewards." (FEHR/GRÄCHTER 2006: 159). Some authors (e.g. BRUNI et al. 2008: 4, FALK/FISCHBACHER 2006: 309, FEHR/GÄCHTER 2006: 159) furthermore differentiate between the above mentioned positive reciprocity (revenging positive action) and a negative reciprocity (revenging hostile action). The relevance of (positive and negative) reciprocity as a determinant of human behavior in general and as a factor influencing an individual's decision to act prosocially or not has been shown in experimental and field research in different disciplines such as psychology, economics or social sciences (cf. ABDULKADIROGLU/BAGWELL 2013: 213, BATSON/POWELL 2003: 467, FALK/FISCHBACHER 2006: 309, FEHR/GÄCHTER 2006: 161, FREY/MEIER 2004: 66, MEIER 2006: 8, REGAN 1971: 627). To summarize, the reciprocity argument implies that the likelihood that a person decides to become involved prosocially increases, when the person or organization to which the involvement is directed, has previously helped the respective individual. Thus, the obligation to give back something to somebody who helped may be a strong motivation for prosocial commitment. Several studies suggest that the norm

of reciprocity also applies to the motivation of alumni to support their university (cf. BARBER 2012: 39, WEERTS/RONCA 2008: 278). According to these studies, alumni who become prosocially active at their university are oftentimes motivated by the intention to pay back what they have received from their university. This intention may arise from their perception of the past or present quality of experience with the university as an organization or its faculty and staff (e.g. quality of education and career preparation and the personal engagement of university faculty and staff for the benefit of alumni) (cf. SUNG/YANG 2009: 805, WEERTS/RONCA 2008: 278) and their belief that they owe "...personal and professional success to the university." (DIAMOND/KASHYAP 1997: 919)

Fourthly, theoretical considerations drawing on Social Identity Theory argue that *emotional attachment* is an important motive influencing an individual's decision between becoming prosocially committed or not (cf. BALDASSARRI/GROSSMAN 2013:1, BIERHOFF 2008: 330, TIDWELL 2005: 450). Empirical and experimental evidence on prosocial behavior in general (cf. BALDASSARRI/GROSSMAN 2013:1, BIERHOFF 2008: 330, TIDWELL 2005: 450) as well as on alumni university support specifically (cf. DIAMOND/KASHYAP 1997: 915, TAYLOR/MARTIN 1995, WEERTS/RONCA 2007: 24) suggest that the stronger a potential benefactor's feeling of emotional attachment is to a person or organization that needs support, the more likely is the decision in favor of prosocial action (cf. DIAMOND/KASHYAP 1997: 917, MEIER 2006: 16, RUYTER/WETZELS 2000: 392). The nature of the personal relationship between two or more individuals is important for an intensive attachment. The more stable and close such a relationship is and the more it is based on sympathy and trust, the more likely prosocial action becomes in favor of one of the persons or organizations involved (cf. BALDASSARRI/GROSSMAN 2013: 1, BIERHOFF 2003: 323, REGAN 1971: 629). Of course this also applies to alumni university support and implies that the frequency and stability of university-alumni contacts – and therefore also those measures promoting it (e.g. alumni contact points) – strongly influence the likelihood of prosocial commitment (cf. BARBER 2012: 35). Attachment is also shaped by what has been called the degree of "we-ness". In addition to the closeness of relationships, "we-ness" considers the similarity between individuals and their perception of belonging to one group. "We-ness" leads to common attitudes, values, opinion and beliefs on specific issues and fosters the identification with one another (cf. BALDASSARRI/GROSSMAN 2013: 2, BIERHOFF 2008: 329, BRIEF/MOTOWIDLO 1986, DIAMON/KASHYAP 1997: 917, LEVINE et al. 2005: 444, MEIER 2006: 16). Thus, a potential benefactor's identification with a person or organization that needs support as well as shared attitudes, values, opinions and

beliefs, increase the potential benefactor's readiness for a prosocial engagement and thus positively affects his decision in favor of its realization. This is also the case for the university-alumni relationship. Several studies show that an alumnus' "...perception of oneness with or belongingness to the university..." (WEERTS/RONCA 2007: 24) and the identification with the university strongly serves as motivation to support the university (cf. WEERTS/RONCA 2007: 24). There is of course also a connection between emotional attachment and the norm of reciprocity: the more stable and close the relationship and the greater the degree of "we-ness" and identification, the more likely a person will be willing to give back something to somebody who previously helped (cf. BIERHOFF 2003: 323, DIAMOND/KASHYAP 1997: 917).

Last but not least, an individual's decision to become prosocially involved or not is potentially influenced by altruism (cf. LEVINE/MANNING 2012: 316). This also applies to the alumni of a university (cf. HOYT 2004: 4). Altruism refers to prosocial behavior motivated exclusively by the willingness to benefit another person, group of persons or organization, without anticipating any rewards (cf. BATSON et al. 1981: 290, LEVINE/MANNING 2012: 316). BATSON (1994: 607) points out that prosocial behavior motivated by altruism may also include self-benefits, but in contrast to the self-interest hypothesis of prosocial motivation (see above), these are rather unintended consequences of the prosocial behavior. In addition to the altruistic motivation of prosocial behavior, which is directed towards individual persons, group of persons or organizations (individualistic altruism), BATSON (1994: 603) further differentiates collectivism and principalism. Prosocial action motivated by collectivism is directed towards increasing the welfare of a collective, such as a university, a community, a nation or even all humanity (cf. BATSON 1994: 604). Oftentimes, altruistically motivated prosocial action towards one person, a group of persons or one organization is actually at least partly motivated by collectivism, as it also increases the welfare of the whole collective (cf. BATSON 1994: 605). Principalism refers to the altruistic motivation of prosocial action, which aims at maintaining a moral principle, norm or value (cf. BATSON 1994: 605), such as justice, social responsibility or fairness (cf. BIERHOFF 2003: 192, 193). For a long time there has been a debate on whether pure, selfless altruistically motivated behavior really exists (LEVINE/MANNING 2012: 317, PILIAVIN 2009: 213). Particularly during the 1970s and 1980s BATSON's empathy-altruism model was strongly challenged by CIALDINI's negative-state-relief model (CIALDINI et al. 1987), which suggests that all altruistic behavior is in the end driven by self-interest and egoism. The negative-state-relief model in this respect argues that individuals are primarily motivated to act prosocially by their willingness to reduce their

own distress (LEVINE/MANNING 2012: 317), which comes from knowing that another person or organization sorely needs support or from the anticipated own emotional distress when support is omitted (BATSON et al. 1981: 290, LEVINE/MANNING 2012: 317, PILIAVIN 2009: 213). In the past decades, many studies were conducted to prove the existence or non-existence of altruism. PILIAVIN (2009) summarizes these as follows: "...in my mind this is {...} a question that has been answered. Some people, some of the time, do help other people out of altruism." (PILIAVIN 2009: 213).

Due to the lack of conceptual work and empirical findings on the motives of alumni spin-off entrepreneurs that influence the decision to become or not to become involved in a university's entrepreneurial support structure, the conceptual framework sketched above relates to the literature on prosocial action in general and alumni university engagement in particular. In summary, the literature review suggests that the decision of alumni spin-off entrepreneurs to become involved or not is based on a mixture of one to five motives: (1) *the perception of need and efficacy*, (2) *expected self-interest*, (3) *reciprocity*, (4) *emotional attachment* and (5) *individualistic, collectivistic or principalistic altruism*. In the following, these motives will be used as categories guiding the qualitative empirical analysis. Its aim is to reveal which motives influence the decision of alumni spin-off entrepreneurs to become or not to become involved with a university's entrepreneurial support structure and how these are affected by the university context – issues that have not been empirically addressed so far. The results will be used to derive and discuss recommendations for a successful mobilization of alumni spin-off entrepreneurs to become involved.

5.3 Data and methods¹⁵

5.3.1 Research design

This study is based on a qualitative research design. As already explained in the introduction of this dissertation (see Section 1.6.1), I preferred it to a quantitative approach for the following reasons:

Firstly, the empirical investigation has an exploratory character as the decision motives for the particular case of prosocial behavior elaborated here – the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure – have hitherto not been subject of empirical investigation. Although the literature review in Section 5.2 reveals potential decision motives regarding prosocial behavior in general and alumni university engagement in particular, I assume that the categorization of motives at least partially deviates in the specific case of prosocial behavior considered in this study. Furthermore I assume that there are additional interesting and relevant aspects for each motive that have not been considered in the literature and that the role of the university context is very specific for the decision of alumni spin-off entrepreneurs to become involved or not in a university's entrepreneurial support structure. I believe that a quantitative approach including an operationalization of potential decision motives into quantifiable variables in order to test deductively derived hypotheses would lead to a reduction of information and consequently to limited insight into the specific subject of investigation.

Secondly, a qualitative research design is usually applied when the subject of investigation is of high complexity, which cannot be completely captured by quantitative procedures of data collection and analysis (cf. YIN 2003). This applies especially to research on individual-related issues, such as "...people's attitudes, behaviours, value systems, concerns, motivations, aspirations,..." (JOUBISH et al. 2011: 2082) that explain why people make decisions and/or act in a certain way (cf. JOUBISH et al. 2011). Correspondingly, in the social psychology literature it is acknowledged that due to the high degree of complexity and comprehensiveness as well as the intensity of interactions between different motives (see Section 5.2), qualitative approaches are considered to be more effective than quantitative techniques when exploring an individual's motive for or against a particular type of prosocial behavior (cf. LOCHNER et al. 2012).

¹⁵ Detailed information on data and methods are already provided in the introduction of this dissertation (see Section 1.6). In order to avoid repetitions, this version of the paper includes only the most relevant information on the research design, the context of investigation, the survey methodology as well as the data coding and analysis. For more information please refer to Section 1.6.

Thirdly, the central aim of this paper is to define recommendations on how to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure. In this respect, I consider it meaningful to support the derivation of recommendations from the findings on motives with the opinion of experienced key informants on university entrepreneurial support structures (for a definition of key informants see Section 1.6.3). Regarding my intention to consider potential recommendations in depth and in detail, I preferred a qualitative approach with open-ended questions to a quantitative approach with predefined variables.

5.3.2 Context of investigation

It is plausible to assume that the motives of alumni spin-off entrepreneurs regarding the decision to become or not to become involved in a university's entrepreneurial support structure are strongly shaped by the surrounding conditions, especially of the university itself. For instance, decision motives like the norm of reciprocity or emotional attachment are likely to be influenced by e.g. a university's entrepreneurial culture. Thus, in terms of comparability, the context of investigation should include one or more universities that are similar regarding spin-off potential. Furthermore, in order to be able to at least carefully and partially generalize, the universities selected should exemplify the regular case, thus being middle-range universities regarding entrepreneurial conditions and spin-off activities.

Two universities in the northern German Bundesland (federal state) Lower Saxony were chosen as context for this investigation: Leibniz Universität Hannover (LUH) und Georg-August-Universität Göttingen (GAUG). As illustrated in Section 1.6.2 of this dissertation, these two universities meet the requirements regarding comparability as they are similar in size with regard to the total number of students and have a similar spin-off potential concerning the total number of students in subjects which are common for spin-off formation (cf. GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN 2014a, LEIBNIZ UNIVERSITÄT HANNOVER 2012). Furthermore, LUH and GAUG are comparable with respect to entrepreneurial conditions (both have established an entrepreneurial support structure for more than a decade, which is of similar quality today) and spin-off activities (cf. SCHMUDE et al. 2011 and Chapter 2). In addition, both universities are located in Lower Saxony and therefore are subject to the same higher education policies, which are responsibility of the federal states in Germany (cf. POWELL/SOLGA 2011: 64).

Moreover, LUH and GAUG are suitable examples of the German standard as both universities exemplify German middle-range universities regarding entrepreneurial conditions and spin-off activities (cf. SCHMUDE et al. 2011).

5.3.3 Survey methodologies

The primary data collection addressed both alumni spin-off entrepreneurs as well as key informants affiliated with LUH's and GAUG's entrepreneurial support structure.

As for the former, I conducted semi-structured face-to-face and telephone interviews with 77 alumni spin-off entrepreneurs, who originated from LUH (43) or GAUG (34) and whose businesses were still located in the respective region (for a definition of who qualifies as alumni spin-off entrepreneur and for an explanation of the sampling design see Section 1.6.3 in the introduction of this dissertation).

During each interview the respective alumni spin-off entrepreneur was asked whether he/she either at the time of the interview or in the past had become involved in any manner in the entrepreneurial support structure of his/her university. I identified a total of 18 alumni spin-off entrepreneurs for whom this was the case (LUH: 8, GAUG: 10). These 18 entrepreneurs were asked questions regarding the extent and particular nature of their engagement and their motives for their decision to contribute to their university's entrepreneurial support structure. Furthermore I asked the 59 alumni spin-off entrepreneurs who reported to never have become involved, to describe the reasons and motives of their decision not to become involved. For all 77 alumni spin-off entrepreneurs in the sample, additional information on the start-up process and support from the university, regional or national organizations and/or programs as well as on the previous and further expected development of the company was collected (see Appendix 2 for the interview manual as well as Appendix 3 for the post-interview questionnaire of the alumni spin-off entrepreneur survey).

The second component of primary data collection included semi-structured face-to-face interviews with 25 key informants (LUH: 13, GAUG: 12). As key informants I considered persons that either worked in the past in or still are affiliated with an organization and position in which they directly deal with LUH's entrepreneurial support structure (for more detailed information on who qualifies as key informant see Section 1.6.3).

During the interviews, I asked the key informants questions regarding the contribution of alumni spin-off entrepreneurs to their efforts to organize the particular university's

entrepreneurial support structure. Furthermore, the key informants were asked to assess the motives of alumni spin-off entrepreneurs to become or not to become involved in the university's entrepreneurial support structure. In addition, the key informants were asked to consider potential strategies to improve the mobilization of alumni spin-off entrepreneurs to become involved (see Appendix 1 for the interview manual of the key informant survey). In the case of content-related discrepancies, I approached the key informants again to resolve these discrepancies. The qualitative survey methodology enabled several advantages during the interviews (cf. MAYRING 2000, PATTON 1990, YIN 2003) (see Section 1.6.3).

5.3.4 Data coding and analysis

I examined the transcribed interviews using typical content analysis procedures (cf. GLÄSER/LAUDEL 2009, MAYRING 2010), supported by the qualitative data analysis software NVivo. As commonly implemented in qualitative research (cf. KELLE/KLUGE 2010, KUCKARTZ 2012, SCHREIER 2012: 89), I applied two central procedures of systematic, rule guided, category based analysis. In a first step I applied the procedure of deductive category application. In this respect, I used the in the conceptual framework from theoretical considerations derived decision motives as categories which serve as basis to structure the transcript material. In a second step, in the scope of the procedure of inductive category development, I refined, modified and specified the deductively derived categories by extracting new from theoretical considerations not anticipated information directly from the transcript material. The scopes and approaches of both procedures are explained in detail in the introduction of this dissertation (see Section 1.6.4). The final coding frames that emerged from deductive category application and inductive category development of the interview material with key informants and alumni spin-off entrepreneurs are presented in Appendices 4 and 5.

I ensured compliance with quality criteria of qualitative research (cf. STEINKE 2004) by applying rule guided procedures as well as by establishing intra- and intercoder reliability in the scope of data analysis (see Section 1.6.4).

5.4 Empirical results

This section is structured as follows: Section 5.4.1 presents the results regarding the motives of alumni spin-off entrepreneurs that influence their decision to become involved – or not – in a university's entrepreneurial support structure. Section 5.4.2 points out how the university context affects each of the derived motives. By combining the results from Sections 5.4.1 and 5.4.2, eight recommendations on how a university can successfully mobilize alumni spin-off entrepreneurs to become involved are formulated in Section 5.5.

5.4.1 The motives of alumni spin-off entrepreneurs that influence the decision to become or not to become involved in a university's entrepreneurial support structure

In the following I systematically present the role of each in Section 5.2 theoretically derived potential motive for the decision of alumni spin-off entrepreneurs between entering an engagement and refraining from an engagement for a university's entrepreneurial support structure.

In summary, the interviews with alumni spin-off entrepreneurs who are presently involved or were involved in the past and with those who have never become involved confirm the theoretical consideration that the individual alumni spin-off entrepreneur's decision is based on one or a mixture of five different motives (cf. BIERHOFF 2008: 194): most alumni spin-off entrepreneurs state that their decision is based on more than one motive. As a whole, all decision motives seem to influence an alumni spin-off entrepreneurs decision between becoming involved or not.

5.4.1.1 Self-interest as a decision motive

Overall, the interview data suggests that the decision between becoming and not becoming involved in a university's entrepreneurial support structure is strongly influenced by the self-interest that an alumni spin-off entrepreneur expects from his involvement. More precisely, it becomes obvious from the interviews that the consideration of self-interest leads some alumni spin-off entrepreneurs to become involved while others decide not to become involved due to a lack of considered self-interest.

Regarding the latter, most of those interviewed alumni spin-off entrepreneurs who have never become involved, base their decision on the expectation that they will not receive any returns from it. As one alumni spin-off founder points out:

"There is no added value for my company. That is the main reason." (USO10)

More precisely, many alumni spin-off entrepreneurs decline an involvement because they expect the costs of an involvement to exceed its benefits. The interviews suggest that it is especially the time factor – the time needed for an engagement – that prevents them from becoming involved. As many alumni spin-off entrepreneurs state, they face high opportunity costs regarding their time. The following statements are only two examples of how alumni spin-off entrepreneurs have different priorities than becoming involved in the entrepreneurial support structure of their university:

"We simply have to focus on different things. In the beginning we had to focus on product development and now we have to focus on the turnover. Aside of these things, there is simply no time" (USO50)

"I have certain tasks here. And one of those tasks is to earn money, so that each employee receives his salary at the end of the month. The share holders expect even more. That means, I have to do a good time-management. I have to assess what to do all day long. If I would then commit myself to something that is not relevant for our turnover, I would already do something wrong. [...] And because of those time constraints I'm not in a phase of life yet in which I am only storyteller and in which I can commit myself to stuff like that." (USO14)

The interviews with key informants support the notion that the consideration of self-interest leads many alumni spin-off entrepreneurs to not become involved in a university's entrepreneurial support structure. According to the key informants, the time constraints and the prioritization of different issues that alumni spin-off entrepreneurs face, complicate their efforts to mobilize alumni spin-off entrepreneurs to assist in reinforcing existing elements and even more in conceptualizing new elements of a university's entrepreneurial support structure:

"It {...} is a matter of time. {...} They are constantly on the run. They have to take care of so many different things. The search for investors and the market entry of their product is highly arduous and time-consuming." (KEY INF. 2)

"See, when you have a business yourself that somehow needs the next round of financing {...}, which is not secure and the firm is in a critical phase, then you first face the responsibility to promote your firm. And what partly happens is that the founders are criticized by their financiers, who say: it is pointless what you do. We need purchase orders, we need cash. You should not be running around and do whatever. That has nothing to do with your added value." (KEY INF. 10)

The interviews with those alumni spin-off entrepreneurs, who are or were involved in a university's entrepreneurial support structure, confirm the suggestion that an involvement has few benefits for them: a majority of two-thirds of them do not state the expectation of benefits for them personally or their company as a reason or a motive for their involvement.

However, the fact that still one-third of the interviewed engaged alumni spin-off entrepreneurs remark to be motivated by self-interest, suggests that benefits of an involvement potentially do exist and that the expectation of these benefits may at least in some cases influence an alumni spin-off entrepreneur's decision in favor of an engagement. In this respect, several different benefits are mentioned. Accordingly, especially the potential access to networks and contacts with founders of new companies and other involved alumni spin-off entrepreneurs is considered a benefit. For example, they expect to find cooperation partners, customers or employees. An alumni spin-off entrepreneur who together with his business partner proactively established and operated an informal entrepreneurship office on his university's campus for example explains his motive as follows:

"And also, we get to meet people who have similar problems as we used to have. And we get to meet cooperation partners with whom we can work together. And indeed, we have a lot of cooperation partners who we met through our engagement. We would not have these contacts without our engagement. We would have to find external developers who would have been also much more expensive." (USO58)

Another alumni spin-off entrepreneur, who on a regular base gives presentations to students in the context of training, coaching and sensitization events, states:

"Partly I am involved because I get in touch with people that I might be able to employ some day. And also I get access to firms that we may cooperate with some day. Because we are still small and sometimes we don't get bigger projects because customers think we are not capable of handling them. {...} But still, sometimes we want to apply for such projects. And in that case it is good to know persons or firms that we can bring in for such a big project" (USO07)

However, as one alumni spin-off entrepreneur clarifies, even though self-interest is always on one's mind, one cannot expect to directly gain an added value every time one becomes involved. Instead, benefits emerge rather sporadically:

"{...} every entrepreneur has his own benefit on his mind.{...} When you meet with people, sometime you get more involved with each other and start cooperating. Of course, sometimes you don't. Sometimes there is an added value in becoming involved, sometimes there isn't." (USO18)

According to the interviewed alumni spin-off entrepreneurs, there are several more benefits of an involvement in a university's entrepreneurial support structure in addition to the access to networks. For some alumni spin-off entrepreneurs for example an added value is the access to creativity, new ideas and opportunities through an involvement with students or scientists who intend to start-up a business. As one alumni spin-off entrepreneur puts it:

"It is exciting to deal with young entrepreneurs and for me, opportunities emerge. You cannot have every idea yourself." (USO18)

Another potential benefit which motivates alumni spin-off entrepreneurs to become engaged is the expectation to enhance one's reputation and recognition. As an alumni spin-off entrepreneur, who once in a while assists actors of a university's entrepreneurial support structure in the realization of different events states:

"On the other hand, and I want to be honest about it, such an engagement is also beneficial to our reputation. It is important for us to be well known in this city." (USO59)

In addition to the hitherto mentioned short term benefits, many alumni spin-off entrepreneurs state to be motivated to become involved by the expectation that those young spin-off entrepreneurs who directly profit from their engagement might return something to them in the future:

"When you help young entrepreneurs, there is of course also the idea that they might be able to return something to you at a later point in time." (USO18)

"{...} by engaging we develop a network. And by helping others we have people that are grateful to us. And when I need help, they might help me out. That way we build our network. {...} We can then draw on people who know how we think and how we act and who are – in case of doubt – favorably disposed towards us." (USO45)

The interviews with key informants reveal that they also assess that benefits for alumni spin-off entrepreneurs who get involved in a university's entrepreneurial support structure do exist. In this respect they also mention the access to networks and the enhancement of reputation.

5.4.1.2 Altruism as a decision motive

The literature suggests that a person's decision between being prosocially active or not, cannot solely be explained by self-interest and cost-reward considerations (cf. BATSON 1994: 604) (see Section 5.2). For instance, often people become involved, although the expected costs definitely exceed the benefits (cf. FREY/MEIER 2004: 6, LEÓN et al. 2012: 390). The results on self-interest as a decision motive (see above) propose that this is also the case for the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure: The majority of those who were involved in the past or are at present do not mention the expectation of benefits for them personally or their company as a motive for their engagement. Relating to the literature, it is therefore plausible to assume that most alumni spin-off entrepreneurs' decision between involvement or lack of involvement is also influenced by – among emotional attachment and reciprocity (see below) – altruism.

Indeed, altruism – the willingness to benefit another person, group of persons or organization, without anticipating rewards (cf. LEVINE/MANNING 2012: 316) – seems to be a significant motivational determinant influencing an alumni spin-off entrepreneur's decision between becoming or not becoming involved in a university's entrepreneurial support structure. The majority of alumni spin-off entrepreneurs who engage at present or did so in the past mention motives related to altruism as at least one important reason for their involvement. The interviews show more precisely that the altruistic motives of the involvement of alumni spin-off entrepreneurs can be further differentiated, as recommended by the literature (cf. BATSON 1994: 604).

First, there are alumni spin-off entrepreneurs whose altruistic motive for an engagement stems from a personal aim to maintain a moral principle or a norm of value (principalistic altruism). The interviews suggest that principalistic altruism as a motive for involvement is for example caused by the belief that it is generally morally mandatory to help and support other individuals. Two alumni spin-off entrepreneurs for example claim to be motivated to give presentations at seminars organized by the entrepreneurship office of their university as follows:

"I assist others for ideological reasons. I like to help others. And I believe that you should be supportive because it is not necessary that others do the same mistakes that I have done before. It is simply the right thing to do" (USO37)

"I do believe that one should pass on such information and experiences. I mean, of course not everything like my business plans and so on, but some experiences are of particular value for other founders and I like to help them this way" (USO56)

Other alumni spin-off entrepreneurs' principalistic altruistic motives come from their opinion that as entrepreneurs they have a particular social responsibility:

"I believe that as entrepreneur I have the responsibility to do something for society. Because, if you don't do that, no one does." (USO27)

Furthermore, a few alumni spin-off entrepreneurs claim their engagement is due to the principle of fairness. In this respect, fairness can only be maintained when the support they have received in the past is further passed on to people who need assistance now:

"I do it because I want to give something of what I have received in the past to those that need assistance today" (USO07)

Last but not least, the principle of exchanging knowledge and experience is perceived to be highly important and is understood to be good for everyone in the end:

"Well, I simply believe in knowledge management.{...}I believe that exchanging knowledge and experience helps everyone. Teaching and learning helps both the teacher and the learner. And that is why I am very open to being involved. I like to talk about what I learned and what I experience but I also like to listen to others in this respect.{...} For example I like to give presentations about my experience. I do it following my fundamental conviction." (USO74)

Secondly, the interviews with involved alumni spin-off entrepreneurs show that altruistic motives in some cases result from the willingness to help other individual spin-off founders (individualistic altruism):

"The main reason is the people themselves. I think many people have an interest in starting-up a business but don't know exactly how to start it and how to run it. And then it is just normal that I help those people" (USO48)

Thirdly, some alumni spin-off entrepreneurs state that their engagement is motivated by the intention to do good for the overall region or country, a motivational aspect called

collectivistic altruism in the literature. In this respect, many of the interviewees acknowledge the importance of business start-ups for the economy and society. As two alumni spin-off entrepreneurs for example summarize:

"I do it because I believe that business start-ups are very important for the economy and for the overall society" (USO18)

"I believe that a region lives from people who say, "I want to get things moving, I have an idea". And you can congratulate everyone having these thoughts. And when we can help them, we do so." (USO35)

Many alumni spin-off entrepreneurs further specify their opinion in this respect. One alumni spin-off entrepreneur explains his opinion by pointing at the important role of entrepreneurship for innovation-driven economic development:

"It is clear that every innovation that has changed the world originated at start-ups and was pushed into the market by entrepreneurs. Not by established large corporations. That has to be clearly acknowledged. And concerning my engagement: I am simply an idealist regarding this topic. And I do it for idealistic reasons" (USO16)

Another alumni spin-off entrepreneur claims to be motivated to become involved in a university's entrepreneurial support structure because he believes that the commercialization of research results is important for a country's competitiveness:

"I am of the opinion that if Germany wants to have a chance in the competition as a site for knowledge and science, the commercialization of research results, also in the form of business start-ups, is highly relevant" (USO73)

Another alumni spin-off entrepreneur mentions the role of an entrepreneurial culture in this respect:

"I think the entrepreneurial culture here in Germany is underdeveloped compared to the United States for example. For a long time, people looked at entrepreneurs and business founders as if they were something evil. That is why nothing happened in order to improve the attitudes. But basically the point is: we need enterprises. I mean, the system of the market economy is based on private businesses. And it basically works pretty well, I believe. Therefore we need people today who take risks. And these people need assistance. Insofar we enjoy being available for that. {...} and basically I think it is a pity that not more people start businesses. The more entrepreneurs the better. Of course, many start-ups fail. But that is in the bag. But I think it would be great if more people had the courage to take risks and start businesses" (USO15)

The notion that altruism is an important motive for alumni spin-off entrepreneurs to engage in a university's entrepreneurial support structure is also supported by the assessment of key informants.

As altruism is an important motive influencing the decision of alumni spin-off entrepreneurs in favor of an involvement, it is plausible to assume that a lack of altruistic attitudes is a significant reason why so many alumni spin-off entrepreneurs decline a commitment. However, the interviews do not directly support this proposition: None of those alumni spin-off entrepreneurs who never engaged, deliberately mention a lack of altruistic attitude as a motive for remaining uninvolved. On the other hand, the fact that many alumni spin-off entrepreneurs decline an involvement because they expect the benefits to be too low and/or the investments to be too high (especially time) indicates that their altruistic attitudes are at least not pronounced enough in order to compensate the disadvantages.

5.4.1.3 Reciprocity as a decision motive

The interviews with key informants and alumni spin-off entrepreneurs reveal that reciprocity – the willingness to give something back in return to what has been received in the past (cf. BRIEF/MOTOWIDLO 1986: 718, DIAMOND/KASHYAP 1997: 919) – is an important aspect influencing an alumni spin-off entrepreneur's decision to become or not to become involved in a university's entrepreneurial support structure. However, the role of reciprocity has to be regarded in a differentiated manner, depending on to whom or what it is exactly directed: the facilities of a university's entrepreneurial support structure and its staff, or the university as a whole.

The interviews show that many alumni spin-off entrepreneurs mention reciprocity in regard to their university's entrepreneurial support structure and in particular its staff, which leads to the decision to become involved. Alumni spin-off entrepreneurs who were engaged in the past or are presently involved frequently state that it is their acknowledgement of the entrepreneurial support structure staff's assistance for their own start-up and their willingness to give something in return, which motivates them to become involved. The following statement from an alumni spin-off entrepreneur who regularly assists the university's entrepreneurship office in the organization of sensitization, consultation and training events and who also exchanges experience with its staff, exemplifies this very well:

"Well, I have to say that these people were also very helpful to us. Without their efforts, it would have been more difficult to get through the founding process. And once in a while we see each other and then I enjoy giving advice or assisting when I am asked" (USO18)

The importance of reciprocity directed at the university's entrepreneurial support structure as a motive for the involvement of alumni spin-off entrepreneurs is supported by the interviewed key informants. In this respect, all key informants agree on the assessment that the engagement of alumni spin-off entrepreneurs is strongly motivated by their willingness to give something back to them as staff of the entrepreneurship office in return for the important assistance they had previously received from them. The statements of two (former) entrepreneurship office employees who affirm that they successfully involved alumni spin-off entrepreneurs in their entrepreneurial support program exemplify this:

"{...} and also what I think plays a role is that they want to give something back to us in return for what they have received before" (KEY INF. 14)

"I think they also have the feeling that they want to give something back, because they also received a lot from us: working space, the application assistance for funding, or coaching. And I think they are therefore more willing to reschedule other appointments or to make sure that another person from the founding team participates in our events. {...} And interestingly, the more they have received from us, the more willing they are to assist us." (KEY INF. 9)

On the other hand, the interviews with alumni spin-off entrepreneurs and key informants reveal that reciprocity in regard to the university as a whole is a negligible motive for becoming involved in a university's entrepreneurial support structure. In fact, not one of the actively involved alumni spin-off entrepreneurs state that the desire to give something back to the university as a whole is a motive. This fact is supported by the assessment of one key informant, who in this respect clearly makes a difference between the university as a whole and the support structure as an assisting facility:

"It is their willingness to give something back. However, I don't believe that this is directed at the university as a whole. I believe that they are very well aware of whom exactly at university helped them. And that was us." (KEY INF. 2)

The negligible role of reciprocity towards a university as a whole as a decision motive may be caused by a lack of emotional attachment to the university.

5.4.1.4 Emotional attachment as a decision motive

The more intense the emotional attachment of a potential benefactor to a person or organization that needs support, the more likely is prosocial behavior in favor of that person or organization (cf. RUYTER/WETZELS 2000: 392). The intensity of emotional attachment depends largely on the nature of the personal relationship between the potential benefactor and the potential receiver. In this respect, emotional attachment increases the closer and more stable a personal relationship is and the more it is based on sympathy and trust (cf. BALDASSARRI/GROSSMAN 2013: 1) (see Section 5.2).

Indeed, the interviews with alumni spin-off entrepreneurs and key informants suggest that emotional attachment influences an alumni spin-off entrepreneur's decision to become or not to become involved in a university's entrepreneurial support structure. However, as it is the case with reciprocity as a decision motive, the role of emotional attachment also has to be regarded in a differentiated manner, depending on to whom or what exactly it is directed: the facilities of a university's entrepreneurial support structure and its staff, or the university as a whole.

Many alumni spin-off entrepreneurs are motivated to become involved due to their personal relationship with the staff of the entrepreneurial support structure. The interviewed key informants also assess the engagement of alumni spin-off entrepreneurs to strongly be motivated by the emotional attachment and the personal relationship between the alumni spin-off entrepreneurs and the entrepreneurship office staff. The following statements of (former) entrepreneurship office employees exemplify this:

"They are usually young entrepreneurs whom we supported a few years ago. That means, there is also a lot of personal contact between us and them. And when we call and ask them, they are usually delighted to help us out." (KEY INF. 2)

"Most importantly, it is about how attached these alumni spin-off entrepreneurs still are with the institution and especially with the respective persons who need their assistance. It is all about personal contacts." (KEY INF. 15)

The importance of personal contact gives reason to presume that the above addressed role of reciprocal behavior is caused less by the willingness to give something back to the entrepreneurial support structure as an organization, but rather by the intention to return favors to the involved staff. The following statement of a former entrepreneurship office employee supports this presumption:

"They of course did it for my sake, because they also received assistance from me. {...} I have to say that I also worked more for the whole project than what I was paid for with my half-time or three-quarter-time position. And the founders rewarded that by saying 'one hand washes the other'. They said: 'okay, you supported us and you made many things possible for us, and now you ask us if we can do a presentation or whatever, then we enjoy doing that'." (KEY INF. 10)

In addition to personal relationships, the emotional attachment of two or more individuals or organizations is influenced by the degree of “we-ness” and identification with one another. Thus, the higher the degree of “we-ness” and identification is, the more likely prosocial action will occur (cf. LEVINE et al. 2005: 444) (see Section 5.2). According to the interviews with alumni spin-off entrepreneurs and key informants, the identification with a university’s entrepreneurial support structure positively influences alumni spin-off entrepreneurs’ motivation to become engaged:

"I believe that they identify very well with us. Not only because we assisted them, but also because we somehow share similar ideas on what we should do with the knowledge capacities here at the university." (KEY INF. 2)

While emotional attachment with the entrepreneurial support structure and its staff is an important decision motive, the interviews suggest that emotional attachment of alumni spin-off entrepreneurs with their university as a whole plays a negligible role as a motive. None of the interviewed alumni spin-off entrepreneurs who were or are presently involved in a university’s entrepreneurial support structure mention this as a possible motive. The interviewed key informants support this view and furthermore suggest that the lack of emotional attachment and identification with the university also serves as explanation why so many alumni spin-off entrepreneurs refrain from becoming involved. Two statements exemplify this very well:

"I do not believe that it is the university. Most of them are not attached too well to the university. What is most important, is the personal relationship to us, who have helped them before." (KEY INF. 12)

"The main problem is that among former students and employee at a university, there is an absolute lack of identification with the university. And that is the reason why also alumni spin-off entrepreneurs do not consider giving something back to their university." (KEY INF. 16)

Another pattern in the interview data supports the importance of both emotional attachment and reciprocity for the decision between becoming involved or not in a university's entrepreneurial support structure: most of the interviewed alumni spin-off entrepreneurs who were or are presently involved, have received assistance from the university's entrepreneurship office during their own start-up period, while the same proportion of those who have never engaged is significantly smaller.

5.4.1.5 Perceived need and efficacy as a decision motive

As explained in Section 5.2, a common motive for prosocial engagement is the perception of a benefactor that his involvement is needed (perceived need) (cf. EISENBERG et al. 2006). Furthermore, a potential benefactor can be motivated by the opinion that his engagement has significant consequences on the subject of support and will make a difference in comparison to other peoples' engagement and that he/she has the competence necessary to help (perceived efficacy). A contrario, a lack of perceived need or perceived efficacy oftentimes lead potential benefactors to refrain from making a commitment to help (cf. KERR/KAUFMAN-GILLILAND 1997: 211).

Indeed, the interview data suggests that the consideration of perceived need and efficacy significantly influences the decision of alumni spin-off entrepreneurs between becoming involved or not in a university's entrepreneurial support structure. Many alumni spin-off entrepreneurs who have supported or are presently supporting a university's entrepreneurial support structure, perceive their involvement to be necessary, both for the reinforcement of the entrepreneurial support structure and for the next generation of spin-off founders.

"I simply believe that it is necessary that I get involved. It is very important that alumni spin-off entrepreneurs share their experience and know-how. Because the persons within the support structure often don't have their own start-up experience. I therefore believe that they need assistance. And as young spin-off founder, you need the contact to experienced entrepreneurs, who can describe their own experience. This is what motivates me to engage." (USO18)

Furthermore, many of the involved alumni spin-off entrepreneurs acknowledge that their contribution makes a difference and believe that they have the competence and specific knowledge to efficiently help (perceived efficacy). In this respect, an alumni spin-off entrepreneur who frequently engages in seminars and workshops for example says:

"I believe many young spin-off founders have an interest in me. They usually have questions I also used to have. And I as a practitioner can better address these issues than a theorist at the technology transfer office. This really makes a difference for a young entrepreneur." (USO48)

An alumni spin-off entrepreneur who together with his start-up partner proactively shaped his university's entrepreneurial support structure by establishing and operating an informal entrepreneurship office at his university mentions both perceived need and perceived efficacy in his explanation on his motives:

"We realized that it was very difficult to find contact points for people who consider starting up a business.{...}So we thought that we as experienced spin-off founders have a lot of important experience in this respect, which is of relevance for people who plan to become self-employed. This was the basic idea and motivation" (USO58)

The interviews with alumni spin-off entrepreneurs furthermore support the theoretic consideration that a lack of perceived efficacy is a common reason of why an alumni spin-off entrepreneur does not become involved in a university's entrepreneurial support structure. Many interviewed alumni spin-off entrepreneurs who have never been involved believe that their competence in the form of start-up knowledge and experience is very specific and cannot be transferred to other spin-offs. According to them, this is the reason why an involvement in a university's entrepreneurial support structure would not make a difference as it neither helps the entrepreneurship office staff nor other spin-off founders:

"The bottom line is that I think that every start-up is very unique. {...} I think it is therefore not possible to generalize from my experience and knowledge and to say this is the right way. Every start-up is different, every product different. Thus, I believe that I have nothing substantial to contribute, which would help a new founder." (USO09)

"It just doesn't suit us to engage and contribute there. Our experience is very very specific. We are not a classic start-up, but we had very specific and very favorable conditions." (USO47)

There are other alumni spin-off entrepreneurs for whom it is not the limited generalizability of the start-up experience in general, but rather a distrust in their own competence as role-models:

„Well, I simply don't think that I am a great role model in this respect. There are others that can do it better and should do it better.” (USO62)

“I don't give presentations or so. I think this is absurd. I am no Bill Gates...” (USO24)

In addition, the interviews with alumni spin-off entrepreneurs who have never become involved in a university's entrepreneurial support structure, suggest that a lack of perceived need is a common reason to remain uninvolved. This insight can be drawn from the fact that the most frequently mentioned reason for remaining inactive is simply that they have never been asked to become involved – a fact that indicates insufficient mobilization. The alumni spin-off entrepreneurs do not perceive the necessity to help and therefore need to be mobilized.

5.4.2 The influence of the university context on the decision motives of alumni spin-off entrepreneurs

Section 5.4.1 revealed that an individual alumni spin-off entrepreneur's decision between becoming and not becoming involved in a university's entrepreneurial support structure is based on one or a mixture of five different motives. Altogether, all theoretically derived decision motives obviously play a role: the consideration of benefits and costs of a potential involvement (self-interest), the degree of emotional attachment with the university as a whole and with its entrepreneurial support structure facilities and specifically its staff, the strength of the willingness to reciprocate, the degree to which an involvement is perceived to be necessary (perceived need) and efficient (perceived efficacy) as well as altruism.

The results from Section 5.4.1 implicitly suggest that the decision motives and thus the decision of alumni spin-off entrepreneurs to become or not to become involved in a university's entrepreneurial support structure are significantly influenced by the university context. In fact, this seems to be the case for all of the identified decision motives except for altruism. Consequently, it is plausible to assume that universities differ in their potential to involve alumni spin-off entrepreneurs in their efforts to develop and realize an entrepreneurial support structure.

The role of the university context is most obvious for the decision motive *emotional attachment*. As shown above, its existence is a strong motivator for alumni spin-off entrepreneurs to become involved, while its absence is an important reason to remain uninvolved. Emotional attachment is a direct consequence of the perception of oneness and

belongingness that alumni spin-off entrepreneurs have with their university, which also fosters emotional identification with the university. In the best case, alumni spin-off entrepreneurs and a university's actors share common values, attitudes, opinions and beliefs on specific issues, such as technology and knowledge transfer through spin-off formation. It is obvious that the emotional attachment of alumni spin-off entrepreneurs differs from university to university. In this respect, universities differ in their ability to evoke feelings of belongingness and identification among its students, staff and alumni in general and among its alumni spin-off entrepreneurs in particular. An important aspect is the degree to which university actors are able to maintain stable and intense personal relationships that are based on sympathy and trust. In addition, universities differ regarding the existence and impact of alumni initiatives, which are considered to be an effective way to bond alumni to the university.

The university context also strongly influences the decision motive *reciprocity*. In this respect, it is plausible to assume that the willingness of alumni spin-off entrepreneurs to return something to their university in the form of an involvement in a university's entrepreneurial support structure differs between different universities, because it is directly affected by the emotional attachment caused by a certain university context. In addition, reciprocity depends on the quality of teaching and research in a university. The more positive the experience of alumni spin-off entrepreneurs is in this respect, the more they will believe that they owe their personal and professional success to the university, and the stronger their willingness will be to return something to their university, such as a commitment to the university's entrepreneurial support structure.

Notably, the empirical results in Section 5.4.1 suggest that the university context must be differentiated when evaluating its influence on the decision motives of alumni spin-off entrepreneurs between becoming and not becoming involved in a university's entrepreneurial support structure. In this respect, the decision of alumni spin-off entrepreneurs is not only influenced by the respective university context as a whole, but also especially by their emotional attachment to, their identification with, their feeling of belongingness to, their willing to reciprocate to as well as the closeness and stability of personal relationships to the university's entrepreneurial support structure facilities (e.g. its technology transfer office, its entrepreneurship office or its start-up centre) and its staff and actors in charge.

The decision motive *perceived need and efficacy* also strongly depends on the university context, although not as fundamentally and directly as the decision motives *emotional*

attachment and *reciprocity*. Universities differ considerably in their efforts and success in activating the perception of need and efficacy of alumni spin-off entrepreneurs. Because many alumni spin-off entrepreneurs' perceived need and efficacy of an involvement in a university's entrepreneurial support structure is limited (see Section 5.4.1.5), their mobilization depends on the extent to which a university staff is able to convince alumni spin-off entrepreneurs that their particular personal engagement is needed and on the university staff's success in communicating why and how their specific experience, knowledge and competences may upgrade a university's entrepreneurial support structure and help young spin-off founders.

Similarly, the university context shapes the expected *self-interest* of alumni spin-off entrepreneurs in an involvement and consequently their decision between becoming involved or not. Universities differ in regard to the actual benefits and costs of involved alumni spin-off entrepreneurs and their awareness of these. It is obvious that a university has some freedom to adjust the respective framework conditions.

The establishment, development and realization of a university's entrepreneurial support structure are usually the responsibility of particular actors in charge at a subordinate level within a university. Thus, these actors usually initiate and organize a potential involvement of alumni spin-off entrepreneurs and consequently their respective mobilization. This strongly suggests that the decision motives *perceived need and efficacy* as well as *self-interest* of alumni spin-off entrepreneurs are less influenced by the respective university context as a whole, but instead by the university's entrepreneurial support structure facilities (e.g. its technology transfer office, its entrepreneurship office or its start-up centre), its staff and actors in charge.

5.5 Recommendations for a successful mobilization of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure

Regarding the potential that the involvement of alumni spin-off entrepreneurs inheres for the development and sustainment of a capable university entrepreneurial support structure, strategies for their successful mobilization are of high interest. Based on the knowledge about the motives that influence the decision of alumni spin-off entrepreneurs to become involved or not and on the insights on how the university context affects these decision motives, eight recommendations on how to successfully mobilize alumni spin-off entrepreneurs are

suggested. The recommendations are supported by suggestions made by the experienced key informants.

As already mentioned above, the establishment, development and realization of entrepreneurial support structure elements is usually organized at a subordinate level within a university, e.g. by the staff of a technology transfer office, an entrepreneurship office or a start-up centre. Therefore each of the recommendations formulated below is primarily directed at these actors in charge. However, the central university management and administration staff of course has a significant influence on the actors in charge of the entrepreneurial support structure and can therefore indirectly reinforce the eight recommendations.

Recommendation 1:

Establish and cultivate networks and personal relationships to alumni spin-off entrepreneurs

Emotional attachment to and identification with the entrepreneurial support structure facilities and its staff have been shown above to be important motives for alumni spin-off entrepreneurs to become involved. Close and stable personal relationships of alumni spin-off entrepreneurs to these facilities and their staff that are based on sympathy and trust foster the feeling of emotional attachment and identification (cf. BALDASSARRI/GROSSMAN 2013: 1). Therefore, a promising strategy for the actors in charge of a university's entrepreneurial support structure is the establishment and cultivation of intense networks and personal relationships to alumni spin-off entrepreneurs. Due to the fact that reciprocity in favor of the entrepreneurial support structure facilities and their staff is another important motivational determinant, this applies especially to those alumni spin-off entrepreneurs, who were previously supported. Their willingness to give something back should be fostered and exploited. Put into practice, networking and personal relationships can for example be facilitated by organizing regular alumni spin-off entrepreneurs meetings. In addition it is crucial that entrepreneurial support structure actors constantly keep track of the development of previously supported spin-off companies and stay in touch with them.

Recommendation 2:

Ensure high-quality start-up offerings and a culture of service

The willingness of alumni spin-off entrepreneurs' to commit to a university's entrepreneurial support structure also depends on their opinion regarding the quality of the start-up offerings as well as the expertise and competence of the actors involved (cf. SUNG/YANG 2009: 805). This especially applies to alumni spin-off entrepreneurs who were previously supported and therefore can evaluate their own experience. Thus, the key actors of a university's entrepreneurial support structure should ensure that the offerings are of high quality and meet the needs of private companies. In this respect, it is important to establish a culture of service, which is practiced by the support structure's staff. As an interviewed key informant explains:

“It all depends on the engagement of individual persons. And there simply is oftentimes a barrier between the mentality in public service and the mentality in private companies. Therefore it is highly important that we orientate more towards the needs of a company. For example, when I reply to an email as late as Friday night at 8 pm, I can be sure that when I ask him for a favor sometime later, he will do anything to help me out.” (KEY INF. 15)

Recommendation 3:

Improve the emotional attachment and identification of alumni spin-off entrepreneurs with their university

As shown above, the absence of emotional attachment to and the lack of identification with a university as a whole is an important reason for many alumni spin-off entrepreneurs to remain uninvolved with a university's entrepreneurial support structure. Thus, improving both aspects could lead to a more effective mobilization of alumni spin-off entrepreneurs. It is important to acknowledge that the absence of emotional attachment and identification with a university is a barrier for an engagement and has its root in the general character of the relationship between German universities and their alumni. According to the interviewed key informants, the emotional attachment of alumni to a university, the alumni identification with a university and the perception of a university's members as a community are underdeveloped in Germany compared to, for example, the United States (cf. KAILER 2010: 256). A sustainable upgrading of university-alumni relationships would – alongside other benefits – also positively affect the willingness of alumni spin-off entrepreneurs to become involved in their university's entrepreneurial support structure. A university should therefore improve the

attachment of alumni by establishing and developing its alumni initiatives. A key informant summarizes this as follows:

"I think this is a general problem of German universities. Alumni are usually not very strongly emotionally attached to the university and they don't really identify with it once they graduate and leave the university. As long as universities don't acknowledge the value of alumni contacts it is very difficult to find alumni who engage, in whatever manner. It won't work until universities establish a more productive alumni culture." (KEY INF. 17)

Recommendation 4:

Convince alumni spin-off entrepreneurs that their engagement is of prime importance

Section 5.4.1 reveals that the perception of alumni spin-off entrepreneurs regarding the necessity of an involvement is an important decision motive for becoming involved in a university's entrepreneurial support structure. This also applies to the perceived efficacy of alumni spin-off entrepreneurs and their acknowledgement that a contribution would make a difference and that they have the competences and specific knowledge to efficiently help. On the other hand, the interviews have shown that a lack of perceived need and particularly perceived efficacy is an important reason for many alumni spin-off entrepreneurs to refrain from an engagement. Many alumni spin-off entrepreneurs believe that they do not have a lot to contribute, because their own start-up was too specific or because they simply do not believe to have the necessary knowledge about starting up a business. However, this is often only a subjective perception. Many alumni spin-off entrepreneurs are simply not aware that their start-up knowledge and experience is important. Consequently, a university's entrepreneurial support structure staff could improve the mobilization of alumni spin-off entrepreneurs by convincing them that their engagement is needed and that their start-up knowledge and experience is of value for the development of a university's entrepreneurial support structure and the realization of specific offerings.

Recommendation 5:

Create benefits for actively involved alumni spin-off entrepreneurs

As shown above, the decision between becoming involved or not in a university's entrepreneurial support structure is strongly influenced by the self-interest an alumni spin-off entrepreneur expects from his involvement (cf. LEVINE/MANNING 2012: 328). Many

alumni spin-off entrepreneurs remain uninvolved because they expect no benefits and/or because they expect the costs to exceed any benefits. Thus, a university's entrepreneurial support structure staff could improve the willingness of alumni spin-off entrepreneurs to become involved by deliberately offering some kind of profit. As a key informant puts it:

"They are very busy. When those entrepreneurs don't have one thing, it is time. Thus, there has to be a benefit for them to become involved" (KEY INF. 7)

Most universities do not have the financial resources to offer sufficient direct financial incentives, e.g. an expense allowance. Instead, the actors of a university's entrepreneurial support structure should foster indirect benefits for those who become involved, such as the access to potential business partners or customers. Such a potential benefit is also mentioned by a key informant:

"An engagement needs to contain a benefit for those who engage. {...} Such a benefit would for example be that you can do business with those you get to meet." (KEY INF. 18)

This implies that an alumni spin-off entrepreneur who is asked to become engaged should be well-suited to the start-up projects he is going to be involved with. Only when the field of business is similar enough, can a value added in the form of business partner and/or customer acquisition be expected. Furthermore, for alumni spin-off entrepreneurs who started a business some time ago and whose business has grown and become established, new start-ups are often not the most suited cooperation partners. For those alumni spin-off entrepreneurs, contacts to other alumni spin-off entrepreneurs from a similar field of business would be more beneficial. Thus, for the development and realization of specific support offerings, the university entrepreneurial support structure staff should try to convince more than one alumni spin-off entrepreneur. It is also important that alumni spin-off entrepreneurs have time for informal conversations and networking during an actual engagement.

Another important motive to become involved is the expectation to improve one's reputation and recognition. This potential benefit can be fostered by a university's entrepreneurial support structure staff by actively making public the activities carried out together with the alumni spin-off entrepreneurs, e.g. via their webpages or local newspapers.

Recommendation 6:

Effectively communicate the potential benefits of an engagement

On the one hand, as shown in Section 5.4.1, benefits of an involvement in a university's entrepreneurial support structure, such as the access to networks or the improvement of reputation potentially do exist and the expectation of these benefits influence the decision of many alumni entrepreneurs in favor for an engagement. On the other hand, however, the expectation to receive no benefits is one of the most important reasons why many alumni spin-off entrepreneurs refrain from an engagement. This apparent contradiction can at least partly be explained by the unawareness of the potential benefits on the part of many alumni spin-off entrepreneurs. Thus, it is plausible that a university's entrepreneurial support structure staff can improve the mobilization of alumni spin-off entrepreneurs by effectively communicating and explaining the benefits of becoming involved when persuading them to become engaged.

Recommendation 7:

Decrease the costs of an involvement

As shown above, many alumni spin-off entrepreneurs decline and involvement because they expect the costs of an involvement to exceed its benefits. It is especially the time that is required when engaging, which prevents alumni spin-off entrepreneurs from becoming involved. Thus, a strategy to improve the mobilization of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure would be to decrease the costs of an engagement, especially regarding the time-based expenditures. This is also acknowledged by a key informant:

"It is obvious that they don't want to spend too much time on it. And certainly they shouldn't dissipate their energies on stuff like that. When an entrepreneur has too much time for engaging, he certainly has got a problem." (KEY INF. 10)

In this respect, a university's entrepreneurial support structure staff should ensure that an engagement requires as little preparation as possible by an alumni spin-off entrepreneur.

Recommendation 8:

Intensify the mobilization efforts and ensure its efficiency

Most alumni spin-off entrepreneurs do not come up with the idea to become involved in their university's entrepreneurial support structure proactively by themselves. Thus, the intensity and quality of the mobilization efforts by the actors in charge of the support structure are important aspects. This insight is emphasized by the fact that a frequent reason why many alumni spin-off entrepreneurs remain uninvolved is that they have never been actively asked to do so by the university entrepreneurial support structure staff. Furthermore, taking into account that many alumni spin-off entrepreneurs state to be generally willing to contribute, there seems to be quite a potential that has so far not been exploited due to a lack of mobilization. Thus, the actors in charge of a university's entrepreneurial support structure should simply intensify the efforts in addressing and approaching alumni spin-off entrepreneurs. Alumni spin-off entrepreneurs need to be actively persuaded and made enthusiastic about an engagement. It is obvious that the success depends on the personalities of the support structure staff. A university should ensure that its entrepreneurial support structure staff has the ability to be motivating and convincing. A key informant puts this aspect as follows:

"I believe that the mobilization highly depends on the persons involved. {...} Alumni spin-off entrepreneurs need to be actively made enthusiastic about an engagement. The persuasiveness of the university's actors is very important. You should not bore the entrepreneurs when you want something from them. You also need sales talent and the ability to convince others." (KEY INF. 19)

5.6 Conclusions

Universities can improve a region's development potential by generating spin-off companies. Therefore however, they need to establish and reinforce a capable entrepreneurial support structure. As explained in the outset, recent empirical evidence suggests that alumni spin-off entrepreneurs play an important role in the evolution and reinforcement of a university's entrepreneurial support structure by contributing important resources and capabilities that a university may lack, such as practical start-up experience, know-how and information (cf. KAILER 2010, LLOYD-REASON et al. 2009, NATHUSIUS 2013).

Therefore, strategies for a successful mobilization of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure are of high interest. This paper addresses these potential strategies and pursues the central objective to formulate empirically based recommendations, on how a university can successfully mobilize alumni spin-off entrepreneurs to contribute to a university's entrepreneurial support structure.

5.6.1 Summary of results

As a successful mobilization of alumni spin-off entrepreneurs depends on whether they can be motivated to engage, knowledge about the motives that influence the decision of alumni spin-off entrepreneurs between becoming involved or not is of particular value. Therefore, the first aim of this paper was to answer the following research question:

(1) What are the motives that influence the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure?

Empirical evidence suggests that at an individual level, it is usually one of or a mixture of five different motives that influence alumni spin-off entrepreneurs. The interviews reveal that the following motives play a role: The consideration of benefits and costs of a potential involvement (self-interest), the degree of emotional attachment with the university as a whole and specifically with its entrepreneurial support structure facilities and its staff, the strength of the willingness to reciprocate to these, the degree to which an involvement is perceived to be necessary (perceived need) and efficient (perceived efficacy) as well as altruism.

In order to formulate recommendations on how university actors can successfully mobilize alumni spin-off entrepreneurs, knowledge on how the university context affects the motives addressed above is crucial. The second research questions deals with this aspect:

(2) How does the university context affect the motives that influence the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure?

This paper shows that all of the relevant motives – except for altruism – depend on and are influenced by the respective university context. More precisely, it is not only the characteristics of a university as a whole on which decision motives depend and are influenced by. Instead, in particular support structure facilities (e.g. a technology transfer office, an entrepreneurship office, a start-up centre) and its staff on a subordinate level within the university play a key role.

At most universities, these actors are responsible for establishing and developing a capable spin-off support structure and for realizing support measures. Thus, initiatives for improving the mobilization of alumni spin-off entrepreneurs to become involved by influencing their decision motives usually originate at this subordinate level.

By combining the results from Research Questions 1 and 2, I intended to answer Research Question 3:

(3) How can a university successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure?

I was able to formulate eight recommendations for university actors in charge of a university entrepreneurial support structure on how to successfully mobilize alumni spin-off entrepreneurs to become involved. In summary, I suggest to establish and cultivate networks and personal relationships with alumni spin-off entrepreneurs and to improve their emotional attachment to and identification with their university of origin. Furthermore, the actors in charge should offer benefits for actively involved alumni spin-off entrepreneurs and clearly describe what benefits are available. Furthermore, the actors in charge should decrease the costs of an involvement – especially in terms of time. In addition, the willingness of alumni spin-off entrepreneurs to become involved can be fostered by ensuring high-quality start-up support offerings and a culture of service and by actively convincing alumni spin-off entrepreneurs that their engagement is of prime importance. Last not but least, I suggest that the actors in charge of a university's entrepreneurial support structure should intensify their mobilization efforts and ensure its efficiency.

5.6.2 Contributions to the literature

This paper contributes to the literature on entrepreneurial support measures at the university level as a determinant of spin-off formation. More precisely, the results advance the state of research on the role of an involvement of individuals who started a spin-off company out of a particular university at an earlier point in time (in this paper referred to as “alumni spin-off entrepreneurs”) for the organization of a capable entrepreneurial support structure. The respective literature provides empirical evidence for such an involvement's important role for the realization of existing support measures (cf. KULICKE et al. 2011: 239, 250, KURATKO 2005: 589, LLOYD-REASON et al. 2009: 609, NATHUSIUS 2013: 161, ROBERT/EESLEY 2009: 6, WILSON 2008: 6), and considers it to be valuable in the scope of the initial establishment and later evolution of a university's entrepreneurial support structure (cf. KAILER 2010: 260, LLOYD-REASON et al. 2009: 603, NATHUSIUS 2013: 76, 166). In spite of the identified potential of an involvement of alumni spin-off entrepreneurs with a university's entrepreneurial support structure and the increased expectations of policymakers in this respect (cf. for instance BMWI 2010: 6, BMWI 2011: 20), the literature lacks a discussion on the strategies to effectively mobilize alumni spin-off entrepreneurs in this respect. In addition, although it is plausible to assume that a successful mobilization of alumni spin-off entrepreneurs depends on whether they can be motivated to become committed, the motives influencing the decision of alumni spin-off entrepreneurs between becoming and not becoming involved in a university's entrepreneurial support structure have so far not been subject of empirical investigation. This paper reduces these research gaps by identifying the respective decision motives of alumni spin-off entrepreneurs and by translating these into strategies for an effective mobilization of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure.

5.6.3 Limitations and further research

The limitations of this paper relate to the confined generalizability of qualitative research. First, this applies to the small number of cases under investigation. The sample includes only 18 alumni spin-off entrepreneurs who are presently involved in a university's entrepreneurial support structure or were so in the past and are thus able to identify their respective decision motives. Secondly, the generalizability suffers from the fact that the interviewees were selected by using a sampling grid which led to a heterogenic sample structure. Thirdly, all interviewed alumni spin-off entrepreneurs and key informants come from only two

universities. However, the motives influencing the decision of alumni spin-off entrepreneurs between becoming or not becoming involved in a university's entrepreneurial support structure are affected by the university context, as the empirical results of this paper suggest. Another potential limitation relates to the face-to-face interview situation. Although spontaneous answers regarding the motives of their behavior were provoked during the interviews with alumni spin-off entrepreneurs, the possibility cannot completely be excluded that answers were given strategically or in a manner that is desired and/or expected by society or by the interviewer. For example, the empirical result suggesting that altruism plays an important role as a decision motive may be biased. Last but not least, due to the small number of cases, the methodological approach in this paper cannot show the relative importance of each motive of the alumni spin-off entrepreneurs that influence the decision between becoming involved or not.

Further research should preclude the limitations of this paper. In order to enable more generalizability, studies on the motives of alumni spin-off entrepreneurs that influence the decision between becoming or not becoming involved in a university's entrepreneurial support structure and on the strategies for their successful mobilization should increase the number of cases (alumni spin-off entrepreneurs) under investigation. Furthermore, choosing alumni spin-off entrepreneurs and key informants from more than two universities will bring further interesting insights. A higher number of cases would also allow to investigate the relative importance of the different decision motives.

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Chapter 6

Conclusions

Universities are increasingly expected to adopt a more fundamental and proactive role in economic progress (cf. DRUCKER/GOLDSTEIN 2007: 22). As so-called "entrepreneurial universities" they are attributed a third mission in addition to their traditional roles of providing higher education and conducting basic research. This third mission refers to an active and direct role in innovation through the "capitalization" of research results in the scope of different knowledge and technology transfer mechanisms (cf. ETZKOWITZ/LEYDESDORFF 2000: 110, ETZKOWITZ 2008: 27-30, LAZZERONI/PICCALUGA 2003: 38). Spin-off formation is acknowledged to be the most efficient transfer mechanism (cf. BEKKERS/FREITAS 2008: 1838, FONTES 2005: 341-346, ROGERS et al. 2001: 259) and to inhere significant potential as an enhancer of structural change, economic development and well-being, especially at the regional level (cf. BERCOVITZ/FELDMAN 2006: 179). Consequently, a vast amount of literature on the determinants of spin-off formation emerged within the past decades (cf. e.g. DI GREGORIO/SHANE 2003, DJOKOVIC/ SOUTARIS 2008, FINI et al. 2011, LINK/SCOTT 2005, LOCKETT et al. 2003, O'SHEA et al. 2008). A key notion of this research strand is that universities dedicated to increasing the quantity and quality of spin-off activity need to establish a capable university entrepreneurial support structure consisting of specific cultural attributes, practical routines as well as support measures and associated facilities (cf. O'SHEA et al. 2005a, ROTHAERMEL et al. 2007).

The research topic of this dissertation is broadly situated within the research stream on the characteristics of a university's entrepreneurial support structure as a determinant of spin-off formation. Its focus is on one particular issue, which can significantly determine a support structure's successful configuration: the contribution of individuals who started a spin-off company out of a particular university at an earlier point in time (in this dissertation referred to as "alumni spin-off entrepreneurs"). In recent years, several studies suggest that a university's entrepreneurial support structure profits from an involvement of alumni spin-off entrepreneurs who provide important but the university lacking resources, such as start-up experience, know-how or information they gained during their own start-up process (cf. KAILER 2010, KURATKO 2005, NATHUSIUS 2013). These studies for instance propose positive consequences of such an involvement on the effectiveness of sensitization measures, on the realization of entrepreneurship education and training events as well as on consultancy and coaching offerings (cf. KULICKE et al. 2011: 239, 250, KURATKO 2005: 589, LLOYD-REASON et al. 2009: 609, NATHUSIUS 2013: 161, ROBERT/EESLEY 2009: 6, WILSON 2008: 6). Furthermore, they consider the contribution of alumni spin-off entrepreneurs to be

valuable within the scope of the initial establishment and later evolvement of a university's entrepreneurial support structure. Accordingly, alumni spin-off entrepreneurs can provide important guidance regarding the idea generation, the initial conceptualization or the later refinement of particular support structure elements (cf. KAILER 2010: 260, LLOYD-REASON et al. 2009: 603, NATHUSIUS 2013: 76, 166).

Nevertheless, the respective stream of literature is still characterized by several shortcomings. The aim of this dissertation was to narrow three major research gaps within the existing literature: (1) a conceptual research gap, (2) an empirical research gap, as well as (3) a research gap, which relates to strategies for a successful mobilization of alumni spin-off entrepreneurs (for a detailed explanation of the addressed research gaps see Section 1.3 and Section 6.1 below). The conceptual research gap refers to the literature's lack of a theoretical concept of university spin-off formation that takes into account an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs, which is plausibly an imperative prerequisite for the proposal that alumni spin-off entrepreneurs are not only influenced by a university's entrepreneurial support structure but in turn also contribute to it. The empirical research gap addressed in this dissertation relates to the literature's shortcomings regarding empirical evidence for the importance of the contribution of alumni spin-off entrepreneurs for a university entrepreneurial support structure in comparison to other sources of know-how, experience and information. The research gap, which relates to strategies for a successful mobilization of alumni spin-off entrepreneurs, refers to the fact that their mobilization to become involved in a university's entrepreneurial support structure has so far not been sufficiently discussed in the literature.

Each of this dissertation's three objectives relate to one of these research gaps. These were (1) to present a revised theoretical concept of university spin-off formation, (2) to empirically reveal the relative importance of the contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure, and (3) to formulate recommendations for university actors, on how to successfully mobilize alumni spin-off entrepreneurs to contribute to a university's entrepreneurial support structure.

Regarding the cumulative approach of this dissertation, its core constitutes three research papers (in the present form integrated into Chapters 3, 4 and 5), of which each independently from each other addresses one of the three research gaps and objectives (for a detailed explication of the structure of this dissertation see Section 1.5). In this final chapter, the results of the three core chapters are summarized and its contributions to the literature are

outlined (Section 6.1). Furthermore, aspects of future research are discussed (Section 6.2) and policy implications are presented (Section 6.3).

6.1 Major results and contributions to the literature

All three core chapters of this dissertation eventually contribute to the literature on the determinants of spin-off formation (cf. e.g. O'SHEA et al. 2008, LINK/SCOTT 2005). The respective research papers are situated within a stream of research, which investigates the features of a university's entrepreneurial support structure that are conducive to spin-off formation (cf. e.g. LOCKETT et al. 2005, O'SHEA et al. 2005, ROTHÄERMEL et al. 2007). In this respect they contribute to the advancement of the current state of research on the role of the involvement of alumni spin-off entrepreneurs for the organization of a capable university entrepreneurial support structure. Although existing studies acknowledge its importance for the realization and evolution of a university's entrepreneurial support structure (cf. e.g. KAILER 2010, NATHUSIUS 2013, KURATKO 2005), the stream of literature is still little developed and addresses many aspects only marginally and superficially. This is the case in spite of increasing policy expectations regarding an involvement of alumni spin-off entrepreneurs (cf. BMWI 2010: 6, BMWI 2011: 20) and its increasing recognition by practitioners within universities or public start-up support institutions. Regarding the nature of the three addressed research gaps, this dissertation makes a conceptual and an empirical contribution to the literature as well as a contribution regarding strategies for a successful mobilization of alumni spin-off entrepreneurs. Each of these contributions is made by one of the core chapters. In the following, all three contributions are outlined by summarizing the major results of the respective chapters.

Conceptual contribution

This dissertation's conceptual contribution to the literature stems from the results given in *Chapter 3* ("A theoretical approach to explain the interdependencies between a university's entrepreneurial support structure and its spin-off entrepreneurs"). The objective was to present a revised theoretical concept of university spin-off formation. It contributes to the literature on alumni spin-off entrepreneur involvement in a university's entrepreneurial support structure by acknowledging an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs. It is conceptually plausible that such an

interdependent relationship exists as prerequisite for the suggestion that alumni spin-off entrepreneurs contribute to a support structure. Accordingly, the individual spin-off entrepreneur is not only influenced by a university's entrepreneurial support structure regarding the decision to become self-employed, the start-up process and the early development of the spin-off company, but can in turn also shape it. However, in spite of the existing studies that indicate to the importance of a contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure (cf. e.g. KAILER 2010, NATHUSIUS 2013, KURATKO 2005), the literature so far lacks a theoretical foundation of university spin-off formation that accounts for such an interdependent relationship. In fact, contemporary concepts of university spin-off formation so far focus only on one direction of effect, namely the role of a university's entrepreneurial support structure for spin-off formation (cf. for example O'SHEA et al. 2005a, ROTHAERMEL et al. 2007), while the influence of spin-off entrepreneurs on the support structure is not taken into account.

The contribution to the literature of Chapter 3 is that it addresses this conceptual shortcoming. Its theoretical foundation for the suggestion of an interdependent relationship between a university's entrepreneurial support structure and its spin-off entrepreneurs is based on the theory of structuration (cf. GIDDENS 1984), on approaches in regional science and economic geography (cf. BATHELT/GLUECKLER 2011), as well as on a literature review regarding the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure (cf. BOSCHMA/FRENKEN 2006). Furthermore, the revised theoretical concept illustrates under which conditions alumni spin-off entrepreneurs influence a university's entrepreneurial support structure. More precisely, relating to AJZEN's (1991) theory of planned behavior it shows, under which conditions an individual actor in charge of a university's entrepreneurial support structure decides to include alumni spin-off entrepreneurs in his efforts to establish, evolve and realize the support structure as well as under which conditions an individual alumni spin-off entrepreneur decides to become involved. In a nutshell, the theoretical concept suggests that both, an individual actor in charge as well as an individual alumni spin-off entrepreneur, will decide in favor of an inclusion, respectively an involvement the more positive his/her attitudes towards it is, the stronger their subjective norm is as well as the larger their perceived and actual behavioral control is.

Empirical contribution

As explained above, existing studies suggest that a university's entrepreneurial support structure can profit from an involvement of alumni spin-off entrepreneurs, who provide important but the university lacking resources, such as hands-on experience, know-how or information they gained during their own start-up process (cf. KAILER 2010, NATHUSIUS 2013, KURATKO 2005). However, while the literature in general acknowledges the positive effects of an involvement of alumni spin-off entrepreneurs, its importance for a university's entrepreneurial support structure in comparison to other sources of know-how, experience and information remain unknown and has hitherto not been subject of empirical investigation. The findings described in *Chapter 4* ("The contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure: Essential ingredient or just a decorative accessory?") contribute to the literature by narrowing this empirical research gap. The objective was not only to reveal whether the contribution of alumni spin-off entrepreneurs is an essential ingredient or just a decorative accessory, but also to show in which way and for which particular elements of a university's entrepreneurial support structure it is of importance.

The results of a qualitative research design on the entrepreneurial support structure of Leibniz Universität Hannover (LUH) suggest that the contribution of alumni spin-off entrepreneurs plays an important role for a university's entrepreneurial support structure – at least in the case of LUH. However, this finding has to be regarded in a differentiated way with respect to the nature of such a contribution. In summary, the results suggest that while the contribution of alumni spin-off entrepreneurs is an essential ingredient for the realization of particular support measures and thus for the overall reinforcement of existing elements of a university's entrepreneurial support structure, it should rather be considered a decorative accessory when it comes to the overall evolution of such a structure. Regarding the contribution to the reinforcement of a support structure more precisely, Chapter 4 reveals that alumni spin-off entrepreneurs are an important component of LUH's start-up support as they provide important know-how, information and practical experience in four different ways: their presence at capability supply measures (entrepreneurship education, training, qualification and coaching events), engagement in information supply measures (advisory and consultation measures), participation in networking events as well as role-modeling in the context of sensitization and mobilization efforts. As for the rather limited contribution of alumni spin-off entrepreneurs to the evolution of LUH's entrepreneurial support structure, the findings in Chapter 4 show differentiated results regarding the different stages of evolution. Alumni spin-

off entrepreneurs played no role in the stage of idea generation – it was coined by Hanover's economic development agency – and only a minor role as know-how and information source in the second stage of conceptualization and configuration of initial support structure elements – other sources like regional partners and other university's TTOs were more important. Regarding the mode of contribution during the second stage, alumni spin-off entrepreneurs were not engaged formally but solely informally by giving advice and suggestions to LUH's TTO's staff. Alumni spin-off entrepreneurs also played a minor role during the third stage of evolution – the sustainment and re-configuration during the further evolution of LUH's entrepreneurial support structure. An important finding in Chapter 4 is that alumni spin-off entrepreneurs, independently of the nature of their contribution, typically do not become involved with a university's entrepreneurial support structure proactively on their own initiative, but mostly reactively upon request.

The results furthermore suggest that the contribution of alumni spin-off entrepreneurs plays an important role for all three elements of a university's entrepreneurial support structure, as identified in the literature. Their minor, informal contribution to its evolution concerns LUH's support measures and the associated infrastructural facilities as well as LUH's general policies on spin-off formation. The decisive and important contribution of alumni spin-off entrepreneurs to the reinforcement of existing elements also mainly targets the support measures – particularly the above mentioned sensitization, information supply and capability supply measures – and the associated infrastructural facilities. Through their engagement regarding sensitization and capability supply measures, alumni spin-off entrepreneurs furthermore significantly affect another element: LUH's culture towards entrepreneurship by positively changing the attitude of students and faculty towards entrepreneurship.

Contribution regarding strategies for a successful mobilization of alumni spin-off entrepreneurs

This dissertation's contribution to the literature regarding strategies for a successful mobilization of alumni spin-off entrepreneurs originates from the findings given in *Chapter 5* ("How to successfully mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure?"). The central objective was to formulate empirically based recommendations for university actors on how to successfully mobilize alumni spin-off entrepreneurs to contribute to a university's entrepreneurial support structure. In spite of the identified potential of an involvement of alumni spin-off entrepreneurs (cf.

KULICKE et al. 2011: 239, 250, KURATKO 2005: 589, LLOYD-REASON et al. 2009: 609, NATHUSIUS 2013: 161, ROBERT/EESLEY 2009: 6, WILSON 2008: 6) and the increased expectations of policymakers (cf. for instance BMWI 2010: 6, BMWI 2011: 20), the literature lacks a discussion on strategies to effectively mobilize alumni spin-off entrepreneurs in this respect. In addition, although it is plausible to assume that a successful mobilization of alumni spin-off entrepreneurs depends on whether they can be motivated to become committed, the motives influencing the decision of alumni spin-off entrepreneurs between becoming and not becoming involved in a university's entrepreneurial support structure have so far not been subject of empirical investigation. The contribution to the literature of Chapter 5 is the reduction of these research gaps by identifying the respective decision motives of alumni spin-off entrepreneurs and by translating these into strategies for an effective mobilization of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure.

By applying a qualitative research design including an interview survey with alumni spin-off entrepreneurs and key informants of two universities (Leibniz Universität Hannover and Georg-August-Universität Göttingen) Chapter 5 reveals that it is usually one of, or a mixture of five different motives that influence the decision of alumni spin-off entrepreneurs between becoming and not becoming involved in a university's entrepreneurial support structure: The consideration of benefits and costs of a potential involvement (self-interest), the degree of emotional attachment with the university as a whole and specifically with its entrepreneurial support structure facilities and its staff, the strength of the willingness to reciprocate to these, the degree to which an involvement is perceived to be necessary (perceived need) and efficient (perceived efficacy) as well as altruism. Chapter 5 furthermore shows that all of the relevant motives – except for altruism – depend on and are influenced by the respective university context. More precisely, it is not only the characteristics of a university as a whole on which decision motives depend and are influenced by. Instead, in particular support structure facilities (e.g. a technology transfer office, an entrepreneurship office, a start-up center) and its staff on a subordinate level within the university play a key role. At most universities, these actors are responsible for establishing and developing a capable spin-off support structure and for realizing support measures. Thus, initiatives for improving the mobilization of alumni spin-off entrepreneurs to become involved by influencing their decision motives usually originate at this subordinate level.

Last but not least, Chapter 5 translates the results on the decision motives of alumni spin-off entrepreneurs into eight recommendations for the actors in charge of a university

entrepreneurial support structure on how to successfully mobilize alumni spin-off entrepreneurs to become involved. In summary, it suggests to establish and cultivate networks and personal relationships with alumni spin-off entrepreneurs and to improve their emotional attachment to and identification with their university of origin. Furthermore, the actors in charge should offer benefits for actively involved alumni spin-off entrepreneurs and clearly describe what benefits are available. Furthermore, the actors in charge should decrease the costs of an involvement – especially in terms of time. In addition, the willingness of alumni spin-off entrepreneurs to become involved can be fostered by ensuring high-quality start-up support offerings and a culture of service and by actively convincing alumni spin-off entrepreneurs that their engagement is of prime importance. Finally, the actors in charge should intensify their mobilization efforts and ensure the efficiency of their efforts. For a more detailed explanation of recommendations see Chapter 6.3 (Policy Implications).

Contribution to the literature on the effects of university spin-off formation

In a broader sense, all the above described contributions of this dissertation relate to the literature on the determinants of university spin-off formation. However, by addressing the research topic of the involvement of alumni spin-off entrepreneurs with a university's entrepreneurial support structure, this dissertation implicitly also refers to the research stream on the effects of spin-off activity. As explained in the introduction of this dissertation (see Section 1.2), most studies analyze the immediate real-economic effects of spin-off formation by using indicators like turn-over or employment creation (cf. e.g. LAWTON SMITH et al. 2006, OSKARSSON/SCHLÄPFER 2008, ROBERTS/EESLEY 2009). The rather indirect and systemic effects of spin-off formation that affect a regional economy in the long-run remain underresearched. According to PATTON and KENNEY's (2010) concept of "University research-centric-based clusters", the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure can lead to such a long-term systemic effect. It proposes that the evolution of a university-internal (and also regional) environment supportive to university entrepreneurship and eventually the development prospects of a cluster, substantially depend on the behavior and the engagement of the university's alumni spin-off entrepreneurs. Optimally, they act as "social actors" by sustainably coining the configuration of the university (and also regional) spin-off support infrastructure, by interacting with various stakeholders, actively co-designing, expressing of opinions or exchanging experience. Following PATTON and KENNEY's concept, it is plausible to

assume that in case the contribution of a university's alumni spin-off entrepreneurs is substantial enough, it induces a self-amplifying process by which the university's entrepreneurial support structure is continuously modified and upgraded. The rationale of this self-amplifying process – which plausibly also applies to university regions that do not have the characteristics of a cluster – was explained in the introduction (also see Figure 1 in Section 1.2): An improved entrepreneurial support structure with a high probability leads to more spin-off activity and consequently to more spin-off entrepreneurs at a university. As a consequence, the number of alumni spin-off entrepreneurs increases in the medium term, as spin-off entrepreneurs become established. Thus, there are also more alumni spin-off entrepreneurs who could potentially contribute to a university's entrepreneurial support structure, which thereby in turn experiences another improvement. The dynamization of spin-off activity as a consequence of an improved entrepreneurial support structure does not only initiate the next cycle of self-amplification, but in the long term also increases the potential for sustainable knowledge-driven regional development (cf. PATTON/KENNEY 2010).

The revised concept of spin-off formation presented in this dissertation, as well as the empirical results on the relative importance of the contribution of alumni spin-off entrepreneurs for a university's entrepreneurial support structure at least implicitly make a strong statement on behalf of the existence of the above illustrated self-amplifying process as an indirect and systemic effect of university spin-off formation.

6.2 Implications for future research

Although this dissertation made valuable contributions to the literature, it leaves some open questions that should be addressed by future research.

First, the objective of this dissertation was limited to an investigation of the contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure. However, it is plausible to assume that alumni spin-off entrepreneurs may also positively influence the entrepreneurial support structure at a regional or even national level. A strong involvement and commitment with respective organizations and institutions could improve regional and/or national entrepreneurial framework conditions – for instance the quality of support measures or the entrepreneurial culture –, which is not only conducive to university spin-off formation but also to entrepreneurial activity in general. In fact, also PATTON and KENNEY (2010) explain the improvement of conditions for and the respective dynamization of spin-off formation not only by the involvement of alumni spin-off entrepreneurs in a university's

entrepreneurial support structure, but in addition explicitly mention their influence on the regional context. Thus, it is plausible to assume that also the above elaborated self-amplifying process as indirect and systemic effect of university spin-off formation can additionally be initiated by the involvement of alumni spin-off entrepreneurs in a region's entrepreneurial support structure. Consequently, further research should broaden the scope of investigation to the contribution to alumni spin-off entrepreneurs to a region's or even nation's entrepreneurial support structure. Similar to this dissertation's approach, a conceptual discussion, an empirical analysis and a formulation of mobilization strategies is essential.

Secondly, regarding this dissertation's contribution to the literature on the effects of university spin-off formation, the results only implicitly indicate to the indirect, systemic and long-term effect of an increased potential for sustainable knowledge-driven regional development caused by the self-amplifying upgrade of a university's entrepreneurial support structure through an involvement of alumni spin-off entrepreneurs. In fact, this dissertation only provides empirical evidence that a university's entrepreneurial support structure profits from the involvement of alumni spin-off entrepreneurs. The subsequent process explained in the introduction of this dissertation (see Section 1.2) – the dynamization of spin-off activity as a consequence of an upgraded entrepreneurial support structure as well as the processes' self-amplifying feature as the increased number of alumni spin-off entrepreneurs implies more alumni spin-off entrepreneur involvement – was not empirically investigated. This dissertation neither provides empirical evidence for a dynamization of spin-off activity as a consequence of the involvement of alumni spin-off entrepreneurs in a university's entrepreneurial support structure, nor does it empirically show that the extent of such an involvement increases over time because of the availability of more alumni spin-off entrepreneurs. Future research should try to empirically trace the whole complex process of this indirect, systemic and long-term effect of university spin-off formation. In addition, it would be interesting to analyze, whether particular university characteristics and/or regional conditions foster or hamper this effect.

Thirdly, because the contribution of alumni spin-off entrepreneurs is obviously an essential ingredient to a university's entrepreneurial support structure, policymakers and practitioners should be interested in factors that support or foster the involvement of alumni spin-off entrepreneurs. In this respect, this dissertation makes recommendations on how the actors in charge of a particular university's entrepreneurial support structure can effectively mobilize alumni spin-off entrepreneurs to become involved. Future research should furthermore investigate the determinants of an involvement of alumni spin-off entrepreneurs in a

university's entrepreneurial support structure. It would be compelling to find out whether such an involvement is favored, respectively hampered, by certain characteristics of or conditions within universities or regions.

Fourthly, this dissertation reveals that the decision of alumni spin-off entrepreneurs between becoming and not becoming involved in a university's entrepreneurial support structure is based on one of, or a mixture of five different motives. However, the methodology of the empirical survey did not allow to identify the relative importance of each decision motive (see below). Future research should follow up this topic. The knowledge about the decision motives can be used to derive recommendations for university actors on how to effectively mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure. Information on the relative importance of the decision motives would enable a prioritization of recommendations.

Fifthly, future research should evaluate the derived recommendations for university actors on how to effectively mobilize alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure. It should analyze which recommendations are conducive in practice and which recommendations do not satisfactorily improve the mobilization of alumni spin-off entrepreneurs.

The necessity of further research on the contribution of alumni spin-off entrepreneurs to a university's entrepreneurial support structure furthermore results from this dissertation's limitations with regard to the applied methodologies. A crucial limitation relates to the confined generalizability of qualitative case study research. The data, which was used for the analyses of the relative importance of the contribution of alumni spin-off entrepreneurs for the reinforcement and evolution of a university's entrepreneurial support structure in Chapter 4 stems from only one single university (Leibniz Universität Hannover). As it is plausible to assume that the analyzed phenomenon strongly depends on individual persons involved as well as on context specifications, further research on the entrepreneurial support structures of other universities in different geographical contexts is recommended. Future studies on the contribution of alumni spin-off entrepreneurs to other universities' entrepreneurial support structures as context of investigation are also an inevitable prerequisite for the above suggested further research on its university and region related determinants.

The same limitation applies to this dissertation's empirical investigation of the motives that influence the decision of alumni spin-off entrepreneurs between becoming and not becoming involved in a university's entrepreneurial support structure in Chapter 5. These motives are

plausibly significantly affected by the university context – a suggestion supported by the empirical results of this dissertation (see Chapter 5). However, because all analyzed data collected by interviews with alumni spin-off entrepreneurs and key informants stems from only two universities (Leibniz Universität Hannover and Georg-August-Universität Göttingen), a generalizability to other universities should be considered with caution. Thus, future research should include more and/or additional universities within the scope of an empirical investigation in order to increase generalizability. Respective studies could also reveal whether particular university and/or regional conditions exert a positive or a negative influence on the motivations of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure.

The generalizability of the results on the decision motives of alumni spin-off entrepreneurs with regard to an involvement is furthermore limited because of the relative small number of interviewed alumni spin-off entrepreneurs. The sample used in Chapter 5 includes only 18 alumni spin-off entrepreneurs who are presently involved in a university's entrepreneurial support structure or were so in the past and are thus able to identify their respective decision motives. Furthermore, generalizability suffers from the fact that the interviewees were selected by using a sampling grid which led to a heterogenic sample structure. Thus, in order to enable more generalizability, further research should increase the size and representativity of the alumni spin-off entrepreneurs' sample. A higher number of interviewed alumni spin-off entrepreneurs would also enable the above suggested further empirical investigation of the relative importance of alumni spin-off entrepreneurs' decision motives.

Finally, this dissertation includes methodological weaknesses regarding the face-to-face interview situations with key informants and alumni spin-off entrepreneurs. As in all interview surveys (cf. PATTON 1990, YIN 2003), the possibility could not completely be excluded that answers were given strategically or in a manner that is desired and/or expected by society or the interviewer. Although spontaneous answers were provoked as recommended by KVALE (1996: 145) and OPDENAKKER (2006: 9), this especially applies to the interviews, which targeted at identifying the decision motives of alumni spin-off entrepreneurs (see Chapter 5). Thus, one should for instance bear in mind that the empirical result suggesting that altruism plays an important role as a decision motive may be biased. Future research should try to develop methodological approaches to more completely ensure veridical answer behaviors of key informants and alumni spin-off entrepreneurs.

6.3 Policy Implications

Policymakers increasingly acknowledge that universities can significantly contribute to economic prosperity by generating spin-off companies. In fact, supporting spin-off formation has become an important component of regional, national and even supranational economic development policy (cf. BATHELT et al. 2010: 520, BENNEWORTH/CHARLES 2005: 538, EU 2011: 19). This is particularly the case in developed economies, where the accelerating international competition increases the pressure to successfully and – regarding the problematic situation of public budgets in many countries – efficiently generate innovation in order to maintain economic prosperity and well-being (cf. BERCOVITZ/FELDMAN 2006: 175, BRAMWELL/WOLFE 2008: 1176, ETZKOWITZ et al. 2000: 314, 326). Thus, strategies and measures aiming at augmenting the number and quality of university spin-offs gain importance and are intensively discussed among researchers, practitioners and policymakers (cf. ETZKOWITZ et al. 2000, ETZKOWITZ/LEYDESDORFF 1997, GARNSEY 2007). Thereby, a general consensus is that spin-off formation can be fostered significantly when a capable entrepreneurial support structure is established and reinforced at universities. These structures should consist of support measures, associated infrastructural facilities (e.g. an entrepreneurship office, an entrepreneurship professorship, an incubator), effective policies on spin-off formation and a positive entrepreneurial climate (cf. O'SHEA et al. 2005a, ROTHÄRMEL et al. 2007). The conceptualization and realization of a university's entrepreneurial support structure is a major challenge for the respective actors in charge and place high demands on their entrepreneurial know-how and capabilities.

The conceptual considerations and empirical results of this dissertation regarding the potential of a contribution of alumni spin-off entrepreneurs for the set-up of a capable entrepreneurial support structure suggest that the involvement of alumni spin-off entrepreneurs should be fostered in order to dynamize spin-off formation. Responsible for the establishment, development and realization of entrepreneurial support structure elements at a subordinate level within the university are particular actors in charge, who usually belong to the staff of a technology transfer office, an entrepreneurship office or a start-up center. These actors are advised to seriously consider an involvement of alumni spin-off entrepreneurs in the scope of their respective efforts and activities. Especially the realization of existing support measures can profit from such a contribution. Alumni spin-off entrepreneurs can provide important know-how, information and practical experience when they act as role models in the scope of sensitization measures and when they are involved as educators, lecturers, coaches or mentors

at education and training events as well as consultancy and coaching offerings. In addition, the advice gained from experienced alumni spin-off entrepreneurs is of high value when it comes to the initial establishment or later evolution of particular support structure components. The actors in charge of a support structure should at least consult or optimally even formally involve alumni spin-off entrepreneurs when conceptualizing new or refining existing elements of a support structure.

The actors in charge of a university's entrepreneurial support structure are of course influenced by policies at a broader scale. The university administration and regional as well national policymakers should encourage the actors in charge to involve alumni spin-off entrepreneurs. A promising approach is to require a certain extent of a university's cooperation with alumni spin-off entrepreneurs within the scope of its entrepreneurship support measures as a prerequisite of access to certain financial resources for spin-off support. A good example of a program, which comprises such requirements is "EXIST-Gründungskultur", a federal German program designed to help universities establish an integrated entrepreneurial support structure (cf. BMWI 2010: 6, BMWI 2011: 20).

An important finding of this dissertation with regard to policy implications is that alumni spin-off entrepreneurs typically do not become involved in a university's entrepreneurial support structure proactively on their own initiative, but mostly reactively upon request. Consequently, the mobilization of alumni spin-off entrepreneurs to become involved should be considered an important task of the actors in charge of a university's entrepreneurial support structure.

One objective of this dissertation was to formulate empirically based recommendations for university actors on a successful mobilization of alumni spin-off entrepreneurs. The eight derived recommendations, which were already summarized above, reflect important policy implications. Thus, it makes sense to address them again at this point (for a more detailed elaboration of these recommendations see Section 5.5). Although the recommendations are primarily directed at the actors in charge of a university's entrepreneurial support structure, they also provide valuable suggestions for a university's administration as well as regional and national policymakers, who may indirectly exert a decisive influence.

As mentioned above, a central recommendation for the actors in charge of a university's entrepreneurial support structure is that they should ensure a sophisticated execution of mobilization efforts. This suggestion can be derived from the empirical observation that actively involved alumni spin-off entrepreneurs primarily behave reactively. In addition, a

frequent reason why many alumni spin-off entrepreneurs remain uninvolved is that they have never been actively asked to do so by the university entrepreneurial support structure staff. Taking furthermore into account that many alumni spin-off entrepreneurs state to be generally willing to contribute, there seems to be quite a potential that has so far not been exploited due to a lack of mobilization. It is obvious that due to their different priorities, alumni spin-off entrepreneurs need to be actively persuaded and made enthusiastic about an engagement. Its success plausibly depends on the personalities of the respective support structure staff. Here a university administration can exercise its influence. It should ensure that the staff that works for the entrepreneurial support structure are individuals, who have the personalities, abilities and skills that enable them to be motivating and convincing.

Another crucial suggestion for an efficient mobilization of alumni spin-off entrepreneurs is to foster the emotional attachment and identification of alumni spin-off entrepreneurs with their university. In fact, the empirical results show that the absence of emotional attachment to and the lack of identification with a university as a whole is an important reason for many alumni spin-off entrepreneurs to remain uninvolved. This recommendation is not primarily directed at the actors in charge of a university's entrepreneurial support structure but addresses in particular a university's administration as well as – to a smaller extent – regional and national policymakers. These actors should work on a sustainable improvement of university-alumni relationships, which would – alongside other benefits – also positively affect the willingness of alumni spin-off entrepreneurs to become involved. It is therefore recommendable that universities establish and develop sophisticated alumni initiatives in order to evolve an "alumni culture".

Furthermore, the actors in charge of a university's entrepreneurial support structure should establish and cultivate networks and personal relationship to alumni spin-off entrepreneurs. Close and stable personal relationships between alumni spin-off entrepreneurs and the staff of a university's entrepreneurial support structure foster alumni spin-off entrepreneurs' emotional attachment and identification with the support structure staff. This increases the willingness of alumni spin-off entrepreneurs to reciprocate for instance by becoming involved. From a practical point of view, the staff of a university's entrepreneurial support structure should regularly organize alumni spin-off entrepreneurs meetings in order to cultivate their network.

Another important empirical result of this dissertation is that many alumni spin-off entrepreneurs remain uninvolved, because they expect no personal benefits and/or because they expect that the costs – especially the time necessary to become involved – will exceed

any benefits. Two possible recommendations can be drawn from this finding. Firstly, the mobilization of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure could be fostered by minimizing the anticipated costs of an engagement, which is often expenditure of time. Secondly, the actors in charge of a university's entrepreneurial support structure should try to create benefits for actively involved alumni spin-off entrepreneurs. The benefits must not necessarily be financial – most universities do not have the financial resources to offer sufficient financial incentives anyhow. Instead, indirect benefits such as the access to business partners and customers or reputational gains should be fostered. There is another challenge in this regard. The empirical results of this dissertation suggest that there are significant benefits of an involvement, but that many alumni spin-off entrepreneurs are not aware of these. Thus, it is plausible to assume that the mobilization of alumni spin-off entrepreneurs can be improved, when efforts to persuade them to become involved include a credible communication and explanation of the potential benefits.

Furthermore, the willingness of alumni spin-off entrepreneurs to commit to a university's entrepreneurial support structure also depends on their opinion regarding the quality of the start-up offerings as well as the expertise and competence of the actors involved. This especially applies to alumni spin-off entrepreneurs who were previously supported and therefore can evaluate their own experience. Thus, the key actors of a university's entrepreneurial support structure should ensure that the offerings have a high quality and meet the needs of private companies. In this respect, it is important that the support structure's staff establishes and practices a culture of service.

Last but not least, a university's entrepreneurial support structure staff could improve the mobilization of alumni spin-off entrepreneurs by convincing them that their engagement is needed and that their start-up knowledge and experience is valuable for the development of a university's entrepreneurial support structure and the realization of specific offerings. This recommendation can be derived from the empirical finding that many alumni spin-off entrepreneurs decline an involvement with a university's entrepreneurial support structure because they believe that they do not have a lot to contribute. According to the interviews with alumni spin-off entrepreneurs this may be due to the belief that their own start-up was too specific or because they simply do not believe to have the necessary knowledge about starting up a business. However, it is plausible to assume that this is often only a subjective perception, as many alumni spin-off entrepreneurs are probably simply not aware that their start-up knowledge and experience is important.

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Appendices

Appendix 1: Interview manual of key informant survey

Main subjects	Sub-topics and interviewer instructions
1. Background information	<ul style="list-style-type: none"> • Role of key informant in LUH's/GAUG's entrepreneurial support structure • Time of professional involvement in LUH's/GAUG's entrepreneurial support structure
2. Status quo of LUH's/GAUG's entrepreneurial support structure	<ul style="list-style-type: none"> • LUH's/GAUG's entrepreneurship support measures and affiliated infrastructural facilities • LUH's/GAUG's university policies on spin-off formation • LUH's/GAUG's entrepreneurial climate (<i>Conversation structured by the elements of a university's entrepreneurial support structure</i>)
3. Evolution of LUH's/GAUG's entrepreneurial support structure	<ul style="list-style-type: none"> • LUH's/GAUG's entrepreneurship support measures and affiliated infrastructural facilities • LUH's/GAUG's university policies on spin-off formation • LUH's/GAUG's entrepreneurial climate (<i>Conversation structured by the elements of a university's entrepreneurial support structure</i>) (<i>During later interviews verification of identified stages of evolution</i>)
4. Sources of know-how and information during the conceptualization and reconceptualization of particular support structure elements at different stages of evolution	<p>(<i>Key informant is asked to relate to the stage of evolution, in which he/she was involved</i>) (<i>Conversation structured by the elements of a university's entrepreneurial support structure</i>) (<i>No predetermination of answer categories</i>)</p>
5. Sources of know-how and information for the realization of particular support measures	<p>(<i>Conversation structured by different support measures</i>) (<i>No predetermination of answer categories</i>)</p>
6. Contribution of alumni spin-off entrepreneurs to the conceptualization and reconceptualization of particular support structure elements at different stages of evolution	<ul style="list-style-type: none"> • Existence of contribution • If existent: Modes of potential contribution • If existent: Degree of formality of involvement • If existent: Mode of activation • Assessment of the importance of specific contribution of alumni spin-off entrepreneurs (<i>Key informant is asked to relate to the stage of evolution, in which he/she was involved</i>) (<i>When key informant does not understand what is meant by a contribution provide further explanation including examples</i>)

7.	Contribution of alumni spin-off entrepreneurs to the realization of particular support measures	<ul style="list-style-type: none"> • Existence of contribution • If existent: Modes of potential contribution • If existent: Degree of formality of involvement • If existent: Mode of activation • Assessment of the importance of specific contribution of alumni spin-off entrepreneurs <p><i>(When key informant does not understand what is meant by a contribution provide further explanation including examples)</i></p>
<hr/>		
8.	Assessment of the motives of alumni spin-off entrepreneurs to become involved in a university's entrepreneurial support structure	<p><i>(Ask only when applicable)</i></p> <p><i>(No predetermination of answer categories)</i></p>
<hr/>		
9.	Assessment of the motives of alumni spin-off entrepreneurs to remain uninvolved	<p><i>(Ask only when applicable)</i></p> <p><i>(No predetermination of answer categories)</i></p>
<hr/>		
10.	Potential strategies to improve the mobilization of alumni spin-off entrepreneurs to become involved	<p><i>(No predetermination of answer categories)</i></p>

Appendix 2: Interview manual of alumni spin-off entrepreneur survey

Main subjects	Sub-topics and interviewer instructions
1. Background information	<ul style="list-style-type: none">• Academic career and pre-start-up phase• Course of the start-up phase• University spin-off development since foundation• Cooperation and contacts with other companies or regional organizations• Knowledge and/or technology transferred from university and core competences of the business• Milestones in the spin-off's development• Future prospects of spin-off's development
2. Involvement in LUH's/GAUG's entrepreneurial support structure	<ul style="list-style-type: none">• Existence of involvement• If existent: Nature and extent of potential involvement• If existent: Degree of formality of involvement <i>(When alumni spin-off entrepreneur does not understand what is meant by an involvement provide further explanation including examples)</i>
3. Motives for becoming involved in a university's entrepreneurial support structure	<i>(Ask only when applicable)</i> <i>(Provoke spontaneous answer)</i> <i>(No predetermination of answer categories)</i>
4. Motives for remaining uninvolved	<i>(Ask only when applicable)</i> <i>(Provoke spontaneous answer)</i> <i>(No predetermination of answer categories)</i>

Appendix 3: Post-interview questionnaire of alumni spin-off entrepreneur survey

- 1 Date and place of the interview
- 2 Name of the (alumni) spin-off entrepreneur
- 3 Year of birth of (alumni) spin-off entrepreneur
- 4 Name of the spin-off company
- 5 Year of official company foundation
- 6 Location of company foundation
- 7 University status of the entrepreneur at the time of foundation (student, research associate, professor)
- 8 Moved from outside into the city for studies or employment at university?
- 9 Number of name of founding partners
- 10 University faculty and institute of (alumni) spin-off entrepreneur
- 11 Year when (alumni) spin-off entrepreneur left the university
- 12 Business field of spin-off company
- 13 Sector of spin-off company
- 14 Current number of employees of spin-off company
- 15 Qualification structure of employees of spin-off company
- 16 Share of full- and part-time employees of spin-off company
- 17 Subsidiaries with location and number of employees
- 18 Turnover classified in 2010
(no turnover, less than 10.000, 10.000 to 20.000, 20.000 to 50.000, 50.000 to 100.000, 100.000 to 500.000, 500.000 to 1 Mio., 1 to 1,5 Mio., 1,5 to 2 Mio., more than 2 Mio.)
- 19 Profit/revenue ration 2010 (in %)
- 20 Geographical distribution of turnover (in %)
(region, Lower Saxony, Germany, Europe, rest of the world)
- 21 Purchase of preliminaries from suppliers or service providers
- 22 Location of suppliers or service providers
(region, Lower Saxony, Germany, Europe, rest of the world)
- 23 Use of materials as a share of turnover (in %)
- 24 Contact information for further questions, information or copy of the interview

Appendix 4: Final coding frames of transcript material from interviews with key informants

Table 1: Final Coding Frame: Dimensions and modes of alumni spin-off entrepreneurs' engagement for LUH's entrepreneurial support structure

Category	Sub-category	Definition	Example	Coding Rules
Dimension 1: Evolution of LUH's entrepreneurial support structure	Mode 1: Formal	Alumni spin-off entrepreneurs contribute/contributed formally to the evolution of LUH's entrepreneurial support structure elements.	-----	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs contribute at present and/or contributed in the past to the evolution of LUH's entrepreneurial support structure (e.g. to the idea generation, configuration and conceptualization of initial support structure elements or its later refinement in the form of reconfiguration efforts) in a formal way, by being part of the official conceptualization team.
	Mode2: Informal	Alumni spin-off entrepreneurs contribute/contributed informally to the evolution of LUH's entrepreneurial support structure elements.	<i>"As mentioned, at that time we didn't say: We have to include them formally in our conceptualization work. But of course we took up suggestions from them. We listened to them when they gave feedback and we also always tried to implement it {...}. However, they didn't sit down formally with us at a table and said, these are the necessary instruments and these are the important aspects. It happened rather during the process that the founders said, look you have to pay attention to this and that. And these tips and ideas we integrated in our conceptualization."</i> (KEY INF. 6)	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs contribute at present and/or contributed in the past to the evolution of LUH's entrepreneurial support structure (e.g. to the idea generation, configuration and conceptualization of initial support structure elements or its later refinement in the form of reconfiguration efforts) in an informal way, by informal knowledge-exchange, whereas alumni spin-off entrepreneurs give advice but are not officially part of the conceptualization team.
Dimension 2: Reinforcement of LUH's entrepreneurial support structure	Mode 1: Presence at training, qualification and coaching events	Alumni spin-off entrepreneurs contribute/contributed to the reinforcement of existing entrepreneurial support structure elements by being present at qualification and coaching events.	<i>"They are present at many different events. If it is about trade mark rights or financing issues. And the participants also demand this practical orientation."</i> (KEY INF. 9)	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs contribute at present and/or contributed in the past to the reinforcement of existing entrepreneurial support structure elements by being present at qualification and coaching events.
	Mode2: Engagement in advisory and consultation measures	Alumni spin-off entrepreneurs contribute/contributed to the reinforcement of existing entrepreneurial support structure elements by engaging in advisory and consultation measures.	<i>"Of course, alumni spin-off founders are also important as they act as experts in certain areas. We then use them as a kind of consultant for young spin-off founders"</i> (KEY INF. 2)	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs contribute at present and/or contributed in the past to the reinforcement of existing entrepreneurial support structure elements by engaging in advisory and consultation measures.
	Mode 3: Participation in networking events	Alumni spin-off entrepreneurs contribute/contributed to	<i>"What we do quite frequently is, we host a founder barbeque. Our</i>	Text is coded into this category, when key informant states that alumni

	the reinforcement of existing entrepreneurial support structure elements by participating in networking events.	<i>motive for that is that we want to bring together alumni spin-off entrepreneurs and young spin-off founders. And I believe that this is an important mechanism of how alumni spin-off entrepreneurs can give something back to the system." (KEY INF. 7)</i>	spin-off entrepreneurs contribute at present and/or contributed in the past to the reinforcement of existing entrepreneurial support structure elements by participating in networking events.
Mode 4: Role-modeling in the context of sensitization and mobilization efforts	Alumni spin-off entrepreneurs contribute/contributed to the reinforcement of existing entrepreneurial support structure elements by role-modeling in the context of sensitization and mobilization efforts.	<i>"...there we always had an initial event named 'Paths into Self-Employment'. At this event I always invited spin-off entrepreneurs who talked about their start-up experience. These were persons, who started-up from one of Hanover's universities. And that of course was an effective way to sensitize and motivate students and staff for self-employment." (KEY INF. 10)</i>	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs contribute at present and/or contributed in the past to the reinforcement of existing entrepreneurial support structure elements by role-modeling in the context of sensitization and mobilization efforts.

Table 2: Final Coding Frame: Form of activation of alumni spin-off entrepreneurs' engagement for LUH's entrepreneurial support structure

Category	Sub-category	Definition	Example	Coding Rules
Dimension 1: Evolution of LUH's entrepreneurial support structure	Form of activation 1: Proactive	Engagement for the evolution of LUH's entrepreneurial support structure emerges from the alumni spin-off entrepreneurs themselves as they anticipate the necessity to change and improve LUH's entrepreneurial support structure.	<i>"Sometimes they bring in new insights and know-how. There are some spin-off founders that contact us once in a while and give updates. They give us hints on how they did certain things, as for venture capital or networks or so. And we can play that back into our offerings" (KEY INF. 2).</i>	Text is coded into this category, when key informant states that the engagement for the evolution of LUH's entrepreneurial support structure emerges from the alumni spin-off entrepreneurs themselves as they anticipate the necessity to change and improve LUH's entrepreneurial support structure.
	Form of activation 2: Reactive	Engagement for the evolution of LUH's entrepreneurial support structure does NOT emerge from the alumni spin-off entrepreneurs themselves. Instead, alumni spin-off entrepreneurs need to be mobilized by the actors in charge of a university's support structure and only become involved after they are asked.	<i>"It was us approaching the founders and we established the contacts in order to listen to their opinion. I guess most alumni spin-off entrepreneurs don't actually have an interest in an entrepreneurial support structure. Furthermore, they didn't know about our initiatives." (KEY INF. 10)</i>	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs need to be mobilized by the actors in charge of LUH's support structure and only engage for its evolution after they are asked.
Dimension 2: Reinforcement of LUH's entrepreneurial support structure	Form of activation 1: Proactive	Engagement for the reinforcement of LUH's entrepreneurial support structure emerges from the alumni spin-off entrepreneurs themselves as they anticipate the necessity to change and improve LUH's entrepreneurial support structure.	-----	Text is coded into this category, when key informant states that the engagement for the reinforcement of LUH's entrepreneurial support structure emerges from the alumni spin-off entrepreneurs themselves as they anticipate the necessity to change and improve LUH's entrepreneurial support structure.
	Form of activation 2: Reactive	Engagement for the reinforcement of LUH's entrepreneurial support structure does NOT emerge from the alumni spin-off entrepreneurs themselves. Instead, alumni spin-off entrepreneurs need to be mobilized by the actors in charge of LUH's support structure and only become involved after they are asked.	<i>"Well, they assist us. But usually we have to approach and ask them if they have time and if they want to be present at certain events to talk about their business." (KEY INF. 9)</i>	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs need to be mobilized by the actors in charge of LUH's support structure and only engage for its reinforcement after they are asked.

Table 3: Final Coding Frame: Elements of a LUH's entrepreneurial support structure affected by alumni spin-off entrepreneurs' engagement

Category	Sub-category	Definition	Example	Coding Rules
Element 1: University culture regarding entrepreneurship		Alumni spin-off entrepreneurs' engagement affects/affected the reinforcement and/or evolution of LUH's university culture regarding entrepreneurship via their involvement in sensitization and mobilization events.	<i>"...there we always had an initial event named 'Paths into Self-Employment'. At this event I always invited spin-off entrepreneurs who talked about their start-up experience. These were persons, who started-up from one of Hanover's universities. And that of course was an effective way to sensitize and motivate students and staff for self-employment."</i> (KEY INF. 10)	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs' engagement affects at present or affected in the past the reinforcement and/or evolution of LUH's university culture regarding entrepreneurship via their involvement in sensitization and mobilization events, no matter if formally or informally.
Element 2: University measures of support and associated infrastructural facilities		Alumni spin-off entrepreneurs' engagement affects/affected the reinforcement and/or evolution of LUH's university measures of support and associated infrastructural facilities.	<i>"I knew some spin-off founders from other occasions and I saw them at different events once in a while. And when I saw them I of course talked to them informally and asked them, where they in retrospect would see their needs for qualification or consultation measures. And some of the suggestions surely influenced our conceptualization work"</i> (KEY INF. 12)	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs' engagement affects at present or affected in the past the reinforcement and/or evolution of LUH's university measures of support and associated infrastructural facilities, no matter if formally or informally.
Element 3: General university policies on spin-off formation		Alumni spin-off entrepreneurs' engagement affects/affected the reinforcement and/or evolution of LUH's general university policies on spin-off formation.	<i>"A classic example is, and I still remember this very well, that alumni spin-off entrepreneurs drew our attention to the importance of founders of young spin-offs connection to the university and the need to stay in contact with it. We therefore implied that it would be best to keep young spin-offs within the university and give them a home. The close relationships to companies that many institutes have, might potentially ease the market entry for spin-offs. Consequently we tried to convince the university to allow founders access to its infrastructure. We got such and other similar suggestions and tips from alumni spin-off entrepreneurs."</i> (KEY INF. 6)	Text is coded into this category, when key informant states that alumni spin-off entrepreneurs' engagement affects at present or affected in the past the reinforcement and/or evolution of LUH's general university policies on spin-off formation, no matter if formally or informally.

Table 4: Final Coding Frame: Important sources of know-how and information during the evolution of LUH's entrepreneurial support structure

Category	Sub-category	Definition	Example	Coding Rules
LUH itself		LUH's own stock of business and management knowledge as important source of entrepreneurial know-how and information during the evolution (e.g. configuration and conceptualization of initial support structure elements or its later refinement in the form of reconfiguration efforts) of LUH's entrepreneurial support structure.	<i>"...we had the advantage to be located at a university, which inherited certain knowledge we could tap into. {...} We therefore first searched for LUH knowledge that we could use. We then contacted the department of economics, more specifically the department of marketing, which supported us a lot in the following years"</i> (KEY INF. 6).	Text is coded into this category, when key informants state that LUH's own stock of business and management knowledge is at present and/or was in the past an important source of know-how and information during the configuration and conceptualization of LUH's initial support structure elements or its later refinement in the form of reconfiguration efforts.
Regional partners		Regional partners as important source of entrepreneurial know-how and information during the evolution of LUH's entrepreneurial support structure (e.g. configuration and conceptualization of initial support structure elements or its later refinement in the form of reconfiguration efforts).	<i>"We were sitting together with regional partners a lot. We heard what they did exactly. It was a close network, we were constantly brainstorming. That is how it developed."</i> (KEY INF. 6)	Text is coded into this category, when key informants state that regional partners (e.g. banks, economic development agencies, technology centers or chambers of commerce) are at present and/or were in the past an important source of know-how and information during the configuration and conceptualization of LUH's initial support structure elements or its later refinement in the form of reconfiguration efforts.
Other university TTOs		Other university TTOs as important source of entrepreneurial know-how and information during the evolution of LUH's entrepreneurial support structure (e.g. configuration and conceptualization of initial support structure elements or its later refinement in the form of reconfiguration efforts).	<i>"We saw that these TTOs had know-how and experience. We acknowledged that we needed to access this knowledge and that we needed to get in touch with the respective persons. We then asked ourselves how to do that and decided to establish a Leonardo-project."</i> (KEY INF. 6)	Text is coded into this category, when key informants state that other university TTOs within Germany and/or internationally are at present and/or were in the past an important source of know-how and information during the configuration and conceptualization of LUH's initial support structure elements or its later refinement in the form of reconfiguration efforts.
Literature and printed material		Literature and printed material as important source of entrepreneurial know-how and information during the evolution of LUH's entrepreneurial support structure (e.g. configuration and conceptualization of initial support structure elements or its later refinement in the form of reconfiguration efforts).	<i>"In the context of my dissertation I was of course dealing with state-of-the-art entrepreneurial support very intensively and I read many studies and so on. On this basis I was of course able to see where something works and how and which statistically evident effects certain measures had."</i> (KEY INF. 10)	Text is coded into this category, when key informants state literature and printed material are at present and/or were in the past an important source of know-how and information during the configuration and conceptualization of LUH's initial support structure elements or its later refinement in the form of reconfiguration efforts.
Scientific community		Scientific community as important source of entrepreneurial know-how and information during the evolution of LUH's entrepreneurial support structure (e.g. configuration and	<i>"I exchanged views a lot with researchers at different institutes. That also really helped a lot."</i> (KEY INF. 10)	Text is coded into this category, when key informants state that the scientific community dealing with entrepreneurship research in general and university spin-off support

	conceptualization of initial support structure elements or its later refinement in the form of reconfiguration efforts).		specifically is at present and/or was in the past an important source of know-how and information during the configuration and conceptualization of LUH's initial support structure elements or its later refinement in the form of reconfiguration efforts.
TTO itself	The TTO itself as important source of entrepreneurial know-how and information during the evolution of LUH's entrepreneurial support structure (e.g. configuration and conceptualization of initial support structure elements or its later refinement in the form of reconfiguration efforts).	<i>"When I started working for the TTO trying to introduce and re-organize certain things, I have to say that I surely profited from what my predecessors had initialized. From the experience they made and therefore from the know-how that the TTO already inherited"</i> (KEY INF. 7)	Text is coded into this category, when key informants state that the stock of experience and know-how within the TTO itself is at present and/or was in the past an important source of know-how and information during the configuration and conceptualization of LUH's initial support structure elements or its later refinement in the form of reconfiguration efforts.

Appendix 5: Final coding frames of transcript material from interviews with alumni spin-off entrepreneurs

Table 1: Final Coding Frame: Motives influencing the decision of alumni spin-off entrepreneurs in favor of becoming involved in a university's entrepreneurial support structure.

Category	Sub-category	Definition	Example	Coding Rules
Self-interest	Access to networks and contacts	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the potential access to networks and contacts with founders of new companies and other engaging alumni spin-off entrepreneurs.	<i>"And also, we get to meet people who have similar problems as we used to have. And we get to meet cooperation partners with whom we can work together. And indeed, we have a lot of cooperation partners who we met through our engagement. We would not have these contacts without our engagement. We would have to find external developers who would have been also much more expensive." (USO58)</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is the anticipated access to networks and contacts with founders of new companies and other engaging alumni spin-off entrepreneurs who could potentially become cooperation partners, customers or employees.
	Access to creativity, new ideas and opportunities	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the potential access to creativity, new ideas and opportunities.	<i>"It is exciting to deal with young entrepreneurs and for me, opportunities emerge. You cannot have every idea yourself." (USO18)</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is the anticipated access to creativity, new ideas and opportunities through contact with students or scientists who intend to start up a business.
	Reputation	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the expectation to improve one's reputation.	<i>"On the other hand, and I want to be honest about it, such an engagement is also beneficial to our reputation. It is important for us to be well known in this city." (USO59)</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is the expected improvement of his/her personal reputation or of the reputation of his/her company.
	Expected benefits from reciprocity	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the expectation that those young spin-off entrepreneurs who profit from alumni involvement might return something to them in the future.	<i>"{...} by engaging we develop a network. And by helping others we have people that are grateful to us. And when I need help, they might help me out. That way we build our network. {...} We can then draw on people who know how we think and how we act and who are - in case of doubt - favorably disposed towards us." (USO45)</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is the expectation that those young spin-off entrepreneurs who profit from their engagement might return something to them in the future.
Altruism	Principalistic altruism	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the personal aim to maintain a moral principle	<i>"I assist others for ideological reasons. I like to help others. And I believe that you should be supportive because it is not necessary that others do the same mistakes that I have</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial

		or a norm of value.	<i>done before. It is simply the right thing to do" (USO37)</i>	support structure is the willingness to maintain a moral principle or a norm of value, such as the belief that it is generally morally mandatory to help and support other individuals, the opinion that as an entrepreneurs he/she has a particular social responsibility or the belief that it is proper to pass on the support they have previously received.
	Individualistic altruism	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the willingness to help other individual spin-off founders.	<i>"The main reason is the people themselves. I think many people have an interest in starting-up a business but don't know exactly how to start it and how to run it. And then it is just normal that I help those people" (USO48)</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is his/her willingness to help other individual spin-off founders.
	Collectivistic altruism	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the intention to do something good for the overall region or country.	<i>"I believe that a region lives from people who say, "I want to get things moving, I have an idea". And you can congratulate everyone having these thoughts. And when we can help them, we do so." (USO35)</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is the intention to do something good for the overall region or country by supporting start-ups and the commercialization of research results, both of which is perceived to be important for the overall economy and society.
Reciprocity	Reciprocity directed at the university as a whole	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the willingness to reciprocate to the university as a whole.	-----	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is the willingness to return something to the university as a whole for what he/she has received in the past, such as a good education.
	Reciprocity directed at the university's entrepreneurial support structure facilities and its staff.	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the willingness to reciprocate to the university's entrepreneurial support structure facilities and its staff.	<i>"Well, I have to say that these people were also very helpful to us. Without their efforts, it would have been more difficult to get through the founding process. And once in a while we see each other and then I enjoy giving advice or assisting when I am asked" (USO18)</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is the willingness to return something to the university's entrepreneurial support structure facilities (e.g. the technology transfer office, the entrepreneurship office or the start-up centre) and its staff for the important assistance during his/her own start-up phase.
Emotional attachment	Emotional attachment to the university as a	The motive of an alumni spin-off entrepreneur to become involved in a	-----	Text is coded into this category, when an alumni spin-off entrepreneur states

	whole.	university's entrepreneurial support structure is based on an emotional attachment to the university as a whole.		that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is an emotional attachment to as well as the feeling of oneness and identification with the university as a whole and its staff. This emotional attachment may be shaped by close and stable personal relationships to university actors.
	Emotional attachment to the university's entrepreneurial support structure facilities and its staff.	The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on an emotional attachment to the university's entrepreneurial support structure facilities and its staff.	-----	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is an emotional attachment to as well as the feeling of oneness and identification with the university entrepreneurial support structure facilities (e.g. the technology transfer office, the entrepreneurship office or the start-up centre) and its staff. This emotional attachment may be shaped by close and stable personal relationships to the actors in charge.
Perceived need		The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the belief that and involvement is needed.	<i>"I simply believe that it is necessary that I get involved. It is very important that alumni spin-off entrepreneurs share their experience and know-how. Because the persons within the support structure often don't have their own start-up experience. I therefore believe that they need assistance. And as young spin-off founder, you need the contact to experienced entrepreneurs, who can describe their own experience. This is what motivates me to engage."</i> (USO18)	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is the belief that his/her involvement is beneficial to a university's entrepreneurial support structure and is beneficial to the new spin-off founders.
Perceived efficacy		The motive of an alumni spin-off entrepreneur to become involved in a university's entrepreneurial support structure is based on the belief that a contribution makes a difference and that he/she has the competence and specific knowledge to efficiently help.	<i>"I believe many young spin-off founders have an interest in me. They usually have questions I also used to have. And I as a practitioner can better address these issues than a theorist at the technology transfer office. This really makes a difference for a young entrepreneur."</i> (USO48)	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of becoming involved in a university's entrepreneurial support structure is the belief that a personal engagement has significant consequences on the subject of support, makes a difference relative to other people's engagement and that he/she has the necessary competence.

Table 2: Final Coding Frame: Motives influencing the decision of alumni spin-off entrepreneurs in favor of remaining uninvolved in a university's entrepreneurial support structure.

Category	Sub-category	Definition	Example	Coding Rules
Lack of self-interest	Lack of expected benefits	The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on the expectation that there are no benefits of an involvement.	<i>"There is no added value for my company. That is the main reason." (USO10)</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is a lack of considered self-interest based on the anticipation not to gain any or only limited benefits and returns from it.
	Lack of willingness to spend scarce resources	The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on the unwillingness to spend scarce resources for such an involvement.	<i>"No, so far I haven't done anything like this because I simply don't have the time. And the time I have I definitely have to spend on different things here in the company". (USO51)</i>	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is the unwillingness to spend scarce resources (such as time), caused by the necessary prioritization of different tasks.
Lack of altruism		The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on a lack of altruism.	-----	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is a lack of altruistic attitudes.
Lack of reciprocity	Lack of reciprocity directed at the university as a whole	The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on a lack of willingness to reciprocate to the university as a whole.	-----	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is an unwillingness to return something to the university as a whole to what he has previously received.
	Lack of reciprocity directed at the university's entrepreneurial support structure facilities and its staff.	The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on a lack of willingness to reciprocate to the university's entrepreneurial support structure facilities and its staff.	-----	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is an unwillingness to return something to the university's entrepreneurial support structure facilities (e.g. the technology transfer office, the entrepreneurship office or the start-up centre) and its staff.
Lack of emotional attachment	Lack of emotional attachment to the university as a whole.	The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on a lack of emotional attachment to the university as a whole.	-----	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is a lack of

				emotional attachment to and identification with the university as a whole and its staff.
	Lack of emotional attachment to the university's entrepreneurial support structure facilities and its staff.	The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on a lack of emotional attachment to the university's entrepreneurial support structure facilities and its staff.	-----	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is a lack of emotional attachment to and identification with the university entrepreneurial support structure facilities (e.g. the technology transfer office, the entrepreneurship office or the start-up centre) and its staff.
Lack of perceived need		The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on a lack of perceived need.	-----	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is that he/she believes that such an engagement is not beneficial to a university's entrepreneurial support structure and new spin-off founders.
Lack of perceived efficacy	Own start-up too specific	The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on their opinion that a contribution would not make a difference because one's own start-up was too specific.	<i>"It just doesn't suit us to engage and contribute there. Our experience is very very specific. We are not a classic start-up, but we had very specific and very favorable conditions."</i> (USO47)	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is that he/she believes that his/her own start-up was too specific and that thus the experiences and knowledge are not transferable to other spin-off entrepreneurs.
	Lack of competences	The motive of an alumni spin-off entrepreneur for remaining uninvolved in a university's entrepreneurial support structure is based on a mistrust in one's own competence.	<i>„Well, I simply don't think that I am a great role model in this respect. There are others that can do it better and should do it better."</i> (USO62)	Text is coded into this category, when an alumni spin-off entrepreneur states that the motive influencing his/her decision in favor of remaining uninvolved in a university's entrepreneurial support structure is a mistrust in his/her competence.

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