LUNDS UNIVERSITET

POTENTIALS AND OBSTACLES FOR CROSS-BORDER KNOWLEDGE INTERACTIONS

PERCEPTION OF LOCAL HEALTH BUSINESS FIRMS IN THE SOUTHERN-DENMARK – NORTHERN SCHLESWIG-HOLSTEIN REGION

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Master thesis in Human Geography

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Abstract

Nowadays, innovation and technological development are considered as crucial for the development and economic growth of regions and nations. Knowledge interactions hold a central position in the innovation process. In line with this, researchers as well as politicians emphasize that knowledge interactions need to be facilitated. This approach has been adapted to the cross-border regional context against the background of European integration and territorial cohesion ambitions in recent centuries. Several studies on cross-border networking and knowledge linkages, but also practical observations of cross-border project managers indicate that the promotion of cross-border knowledge interactions encounters difficulties.

In this thesis, potentials and obstacles for cross-border knowledge interactions of small-sized health business firms in the Southern-Denmark – Northern Schleswig-Holstein region have been investigated. The theoretical conceptualisations on 'proximity' and 'knowledge interactions' form the analytical foundation for this study. Against the background of a critical realist perspective, a perception approach is applied.

In-depth interviews with three Danish and four German health business firms enabled both the inquiry of these firm's existing and aspired knowledge linkages to actors across the border, as well as the investigation of the firm's perception of differences of the cross-border region. On the basis of single case and comprehensive analyses, varying types and levels of proximities that favour, respectively inhibit the development of different kinds of cross-border knowledge interactions, have been identified. The results show that a high functional proximity and related/high level of cognitive proximity are crucial for the initiation of all kinds of knowledge interactions. If this condition is fulfilled, cross-border knowledge interactions are probable. The kind of existing cross-border knowledge interactions seem to depend on the perceived level of knowledge about the cross-border region and the perceived level of relative geographical, formal and informal institutional proximity.

The results of this thesis are highly case study dependent. Consequently, this paper does not provide generalisable insights. Instead, the presented cases and results need to be understood as first attempt to gather knowledge about health business firm's perception and cross-border knowledge linkages in the Southern-Denmark – Northern Schleswig-Holstein region.

***Key words*:** knowledge interaction; knowledge linkage; cross-border region; perception approach; spatial proximity; non-spatial proximity; Southern-Denmark; Northern Schleswig-Holstein; health business firms.

Preface and Acknowledgements

This master thesis has been written at the Department of Human Geography at Lund University in spring term 2014. I would like to thank all those that have supported and helped me through the process of thesis development and writing.

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During spring term 2014, I have also been engaged in a student employee position at a consulting firm in Kiel, called DSN. The research idea that underlies to this thesis arose from a monthly internal meeting, in which Frank Jürgensen, the HANC project manager, described the problem of low participation of health business firms in the HANC project activities. *Frank Jürgensen*, *Ralf Duckert* and *Rolf Herrmann* (DSN) gave me feedback on my research idea, provided me with access to the HANC's internal sharepoint and fed me with contact information about some Danish health business firms. I appreciate their help and I hope to have achieved some valuable results.

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It has been a great experience to carry out a whole research project. I have learnt and experienced a lot; however I particularly like to highlight the following two learning aspects. This thesis is built on evolutionary economic geography approaches that emphasize the significance of, amongst others, tacit knowledge. Before carrying out this project on cross-border knowledge interactions and talking to several businesses, I have not been aware of that type of knowledge in its entirety – this changed! Further I am impressed by the stock of technological knowledge and innovation level that the visited small-sized businesses hold.

Finally I also give thank to *Philipp Hummel* for serving 'Fruchtzwerge', holding motivating speeches, being patient and loving.

August 2014 *Astrid Eggert*

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List of Abbreviations

Abbreviation	Complete Wording
ApS	Anpartsselskap (limited liability company)
A/S	Aktieselskap (joint-stock company)
CEO	Chief Executive Officer
CB	**Cross-border**
CoKG	Kommanditgesellschaft (private limited partnership)
COPD	Chronic Obstructive Pulmonary Disease
ESA	European Space Agency
EU	European Union
GmbH	Gesellschaft mit beschränkter Haftung (limited liability company)
HANC	Healthy Ageing Network of Competence
HUGE	Department of Human Geography
ICT	Information and Communication Technology
NASA	National Aeronautics and Space Administrations
n.d.	No date available
NIS	National Innovation System
NSH	**Northern Schleswig-Holstein**
oHG	Offene Handelsgesellschaft (General partnership)
R&D	Research & Development
RIS	Regional Innovation System
SD	**Southern Denmark**
SIS	Sector Innovation System
Syddanmark-Schleswig-K.E.R.N.	Syddanmark-Schleswig-Kiel-Eckernförde-Rendsburg-Neumünster (Southern-Denmark – Northern Schleswig-Holstein region)

1 Introduction

1.1 Research Frame and Research Question

There is a widespread agreement in the sphere of evolutionary economic geography that in todays globalised knowledge economy, the competitive strength of nations and regions rests upon technological development and innovation (Asheim and Gertler, 2006; Lundquist and Trippl, 2009). In Europe, the regional innovation approach became popular to apply to cross-border (CB) areas against the background of European integration and territorial cohesion ambitions in the last centuries (Lundquist and Trippl, 2009). It is assumed that enhanced regional CB interactions will increase knowledge spillovers, the transfer of especially tacit knowledge, foster collective learning and thus raise the border region's innovation capacity (Tödtling et al., 2009).

This thesis will contribute to the research stock on CB innovation by broaching the issue of CB knowledge interactions in the context of small-sized health business firms in the Southern-Denmark – Northern Schleswig-Holstein (SD – NSH) region. The aim of this thesis is to identify potentials and obstacles for the different kinds of regional CB knowledge interactions. Potentials and obstacles are derived on the basis of a 'perception approach' of firms on CB differences, respectively proximities.

So far several empirical studies describing and analysing specific types of knowledge interactions in European CB regions have been published (see Van Houtum and Van der Velde, 2004; Hassink and Dankbaar, 1995; Maggioni and Uberti, 2008). Van Geenhuizen (1996) for instance studied trans-border networking among companies in the Dutch-Belgian border region and Koschatzky (2000) conducted a survey study on knowledge linkages of firms in Baden and the Alsace. These and other mostly quantitatively oriented studies reveal that "*cross-border innovation linkages seem to be more the exception than the rule*" (Trippl, 2010, p. 154). Lundquist and Trippl (2009; 2013) made substantial contribution to CB innovation studies by presenting a theoretical framework to comprehensively identify factors favouring and inhibiting the development of CB regional innovation systems (RIS) on the basis of the proximity approach. There is no empirical study on knowledge interactions – the relational dimension of RIS - that applies a likewise comprehensive analytical framework in order to explain the prevailing pattern on low knowledge interaction activities in CB regions. This might explain why Michaela Trippl (2010) calls amongst others for more research activities to deeply investigate the CB relational dimension and thus CB knowledge interactions.

This thesis will bring together theoretical approaches of four stands of literature – namely on knowledge interactions, spatial and non-spatial forms of proximity, RIS and path dependency – and relate these to a CB context.

This study will investigate potentials and obstacles for different kinds of CB knowledge interactions. The study applies qualitative case study inquiries on CB knowledge interactions departuring from a critical realist perspective. Seven in-depth interviews with small-sized health business firms in the SD – NSH region form the database to the case studies. It is primary the firm's perception of differences between the home region and the region across the border that is investigated. These differences are analysed on the basis of spatial and non-spatial approaches of proximity. It is questioned, what different levels and types of proximity have an impact on the development of varying types of CB knowledge interactions. Furthermore, existing knowledge linkages and motives for existing linkages are investigated, as it is assumed that firms' act in path dependence.

The thesis will deal with the following main research question:

- ***What type and level of proximity favours, respectively inhibits the development of different kinds of CB knowledge interactions?***

The choice to apply a case study approach to empirically deal with the research question is reasoned twofold. First, the research focus and case set out in this thesis originates from an observation of the 'Healthy Ageing Network of Comptetence' (HANC). HANC is a CB project implemented under the 'Interreg operational programme 4 A 2007-2013' of the SD – NSH region. The HANC project aims amongst others at developing a CB 'healthy ageing network' including researchers, users, health care providers and firms (HANC, n.d.). Several initiatives have been implemented to facilitate various forms of knowledge interactions, such as formal and informal networking. But in regard to health business firms, it showed to be a challenge to actively involve them in CB collaboration and virtual networking. This problematique forms the basic impetus to the chosen research focus and research question of this thesis. The observed difficulties indicate that there are factors inhibiting health business firms to participate in CB knowledge interactions.

In the second place there actually seems to be only little known about health business firms' knowledge interaction pattern in the SD – NSH region. Furthermore, the local health business firms' attitude towards panning out linkages to the area across the border is not systematically investigated. Most knowledge seems to be tacitly embedded in several CB project managers' and local firm managers' minds in the CB region. Published studies focusing on the Danish-German border context mainly concentrate on historical analyses of CB institutionalised cooperation and socio-institutional barriers for cooperation in general (see Klatt and Herrmann, 2011).

Thus the HANC project's observation and the specific gap of knowledge set out the empirical framework to this thesis. The focus is on:

- Firms (central actor)
- Health business (business sector)
- Southern-Danmark – Northern Schleswig-Holstein region (CB region)

Reasoned by low levels of knowledge about present knowledge interactions of local health business firms in the SD – NSH region, this study needs to be understood as a first attempt to gather knowledge about the specific research case. The aim of this thesis is less to provide general insights about the interplay of proximity and knowledge interaction in a CB setting, but rather to understand rationales of the specific case study firms' view on potentials and obstacles for regional CB knowledge interactions.

On the grounds of the central role of firms in this study, a 'perception approach' is applied in order to identify obstacles and potentials for CB knowledge interactions. Firms are viewed at as subjects of bounded rationality, whose decision-making depends on interpretation processes of the environment. Thus I argue that it is meaningful to gather knowledge about a firm's motives, experiences and perceptions of the CB environment and differences (Macharzina and Wolf, 2006; Boschma, 2005). A firm's perception of the CB environment will be decisive for the initiation of knowledge interactions, not the real differences in socio-economic assets. These perceptions form the glasses that firms' see through when interpreting ‚reality'. This point of view is based on a critical realist perspective towards the real and cognition processes.

1.2 Thesis Organisation

This research paper is organized in the following way. ***Chapter 2*** briefly outlines the approached stands of theoretical literature on knowledge and innovation, knowledge interactions, RIS, spatial and non-spatial forms of proximity and relates these to the CB context. In the following ***chapter 3,*** the applied ontological and epistemological perspective, the qualitative research methodology, the research design, interview method and the actual process of the empiric inquiry are presented. ***Chapter 4*** broaches the issue of health business as well as of existing attempts of CB cooperation in the Southern Denmark – Northern Schleswig-Holstein region. The interviewed health business firms and rather descriptive results of the analysis are illustrated in ***chapter 5***. ***Chapter 6*** provides a comprehensive discussion on the results of the single case study analyses as well as a critical reflection upon both methods and results of the inquiry. In ***chapter 7***, relevant research findings are subsumed and the significance of the research findings is assessed.

2 Theoretical Fundamentals

2.1 Departure in Evolutionary Economic Geography

This thesis takes off in the field of economic geography, applying the endogenous evolutionary perspective. According to Plummer and Sheppard (2006) neo-classical geographical economists follow the principle of a rational, self-interested, autonomous economic actor that in aggregation form socio-economic processes and patterns. In line with this, space is viewed at as exogenous to economic processes. This perspective on social actors and space is opposed by endogenous approaches on economic spatial processes and patterns. In this regard, Plummer and Sheppard (2006, p. 622) resume:

"*Economic actors are neither fully rational nor autonomous. Their interests and preferences are shaped by their socio-spatial position, their knowledge is imperfect, and they engage in collective action. Their actions shape, but also are shaped by, the social structures and cultural context in which they find themselves*".

This recognition of spatial structures producing socio-economic processes, yet also spatial structures being result of socio-economic processes, is referred to the ontological perspective on socio-spatial phenomena as dialectically, inter-reactive, and interdependent (Plummer and Sheppard, 2006; Soja, 1980).

Central to evolutionary economist thinking is the idea of a self-transforming economy. With referral to Witt (2003), Boschma and Martin (2010) highlight three commonalities of evolutionary research perspectives; they cover dynamical and irreversible processes and view at "*the generation and impact of novelty as the ultimate source of self-transformation*" (p. 537). Driving power in this process is knowledge adoption, transformation and creation and hence innovation. Economic growth is considered as "*not simply being a result of calculation within known circumstances, but of human imagination and the search for novelty and competitive advantage*" (Metcalfe et al., 2006, p. 9).

Following this perspective, evolutionary economic geographers are particularly interested in the spatial structure of novelty, respectively the processes and mechanisms that favour and inhibit the adoption of novelty in economic space. Thus the focus relies on the "*spatial organization of economic production, distribution and consumption*" respectively of innovations and of economic agents being the carrier and creator of knowledge (Boschma and Martin, 2010, p. 539). There is no single coherent framework in evolutionary economic geography. Yet, all have in common that they link micro-economic behaviour and macro-spatial economic outcomes; thus for instance linking individuals and firms' behaviour to spatial agglomeration patterns (Boschma and Martin, 2010).

The most prominent issue that evolutionary economic geographers deal with is the simple empirical observation of a very distinctive geography of innovation activities, e.g. spatial concentration of different industries and firms (Asheim and Gertler, 2006). Endogenous evolutionary approaches – as for instance on innovative milieus, RIS, learning regions, regional clusters and networks – propose the nature of knowledge production and diffusion as well as of innovations to be decisive to explain this spatial phenomena (cf. Tödtling et al., 2009). Regarding the innovation process, knowledge is considered as input factor, knowledge interactions as exchange and transformation mechanism which increase the value of applied knowledge stock, and innovation is viewed at as potential output to this process (Tödtling et al., 2009). Hence, knowledge interactions hold a central position in the innovation process. With reference to Chesbrough (2003), Lorenz and Lundvall (2006) and Nonaka and Takeuchi (1995), Tödtling et al. (2013) claim a broad acceptance of this view on the innovation process as open, interactive and based on both the exchange and transformation of tacit and codified knowledge.

2.2 Types of Knowledge and Knowledge Interactions

With regard to socio-spatial issues the distinction between tacit and codified knowledge is of particular interest. Codified knowledge refers to the written-down elements of knowledge that are easy to transfer and to absorb when prior related knowledge is present (cf. Jensen et al., 2007). In contrast, tacit knowledge is related to elements of knowledge that are socially embedded respectively embodied and produced in learning practices. Tacit knowledge is context-laden, socially organized, highly costly and sensitive in regard to transfer mechanisms (Maggioni and Uberti, 2009; Asheim and Gertler, 2006). The exchange of tacit knowledge is claimed to rely on trust-based relations and thus to be favoured by face-to-face contacts (Trippl, 2010; Asheim and Gertler, 2006). This differentiation of tacit and codified knowledge is significant as their impacts differ in regard to knowledge exchange and learning processes.

Bullinger et al. (2004) claim that in current centuries, individual players cannot anymore aggregate all competences needed to create innovation due to the development of increased technological complexity and knowledge stock. This increased specialisation and development towards multi-technological products and services reasons firms' need of external knowledge sourcing. Thus linkages to actors holding complementary resources that a single firm is not able to accumulate, plays a crucial role for innovating activities (Koschatzky, 2000). Studies on innovation networks (see Koschatzky, 1999; Tödtling and Kaufmann, 1999) demonstrate the positive correlations among increased frequency of knowledge sourcing through networking and the innovation capacity. These studies also confirm the spatial pattern of prevalent regional linkages to R&D institutions and spatially more extended linkages to customers. Moreover, they point out the positive impact of complementary linkages of firms to actors at both regional, national and higher spatial levels.

This observation of a varying spatial range of linkages to different types of knowledge sources invites us to dig into a more differentiated approach on knowledge interactions. According to Tödtling et al. (2009), the prominent concepts on (regional) interactive innovation lack clarity on the type of knowledge relations involved. The term knowledge interactions itself refers both to the relational and actor-centered dimension of interaction. Tödtling et al. (2009) frame a classification of different types of knowledge interactions in the innovation approach along two dimensions. The first dimension is based on Storper's (1997) concept of traded (formal) and untraded (informal) relations. The second dimension follows Capello's (1999) distinction between static and dynamic knowledge interactions. Static knowledge interactions refer to situations where "*'ready' pieces of information or knowledge [are transferred] from one actor to the other actor*" (p. 61). In contrast, dynamic knowledge interactions are related to collective learning processes through joint activities among involved actors. In collective learning processes, knowledge is interactively transferred and newly created, thus the stock of knowledge among all involved actors increases.

On the basis of the two approached dimensions on the variety of knowledge relations, Tödtling et al. (2009) categorise the following four ideal types of knowledge interactions: Market relations, formal networks, knowledge externalities/spillovers and informal networks. Table 1 illustrates this classification of knowledge interactions (see cursive script) (Tödtling et al., 2009).

Tödtling et al.'s (2009) conceptualisation of ideal types of knowledge interactions forms the analytical foundation to this study, as potentials and obstacles for these four types of knowledge interactions in a border-crossing setting are aimed to be identified. The knowledge interactions, focused on in this thesis, all start from small-sized health business firms and are linked to different actors and institutions across the German-Danish land border. The information provided by the interviewees about present and potential future knowledge interactions needs to be classified in the analysis of the empirical data. In some cases it might not be an easy task to class the provided data, as in real, there are considerable overlaps between the market relation and network category, as well as between the knowledge spillover and informal networking category (Tödtling et al., 2006). Thus, Capello's dimensions of dynamic-static knowledge interactions have to be rather understood as continuum. In order to ease the case some exemplary knowledge linkages are presented and assigned to the knowledge interaction categories (see bullets in table 1). These examples serve as point of reference in the case study analysis. The term knowledge linkage will be used in a slightly different way concerning the approached definition of knowledge interactions. The term knowledge interaction is restricted in regard to the four ideal types of knowledge interactions that emphasize the particular quality of interaction. Against it, knowledge linkages are intrinsic to knowledge interactions and refer to a certain context of actor specific relations and will be rather used as specification of knowledge interactions.

Table 1: Types of knowledge interactions and examples of knowledge linkages in the innovation process (combination of Tödtling et al., 2009 and Trippl, 2012)

	static (knowledge transfer)	**dynamic (collective learning)**
formal / traded relations	*market relations* - contract research - consulting - licenses - buying intermediate goods	*cooperation / formal networks* - R&D collaborations - shared use of R&D facilities
informal / untraded relations	*knowledge externalities and spillovers* - labour mobility - monitoring competitors - participating in fairs and conferences - reading scientific literature, patent specifications	*milieu / informal networks* - informal contacts - social events - internet chatrooms - virtual knowledge communities

The following subsections provide a brief characterisation of the four types of knowledge interactions based on Tödtling et al.'s (2006; 2009) demonstrations. In addition exemplary knowledge linkages are designated.

Market relations

Knowledge and technology is not only embodied in humans itself, but also in its products and services. Sold 'ready' machinery, software, studies and licences transfer inherent knowledge from producer to buyer in static trading relations. As indicated above market relations exhibit a usually long-range spatial pattern. A typical example for market relations are vertical supplier-customer knowledge linkages.

Knowledge externalities or spillovers

Knowledge externalities and spillovers are characterized by the static transfer of knowledge without formal compensation. Knowledge flows rather tacitly from one actor to the other actor in a prevalent local environment (Simonen and McCann, 2010). Examples for this kind of knowledge interaction are the exchange of knowledge through publications, labour mobility and informal meetings at fairs and conferences.

Collaboration / formal networks

In contrast to market linkages, networks are not products of simple knowledge exchange mechanisms based on transaction cost logic. Formal networks are rather characterised by collectively and interactively developed knowledge. This kind of knowledge interaction requires more durable relations and refers to dynamic collective learning processes. Tödtling et al. (2009) classify innovation networks and R&D cooperations as examples of this kind of knowledge interaction. Moreover, they emphasize that this type of knowledge interaction is specifically related to highly selective search mechanisms on strategic and complementary competences.

Informal networks

Informal networks refer to relations that "*are particularly based on trust, a shared understanding of problems and objectives, and the acceptance of common rules and behavioural norms*" (Tödtling et al., 2009, p. 61). Typical for this kind of knowledge interaction is that ideas and knowledge are rapidly exchanged and that the knowledge stock increases on the basis of collective learning. Prominent to informal networking is the high degree of tacit knowledge that is exchanged.

2.3 Cross-Border Regional Innovation System

The spatial focus of this study relies on the (administrative) regional dimension and the border-crossing context. Regional knowledge linkages are assumed to play a key role for innovation activities as socially embedded tacit knowledge is easier spilled over and collective learning is easier performed by face-to-face contacts in spatial closeness.

The innovation system approach is useful to recognise that knowledge actors and linkages are interdependently embedded in a specific regulatory context. The sector innovation system (SIS) approach highlights the relevance of specific sector institutions, and the NIS respectively RIS approach emphasizes the national and regional institutional infrastructure, where knowledge interactions are embedded in (Tödtling et al., 2009).

During the last decades, the focus on regional-IS increased due to stronger emphases on the nature of knowledge, as sticky and spatially bounded (Tödtling and Trippl, 2005). Autio (1998) provides a first illustration of regional interaction among two regional subsystems, the 'knowledge application and exploitation' and the 'knowledge generation and diffussion' subsystem. These subsystems are embedded in a specific regional socio-institutional context and influenced by external knowledge sources, which origin in other RIS, NIS and international institutions. Tödtling and Trippl (2005) add another subsystem to Autio's RIS concept, the 'policy subsystem' and roll out the powerful role of policy actors in shaping a RIS.

Michaela Trippl (2010) translates these subsystems and contexts into four core dimensions of a RIS, being further outlined in the following.

The ***knowledge infrastructure dimension,*** respectively the 'knowledge generation and diffusion subsystem' consists of institutions that produce and diffuse knowledge to other parts of the RIS. This could be educational and public research organisations but also technology and workforce-mediating organisations (Tödtling and Trippl, 2005). The ***business dimension*** refers to the subsystem of 'knowledge application and exploitation'. This dimension is central to the innovation process and covers firms and firms' horizontal and vertical knowledge linkages to other firms, such as customers, contractors, collaborators and competitors (Tödtling and Trippl, 2005). The ***governance dimension***, also referred to as the 'regional policy subsystem', comprises regional policy

institutions and regional development agencies that promote regional competitiveness by for instance finance, subsidies as well as innovation and cluster policies (Trippl, 2012). The *socio-institutional dimension* is related to formal and informal institutions prevailing in the region and having a significant impact on regional actors' behaviour and relations (Trippl, 2010). This dimension emphasizes the socio-cultural embedded and path-dependent character of RIS (Autio 1989). Formal institutions are defined by laws and regulations, while informal institutions refer to routines, conventions and habits (Trippl, 2010).

On the basis of Autio's (1998) notion of the importance of innovation process intensity, referring to the central role of interactions between operating institutions, Trippl (2010) defines a fifth core RIS dimension, the ***relational dimension***. This is another expression for the terms of knowledge interactions and knowledge linkages expounded above, merely applied to a RIS context.

In the following, the term 'dimension' will not be applied to the socio-institutional 'dimension', as formal and informal institutions rather form a ***socio-institutional context,*** where all actors are embedded in respectively embodied with, whether they are knowledge exploitators or generators. It needs to be recognised that firms are not only embedded in a socio-institutional context at a single spatial scale, but rather in a multi-scalar spatial context. Firms are for instance linked to local, regional, national and international settings and actors.

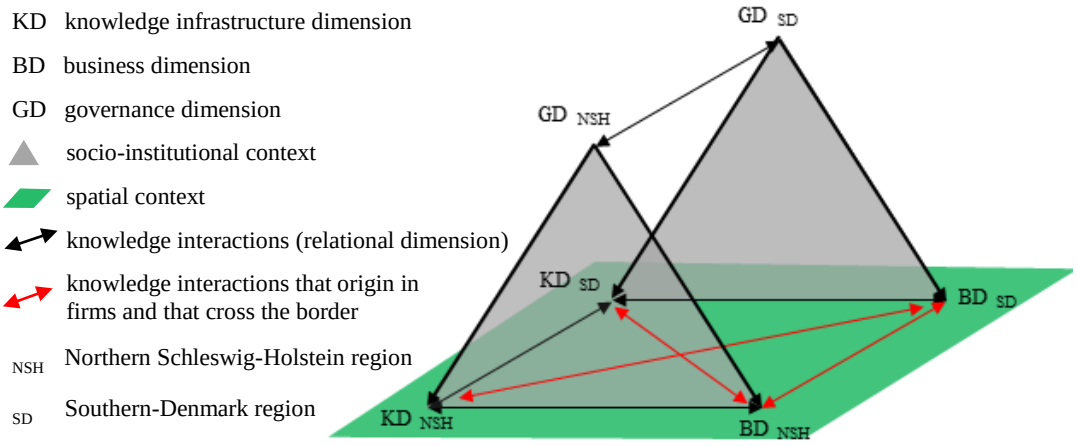


Figure 1: Schematic illustration of a double-RIS, applied to the research case (author's illustration, 2014)

In regard to a CB area the concept of different RIS contexts and dimensions needs to be adjusted. CB areas are simply defined as "*... area[s] consisting of adjacent territories belonging to different nation-states*" (Lundquist and Trippl, 2013). Thus, in a CB setting two RIS exist, respectively a doubled number of RIS dimensions and contexts. This is demonstrated in a simplified way in figure 1Figure 1. Linkages to outside of the CB regional context, particularly the national and regional context, are not presented for reasons of clarity. CB knowledge interactions are based on knowledge linkages among actors that resident in different nation-states, and thus regions. The illustration of a double-RIS is already applied to the case

study area, the SD – NSH region. The figure, for example, highlights in red those knowledge linkages that are of interest in this study and shows how they are embedded and related to other RIS dimensions/contexts; these knowledge linkages start in the business dimension in the NSH or the SD region and are linked to actors of the knowledge infrastructure and business dimension across the border.

2.4 Proximity and Distance

So far, spatial proximity, in line with emphases of the regional level, has been highlighted and claimed to be significant for knowledge transfer and collective learning, due to reasons of stickiness of tacit knowledge and the significance of face-to-face contacts. One could assume that in regional CB settings, where no physical barriers (e.g. mountains) are present and a good transportation infrastructure exists, knowledge interactions would 'grow on breeding grounds'. As this does not match with empirical evidence (see Trippl, 2010), economic geographers suggest non-spatial forms of proximity to have significant impact on the development of knowledge interactions. These are related to the circumstance that adjacent border regions often differ in regard to political and economic history, technological trajectories, formal and informal institutional set-up, and governance structures (Lundquist and Trippl, 2013). In the following section, I will particularly present this non-spatial forms of proximity and highlight their significance in relation to the research question of this paper.

Deriving from the 'French School of Proximity Dynamics', Boschma (2005) and Lundquist and Trippl (2013) defined several related proximity categories. This study adapts to these conceptualisations and categorisations of different proximity types and applies the following proximity types: Geographical proximity, cognitive proximity, functional proximity and formal and informal institutional proximity.[1] This categorisation helps to identify varying kinds of differences among the SD and the NSH border region that are perceived by health business firms. On the basis of the perception of these differences, both factors favouring and inhibiting CB knowledge interactions will be identified.

[1] Boschma (2005) identifies two other forms of proximity: Organisational and social proximity. ***Organisational proximity*** is defined "*as the extent to which relations are shared in an organizational arrangement, either within or between organizations*" (Boschma, 2005, p. 65). ***Social proximity*** refers to social ties and relations and is "*defined […] in terms of socially embedded relations between agents at the micro-level*" (Boschma, 2005, p. 66). It is assumed that trust-based friendship but also an open and communicative attitute facilitates the exchange of tacit knowledge. These two types of proximity will not be directly applied in the analysis of this thesis. It is not feasible to analyse the impact of what type of actor (organisation) is involved in knowledge linkages in this limited thesis framework. The same applies to social ties and social proximity.

First, ***geographical proximity*** needs to be defined. It refers to the notion of spatial proximity and describes the geographical distance between actors both in terms of absolute and relative meaning (Boschma, 2005).

A firm's engagement in knowledge sourcing is based on purposes of knowledge aggregation to exploit complementary knowledge in meaningful ways. Due to the fact that economic actors are rationally bounded, they act risk avoiding and conduct routinised behaviour (Boschma, 2005). Thus, "*firms search in close proximity to their existing knowledge base, which provides opportunities and sets constraints for further improvement*" (Boschma, 2005, p. 63). Knowledge interaction is only purpuseful when new combinations and unexploited synergies are offered. Hence, the external knowledge source needs to hold knowledge that is novel. But novel knowledge can only be utilised in a proper way, when prior knowledge is present. A certain level of absorptive capacity is crucial to contextualise and decontextualize the knowledge that is received through interaction and to engage in active communication. This discussion on the level of relatedness in regard to knowledge base hits the term ***cognitive proximity***.

Functional proximity is described as the "*differences between regions in innovation performance*" (Lundquist and Trippl, 2013, with reference to Maggioni and Uberti, 2007). As in this thesis it is the perception of individual firms, not 'objective' characteristics of regions, which are the subject under investigation, this understanding of proximity is transferred to the individual business level. The main target of any firm is to make profit, hence firms assess markets in regard to potential business opportunities, and respectively they search for demands that can be satisfied through the firm's goods and services. In this thesis functional proximity is understood as the extent to which firms perceive a market demand as complementary to the individual firm's specialised supply of knowledge, goods and services. In order to reduce costs and avoid risks, firms search market demands that are close to the supplied products, services and knowledge.

Institutional proximity is associated with formal and informal institutions and the degree to which they differ (Boschma, 2005). In this study, three forms of institutional proximity are differentiated.

> ***Informal institutional proximity*** refers to informal institutions and is defined by the extent to which cultural norms and habits are shared (Boschma, 2005). ***Language proximity*** is subsumed under informal institutional proximity and refers to the level of interactive communication capability of the actors involved. Closeness in regard to shared language, habits and culture is assumed to enable knowledge transfer and interactive learning.
>
> ***Formal institutional proximity*** is associated with formal institutions, such as laws, rules and administrative bodies that regulate interactions and relations among individuals and groups (Boschma, 2005).

All these different types of proximities have in common that they reduce risks and transaction costs, as well as facilititate interactive communication (Boschma,

2005). Furthermore, high levels of proximity among CB areas are assumed to create potentials for CB knowledge interactions – and low levels of proximity are regarded as barriers to CB knowledge interactions (Lundquist and Trippl, 2013). However, it remains to identify what level of proximity and what type of proximity is most influential in relation to the development of CB knowledge interactions. In addition, it is not yet clear, what type of knowledge interaction is particularly sensitive to what kind of proximity.

2.5 Path Dependency

In regard to the analysis of potentials and obstacles for CB knowledge interactions, another phenomenom is of importance: Path dependency. The path dependency concept points out that a firm's present decisions are limited by decisions made in the past (Henning et al., 2013). In other words, today's decisions are influenced by decisions made in the past, and decisions of tomorrow are influenced by today's moves. In evolutionary thinking, this is reasoned by firms' efforts to reduce uncertainty and transaction costs (Heimeriks and Boschma, 2014). As firms are subject of bounded rationality, knowledge linkages that have been established in the past may be less risky than the creation of new linkages. This particularly applies to knowledge interactions that are characterised by the transfer of tacit knowledge. To transfer tacit knowledge requires a certrain degree of trust and closeness, often based on face-to-face contacts. This implies that a firm's perception of potentials and obstacles for CB knowledge interations is influenced by the firm's current knowledge interaction pattern that is based on past decisions.

2.6 Contextualisation of the Approached Theoretical Concepts

This thesis discussion takes off by linking individual an economic agent's behaviour to macro-spatial economic outcomes. This is applied by questioning the underlying processes, mechanisms and perceptions that influence health business firms decision-making (micro socio-economic input) concerning the initiation and further development of CB regional knowledge interactions (macro socio-economic output). When analysing potentials and obstacles for CB knowledge interactions, a future-oriented perspective is applied. In line with evolutionary economic thinking it is assumed that the firms' past decisions on knowledge linkages have an impact on its future decisions. Present knowledge interactions involve already accumulated knowledge about the actor involved, but also the socio-institutional environment where knowledge interactions are embedded in. This already aquired knowledge reduces the risks and costs for further development of knowledge interactions that follow the chosen path. Present knowledge interactions therefore need to be covered within the analysis. The CB-RIS approach helps to put the economic agent into a set of specific actor-dimensions and contexts that firms are related to and embedded in. The proximity concept is useful to understand an individual's risk and cost-reducing behaviour

more deeply. The above outlined different types of proximities can be easily connected to the CB-RIS dimensions and contexts. Thus for instance, firms in the SD region are part of the regional business dimension and can potentially be linked to actors of both the business dimension and the knowledge infrastructure dimension across the border. I assume that firms decide about the initiation and further development of CB linkages to these actors on the basis of already acquired (path dependent) knowledge and by interpretating functional, cognitive, formal and informal institutional features across the border. A firm relates this perceived features to its economic specialisation, knowledge base, and socio-institutional context. When relating the external environment to the firm's individual characteristics, differences are recognised and assessed. These perceived differences potentially form obstacles and potentials to CB knowledge interactions. It is suggested that firms act within the boundaries of the possessed knowledge. It is hence central to include a firm's level of knowledge about the CB region in the analysis.

3 Methodology and Research Design

3.1 Critical Realist Perspective of Causal Explanation

In scientific research processes, specific research questions are answered through the deployment of the appropriate methodology. The choice of methodology is central to research as it defines the construction and interpretation of used data. The applied methodology needs to be elaborated in order to ensure comprehensibility of the generated findings, the provided conclusions and its limitations (Cloke, 2004). However, as methodological choices are furthermore of philosophical character concerning reality and cognition processes, these need to be demonstrated, too (Graham, 2005).

My research approach follows the ontological and epistemological assumptions of critical realism. The critical realist perspective on knowledge and reality is a critical synthesis of the assumptions and methods of two social-scientific meta-theoretical approaches: Positivism and social constructivism. While constructivists refuse the existence of 'neutral reality' and highlight socially bounded knowledge (Gergen, 1985), positivists claim the existence of 'objective reality' that is possible to describe and understand by experience a posteriori (as cited in Ek, 2012). For a critical realist the real and the socially constructed world are intransitive dimensions (Sayer, 2000). Critical realists confirm to the existence of the real, be it objectivs, their structures and powers. But they deny that humans are able to recognise the real, as humans approach to the real on the basis of experiences and observations (Sayer, 2000).

Central to the critical realist perspective is the causal approach to explanation. Cloke (2004, p. 8) briefly outlines the causal approach to explanation, with reference to Sayer (1992; 1997) in the following way:

"*In this view, an explanation amounts to statements about what actually causes an event to happen, and an adequate causal explanation requires the discovery of relations between phenomena and of some kind of mechanism which links them. To produce an explanation we therefore need a knowledge of the underlying structures and mechanisms that are present and of the manner in which they generate or produce the phenomena we are trying to explain*".

In contrast to positivists searching for law-like explanations, regularities and statistical correlations, critical realists look for the circumstances that cause the phenomenon. Cloke (2005) further distinguishes between causal explanation based on abstraction and subjectivity. While abstractive causal explanation focuses on explaining a phenomenon on the basis of examination of mechanisms, structures and events, and how they are related to each other, subjective causal explanation is concerned about studying meanings, perceptions and motives of social actors that cause the particular phenomenon.

Both abstractive and subjective causal explanation perspectives form the foundation to the research design and methodology that is applied in this thesis. In order to identify obstacles and potentials for CB knowledge interactions of health business firm's, the following knowledge is needed to find explanations:

- An understanding about the health business firm's socio-economic, historical and spatial characteristics, in other words mechanism and structures that characterise the respective firm, e.g. the firm's historical development, belonging to a particular sector, number of employees, knowledge base, innovation and external knowledge sourcing pattern, present and past knowledge linkages and spatial distributions of these.
- An understanding about the motives for present and future knowledge interactions and perceptions of differences across the border. In this regard a 'perception approach' is adapted. As knowledge interactions are social activities that are motivated by social actors, here firm managers, I assume that decisions concerning present and potential future knowledge linkages are based on a manager's interpretation of the external environment (see Sayer, 2000; Macharzina and Wolf, 2008). Ley (1974) argues in this regard that researchers have "*... to discover the salient environment which prompts decision making and behaviour, the environment as perceived and experienced, and its forces which provide rules for human actions [sic] Only by coming to grips with the experiential environment, ... only by exploration of the topographies of meaning, may we uncover regularities in behaviour. [...] To understand the environment as perceived ... is an invitation to more subjective methodologies*" (p. 4 and 9 as cited in Cloke, 2004).

This leds to a discussion on methodology that is useful to apply in regard to this thesis' research question. Since this thesis does not deal with questions concerning the extent of CB knowledge linkages of health business firms, or spatial distribution pattern of these linkages, but rather aims at understanding why certain CB knowledge linkages are present and why others are not, it is meaningful to focus on a small number of case studies in order to find motives, and mechanisms that reveal why firms are seemingly not eagerly interested in participating in formal and informal CB networking (see chapter 4.5). This focus on a limited number of research objects is associated to the term 'intensive study' (Cloke, 2004).

Cloke (2004) suggests that positivist and critical realist perspectives can be meaningfully applied in a complementary research framework, where on the basis of 'extensive study' (ref. positivist perspective) questions regarding countable and measurable extent and distribution issues could be usefully applied, as a preliminarly work to the intensive study, in order to set a broad context. I fully agree that it would have been useful to gather more extensive descriptive material about present health business firms and health related actors, respectively their interactions within the SD – NSH region, before carrying out an intensive study. However, this would have required statistical data, financial resources and more time to carry out this thesis. This thesis does not aim at presenting a

complementary view on the researched cases; it will not be revealed if the perceptions of the interviewed firms correspond to 'reality', respectively to which extent they could be generalised.[2]

Concerning the unification of the empirical and the theoretical there are three main approaches, namely induction, deduction and abduction. While deduction is used in respect to the notion 'from general to particular', induction conversely refers to 'from particular to general' (Cloke, 2004). This study contains both inductive and deductive elements of reasoning. This is hardly surprising as "*such distinctions are invariable overdrawn and […] most research tends to contain both inductive and deductive moments in a constant, if uneven and sometimes unappreciated, dialogue*" (Cloke, 2004, p. 5). Still the methodological research approach underlying to this thesis analysis is merely related to abductive reasoning that can be understood as a process of comprehension by combining deduction and induction dialectically (Thagaard, 2014, with reference to Alvesson and Sköldberg 1994). This perpective is useful to apply when observations are seeked for to explain by causal relations respectively theory (Stangl, n.d.). In this thesis the observation that there have to be barriers for CB knowledge interactions, formes the initial point that is searched for to be explained. In order to investigate this observation established evolutionary geographical concepts form the theoretical research foundation that is manifasteted in the research question and imposed to the produced case study raw data. Thus for instance during the coding phase, the elements of the interview text are sorted along the four types of knowledge interactions and various proximities. However, inductive procedures are central to this study, too, as subjective causal explanations are looked for in order to explain the observation. In this regard interpretations based on produced and meaningful constructed empirical data are applied. These are derived by the search for patterns and regularities that can be interpreted (Cloke, 2004).

3.2 Qualitative Method and Research Design

On the basis of the above outlined epistemological perspective, this thesis applies qualitative method to answer the research question. This paper does not seek for general statements, but rather illustrates motives, perceptions and contexts of several unlike health business firms in regard to CB knowledge interaction to contribute to the existing theoretical framework.

Qualitative data are meaningful to gather as they reveal the quality of a particular social phenomenon in line with processes that the phenomenon is embedded in. This quality – not quantity – can only be accomplished in close relation to actors that have impact on the phenomenon (Thagaard, 2009). In this study, this is realised by approaching in-depth interviews on seven small-sized health business firms. These seven firms are viewed at as case studies. In order to dig into the topic of CB knowledge interaction and health business, a limited desk research

[2] 'Reality' would refer to the 'actual' differences of economic specialisation and instutional regulations within the health sector investigated in an explorative extensive study.

has been carried out in advance and during the process of research. The information found are supposed to back up the understanding for the specific context that is applied to this thesis and to identify appropriate firms to select for participation. Basic results of the desk research are briefly presented in chapter 4 'Contextual Fundamentals'.

The main advantage of applying qualitative interviews is that it allows a great flexibility and adaption to the informant's views as well as it increases the interviewee's freedom of expression (Turner, 2010). When carring out interviews of high quality, several issues have to be respected. First, the quality of results highly depends on the researcher's experiences and preparations with qualitative interviewing (Thagaard, 2009). As my experiences in qualitative research dates back to some years ago, I chose to carry out my first interview as a pilot-test, to pick up pace and confidenciality as well as to critically re-adjust the interview-guide. As the first interview provided me with useful information, I decided to include the data in the following analysis. Second, an interview situation of friendliness and trust needs to be arranged, as knowledge flows more easily then – particular in situations where private firms are involved (see Thagaard, 2009).[3] Thus, I decided to carry out the interviews face-to-face at the offices of the interviewees. Third, the most proper selection on potential informants has to be applied. Fourth, the interview needs to be prepared by means of an appropriate interview guide.

Selection criteria

Since this study aims at understanding the motives of health business firms for present knowledge linkages and perception of differences of a CB area, illustrative information is needed (Valentine, 2005). As this study does not seek for representation of all health business firms, I chose to define selection criteria that would help to identify illustrating cases. These are the following:[4]

- 3-4 German and 3-4 Danish small-sized firms[5]
- Localisation of the firm's main office within SD – NSH region
- The interviewee needs to hold strategic knowledge about the firm
- Selection of private businesses producing/developing goods/services that contribute to the preservation and recovery of health (see Chapter 4.1)
- The firms should be located at different places across the SD and NSH region
- Firms located within one national territory should differ in regard to the health business industry/sector

[3] This particular applies for private businesses, which 'are known for' limited willingness to broadcast internal knowledge to externals.

[4] At the beginning of the inquiry I also aimed at interviewing only innovative firms, as I assumed most CB knowledge interaction potentials in innovative firms. I had to revise this criterion, as it is hard to identify which firm is innovative and which is not. Further, to include cases of non-innovative firms, supports the idea of finding illustrative cases.

[5] This criterion was chosen to ensure an element of similarity, to allow some comparability. Furthermore, is showed to be difficult to get in contact with managers at medium-sized firms. Thus this selection criterion was adjusted during the selection process.

- Selection of health business sectors/industries should be as similar as possible on both sides of the border

Interview guide

Regarding the qualitative interview design I chose to apply the general interview guide approach (Turner, 2010) (see appendix A, latest version). The interview guide aims at providing a certain structure and guidance during the interview (Turner, 2010). I formulated five core sections and two further excursion sections[6]. Each section of the interview guide provides information about the type of information that is searched for during the conversation and provides exemplary sub-questions that 'could be asked' (see appendix A). As I am not a native English speaker this pre-formulation was intended to help in cases of expression difficulties. Further, the formulated questions are worked up in a way that responses are open-ended. Important when applying this interview method is a balanced proceeding between the introduction of broad thematic questions and the digging into a topic by following the participant's responses by means of follow-up and probing questions. This implies that on the one hand the researcher needs to ensure that the same general areas of information are collected from each interviewee, but also to freely adopt to the specific situation to explore the interviewee's motives, perceptions and contexts, on the other hand (Turner, 2001).

Important to acknowledge is that the qualitative results of the interviews are influenced both by researcher and interviewees. Even though the questions are 'property' of the researcher, the interaction during the interview is shaped by an intertwinned process of questioning, listening, interpretating, answering and so forth. Both researcher and interviewee question and answer on the basis of pre-structures, pre-understandings, and prejudices (see Gadamer, 2006). To reflect on them during interviewing is not an easy task, but interactions and reaction also allow for readjusting and correcting present prejudices.

3.3 Process of the Empiric Data Pooling

The process of selection itself is mainly based on a sample provided by an unofficial database of the HANC partners. It contains amongst others a list of more than 100 firms within the SD – NSH region that 'have something to do with active and healthy ageing' (Welfare Tech, 2014). My research does not particularly focus on 'active and healthy' businesses, but certainly there is a great coherence to 'health business firms' (definition see chapter 4.1). Furthermore, it was the most appropriate and accessible database to apply. The selection was performed on the basis of further desk research on the websites of the 112 healthy ageing firms and some research on membership lists of local cluster organisations

[6] These excusions are rather directed to gather some additionally information for the HANC project partners.

within the life science sector (Life Science Nord e.V, 2014).[7] The process of data collection started by contacting appropriate health business firms in the SD – NSH region via phone recruiting. In order to provide more detailed information about the research project, a brief outline of the research project and the interview topics were additionally provided via e-mail (see appendix B). About 50 percentage of all firms contacted agreed in participating in this study.

One of the selection criterion is that firms selected within a national territory should differ in regard to the health industry sector they belong to. Based on this requirement, the selection of different health industry sectors should be similar on both sides of the border. Due to observered differences in economic specialisation of both adjacent border areas[8] and dependence on firms' willingness to participate in this study, this selection criterion could not be fully accomplished. Thus for instance, no firm within the telemedicine sector could be identified within the NSH region. Solution to this problem has been the selection of firms belonging to an 'adjacent' health business sector; in this case the health IT sector. Table 2 illustrates the selection of Danish and German health business firms belonging to different health business sectors and presents them paired in regard to 'similar health business sectors'.

Table 2: Selection of 'similar' health business firms on either side of the border (authour's illustration, 2014)

SD region	**NSH region**
▪ telemedicin and telemonitoring (Medisat)	▪ health IT services for medical engineering and life science industry (Soventec) ▪ health IT and R&D services for medical engineering industry (Frictionless)
▪ medical engineering (Innovision)	▪ medical engineering (Eschweiler)
▪ development and production of durable medical equipment (Vendlet) [▪ retail of (intelligent) durable medical equipment] (WellTech)[9]	▪ retail of durable medical equipment (Sanitätshaus Thiel und Scheld)

Altogehter eight in-depth interviews have been carried out. All interviewees hold strategic knowledge about their firms and are either in the position of ownership, business mananger or long-term responsible employee. The interviews with German firms were hold in German language and those with Danish firms in English, German and Danish language. The empirical part of this thesis is based on seven of these eigth in-depth interviews. The interview that was hold in Danish language (WellTech) could unfortunately not been used in a proper way. It has not been feasible to me to render a complete transcription that would have met the requirements for analysis, due to listening comprehension difficulties.

[7] Further, I have to note that the HANC project partners helped me trough the process of selection and suggested me some firms in Denmark that they already knew and that might be willing to participate to my study. Actually only one of the suggested firms participated.

[8] This observation is based on a desk research analysis of existing health business firms in the SD – NSH region, on the basis of Welfare Techs 'Mapping of Competence' (Welfare Tech, 2014).

[9] WellTech is not considered in the analysis.

The length of the seven in-depth interviews lasted 27 to 61 minutes (average 47 minutes). All interviews were recorded and transcripted word by word. A simplified way of transcription was applied as the oral text has been literally written down (see Dresing and Pehl, 2013). Moreover, all interviewees gave the permission to present the results of the interviews in this thesis. Some requested to ex ante 'proof read' those sections with clear reference to the individual firm. However, the actual interview transcripts are not attached to this formal study by reasons of confidentiality. It will be possible for Lund University staff, respectively the supervisor and examiner to get access to the interview transcripts.

The in-depth interviews were held open and flexible to a very high degree. It has been ensured that the same general topics were addressed in all interviews. However, the sequence of topics differed as well as the extent to which key topics were digged into. The pre-formulated questions had nearly been used, as the interviews were more or less akin to a conversional style, where I just had to 'drive' into the right directions and follow the thoughts of the interviewees. The quality of the interviews increased interview by interview, as know-how and confidentiality increased, too. Further, technical terms were not applied in the interviews. Instead, theoretical terms and concepts underlying to the research question and approach were deployed in a very practical way.

Coding and Categorising for issue-focused analysis

After generating the data the raw material was prepared for the analysis by 'sifting and sorting' through coding, forming the base for issue-focused analysis (Cloke, 2004; Thagaard, 2009). At the beginning all interview transcripts have been read carefully, altogether nearly 100 pages. I decided to apply descriptive and thematic coding. This means, I prepared a matrix database crossing (x) and (y). (x) contains headings that are directed to various issues that have been discussed with the firms during the interview (see appendix D). (y) refers to the seven interviewed firms. On the basis of a systematically coding of the interview texts, all relevant phrases and sentences, but also descriptive summaries were categorised and matched to the thematical headings (see Cloke, 2004; Thagaard, 2009). These thematic headings are both deductively and inductively derived from the theoretical framework and from the generated qualitative data itself. The issue-focused approach facilitates a more comprehensive analysis of the case studies. Problemetic to this kind of approach is that is hampers the researcher to retain to a holistic perspective of each case. Therefore chapter 5 provides a single case presentation and analysis. In chapter 6 the results of a comprehensive analysis are discussed and presented.

The following figure 2 illustrates several key phases of the research process underlying to this thesis in a quite simplified manner. The research phases are not

processed in a strictly successive order, but are rather geared to each other by several feedback loops.

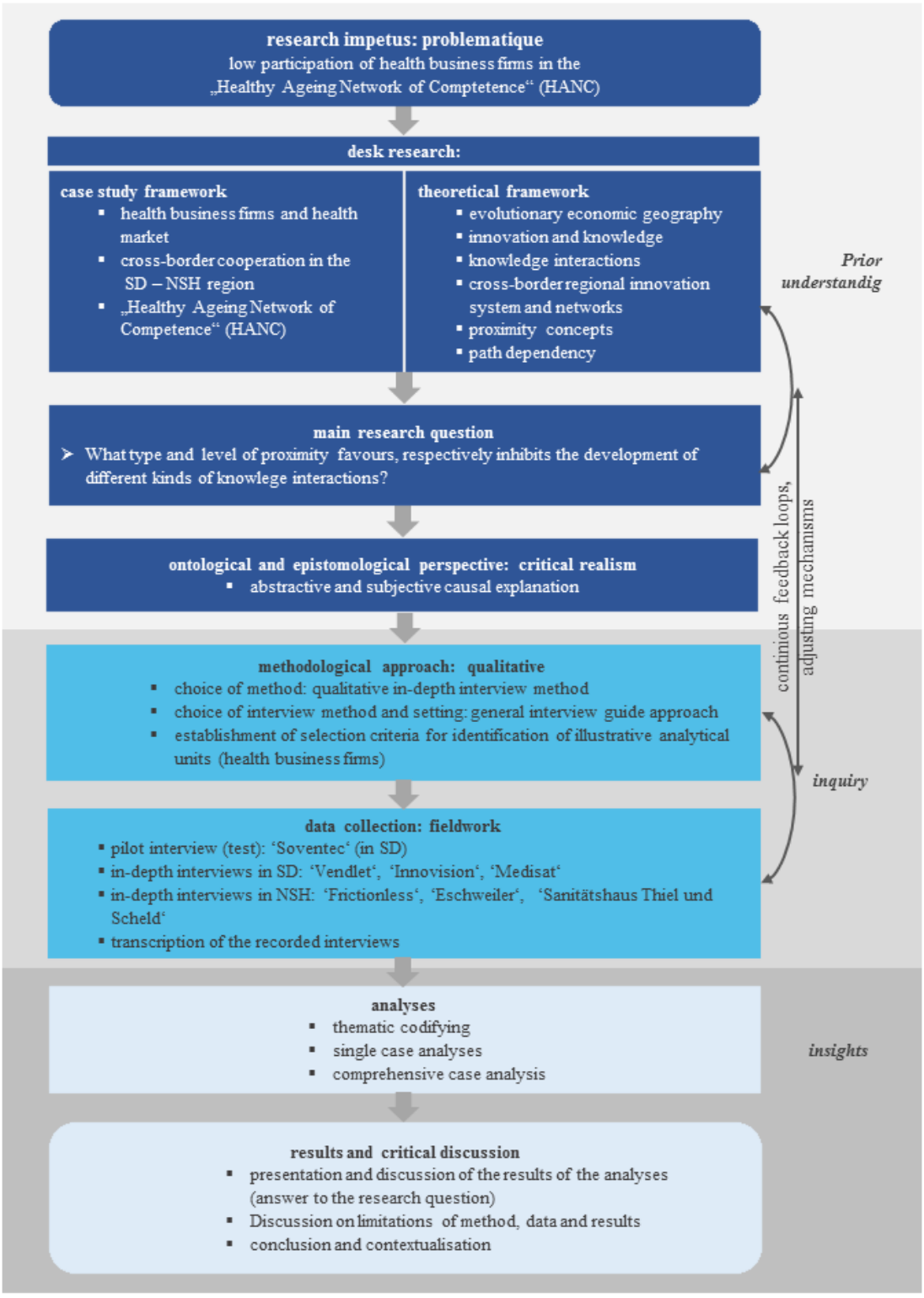


Figure 2: Illustration of research proceeding (author’s illustration, 2014)

4 Contextual Fundamentals

4.1 Health Care Economics

The term 'health care economics' is an umbrella term, comprising a vast and differential set of subbranches of the economy that 'have something to do with health' (Goldschmidt, 2013). According to Hilbert et al. (2009), 'health care economics' can be described by an 'Onion model of health care economics' (see appendix C), consisting of three main layers:

(1) The ‘core’ refers to institutions that directly deal with ambulatory and inpatient acute care and geriatric care, e.g. hospitals, clinics, rehabilitations, medical centers, pharmacies and care homes.
   - ‘Core-supporters’ are institutions that deal with the management of the core, such as health care administrations, health insurances, health R&D and educational insitutions.

(2) ‘Intermediate and supply industry’ refers to health care industries, as for instance pharmaceutical industry, medical engineering industry, gerontology, biotechnology industry, genetic engineering, health trade professions, wholesale and retail of medical equipment.

(3) ‘Edge and neighbouring sectors’ are those that are 'somehow' related to people’s health, as health tourism, health related recreation and sports, health related services, healthy eating and assisted living.

This study will concentrate on the second layer of the above referred ‘Onion model of health care economics’ and thus on private businesses producing and developing goods and services that contribute to the preservation and recovery of health (DSN, 2013). These businesses are referred to as health business firms in the context of this study.

4.2 Health Businesses in Schleswig-Holstein and Southern-Denmark

Schleswig-Holstein

According to a study on 'health care economics' in the German Bundesland Schleswig-Holstein, ‘health care economic’ is a main pillar for employment and gross value in the most northerly German Bundesland (Hilbert et al., 2009). The study’s authors identify the following health business branches as key branches: *Pharmaceutical industry, medical engineering industry and life science engineering industry*. These branches and the telemedicine/telematic sector are considered as future growth branches. Unfortunately there are neither data available in regard to the NSH region nor in regard to numbers of firms in the

mentioned branches.[10] On the basis of Welfare Tech's (2014) unofficial database, comprising 'healthy ageing' actors in the NSH region, two other core branches could be identified: *Health trade professions and retailers of durable medical equipment.*

Southern-Denmark

In line with the German authorities do the Danish authorities emphasize the great potentials in regard to health business for economic growth and public health (Ervervs- og Vækstministeriet, 2013). But, while the Germans refer to 'health care businesses', the Danish talk about the importance of further development of 'health and ambient assisted living technology' solutions (see e.g. Welfare Tech, 2013; Ervervs- og Værksministeriet, 2013). As in the German case, there are no public data available on southern Danish health businesses. But, reports and Welfare Tech's unofficial database on healthy ageing actors in the SD region confirm the significance of businesses dealing with '*ambient assisted living technology'*. Welfare Tech's (2014) database of competences reveals the predominant position of firms developing *IT/telemedicine and –monitoring solutions* and *durable medical equipment.* According to the Danish Ministry of Business and Growth (2013)[11], Denmark is also well-positioned respectively firms developing pharmaceuticals and medical devices. However, only a few firms within these branches are located in the SD region (Welfare Tech, 2014).

There could be written much more about southern Danish and northern German health businesses, and particularly how they are embedded into the respective national health care system, but a comprehensive desk research on this issues is not objective to this study.

4.3 Institutionalised Cross-Border 'Health Development'

The SD – NSH region is one of the socalled Euroregions, which form the regional core element of European intergration efforts that are based on the political vision of a borderless Europe. Even though informal CB cooperation goes back to the late 1950s the actual SD – NSH Euroregion was established as late as 1997 (Klatt and Herrmann, 2011). According to Klatt and Herrmann (2011), there is still no indication of functional integration, despite of a strong position of the national minorities and the further development of insitutionalised CB cooperation projects in recents years. According to Perkmann (2003), the SD – NSH region is an integrated micro-CB region with strong local authorities acting as institutional entrepreneurs.

From 2007 to 2013 the European Commission launched the fourth Interreg regional development programme (Die Grenzregion Syddanmark-Schleswig-K.E.R.N., 2007). The Commission's objective is to develop a competitive and dynamic knowledge based CB economic area. On the basis of a socio-economic

[10] The data that are available are neither complete nor up-to-date (see Hilbert et al., 2009).
[11] In Danish language: Ervervs- og Værkstministeriet (2013).

analysis and a SWOT-analysis specific objectives, priorities and action fields were established that focus on the region's needs and strenghts. The CB cooperation partners defined "*strengthening and consolidation of the regional knowledge based economy*" as first priority to approach (Die Grenzregion Syddanmark-Schleswig-K.E.R.N, 2007, p. 43). Within the scope of this priority the programme identified the growing ageing population as a powerful mega trend that cannot be ignored when planning for future knowledge and production structure as well as already an existing regional comparative knowledge advantages within the health and welfare technology sector of the SD – NSH region. This identified future potential has been implemented under action field five 'health development'. But in regard to actual and projected health business characteristics and development, only little is said in the Operational Programme. It is solely mentioned that a growing health business market is viewed at as a development chance of the Danish-German border region, but no potential analysis on the integration of the German and Danish health market has been carried out.

4.4 Health Care Cooperation

As indicated in the introduction, there are neither descriptive statistical data nor empirical information available about CB regional market relations and collaborations of local health business firms in the SD – NSH region. Besides, no public document could be found that stresses the objective of CB health market integration. But in line with the Interreg programmes, which mainly focus on supporting public institutions, several CB projects in the realm of public health care and research could be identified, e.g.:

- Cooperation among Danish and German hospitals in the scope of radiotherapy and breast cancer diagnostics (Ministerium für Justiz, Arbeit und Europa des Landes Schleswig-Holstein, 2008)
- Patient care in CB stationary institutions (Ministerium für Justiz, Arbeit und Europa des Landes Schleswig-Holstein, 2008)

Some recent implemented CB Interreg projects also include private firms in cooperation projects. These are for instance:

- The 'eHealth' project, a cooperation among Danish health businesses and the University of Applied Science in Flensburg, aiming at practical relevant research and the initiation of technology transfer (Gatermann, 2013)
- 'ROBIN – ROBotics: Innovation for healthcare', a cooperation project among hospitals, cluster organisations and health businesses that aims at developing health care robotics, technology transfer and product commercialisation (Die Grenzregion Süddänemark-Schleswig-K.E.R.N., 2013)

Taking into account the low functional integration of the border region and the various Interreg project attempts to support CB health care and research, there are

strong evidents that the EU regional and local policies are the driving force behind the proliferation of the SD – NSH health region.

4.5 The HANC Project

Another project that has been realised within the realm of policy-driven attempts to support the integration of the Danish-German CB health region is the 'Healthy Ageing Network of Competence' (HANC) [12]. This project is implemented under action field five 'health development' within the framework of the Interreg 4 A programme 2007-2013 of the SD – NSH region (Die Grenzregion Syddanmark-Schleswig-K.E.R.N., 2007). The project has been initiated by research, public and network organisations of the CB region, the so called HANC project partners. It is the only project among all the other Danish-German CB projects that applies a holistic quadro-helix approach, aiming at the creation of a CB network. The HANC project partners describe HANC as a "*platform for cooperation between researches, users, health care providers and companies […] (to) find better solution to serve the needs of the older adults for Active and Healthy Ageing through optimising opportunities for physical, social and mental health*" (HANC, 2014a).

The overall objective is to contribute to the development of a sustainable integrated CB health region, able to face the demographic change and strengthen the regional competitiveness (see HANC, n.d.). This shall be accomplished amongst others by "*promoting the rapid transfer of knowledge to develop products and services as well as their commercialisation through HANC partners for local, regional and international markets*" (HANC, n.d.).

When referring to network establishment and development, the HANC project partners aim at creating dynamic learning networks. So far, actual collaboration has only been initiated in the framework of a pilot study including universities and the civil society. Against it, various actions have been implemented to support informal networking among 'competent' actors, as for instance the realisation of workshops and a virtual networking service[13] (HANC, 2014c). The online networking service is intended to gather all relevant local actors at a central meeting spot to consequently opening up opportunities for CB collaboration. The HANC project partners present several aspects as advantages to gain for health business firms, when being part of the CB healthy ageing network of competences (see HANC project flyer page 1, appendix E).

As highlighted at the beginning of this paper, it is a major challenge to convince firms to participate in the CB networking efforts of the HANC group (Jürgensen, 2014, one-to-one conversation). The network-website reveals that twelve out of

[12] The term 'Active and Healthy Ageing' become common to apply in public area within the last years. According to the WHO (2002) it can be described as "*process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age*". The European Commission (2014) launches the 'European Innovation Partnership in Active and Healthy Ageing' in order to "*increase the average healthy lifespan by two years by 2020*".

[13] See HANC network website: http://healthy-ageing-network.eu/our-network/

36 registrations refer to local health business firms (HANC, 2014d). This seems be a good quote at a first glance, as a third of all registrations trace back to firms. But considering that there are at least 112 health(y ageing) business firms located in the CB region, these twelve registrations seem relatively small.[14] All these firms have been contacted via e-mail and some have been visited by the HANC project partners to promote the HANC-network (Welfare Tech, 2014).

On the basis of the observed challenge to include health business firms actively into HANC activities, the HANC project partners are willing to initiate a transition "*From: Public funded AHA dissemination […] To: Market driven and financed AHA innovation network*" and "*from solution driven (to) market driven*" customer segments (HANC, 2014b). In this regard the HANC project partners are also aware of the need to still answer the question: "*Why team up with HANC? What is in it for me?*" more reasonable.

Against this background the empirical case studies presented in this thesis might contribute to gain increased insights about health business firms' needs. The results of this thesis project might contribute to improved understanding of health business firms' views on potentials and obstacles for CB knowledge interactions, including market relations. Thus, the case study results provide a starting point for a more advanced potential analysis of the integration of the German and Danish health market.

[14] This number originates from the HANC project partner's database 'mapping of competences' (Welfare Tech, 2014). This database comprises a dataset about networks, public institutions, hospitals, care homes, educational institutions, municipalities, associations, business development organisations and companies that are connected to healthy ageing and located in the SD – NSH region. This study identified existing health business firms, primary on the basis of Welfare Tech's prior conducted desk research. The quality of the database cannot be ruled out. It only showed that 4 to 5 additional health business firms could be identified on the basis of a membership list of the Life Science Nord e.V. cluster organisation (Life Science Nord e.V., 2014).

5 Results of the Single Case Analyses

In the following sections the results of a single case study analyses are presented. Chapter 5.1 provides an overview of general data concerning the interviewed firms. The primary objective is to put the reader into the shoes of the interviewee's perspective. The following seven sub-chapters address the specific cases of the interviewed health business firms. All descriptive information provided in these sections are derived from the in-depth interviews.

Each chapter starts with a brief presentation and continues with a depiction of the nature of present knowledge linkages. These linkages are sorted, presented in tables and the most important analytical and descriptive features are outlined in a short sub-text. Note that in the tables all by the interviewee's mentioned existing knowledge linkages are presented, non-regarding spatial extent of these. But, Danish-German knowledge linkages are highlighted by bold and cursive script.

In what follows a description of the interviewee's visions and motives for future CB knowledge interactions in the SD – NSH region is provided. Against this background, main explanations of the interviewees, concerning differences forming potentials and obstacles for future CB knowledge interactions, are presented. These explanations are linked to different proximity categories by the author. Each sub-chapter provides a summary of factors that are perceived as obstacles or potentials by the interviewees.

It needs to be acknowledged that even though only interview material is used to present the seven cases, the case presentations itself highly depend on the author's sifting and sorting of the data and theory-led interpretation. For instance, the depicted levels of proximities (high, medium and low) have to be understood as interpretation of the interview texts. The sub-sections provide references and quotations to the interviewee's statements, in order to allow for differenciation to the author's analysis.

5.1 Overview of Case Study Health Business Firms

In the following table 3, key characteristics of the seven case study firms are presented. This overview aims at providing the reader general sorted information about the interviewed health business firm's location, number of employees, sector and main products and services provided. Figure 3 demonstrates the case study firm's location within the SD – NSH region.

Table 3: Overview of key characteristic of seven case study firms (author's illustration)

Firm	Location	No. employees	Health industry/sector	Main products and services
Eschweiler GmbH & Co KG	Kiel, NSH	20	Medical engineering industry	Development and production of blood gas and electrolyte analysis devices and intermateable equipment
Frictionless GmbH	Kiel, NSH	2	Health IT and R&D service sector	Service in managing post-marketing clinical studies of medical devices Service in illustration and animation of medical anatomy and devices (focus on endoprosthetic implants), development of medical Apps
Innovision Aps	Glamsbjerg, SD	7	Medical engineering industry	Development and production of medical instruments, e.g.'Innocor' (non-invasive cardiopulmonary measurement device)
Medisat A/S	Odense, SD	20	Telemedicine, and -monitoring industry	Development and production of telemonitoring and -medicine products: 'Patient briefcase' and 'Home care phone'
Sanitätshaus Thiel & Scheld oHG	Flensburg, NSH	36	Health retail industry & custom fabrication	Sale of durable medical equipment Production of specific orthopedic products Service in adjusting medical products to custom-tailored needs
Soventec GmbH	Dannewerk, NSH	5	Health IT service sector	Services in custom-tailored software services that support manufacturing and quality management processes of medical engineering and life science firms and institutions Development and sale of laboratory software platform LabOS
Vendlet ApS	Aabenraa, SD	11	Durable medical equipment sector	Development and production of electro-mechanic patient turning system, cushions and incontinence sheets

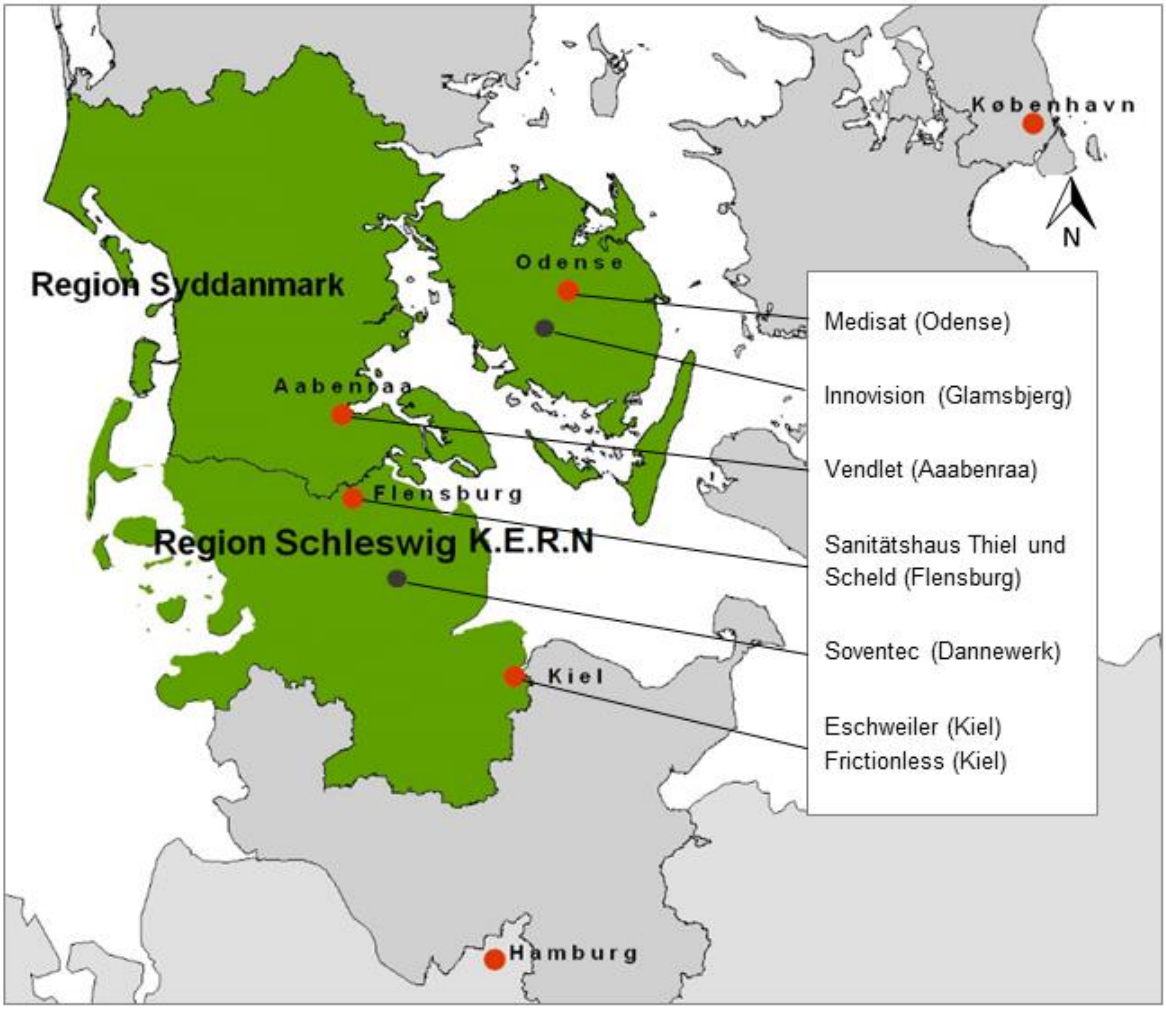


Figure 3: Illustration of case study firm's location

(map source: Deutsch-Dänische Journalismus Sommerakademi, 2013; adapted and revised by author, 2014)[15, 16]

[15] The map only intents to illustrate the case study area and location of interviewed firms. Scale is not available.

[16] Region Syddanmark = Southern Denmark region, Region Schleswig K.E.R.N = Northern Schleswig-Holstein region.

5.2 ESCHWEILER GMBH & CO KG, …

Interviewee: Michael Kuhl, business manager

… located in Kiel – Germany, is a family-owned enterprise that produces blood-gas and electrolyte analysis devices. According to Eschweilers' business manager Michael Kuhl, it has been Mr. Eschweiler who developed the first blood-gas-analysis device in the world in 1951.[17] Today blood-gas-analysis devices are used in daily routine by pulmonologists and intensive care stations all around the world. Eschweiler is one of approximately ten firms in the world that produce this sort of medical device. In addition the firm produces and trades intermateable equipment, as for instance calibration. Michael Kuhl describes Eschweiler as one of the smallest firms among these ten producers of blood-gas-analysis devices and as a rather less technologically innovative firm compared to its competitors. Instead the 20 Eschweiler employees are highly specialised in delivering robust and basic technique to distribution partners in mostly "*small and third world countries*", e.g. India and Algeria. In Europe Eschweiler products are sold to France, Czech Republic, Serbia and the German home market. Thus Eschweiler is a niche supplier within the medical engineering industry that is highly specialised regarding the market base. In respect to CB relations Eschweiler is only dealing with two suppliers of the SD region.

Nature of Eschweiler's knowledge linkages

Table 4 illustrates the result of an analysis of Eschweiler's present knowledge linkages sorted on the basis of Tödtling et al.'s (2009) categorisation of types of knowledge interactions. As described above Eschweiler is a specialised niche supplier that is strongly tied to its customers. With exception of a newly initiated R&D collaboration, Eschweiler is not engaged in collective learning. This is mainly reasoned by long-time established relations to all relevant distribution partners and little efforts to be innovative and to initiate new market contacts. The main source of external knowledge for product development issues are customer's feedback and monitoring of competitors via websites. Otherwise Eschweiler stays rather passively informed on the basis of various spillover linkages. The recent initiation of an R&D collaboration with the local university is reasoned by rethinking of Michael Kuhl about the firm's need to technologically develop. For the same reason new trainee positions for students were established. Even though students are not actively involved in development tasks, some new ideas might spillover according to Eschweiler's business manager.

[17] Michael Kuhl also mentions that Radiomenter invented the blood gas analysis in 1951, too.

Table 4: Present knowledge linkages of Eschweiler GmbH & Co KG, sorted on the basis of Tödtling et al.'s (2009) categories of types of knowledge interactions

market relation	**collaboration**
customer relation: ▪ distribution partners ▪ final consumers (e.g. laboratories, doctors) ***suppliers: e.g. specialist manufacturing firms***	R&D collaboration with University of Applied Science Lübeck
spillovers and knowledge externalities	**informal networking**
trainee position for students active monitoring of competitors via website passive membership in: ▪ cluster organisation 'Life Science Nord' ▪ medical engineering association 'Spectaris' ▪ trade association in Kiel participation in medical engineering fair 'Medica' participation in events of the 'Business development agency Schleswig-Holstein/use of 'joint office' abroad	

Visions and motives for future CB knowledge interactions with SD

Due to the dominant established position of the most innovative competitor in regard to the development of blood-gas-analysis devices in the world 'Radiometer', which was founded in Copenhagen Metropolitan Area, Eschweiler is "*not even thinking about competing with the big brother in Denmark*". Eschweiler's current SD supplier relations will be continued because one of the suppliers is one of few specialists and the other supplier relation was recently established on the basis of a best price-quality decision making.

Perceived CB differences forming potentials and obstacles

Eschweiler faces no potential business opportunity in SD, reasoned by the competitor's dominant market position. Michael Kuhl states: "*It would be illusory to make profit. The Danish and German medical engineering market is highly sophisticated and so are our competitors.*" In regard to the socio-institutional SD context, Eschweiler does not hold much knowledge. On the basis of the experiences with the SD suppliers, Michael Kuhl states that he does not perceive any formal institutional differences. All business contracts are formulated in English and communication is also facilitated through good English proficiency of both Eschweiler and Danish suppliers. In regard to informal institutional differences Eschweiler's business manager explains "*I don't see anything that would mitigate against business relations with Danish. We don't fear contact and have good experience with our suppliers. But as said, 'our competitor'…*"

Perceived factors favouring CB knowledge interactions

✓ - None (maintain supplier relations) -

Perceived factors inhibiting CB knowledge interactions

- No business opportunity, due to innovative competitor's strong market position in Denmark (low functional proximity)
- Low level of knowledge about the CB region

5.3 FRICTIONLESS GMBH…

Interviewee: Bernd Borm, owner and managing director

… is a two-man business located in Kiel – Germany, founded in 1999. Bernd and Nele Borm provide services for medical engineering firms and particularly for firms producing endoprosthetic implants. Bernd Borm is a specialist in illustrating and animating medical anatomy and instruments. Besides, he also develops user interface software in the realm of ophthalmology. Nele Borm supports clinical R&D institutions in managing post-marketing clinical studies of medical devices on behalf of medical engineering firms.

Nature of Frictionless' knowledge linkages

Frictionless is connected to the most relevant international players in the development and production of endoprosthetic implants. These firms are mainly located in Southern Germany, Switzerland and in the United States - and none of them is located in Denmark.

Table 5: Present knowledge linkages of Frictionless GmbH, sorted on the basis of Tödtling et al.'s (2009) categories of types of knowledge interactions

market relation	**collaboration**
customers: ▪ medical engineering firms ▪ medical centers contract workers/freelancers	- none -
spillovers and knowledge externalities	**informal networking**
tax consultant visit of fairs and conferences	virtual communities: active participation in specialist fora personal social business network membership in a working group 'Medical engineering' in Hamburg

Table 5 illustrates the result of an analysis of Frictionless' present knowledge linkages sorted on the basis of Tödtling et al.'s (2009) categorisation of types of knowledge interactions. Frictionless' knowledge linkages are characterized by interdependent knowledge transfer and transformation particularly from and to

customers and 'virtual' specialists at the global level. The firm is highly embedded within a small specialised sector and searches for linkages and complementarities only within this scope. Frictionless acts as service and consultant agency providing specialist know-how to its customers in a rather static manner, but also depends on feedback loops and external business and technological complementary knowledge. Bernd Borm emphasizes: "*In our business realm, you only get access to innovative knowledge on specialist websites and fora!*" Frictionless utilises tacit knowledge to a high degree. A key feature of Frictionless' knowledge linkages is that they are neither regionally nor nationally bounded. Instead meetings on occasion, word-of-mouth recommendations and the personal social business network form the basis for trustful cooperations all over the world.

Visions and motives for future CB knowledge interactions with SD

Primary due to the fact that there are, according to Bernd Borm, neither potential customer-firms nor clinical R&D institutions in Denmark that have been involved in testing and documenting medical engineering instruments, Frictionless is not interacting with Danish health actors and is also not aiming at interacting with the SD region in a business context. Bernd Borm explains: "*Only in the case of business depression, if we suddenly would need to acquire new customers, we would maybe look across the border and identify demands that we could satisfy. And of course we would collaborate with medical clinics and firms in Denmark, if they start to carry out post-clinical studies respectively develop endoprosthetic implants*".

Perceived CB differences forming potentials and obstacles

Frictionless is highly aligned its customers, thus the spatial pattern of knowledge linkages mainly depends on where potential customers are located. According to Frictionless, there is no business case and no complementary knowledge in the SD region that could be utilised. This constitutes the main barrier for CB knowledge interactions. Additionally, the main external knowledge sources, besides customers' feedback, are virtual communities. Bernd Borm further illustrates that there is no need for establishing new knowledge linkages, as the firm already is highly embedded and does not seek for growth. Due to no established CB knowledge interactions, Bernd and Nele Borm hold nearly no knowledge about the SD region. Against the background of some holiday experiences, Bernd Borm illustrates: "*The Danish are very nice, relaxed people.*" He further explains that he speaks fluently English, which is normally in his business and thus differences of native language would not constitute a barrier to interaction.

Perceived factors favouring CB knowledge interactions

- ✓ - None -

Perceived factors inhibiting CB knowledge interactions

- No business opportunities due to strong differences in economic specialisation (low functional proximity)
- Strong differences in knowledge specialisation, lack of synergies (low cognitive proximity)

5.4 INNOVISION APS …

Interviewee: Knud Pedersen, Application Specialist

… is a specialist firm within the medical engineering industry. The firm is located in Glamsbjerg – Denmark, and has been part of a space business company that develops equipment for ESA and NASA since the 1980s. As several equipment could also be used in the hospital realm, the firm divided and Innovision was founded as a spin-off, focusing on medical devices. The main products that are developed and assembled by Innovision are the 'Innocor', a non-invasive cardiopulmonary measurement device, which enables medical scientists and practioners to measure the blood flow parameter – and the AMIS 2000, a pulmonary gas exchange measurement device. Knud Pedersen describes the 'Innocor' as highly innovative, as it is the only device in the world so far that facilitates the non-invasive measurement of the 'blood flow' parameter in clinical routine.

Nature of Innovision's knowledge linkages

Innovision products are sold to hospitals, universities and medical drug companies in the United States and in whole Europe. According to Knud Pedersen, German customers are actually much more important for the firm's performance, than Danish customers. Even though there are only seven Innovision employees at present, Innovision holds a German salesman, whose network is highly important for the firm.

Table 6 illustrates the result of an analysis of Innovision's present knowledge linkages sorted on the basis of Tödtling et al.'s (2009) categorisation of types of knowledge interactions. Central to Innovision are market relations, to customers as well as to suppliers. While the establishment of supplier relations is mainly based on issues like 'who in the world provides the intermediate good we need, in best quality-price relation?', customer relations highly depend on 'preliminary' knowledge linkages diffusing and sourcing social business interactions. The technically skilled sales manager is marketing both Innovision's innovative knowledge and products. The application of Innovision's products requires a routine change by doctors, as the simple static transfer of Innovision's knowledge via products is not sufficient. Before traded customer relations are established, both Innovision and a potential customer are engaged in untraded dynamic learning processes (negotiating knowledge supplied and demanded). These knowledge linkages are characterised by the exchange of tacit knowledge, face-to-face meetings on occasion and social business ties of the sales manager.

Additionally, Innovision is actively studying scientific papers, to inform about trends and key persons; hence absorbing rather codified knowledge. Innovision's spatial pattern of knowledge linkages is global in regard to preparatory and actual market relations, but still the firm holds local ties to students, the parent company and a recently established Innovision spin-off firm.

Table 6: Present knowledge linkages of Innovision ApS, sorted on the basis of Tödtling et al.'s (2009) categories of types of knowledge interactions

market relation	**collaboration**
customers: hospitals, universities, medical drug companies suppliers	collaboration with students (R&D tasks) (business-alliance in the past)
spillovers and knowledge externalities	**informal networking**
monitoring specific research papers and working groups online	***personal social business network of the salesman to potential customers and related businesses – search for business alliance*** personal relations to ‚parent company' and ‚spin-off company'

Visions and motives for future CB knowledge interactions with NSH

As indicated above, Innovision is already linked to some extent to the German market, but not to NSH. Therefore Innovision is interested to build up market relations to hospitals and universities in Schleswig-Holstein, too (respectively NSH). In the past Innovision employed several non Danish trainees, e.g. for modelling tasks. Knud Pedersen elucidates that Innovision's staff turnover is low. Therefore 'outsider's knowledge' and new ideas are appreciated. He states that medical engineering students from Germany, whose English knowledge is proficient, could potentially get a trainee position.

Perceived CB differences forming potentials and obstacles

Knud Pedersen further explains that Innovision faces in general the problem that its products are either 'too novel' or disputed in regard to the chosen technological trajectory, also in Germany. He illustrates that: "*When Innovision was founded, we thought that the growing ageing population forms a basis for great business opportunity, particular in countries like Germany where many people live, get old and have heart problems. But it hasn't shown yet – the great business*". He demonstrates that there is a big business opportunity for Innovision products, but also that it is difficult to market the Innovision products. This is reasoned by the novel technology provided by Innovision, which is 'not yet usually' applied at the world's leading hospitals and universities. According to Knud Pedersen, Innovision's success highly depends on the opinion of the experts regarding the question 'whether it is useful to measure the blood flow parameter, or not'. This is why the Innovision

salesman goes directly to the distinguished experts to demonstrate the usefulness and to initiate routine change. When it comes to institutional differences, Knud Pedersen portrays: "*The only thing that is different in Germany, is the way they start a letter, but the rest is no problem. It can just be problematic that Germans often don't speak so well English, but now we have a German salesman.*" Innovision's knowledge about the German market, knowledge specialisation and socio-cultural context is very high. They do not see any barrier in regard to administrative differences, but Knud Pedersen points out that in the past they ran a subsidiary Innovision GmbH in Germany, to ease the taxation case. Since a subsidiary was too costly for the small firm, they had to close it.

Perceived factors favouring CB knowledge interactions

- ✓ Potential business opportunities, demand for Innovision products due to demographic change (high functional proximity)
- ✓ High level of knowledge about German institutions, market and language
- ✓ Good communication due to German sales man (high language proximity)

Perceived factors inhibiting CB knowledge interactions

- ○ Substantial difference in technological trajectory (medium cognitive proximity), these differences could potentially act synergetical
- ○ Novel knowledge is hardly absorbed due to doctor's routine (not only cognitive differences, but mainly informal institutional differences create an obstacle)

5.5 MEDISAT A/S …

Interviewee: Jørgen Thomsen, head of department

… is a spin-off firm of a traditional IT company in Odense – Denmark, that has been bought by a huge Danish energy company called Trefor, in 2014. Medisat provides innovative telemedicine and -monitoring products and services for hospitals and care homes. In 2006 a doctor at Svendborg hospital asked his neighbour, todays Medisat CEO, for help in developing a telemedicine product for COPD-patients[18]. Within the framework of the EU-project 'Better Breathing', Medisat developed the idea of a 'patient briefcase' and 'home care phone' in cooperation with the University of Southern Denmark. Normaly COPD-patients need to stay several weeks in hospital during a year. The 'patient briefcase' is a portable device composed by monitor, software and medical devices as e.g. spirometry. It facilitates the measurement of pulmonary parameters at the patient's home and enables the patient to send recorded data in real-time to the hospital – hence patients' duration of hospitalisation is reduced immensely and expenses are saved. Medisat's products are leased to customers, which "*get a whole package, the idea, the de- and installation services at the patient's home and the product itself*".

[18] COPD [med. abbr.]: chronic obstructive pulmonry disease (smoker lunges).

Nature of Medisat's knowledge linkages

Table 7 illustrates the result of an analysis of Medisat's present knowledge linkages sorted on the basis of Tödtling et al.'s (2009) categorisation of types of knowledge interactions.

Table 7: Present knowledge interactions of Medisat A/S, sorted on the basis of Tödtling et al.'s (2009) categories of types of knowledge interactions

market relation	**collaboration**
customers: ▪ hospitals ▪ municipalities (care homes) consultants, e.g. engineer suppliers	R&D collaboration: EU-project 'Better Breathing' – hospital collaboration (in the past)
spillovers and knowledge externalities	**informal networking**
social media: presentation in LinkedIn, Danish national TV ***presentation in fairs*** participation in conferences	social business networking, e.g. sponsor of local football club active member of 'WelfareTech' ***negotiation with Kiel university medical center to establish a cooperation-project***

Medisat's business case is based on a government forced need for cost reduction in Danish hospitals, thus Medisat is embedded in the Danish NIS. So far, the 'patient briefcase' is used in 'hospital region Fynen', as well as in a project-partner hospital in Norway and the United Kingdom. The 'home care phone' is applied by some local Danish municipalities. Hence, customers are primary located within regional proximity to Odense office. The same applies to many informal network ties. This is reasoned by Medisat's strong need to place its product on the market. In order to spread the knowledge about the novel technology and initiate routine change of nurses, doctors and patients, face-to-face meetings are highly significant. In line with this, Medisat was also engaged in a business-alliance with the Danish energy company TREFOR in the past.[19] TREFOR enabled Medisat to ease contact making with Danish municipalities. The initial formal contact to TREFOR and also to a consultant, was made within a social business meeting of sponsors of the local football club. In regard to knowledge accumulation, Medisat has built up ties to local hospitals and patients, looking for ways to exploit knowledge and later apply it for business purposes. Thus, Medisat is strongly embedded in the region, too. Now Medisat begins to establish knowledge linkages that go beyond the regional and national border and engages in preparative informal networking to initiate market relations and collaboration to technologically further develop its products. In regard to supplier relations, Medisat now searches for non-European producers of semi-finished goods.

[19] Recently, they have been bought by Trefor.

Visions and motives for future CB knowledge interactions with NSH

Currently, Medisat is negotiating with Kiel university medical center (NSH region) to implement the 'patient briefcase' in a cooperation project, in order to enter the German market. Medisat searches actively for informal linkages to gain access to tacit knowledge about distribution channels, the German market and demands for telemedicine products. Jørgen Thomsen explains that in the future, they could imagine to cooperate with students to further develop and market products, if the students speak proficiently English.

Perceived CB differences forming potentials and obstacles

Jørgen Thomsen states that there is a big market opportunity to develop telemedicine and –monitoring devices due to a growing number of COPD patients in Germany, too. As the 'patient briefcase' potentially could be adapted to other deseases, also the growing number of elderly people forms the foundation for business potentials. He outlines that*:* "*Germans are not yet experienced with telemedicine products. They just now start talking about and learning about it*". In contrast to the Danish government, where hospitals are forced to reduce hospitalisation of patients, this innovation pressure is not present in Germany. According to him, this is not particular problematic, but rather strong differences between the Danish and German health care system complicate the case. Jørgen Thomsen demonstrates that: "*In Denmark only one health actor needs to agree to the implementation of a new technique at a hospital, in contrast to Germany where hospitals, insurances and outsales want and need to be asked and discussed with.*" He also points out that, similar to the Danish case, people need to familiarise with routine changes in care and treatment culture – "*It is difficult to make a hospital work otherwise than they are used to do*". Otherwise, he perceives the Germans as "*very polite and helpfully*". However, his personal CB knowledge is limited. He explains that Medisat's sales manager gained basic understanding about the German case. In regard to language, Jørgen Thomsen, indicates that some Germans lack English proficiency, which hampers easy communication and thus negotiation.

Perceived factors favouring CB knowledge interactions

- ✓ Potential business cases, as costs could be reduced in German hospitals by applying Medisats products (high functional proximity)
- ✓ Potential for telemedicine knowledge synergies (medium cognitive proximity)
- ✓ Medium level of knowledge about German institutions and market

Perceived factors inhibiting CB knowledge interactions

- ○ Novel knowledge requires routine change of doctors and nurses (not cognitive differences, but difference in regard to informal institutional proximity form obstacles)
- ○ Strong differences between the Danish and German health care and reimbursement system (low formal institutional proximity)
- ○ Differences in English proficiency (medium language proximity)

5.6 SANITÄTSHAUS THIEL UND SCHELD OHG …

Interviewee: Jan Petersen, one of three owners and business managers

… is a general partnership of three long-established 'medical supply stores' in Flensburg - Germany that merged into one business in the last decades. 'Sanitätshäuser' are a unique German form of business that provide services in orthopaedic craftsmanship and trade of durable medical equipment, e.g. compression hosiery and prostheses. Additionally to retailing these products, Sanitätshaus Thiel und Scheld also produces certain products themselves, e.g. medical corsages. Moreover, some equipment is adjusted to the patients needs, e.g. prosthesis shafts. Sanitätshaus Thiel und Scheld is specialised in providing orthopaedic craft for the local hospitals. There are 36 employees that run the workshop and operate in three stores in Flensburg and Kappeln.

Table 8: Present knowledge linkages of Sanitätshaus Thiel und Scheld oHG, sorted on the basis of Tödtling et al.'s (2009) categories of types of knowledge interactions

market relation	**collaboration**
customers: patients benefactors: health insurences, professional associations suppliers: sales representatives of durable medical equipment producers retailer cooperative coalition of several medical equipment stores	
spillovers and knowledge externalities	**informal networking**
trainees and vocational school ***listed as potential retailer at Danish municipalities*** visiting fairs participation in further trainings of supplying firms	personal social business network active membership in networks: ▪ doctor's surgeries 'lymph drainage' ▪ 'Gesundheitsregion Nord'

Nature of Sanitätshaus Thiel und Scheld's knowledge linkages

Sanitätshaus Thiel and Scheld is highly embedded in the German local and regional market, as retailer relations to customers as well as main informal linkages exhibit the central position of Flensburg (city) and its surrounding. Flensburg is located at the Danish-German border and as the standing of the German Sanitätshaus is high – according to Jan Petersen – some Danish patients cross the border to become served. Sanitätshaus Thiel and Scheld is also linked to SD municipalities by a list of potential retailers of durable medical equipment. Further, they are related to 50-60 producers of durable medical equipment in the world, but no Danish ones. Besides the regional level, the national level also plays a crucial role. In order to reduce costs per unit, Sanitätshäuser all over Germany are organised in retailer cooperatives. Due to reorganisation of German health care insurances in recent years, calling for tenders only at the Bundesland level,

Sanitätshaus Thiel and Scheld established a coalition with other medical equipment stores being located at different places in Schleswig-Holstein. Even though the Sanitätshaus is directly related to patients, a main market link goes to health care insurances, paying most durable medical equipment, but also regulating prices.

Significant for static learning effects, in regard to products sold, adjusted and produced are feedback loops of customers (patients) and customer's doctors as well as further trainings of supplying firms. Collective learning takes place, even though not often, when the Sanitätshaus retailers interactively discuss with doctors, e.g. the optimal level of amputations. Table 8 illustrates the result of an analysis of Sanitätshaus Thiel und Scheld's present knowledge linkages sorted on the basis of Tödtling et al.'s (2009) categorisation of types of knowledge interactions.

Visions and motives for future CB knowledge interactions with SD

According to Jan Petersen: "*There could of cource be more Danish patients that cross the border to become served at our place*". Even though he would like to increase market relations to Denmark, he explains to neither be willing to open a subsidiary in Denmark nor to offer delivery services to Danish hospitals. In the case that professional in-firm training courses would be accredited and coordinated among the German and Danish educational institutions, Jan Petersen could imagine to employ and train a Danish student to become orthopaedic technician.

Perceived CB differences forming potentials and obstacles

Jan Petersen points to a strong difference regarding the retail organisation of medical equipment in Germany and in Denmark. While in Germany medical equipment stores are private, they are public and affiliated with hospitals in Denmark. Thus, there are no potentials for business-alliances. Further, there are no health care insurances in Denmark, compared to Germany, which creates a difference in regard to price regulation. Jan Petersen explains that within recent years the German health care insurances put massive pressure on prices, non-regarding quality issues. This decreased price level and the strong Danish currency have the effect that the German market provides cheap medical equipment products for the Danish. Against this background, Jan Petersen perceives the Danish as financially strong and potentially attractive customers. He adds that Danish customers told him that the service quality is much better at his Sanitätshaus, than in Denmark. However, it is problematic for Sanitätshaus Thiel und Scheld to acquire more customers without opening a new subsidiary in Denmark, as geographical distance between Flensburg and the SD more densly populated places (e.g. Aaabenraa and Sønderborg) is perceived as too far away and time consuming for patients to commute, and for the Sanitätshaus to offer a constant delivery service. However, Jan Petersen demonstrates that it is not profitable to open a subsidiary, as it would cost time and money, it would require skilled Danish speaking employees and more knowledge about Danish

regulations and institutions. In this regard, Jan Petersen states "*I assume the Danish state to not be very interested in private businesses to open medical stores. Furthermore, we would depend on those Danish patients that willingly agree to become served from a German retailer. This is a risky situation*". When it comes to language, Danish does not create a main barrier, since Sanitätshaus Thiel und Scheld employs some Danish speaking workers. But rather English deficiencies hamper engagement in for instance CB virtual networking.[20]

Perceived factors favouring CB knowledge interactions

- ✓ Potential business opportunities, as German prices are attractive for Danish customers (high functional proximity)
- ✓ Active communication with customers is facilitated through Danish language knowledge (high Danish language proximity)

Perceived factors inhibiting CB knowledge interactions

- ○ Spatial distance hampers spontaneous face-to-face meetings with customers (low relative geographical proximity)
- ○ Strong differences concerning the institutional set-up (private/public medical stores) (low formal-institutional proximity)
- ○ Active communication with CB inititative like HANC is inhibited due to deficiencies in English knowledge (low English language proximity)

5.7 SOVENTEC GMBH …

Interviewee: Kai Diercks, owner/ managing partner; Christina Bober, business manager

… is a provider of software solutions for the life science and medical engineering industry. The firm was founded in 1999 in a NSH village called Dannewerk and employes five persons at present. Soventec provides custom-tailored software services that support manufacturing and quality management processes of medical engineering and life science firms and institutions. In addition Soventec sells the in-house developed laboratory software platform LabOS.[21] Christina Bober describes Soventec as innovative and indicates that reasoned by low half-life of knowledge within the software sector, the firm needs to be at the innovative knowledge forefront. Soventec's customers are mainly German, but some business contacts also range to Switzerland and Great Britain.

Nature of Soventec's present knowledge linkages

So far, there are no CB knowledge interactions to *health business* actors in the SD region. However, Soventec acquired some knowledge about the Danish business context when visiting the Life Science cluster organisation 'Biopeople' that is

[20] The HANC network communicates at the virtual level only in English.

[21] LabOS is primary applied in the context of biobanking.

located in the Copenhagen Metropoliton area. Besides, Kai Diercks is informally gathering with southern Danish entrepreneurs in a CB twinning-initiative.

Table 9 illustrates the result of an analysis of Soventec‘s present knowledge linkages sorted on the basis of Tödtling et al.’s (2009) categorisation of types of knowledge interactions. Soventec is engaged in all four different types of knowledge interactions. In order to be innovative and stand at the knowledge forefront, the firm particularly pays attention to accumulate new knowledge and contacts through active informal networking, and co-development with Fraunhofer research institute. These dynamic learning interactions take prevalent place within the Schleswig-Holstein region. Soventec’s technological knowledge stock is specialised in software-hardware bridging solutions for biobanking, but can also be adopted to related needs of life science and medical engineering actors. This might reason why Soventec holds rather many weak ties to actors applying a related knowledge stock, than simply being connected to a specialised group of actors by strong ties and interdependencies. According to Soventec, from time to time personal meetings are of great significance, also in regard to market relations. Soventec emphasizes the need for mutual cognitive and cultural understanding, implying the need for trust-based relations. Many business contacts have been established on the basis of word-of-mouth recommendations and the personal social business network.

Table 9: Present knowledge interactions of Soventec GmbH, sorted on the basis of Tödtling et al.’s categories of types of knowledge interactions

market relation	**collaboration**
customers: ▪ medical engineering firms ▪ R&D institution: Fraunhofer Institut	R&D collaboration: Fraunhofer Institute
spillovers and knowledge externalities	**informal networking**
management consultant participation in: ▪ fairs/ conferences ▪ ***CB twinning-initiative of entrepreneurs (‘ Economic seniors’)*** ▪ ***Chamber of Industry and Commerce Lübeck (organized a visit to the Life Science cluster ‘Biopeople’ in Copenhagen)***	active member in network organisations: ▪ Life Science Nord e.V. (cluster organisation) ▪ ‘Economic seniors’ social media networking, e.g. Xing personal social business network

Visions and motives for future CB knowledge interactions with SD

The Soventec managers aim at increasing informal networking with Danish life science actors in order to get to know potential business partners. They are also potentially interested to participate in CB professional and result-oriented working groups, to employ Danish trainees and to visit professional fairs in Denmark. These kinds of interaction are viewed at as potential knowledge sources

to follow the trend and observe the market. A main potential of future CB knowledge interactions lies in preparative informal knowledge interactions and subsequent market relations.

Perceived CB differences forming potentials and obstacles

For Soventec, the main current barrier for further development of formal and informal CB knowledge interactions is a deficiency in knowledge about concrete Danish business and knowledge actors within the life science and medical engineering sector. Furthermore, they assume that there are sandtraps and that they "*could commit a blunder*", as they imaging the Danish business culture to slightly differ from the German. In regard to the level of cognitive differences to Danish businesses and knowledge institutions, they assume the Danish technological environment and competence level to be very high and complementary to Soventec's stock of knowledge. The interviewees assess the Danish market as providing potential business opportunities and suggest that there is a demand for the products developed by Soventec. The five Soventec employees all speak English in a highly proficient way, but they do not speak Danish. According to Kai Diercks, English is the usual business language, and in consequence this 'lack' of Danish skills does not constitute a barrier to formal knowledge interactions. But he acknowledges that: "*It would be nice to know a litte Danish, as some kind of a handsome gesture, as many Danish people know German, too. It is not allways about hard facts at the beginning of a business conversation*". When it comes to the spatial context, they point out that in software sector "*distance does not matter*", but they also emphasize the necessity to meet personally from time to time when developing a custom-tailored software solution, be it (social) business partners or R&D institutions.

Perceived factors favouring CB knowledge interactions

- ✓ Potential complementary knowledge stock and competent technological environment (high cognitive proximity)
- ✓ Potential business opportunities, demand for Soventec's services (high functional proximity)
- ✓ Potential good communication, through high level of English of the Danish people (high language proximity)

Perceived factors inhibiting CB knowledge interactions

- ○ Low level of CB knowledge[22]
- ○ Slight difference in business culture and no Danish language knowledge (medium informal institutional proximity)

[22] Soventec notably does not differ between CB potential knowledge interactions at the CB regional level (SD) and the CB national level (whole Denmark).

5.8 VENDLET APS, …

Interviewee: Peter Maindal, owner and business manager

… located in Aabenraa – Denmark, is an innovative business within the production of durable medical equipment. Vendlet is specialised in the development of an electro-mechanic patient-turning system for bedridden patients and the only provider of this system in the world. The patient-turning bed was developed and commercialised in 1983 by a Danish technician, whose daughter needed care. In 2010 Peter Maindal brought the company and professionalised the business. Additionally to the patient-turning system, 'positioning cushions' and incontinence sheets have been developed by Vendlet.

Nature of Vendlet's knowledge linkages

Vendlet sells its products to hospitals, health educational institutions and care homes in Scandinavia, the Netherlands, the United Kingdom and even to Australia and New Zealand. In Denmark Vendlet additionally provides services around the patient-turning system as free trainings. So far Vendlet is not linked by market relations to German health actors, but a collaboration with a German Fraunhofer research institute has been recently initiated by the medium of the Danish cluster organisation Welfare Tech.

Table 10: Present knowledge interactions of Vendlet ApS, sorted on the basis of Tödtling et al.'s (2009) categories of types of knowledge interactions

market relation	**collaboration**
customers: ▪ care homes ▪ hospitals ▪ elderly patients ▪ 'health school' suppliers	collaboration with educational institutions, e.g. free training services ***R&D cooperation: Fraunhofer Institut 'Ambient Assisted Living Technology'***
spillovers and knowledge externalities	**informal networking**
visiting fairs	active membership in cluster/network organisations: ▪ cluster organisation 'Welfare Tech' ▪ branch association 'Danish Rehab Group' ▪ and others ***personal social business network***

Table 10 illustrates the result of an analysis of Vendlet's present knowledge linkages sorted on the basis of Tödtling et al.'s (2009) categorisation of types of knowledge interactions (see chapter 2.2). Vendlet mainly exploits in-house professional knowledge and is strongly engaged in diffusing both knowledge about its innovative patient-turning system but also knowledge about professional care and 'ambient assisted living technology'. All four types of knowledge

interactions are activated in this regard. However, Vendlet also searches for external business knowledge and key actors to identify business opportunities and distribution channels. In the Danish context, Vendlet is highly engaged in interactive networking. Thus, for instance, business relations with 'public health schools' are coupled with trainings and seminars. Peter Maindal's informal network is characterised by various weak ties to actors of the Danish health market, health care system and supportive institutions (e.g.Welfare Tech). This means that Vendlet is highly embedded in the national context.

Visions and motives for future CB knowledge interactions with NSH

Peter Maindal is willing to enter the German market by means of a German business cooperation partner, as he experienced great difficulties in negotiation processes in the past. Hence, on the basis of informal networking and contact making, he searchs for the right business partner. The initiation of CB regional supplier relations depends on the suppliers quality-price level, and is thus within the realm of possible. In line with established customer-relations, he could also imagine to offer professional trainings about 'ambient assisted living technology'.

Perceived CB differences forming potentials and obstacles

According to Peter Maindal, the demographic change offers great business potentials in countries like Germany, where much more inhabitants live than in Denmark and where purchaising power is well. The Vendlet manager observes the German market intensively. His very good German language proficiency is helpful in this regard. He identified three great differences between Germany and Denmark that constitute barriers to his eagerness in entering the German market. First, he claims that in German care institutions professional knowledge and qualification is less appreciated and premised than in the Danish context. Second, he perceives the German care culture to be behind one's time, as "*It is still the polish low paid women that gives care*". According to Peter Maindal, "*German care institutions don't pay attention to workers protection, to issues of dignity and cost savings through mechanic handling – Important is that it is cheap! That is how it has been in Denmark 30 years ago.*" As third and most critical difference, he points towards the different structure of the German and Danish health care and reimbursement system. While in Denmark the municipalities pay all expenditures, in Germany there are more than 300 health insurances that more or less negotiate with medical stores and dictate prices. Peter Maindal describes that these institutional differences make it nearly impossible for Danish medical equipment producers to find the right distribution channels, partners and niches. This is why he aims at finding a German established business partner, who knows the right distribution channels and who is well-known. He also indicates that low English proficiency of many Germans is critical for many other Danish firms, as less Danish people learn German language recently. Language became a problem for his business once, too, as a potential German cooperation partner neglected to sign an English written contract, due to juristical uncertainties.

Perceived factors favouring CB knowledge interactions

- ✓ Potential business opportunity due to demographic change and subsequently demand for qualitative care products (high functional proximity)
- ✓ Potential very good communication due to high level of German and English proficiency (high language proximity)
- ✓ Good level of CB knowledge about German market, culture and institutional set-up

Perceived factors inhibiting CB knowledge interactions

- ○ Strong differences between the Danish and German health care and reimbursement system (low formal institutional proximity)
- ○ Strong differences between the Danish and German care culture (low informal institutional proximity)
- ○ Moderate differences in knowledge stock of Danish and German care professionals (medium cognitive proximity)

6 Discussion

Chapter 6.1 combines the seven case study analyses and provides an answer to the research question underlying to this thesis as proposed in chapter 1. The following sections comprehensively discuss, amongst others, the firms' present knowledge interaction's impact on future potential knowledge interactions, and the relation between the different existing CB knowledge interactions and the types and levels of perceived CB differences.

6.1 Comprehensive Analysis and Discussion

Present knowledge interactions impact on future potential knowledge interactions

When comparing the seven case study firm's existing Danish-German and SD – NSH knowledge interactions in line with the firm's view on future knowledge interactions, some pattern reveal (see table 11, columns to the right; see appendix F for more detailed information).

Those firms that neither hold Danish-German nor SD – NSH knowledge interactions (see Eschweiler and Frictionless), are also not interested in the initiation of CB knowledge interactions. Eschweiler's supplier relations are neglectable in our discussion, as they are rather cost-driven. Both firms have in common that they act dominantly international and that they are niche suppliers either in regard to knowledge base or market base.

The other five firms are either linked to CB national or regional actors. With exception of Sanitätshaus Thiel und Scheld, they are willing to actively increase knowledge interactions across the Danish-German border. They particularly aim at the initiation of market relations, backed-up by informal networking.

Medisat and Vendlet show some similarities. Both firms act as innovative entrepreneurs, spreading innovative knowledge about a new technology to merchandise their products (telemedicine and intelligent medical care) and both are mainly embedded in the regional and national Danish settings, reaching out to other nations recently. They are actively searching for health care market knowledge and contacts by informal networking. To ease the development of market relations, they already are, respectively are willing to involve in formal collaborations. They are not only engaging with knowledge exploiters, but also with knowledge generators respectively diffusers.

The other three firms show rather individual patterns. Sanitätshaus Thiel und Scheld, which is strongly locally embedded in regard to its customer base and nationally in regard to other knowledge linkages, already holds some Danish customer relations. However, the Sanitätshaus does not aim at activily increasing CB knowledge interactions, but rather maintaining existing ones. In contrast to that, Innovision's static knowledge interactions are globally oriented, but also

include existing linkages to national German, but not NSH actors. Against this background, Innovision is potentially interested to also engage in market relations in NSH too, supported by informal networking linkages. Of these five firms, being interested in CB knowledge interactions, Soventec holds the weakest ties to actors across the border, still looking for knowledge, contacts and potentials customers.

Different types and levels of perceived proximities impact on present and aspired CB knowledge interactions

It remains to elucidate why some firms are interested in further development of CB knowledge interactions, and why others are not. The obversation that there is a relation between present knowledge interactions and the interest to more deeply engage in CB knowledge interaction, does not serve as an explanation. The results of the more sophisticated analysis provide causal explanations and show that it is rather the type and level of perceived proximity that may provide a more advanced understanding.

case study firms (y)	**CB know-ledge**	**level of perceived proximity (x)**						**present German/ Danish KI**	**present SD-NSH KI**	**interest in SD – NSH knowledge interaction**
		functio-nal	**cogni-tive**	**CB geogra-phical**	**formal institu-tiona**	**informal institu-tional**	**lan-guage**			
Frictionless	very low	low	low	n.i.	n.s.	**high**	**high**	none	none	none
Eschweiler	low	low	n.s.	n.i.	n.s.	**high**	**high**	none	(supplier relation)	maintaining
Sanitätshaus Thiel und Scheld	medium	**high**	n.s.	low	low	**high**	**high**	none	few customer relations	maintaining
Soventec	very low	**high**	**high**	favouring	n.s.	medium	medium	spill overs /ext.	spillovers/ ext.	customer relation, informal networking
Medisat	medium	**high**	medium	favouring	low	Low*	medium	spillover/ ext.	informal networking	customer relation, informal networking
Vendlet	**high**	**high**	medium	favouring	low	Low*	**high**	collabo-ration	informal networking	customer relation, collaboration, informal networking
Innovision	medium	**high**	medium	n.i.	n.i.	Low*	**high**	customer relation	none	customer relation, informal networking

Table 11: Compact overview of the case study's perceived proximities (to business actors), present and aspired CB knowledge interactions (author's illustration, 2014).

n.s. = no statement,

n.i. = no impact,

ext. = externalisiert,

KI = knowledge interactions

* low informal institutional proximity refers to strong differences in cultural background in a professional setting (e.g. care culture)

Table 11 presents, in a highly aggregated way, an overview of the seven interviewed firm's level of CB knowledge, perceived proximities and present as well as potential CB knowledge interactions within the SD – NSH region (see appendix F and appendix G for more detailed analytical information). The data provided for functional and cognitive proximity are only related to differences in regard to actors of the business dimension (see appendix G for details about actors of knowledge infrastructure dimension). In the table, low levels of various proximities are coloured and high levels of proximities are highlighted by means of bold script.

When studying the table, it becomes obvious that a firm's perception of a potential business case across the border is crucial for the initiation of all kinds of knowledge interactions. Thus, it can be easlily explained why *Frictionless and Eschweiler* do nearly hold any CB knowledge interactions, and furthermore, why they are not interested to establish CB knowledge interactions. For instance, Frictionless does neither perceive any cognitive nor functional proximity with business actors in the SD region. All firms that assume that there is a potential business case across the border, perceive high functional proximity and are engaged in certain Danish-German or SD – NSH knowledge interactions. Following the results of the analysis, the main factor inhibiting and favouring CB knowledge interactions is **functional proximity.**

It is reasonable to further inteprete the perceived level of cognitive proximity, as crucial for the inititation of knowledge linkages, which is highly aligned to functional proximity. In line with statements of the literature about the significance of cognitive proximity for knowledge interaction (see e.g. Boschma, 2005), it is meaningful to argue that there is a strong interdependency between a perceived business opportunity and the inter-actors absorptive capacity of provided goods and services respectively knowledge. Thus functional and cognitive proximity goes hand in hand to a certain degree. All the interviewed Danish firms sense greate business opportunities in Germany, and describe existing cognitive differences to a certain level. Thus for instance, Medisat holds innovative telemedicine knowledge, Vendlet provides innovative care knowledge and Innovision offers novel knowledge for medical examination for cardic patients. These innovative services and products do not exist in Germany, but there are many potential business actors that hold related knowledge. Patients need care in Germany, too. Cardiac diseases are treated in Germany, too. In contast, when having a closer look to the Frictionless case, there is according to Frictionless no firm in Denmark holding endoprosthetic implant specialised knowledge. This means that a **related cognitive proximity** is sufficient to act as a factor favouring CB knowledge interactions, but also that too much cognitive distance inhibits firms to perceive business cases.

The here presented analysis is embedded in a predefined spatial setting, the SD – NSH CB region. The results of the analysis show that firms mainly perceive this geographical level of distance as non-decisive for the initiation of knowledge interactions. While talking to the interviewees, repeating that this study is about

the SD – NSH region, it became clear to me that the firms do not much identify with these administrative definition of what is 'CB regional'. The term CB knowledge interaction was rather interpreted as general German-Danish interactions. For those firms, being internationally involved in informal networking and market relations, the CB region carries nearly no weight (see Frictionless, Innovision, Eschweiler). And for those firms being mainly embedded in the Danish or German national setting, geographically proximity to the region across the border, is perceived as favouring knowledge interactions as personal meetings from time to time are easilier realised (see Medisat, Vendlet and Soventec). For *Sanitätshaus Thiel und Scheld* the case is quite different. As the Sanitätshaus is strongly tied to the local customer base, the geographical distance to more densly populated areas in SD is perceived as too far. In this case, perceived low relative **geographical proximity** acts as main factor to inhibit increased CB knowledge interactions.

Next, I suggest the **level of knowledge about the CB region** to be crucial for the development of knowledge interactions. This becomes particular clear in the *Soventec* case. Soventec perceives no strong differences that serve as insuperable barrier for CB knowledge interactions. Still, they are only linked by some static and informal linkages to actors in the SD region, so far. This is reasoned by Soventecs low level of knowledge about the SD region. To reach out to Scandinavia is a rather recent attempt of **path creation** that is 'hampered' by Soventec's **path dependent** already existing efficient knowledge linkages to other regions. Also Eschweiler's and Frictionless' behaviour is influenced by path dependency, as they point out that as long as existing linkages are fruitful and profitable, they see little reason to change business routine.

In regard to *Medisat, Vendlet and Innovision* another type of proximity acts as main factor inhibiting efficient CB knowledge interactions, namely **formal and informal institutional proximity**. Particularly the Medisat and Vendlet cases are characterised by good levels of functional and cognitive proximity favouring knowledge interactions. But they face problems due to differences in the German and Danish health care system, ways of treatment and care culture/routine. Against the background of a potential good business case, these firms are actively searching for knowledge linkages that help to bypass these differences. Especially informal networking is significant in this regard, but also forms of formal collaboration. The data also reveal that interactive communication is eased through language knowledge of the CB region. Thus for instance, Innovision and Vendlet seem to have a leg-up on Medisat, as they are able to interactively communicate with the CB actors in native language, as both hold formal knowledge interactions.

Proposal of specific order between types of knowledge interactions

Against the background of inductive analysis of the interview material, I sifted a specific order between the four types of knowledge interactions that firms are engaged in, when willing to establish CB business relations (see figure 4). There

are indications that point out that business relations are initiated by informal and static knowledge transfer about potential business cases. Key target of the firms is to get involved in profitable market relations. In order to get access to these, firms engage in informal networking and collaboration. If a firm got interested, it actively searches for personal contacts and more knowledge to both accumulate more tacit knowledge and to learn, but also to diffuse knowledge about its services and products. Through informal networking involved actors interactively learn about each other and identify synergies. In cases, where it is hard to get access, but also to absorb the received knowledge efficiently (due to cognitive and institutional differences), collaborations are initiated. Collaborations enable the firms to interact more focused and trustbased. In collaborations both partners need to adapt to the situation of the partner and decode and contextualise the received knowledge collectively. Thus, differences are bypassed or removed. The newly learned knowledge builds the foundation for a potential innovative business case.

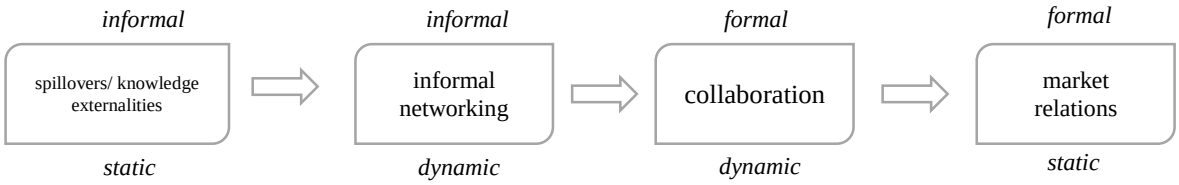


Figure 4: Specific order between types of knowledge interactions (author's illustration, 2014)

Observed relation between type of existing and aspired CB knowledge interactions and type and level of perceived differences (proximities)

It showed to be crucial for the firms to seek for market knowledge and contacts to make profit and to search for complementary technologically knowledge in order to be competitive. These sourcing mechanisms for external knowledge differs between the case study firms, as described in the single case analysss on nature of knowledge linkages in chapter 5. In the following an observation made, when comprehensively analysing the seven case studies regarding potentials and obstacles for CB knowledge interactions with actors of the business dimension, is presented. The results of the analysis indicate that there is a relation between the perceived type and level of proximity and type of existing and aspired CB knowledge interactions (Danish-German and SD – NSH) to actors belonging to the business dimension (see chapter 2.3 RIS approach). Figure 5 schematically illustrates the observed relation. Along the x-axis (→) the seven case study firms are lined up in a specific order that depends on the level of existing and aspired type of knowledge interactions across the border (both SD – NSH and Danish-German linkages are considered. This order is arranged in line with the proposal presented above (see figure 4).

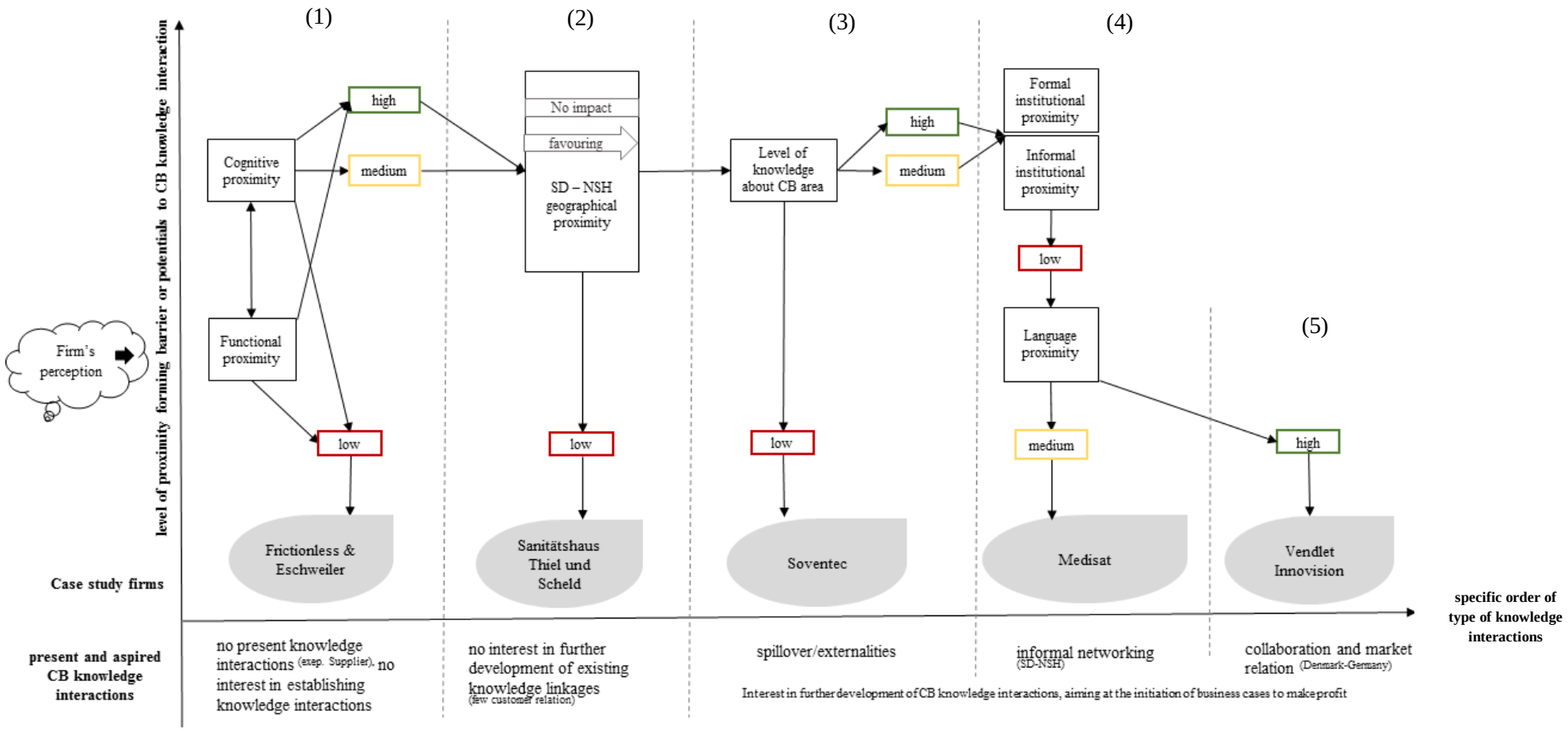
To the left Frictionless and Eschweiler are named, who hold nearly respectively no current knowledge interactions, and are neither interested in further development of CB linkages. To the right Vendlet and Innovision are presented,

which currently hold formal knowledge linkages across the border. Inbetween these opposing levels of CB knowledge interactions, the other three firms are separately placed. More to the left, Sanitätshaus Thiel und Scheld, which is not interested in actively further developing exiting CB knowledge linkages, and more to the right, those that are willing to develop CB knowledge linkages. Thus a specific order along existing and aspired level of CB knowledge interaction is constructed.

Above, corresponding to the order of case study firms, the most important feature that is perceived as barrier by the seven case study firms, is presented and set in relation to them. A sort of filtering mechanism reveals. Important to acknowledge is that the presented findings can only be related to the case studies so far, but they could also act as foundation of hypothesis development and testing. In the following the observed relation, which is illustrated in figure 5, is briefly summarised.

(1) ***Functional and cognitive proximity:*** Low levels of functional and cognitive proximity act as exclusion criteria for all kinds of knowledge interactions. Medium and high functional and cognitive proximity correlate with the initiation of CB knowledge interactions.
(2) ***Geographical proximity:*** Low level of relative geographical proximity inhibits the (further) development of existing knowledge interactions. Besides good levels of geographical proximity have either no impact on the perception of a barrier, or favour the development of CB knowledge interactions.
(3) ***Level of knowledge about the CB region***: When there are good levels of cognitive, functional and geographical proximity, the level of knowledge about the CB area is critical for the type of CB knowledge interactions. A low level forms an obstacle to the engagement in knowledge interactions that are either formal or highly interactive. This applies to the Soventec case, where spillovers notwithstanding initiate interest to further develop CB knowledge interactions.
(4) ***Informal and formal institutional proximity:*** In those cases where the three mentioned proximities (including the level of knowledge about the CB region) are medium and/or high, informal and formal institutional differences across the border become crucial, as low levels act as barriers to the initiation of market relations. In order to overcome these differences informal networking is deployed.
(5) ***Language proximity:*** High levels of language proximity, and thus facilitated active communication, seem to support formal knowledge interactions, in addition to informal networking.

Figure 5: Descriptive illustration of the relation between type of existing and aspired knowledge interactions and perceived level of different proximities (author's illustration, 2014)



Further analysis showed that the interviewed firms are merely not interested to engage in CB knowledge interactions with *actors of the knowledge infrastructure* dimension (see appendix G). This cannot be comprehensively discussed in this paper, due to limitations of the length of the thesis. But is can be pointed out that those firms that already hold knowledge linkages to R&D institutions or students (see Eschweiler, Medisat and Innovision) are not interested to engage in further linkages to knowledge generators, as they feel well served. These existing linkages also exhibit at rather local spatial pattern – not a cross-regional pattern, which goes in line with observations made by other researchers (cf. e.g. Simonen and McCann, 2010; Koschatzky, 2000; Maggioni and Uberti, 2008). Theoretical concepts of path dependency and the favouring role of spatial proximity for the exchange of tacit technological knowledge explain this pattern fairly well.

Perception differences among German and Danish health business firms

The desk research and selection proceeding of the seven case study firms that underly to this thesis, already indicated that there are differences in economic and knowledge specialisation of firms in the SD and NSH region (see also chaper 3.3 and 4.2). This specialisation seems to have impact on existing and aspired CB knowledge interactions. The interviewed NSH health business firms are much less interested in CB knowledge interactions than the SD health business firms. Medisat, Vendlet and Innovision (SD) search for market relations that reach across the Danish-German border, facilitated by informal networking and collaboration. Common to these firms is also that they hold rather innovative knowledge, products and services that are rather new to the market, and can be potentially exploited all over the world. Geographical promitity to the NSH region does not play a crucial role, but rather closeness to the whole German market. The firms do not particular differenciate between the CB region and the whole German territory. It seems to be rather the case that differences in size of potential market base is facilitating CB knowledge interaction. 80 million German inhabitants, compared to 5 million Danish inhabitants seem to have an appealing effect. In contrast the small Danish market seems to be less attractive for the interviewed German firms. There are indications for less variety of existing health business sectors in Denmark. Furthermore, the interviewed NSH firms are strongly embedded in a specific sector (SIS).

6.2 Critical Discussion on Method and Data

This thesis applies an abductive research approach, combining established theory and empirical interpretations to investigate factors inhibiting and favouring different types of CB knowledge interactions. In line with critical realist thinking, questioning ‘what causes an event to happen’, this thesis searches for knowledge about the agent, which is engaged in the event of knowledge interaction – here health business firms – and for mechanisms and relations that influence the initiation and development of CB knowledge interactions. Data about the health business firms have been produced in in-depth interviews by questioning the

subjective perspective of the firms, which is decisive for the engagement in CB knowledge interactions. This empirical database allowed to search for mainly subjective causal explanations. The analysis of the data has been structured along existing theory, which provided a preunderstanding of factors that are assumed to have impact on the development of CB knowledge interactions. Hence, the firm's perception of CB regional differences has been analysed and structured against the background of different types of proximities, and the firm's existing knowledge interactions have been categorised along Tödtling et al.'s (2009) conceptualisation.

This approach is limited by some issues that are related to the combination of theory and empirical data. When applying abductive reasoning to explain a phenomenon, the assumptions provided by existing theory enable the researcher to structure the search for explanations. On the one hand, this facilitates the research process, but on the other hand, this also imposes restrictions to the investigation. In this thesis the research question itself explicitly narrows the search for causal explanation in order to understand perceived obstacles and potentials for CB knowledge interactions. Even though I argue that the theoretical approach on differing proximities is meaningful to apply and helpfully to understand individual economic agent's behaviour, I suppose that the focus on proximities and distances, acts as cognitive boundary for a researcher approaching to the critical realist thinking. The researcher (me) potentially overlooks other structures and mechanisms that could have impact on the development and initiation of CB knowledge interactions.

This study covers mainly the perception of the interviewed firms on CB differences as well as the analysis and interpretation of these perceptions. Contextual information about the interviewed health business firms is not indeptly and comprehensively studied in this thesis. A more sophisticated research about the environment that the firms are embedded in could serve as a foundation for abstractive causal explanations. In this thesis the focus is merely on subjective reasoning of individual firms. In the single case analysis these firms are only contextualised to the environment in which they are embedded in to a certain degree.

Furthermore, this thesis' investigation does not provide insights about factors that might influence a firm's specific perception of the environment. Particularly internal features of the firms that potentially have impact on decision-making concerning knowledge interactions, have not been comprehensivly studied. It has not been purpose of this thesis to explore internal factors of firms that form obstacles and potentials for CB knowledge interactions, but it could be a meaningful extention in further investigations. Besides, this thesis did not pay attention to organisational and social proximity, mainly in order to limit the investigation and make it more feasible. Also, no particular attention has been paid to the kind of different actors involved in knowledge linkages, be it hospitals, universities, private businesses or cluster organisations. A more sophisticated investigation could potentially also dig into this micro-area of social relations forming obstacles and potentials for CB knowledge interactions.

In order to answer the research question, which focuses on the relation between types of CB knowledge interactions and proximities, a case study approach based on the selection of seven firms is meaningful to apply. Different illustrating cases provide a more holistic database to investigate the perception of different forms of proximity and its impact on CB knowledge interactions. It would not be meaningful to only focus on one or two cases, as no comprehensive knowledge could be gathered (see chapter 6.1). Still, the approach to focus on seven firms limits the extent of in-depth understanding of the single cases. Reducing, coding and abstracting impedes deepended comprehension of the single health business firm's views and perceptions.

Furthermore, the analysis of the interview data is dependent on the researcher's interpretation, coding and reflection upon the interviewee's statements. But also during the interviews itself, the researcher acts a driver towards the general topics that are assumed to have impact on the research question. Even though the qualitative method allows for a rather high degree of flexibility, the interviews are limited regarding the extent of in-depth digging into a case, particularly due to time restrictions. This hampers the development of a common understanding between interviewee and researcher.

The here presented results of analyses are highly dependent on the researchers interpretation of the empirical data. This particularly applies to the categorisation of existing knowledge linkages along four types of knowledge interactions, the level of perceived proximity (high, medium and low) and the analysis of what type of proximity is most decisive to act as barrier or potential. For example, I propose in the comprehensive analysis that for Sanitätshaus Thiel und Scheld geographical distance, not low institutional proximity, acts as the most decisive barrier that inhibits further development of CB knowledge interactions (chapter 6.1). This is derived from Jan Petersen's emphasis on this issue during the interview. This thesis paper does not provide general access to the interview transcripts and thus to the original data. This might cause difficulties for the reader to follow my sifting, sorting and interpretation of the data.

I need to add that my understanding for issues like transfer of tacit knowledge and collective learning increased highly while carrying out the interpretation and analysis of the collected data and that it was restricted during the phase of collecting empirical data, even though I had read many theoretical papers before. This had impact on the type of follow-up questions asked, the quality of information as well as subsequent the sifting and sorting of the collected data. Retrospectively I suggest that another approach of the research design could potentially be more appropriate. It would have been helpful if the interviewees reflect upon my interpretations. This would be most feasible to do in a second face-to-face meeting. This reflection meeting would also allow more detailed questions that have been missed out in the first interview. However, such a more sophisticated research design would have required more time and financial resources.

7 Conclusion and Contextualisation

The aim of this thesis is to shed light on factors inhibiting and favouring different types of CB knowledge interactions (defined by Tödtling et al., 2009). The theoretical concept of non-spatial proximity served as analytical foundation and the (subjective) causal explanation perspective as methodological guide to answer the question. As the results of the single case and comprehensive analyses show, this research approach accomplished the investigation of potentials and obstacles for different kinds of CB knowledge interactions, non-regarding the above outlined limitations and potentials for more sophisticated and related research.

The single case analyses on the seven interviewed firms facilitated the identification of the firm's visions and motives on future CB knowledge interactions in the SD – NSH region. Furthermore, the perceptions, experiences and views about differences of the CB region are analysed along functional, cognitive, geographical, formal and informal institutional proximity as well as the level of CB knowledge.

The comprehensive analysis allowed to bring the single case analyses results together. It revealed that there is a correlation between the existing type of knowledge interactions and the aspired ones. This needed to be explained. In line with the chosen research approach, the firm's perceptions of different types and levels of proximities were set in relation to the firm's existing and aspired types of CB knowledge interactions. The results of the analysis indicate that particularly the level of perceived functional and cognitive proximity (which seem to be interdependent) act as decisive factors for the initiation and development of CB knowledge interactions in general. Further inductive analysis identified a specific sequence of the four types of knowledge interactions (see figure 4). This order of types of knowledge interactions that firms seem to engage step-by-step in order to get access to potential business cases, served as basis to construct a sort of classification of the seven case study firms. This order than was related to the finding regarding the type and level of proximity that act as main barrier, for the individual firm. The results of this highly inductive and descriptive analysis show what kind and level of proximity form obstacles and potentials for different types of knowledge interactions.

It needs to be questioned how the presented results can be claimed to be warranted knowledge. I argue that particularly the single case analyses facilitate a comprehensive understanding of the specific interviewed firms CB knowledge linking behaviour. The findings cannot be generalised, but could potentially act as input for an extensive study, based on more standardised questionaries, covering e.g. type, spatial range, intensity and motives of CB knowledge linkages more organised. The necessity to reduce information and to categorise these is problematic in regard to the presentation of the analysis of the single cases. This potentially limitates the correctness of the presented findings.

Concerning the comprehensive analysis, it needs to be emphasized that all knowledge generated through correlating a firm's perceived CB differences and

existing as well as aspired knowledge interactions, highly depend on the selection of the individual firms. The findings could potentially differ, when repeating the inquiry on the basis of seven other firms. No comprehensive knowledge can be provided to contextualise these findings proficiently. Thus I also decide to not discuss policy implications.

Still, some indications that go beyond the scope of the research question are meaningful to point out. The investigation of this thesis roots in the emphasis of politicians to enhance regional CB knowledge interactions in order to strengthen the CB regions innovation capacity (see Die Grenzregion Syddanmark-Schleswig-K.E.R.N., 2007). This means that the spatial focus on CB regional interactions and also policy support to this administratively constructed area is imposed upon the individual actors within the region. The interviewees mainly did not identify with the SD – NSH region. This thesis has not put much emphasis on knowledge linkages between the business dimension and the knowledge infrastructure dimension, but the single case analyses provide some indications on the rather local or regional (within one national territory) ties of firms to knowledge generators and diffusers. In contrast, market linkages exhibit a rather long-range spatial pattern. These observations go hand in hand with the literature (see e.g. Tödtling et al., 2009). There are also indications that, particularly in the health context, the NIS – in which firm's are embedded in in regard to informal and formal institutional settings, plays a more decisive role than the regional-IS.

It also showed to be crucial for all firms to engage in personal meetings. These are mostly carried out in time-to-time meetings, but varying dependently on the actor involved and type of knowledge interaction. All seven health business firms pointed out that policy-driven attempts to enhance CB knowledge interactions should pay attention to this by facilitating personal meetings. In relation to this, the majority of the firms claimed virtual CB networking unrewarding. This issue will not be further discussed in this thesis paper as it is too specific in relation the the research question. The in-depth interviews also covered some, here called excursion topics. The results of the analysis of these excursions topics, about the firm's views on issues like CB virtual networking but also specified needs for support, will be presented to the HANC project manager separately from this thesis paper.

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Appendices

Appendix A: Interview guide (author's illustration, 2014)

Instructions to the formulation of questions

- Clear and open-ended wording
- Questions have to be asked one by one
- Careful about asking why questions! (could sound critically)
- Use: Who, What, How-questions
- Ask for experiences: descriptive
- Ask for explanations: descriptive and normative
- Neutral wording – Don't influence the focus and opinion of the interviewee
- Use follow-up questions!
- Q = Question

Introduction

- Presentation of research background and myself
- Aim of the interview
- Confidentiality of data
- Question for recording

Topic 1 - General description of the firm and general information about the interviewee

- Q *Could you first tell me about what your firm does and what you do?*
  - Q Firm should describe themselves! The following information should be covered: Services/ product, historical milestones, number of employees, location of firm
- Q "*Please, describe how your firm has been / is innovative!"*
- Q *"Please, tell me about knowledge background of your employees!"*
- Q *"What kind of knowledge do you need to further develop your products?"*

Topic 2 - Present knowledge linkages

- Q *"Please tell me about important linkages from your firm to external actors?"*
- Q *"How does your firm organize the search for complementary knowledge that is external to your firm?"*
  - [Potential linkages that should be asked for. But start with information provided in Topic 1 and dig into what the interviewee holds for important to tell!]
    - Q Customers
    - Q Suppliers
    - Q Competitors
    - Q Network/cluster organisations
    - Q Fairs and conferences
    - Q Virtual (knowledge) communities

- Social business events
- Reading of patents specifications, journals
- Collaboration with R&D institutions
- Collaboration with educational institutions
- Student cooperations (trainee, thesis writing)
- Technology transfer organisations
- Consultants
- Labour mobility

- *"Are there other important sources of knowledge?"*

- Characteristics about spatial range of existing link:
  - E.g.: Customer: *"As you said, you sell to the US market, are there other important customers and where are they located?"*
- Existing CB regional linkages:
  - E.g.: *"Are there maybe supplying firms from Denmark?"*
- Deepen knowledge about most important knowledge linkages:
  - *"Please describe the nature and intensity of collaboration?"*
- Questioning motive:
  - *E.g.: Trainees: "Why does your firm employ trainees?"*
- Knowledge linkages that are particular important for development:
  - *"What type of knowledge linkage is most important for your firm to develop innovative products?"*
- Personal contacts:
  - *"How important are personal business contacts for you and why?"*

Topic 3 - Present CB knowledge (linkages)

- Knowledge stock and experience:
  - *"Have you been in Denmark/Germany before?"*
    - *"Please tell me about your experiences!"*
  - *"What do you know about the Danish/German health market and health sector"*
  - *How have you experienced Danish/German in a working context?"*
  - *Are there existing CB linkages?*
    - *If yes, "how did they develop?", "What are the motives for the CB linkages?"*
    - *If no, why are there no CB linkges?*

Topic 4 - CB differences

- Projection into future
  - Business dimension*: „Is there a market for your products in SD-NSH?" "Are there business actors that your firm is interested in to be linked with in the SD/NSH region?*
  - Knowledge infrastructure dimension*: "Are there knowledge intitutions or other actors that your firm is interested in to collaborate with in Southern Denmark / NSH?"*
    - *"Please describe why the Southern Denmark / NSH region and actors located there are* ***not*** *interesting to your firm!"*
  - Formal-institutional dimension: *Could you describe any the institutional / administrative differences between Denmark and Germany?*

- *Assess the impact of these differences for CB interactions of your firm!*
- informal-institutional dimension: *Could you describe cultural differences between Denmark and Germany*
  - *Assess the impact of cultural differences for CB interaction for your firm!*
- language dimension*: Could you describe your firm's language profile and describe differences between Denmark and Germany?*

- Spatial dimension: *Please, assess the role of (geographical) distance to potential innovation partners in the NSH/ SD region for CB knowledge interactions!*

Topic 5 - Impact of differences for different forms of knowledge interactions

- Depends highly on the given answers. Questions that sort between forms of knowledge interactions, and ask if despite of the described differences that form obstacles to a particular knowledge interactions, other forms of knowledge interactions, still could be potentially developed, e.g.
  - *"Although you do not see any business opportunity in SD-NSH, would you be interested in student trainee exchange, or R&D collaboration? If yes, why? If not, why?"*

Excursion - Healthy Ageing

- Politicians and planners have identified ageing as mega trend that creates new business development opportunities for firms:
  - *"Do you see a (new) business development opportunity for your firm in regard to the growing elderly population? "*

Excursion HANC – Virtual networking in CB context

- Introduce HANC and Interreg CB cooperation efforts, before questioning.
  - *"Have you heard about HANC before I contacted you?"*
  - *"Why have / haven't you joined the online networking service HANC?"*
  - *"Do you think a virtual CB network could be helpful for your firm?"*
  - *"What functions and information's do you expect a virtual network to provide in order to join it and beneficially use it?"*
  - *"In the case you are willing to cooperate across the border, but virtual networking like HANC does not seem useful to your firm, what instrument do you think could help you? / What kind of support do you need?"*

Follow-up questions

Could you tell me more about … , please!

Do you think that …?

How have you experienced …?

Did I understand right that …?

What does this mean?

Appendix B: Research project outline (author's illustration, 2014)

(page 1)

QUALITATIVE STUDY ON:
DIFFERENCES ALONG THE SOUTHERN-DENMARK – NORTHERN SCHLESWIG-HOLSTEIN BORDER FORMING OBSTACLES AND POTENTIALS TO CROSS-BORDER KNOWLEDGE INTERACTIONS IN THE REGION?!

LUNDS UNIVERSITET

Master thesis project in Human Geography, Lund University, Sweden
Astrid Eggert (master student) supported by EU-funded Danish-German cross-border cooperation project "Healthy Ageing Network of Competence" (HANC)

SOUTHERN-DENMARK – NORTHERN SCHLESWIG-HOLSTEIN REGION

The cross-border region aims at developing a sustainable integrated cross-border health region, able to face the demographic change and strengthen regional competitiveness. In order to achieve this objectives several projects – facilitating cooperation, network development and knowledge transfer among firms, research and public institutions – are supported by the EU-funded Interreg programme IV A 2007-2013. One of these projects is "HANC".

HEALTHY AGEING NETWORK OF COMPETENCE (HANC)

HANC forms a platform for cooperation between researches, users, health care providers and companies to find better solution to serve the needs of the older adults for Active and Healthy Ageing through optimizing opportunities for physical, social and mental health.

The HANC coordinators support this research study as knowledge is needed about factors inhibiting and favouring knowledge transfer, collaboration and networking, particularly in regard to health business firms.

RESEARCH OBJECTIVE

This master thesis research project:

- aims at investigating how differences in environmental-institutional settings in the Southern-Denmark – Northern Schleswig-Holstein region are experienced and perceived by local health business firms,
- and questions if these perceived differences constitute obstacles and/or potentials to cross-border knowledge interactions of local health business firms in the Southern-Denmark – Northern Schleswig-Holstein region.

KNOWLEDGE INTERACTIONS

Firms are linked to various actors and institutions trough for instance market relations, collaboration and informal networking. Through these linkages various kinds of knowledge, information and resources are transferred, transacted and transformed. Knowledge interactions are regarded as significant preconditions to innovation activity.

CROSS-BORDER DIFFERENCES

Knowledge interactions are embedded into specific environmental-institutional settings. These settings differ along adjacent territories belonging to different nation-states and may constitute potentials and/or obstacles to (the initiation) of cross-border knowledge interactions for firms.

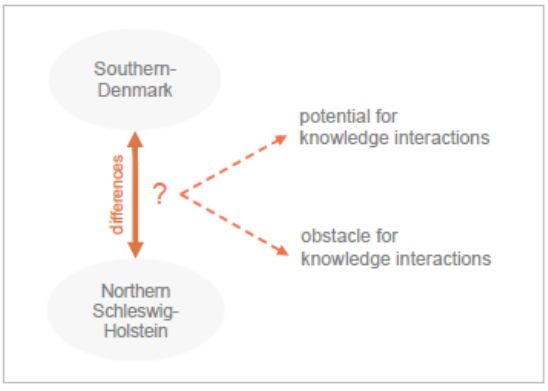

Fig. 1: Illustration of research framework

(page 2)

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Practical use of research results

The results of the thesis project may contribute to a better understanding of factors favouring and inhibiting the initiation of cross-border market relations, labour mobility, collaboration and networking in the health sector. This increased understanding may be utilized in the improvement of HANC strategies that support knowledge transfer and collective learning among actors in cross-border regions – particularly of health business firms!

EXPERIETIAL AND EXPLANATORY STORIES OF LOCAL HEALTH BUSINESS FIRMS

So far only little is known about cross-border knowledge interactions of health business firms in the Southern-Denmark – Northern-Schleswig-Holstein region.

This study applies a qualitative investigational approach to identify obstacles and potentials for cross-border knowledge interactions. In this regard experiential and explanatory stories of local health business firms on knowledge interactions and the region across the border will help to identify obstacles and potentials for cross-border knowledge interaction to local health business firms.

DATABASE: IN-DEPTH INTERVIEWS

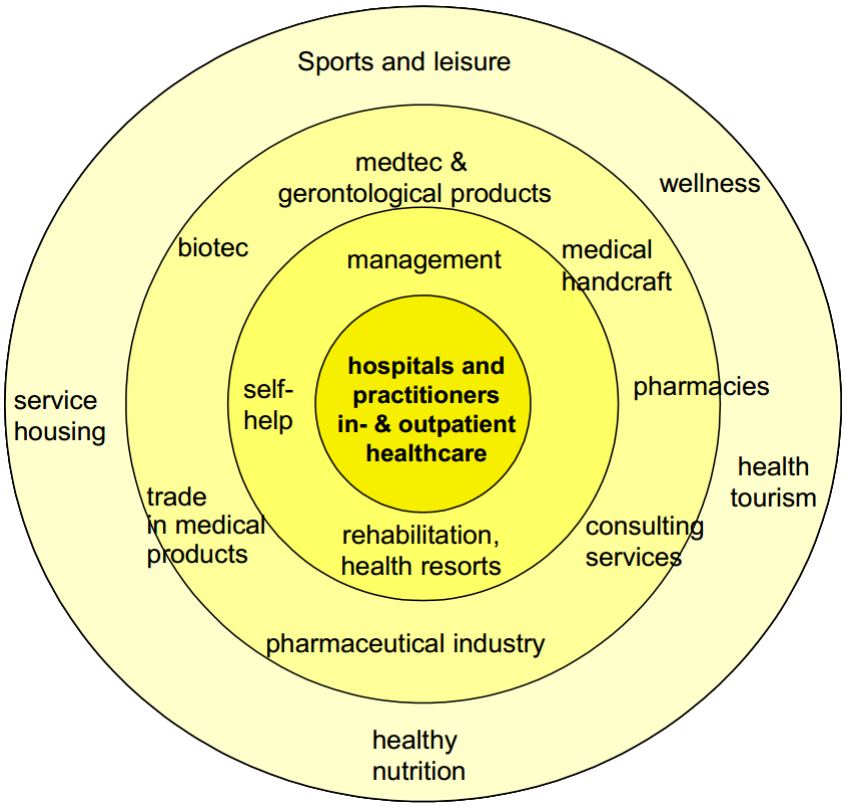
- approx. 6 in-depth interviews with health business firms in the Southern-Denmark – Northern Schleswig-Holstein region (3 Danish and 3 German)
- specific requirements to the selection of health business firms:
  - 'innovative' health business firms, focusing either focus on product-design or technology and ICT
  - interviewee should hold strategic knowledge about the firm
- partly standardized open-ended interview design
- each in-depth interview lasts about approx. 30-40 min.
- interview setting will be at the firms location
- admission to recording of the interview is beneficial
- all data (recorded and noted) will not be passed on to third parties (deletion after thesis submission)
- preferred interview languages are English and German (optional Swedish and Norwegian)

INTERVIEW-TOPICS

- general information (about the firm and interviewee)
- present knowledge interactions of the firm to other actors and institutions
- cross-border knowledge of the interviewee
- cross-border differences
- obstacles and potentials to cross-border knowledge interactions
- specific focus on virtual networking in cross-border regions, e.g. HANC Online Networking Service: http://healthy-ageing-network.eu/

Interview period: 23rd June 2014 - 18th July 2014

Appendix C: Onion model on health care economics (Hilbert et al., 2009)



Appendix D: Thematic coding by means of matrix (author's illustration, 2014)

name of firms	**general information**		**specifics on knowledge sourcing and innovation**		**knowledge linkages**		**RIS dimensions and differences**		**excursion**	
	location	***x, x, x***	***innovation pattern***	***x, x, x***	***customers***	***x, x, x***	***business dimension***	***x, x, x***	***HANC***	***x, x***
Eschweiler										
Frictionless										
Innovision										
Medisat										
Soventec										
Sanitätshaus										
Vendlet										

See next page for headings inductively and deductively derived and used for sorting the interview text (x = deployed thematic 'headings')

General information

- location
- corporate form of the firms
- name of the interviewee and position
- health business sector of the firm
- product groups and services
- number of employees
- language knowledge of firm's employees
- history of the firm

Specifics on knowledge sourcing and innovation

- product development characteristics
- innovation pattern
- most important external knowledge sources for innovative development
- significance of personal contacts

Knowledge linkages

- customers
- suppliers
- competitors
- business-collaboration
- network/cluster organisations
- fairs and conferences
- virtual communities
- social (business) events
- journals
- patent specifications
- R&D institutions
- educational institutions
- student cooperation
- technology transfer organisation
- consultants

RIS dimension and proximities

- CB knowledge and experience of the interviewee
- business dimension
- knowledge infrastructure dimension
- governance dimension
- formal institutional context
- informal institutional context
- language context
- spatial context
- main barrier

Excursion

- view on healthy ageing
- view on policy initiated CB supportive attempts
- HANC
- Others

Appendix E: HANC project flyer

(source: HANC, 2014e, page 1)

(source: HANC, 2014e, page 2)

WHAT IS HANC ABOUT

HANC is a platform for cooperation between researchers, users, health care providers and companies. By optimising opportunities for physical, social and mental health, together they find solutions to cater for the "Active and Healthy Ageing" of the elderly.

WHAT IS "ACTIVE AND HEALTHY AGEING"

"Active and Healthy Ageing" is the process whereby opportunities for health, participation and security are optimised in order to enhance the quality of life of ageing people. It applies to both individuals and population groups. (WHO)

"FUNCTION" AS A KEY CONCEPT

Functionality is a broad concept that refers to various dimensions such as physical, medical, biological, mental or social functions.
The functional level of a person determines the specific and individual need of a person for support in "Active and Healthy Ageing".

FOCUS AREAS

PERSONALISED SUPPORT FOR FUNCTIONAL INDEPENDENCE

HANC aims to improve the level of understanding to the degree of support elderly people require to maintain or improve their functional independence throughout life.

Personalised products and services as well as the surrounding environment must be in a position to respond to the individual needs of elderly people.

CONNECTING INTERDISCIPLINARY COMPETENCIES FOR NOVEL SOLUTIONS

BIOLOGY
BIOMEDICINE
DEMOGRAPHY
ENGINEERING
EPIDEMIOLOGY
EXERCISE
GEOGRAPHY
GERIATRIC MEDICINE
HEALTH SCIENCES
MANAGEMENT
PHILOSOPHY
PHYSIOLOGY
PSYCHOLOGY
PUBLIC HEALTH
ROBOTICS
SOCIAL POLICY
SOCIAL WORK
SOCIOLOGY
TECHNOLOGY AND ICT

AND MORE...

WHAT HANC CAN DO FOR YOU

- HANC raises your awareness for "Active and Healthy Ageing" with regard to societal challenges and requirements as well as new solutions and markets
- HANC creates opportunities and presents success stories
- HANC integrates academia, the economy, society and policy to create a joint framework for the promotion of "Active and Healthy Ageing"
- HANC promotes and encourages horizontal, vertical and cross-border cooperation between providers in the field of "Active and Healthy Ageing"
- HANC provides services to partners for knowledge transfer

Appendix F: Overview of the case studie's present and aspired CB knowledge interactions (author's illustration, 2014)

Case studies	Present German-Danish knowledge interactions	Present SD-NSH knowledge interactions	Concrete vision and »motive on future SD-NSH knowledge interactions	Type of actor linked in potential SD – NSH knowledge interaction
Eschweiler (NSH)	none	*market relation:* - supplier relation	(maintain supplier relations » to access intermediate good needed and good price-qualitative level)	(business actor)
Frictionless (NSH)	none	none	none	none
Innovision (SD)	*market relation:* - customers relations *informal networking:* - social business network	none	***market relation:*** - customer relation (»profit) ***informal networking:*** - social business network (»gain access to business cases, spread knowledge about innovative technology)	▪ knowledge exploiters – customers (hospitals and universities)
Medisat (SD)	*spillover/ externalities* - presentation in fairs	*informal networking:* - negotiation with R&D institute in NSH for collaboration project	***collaboration*** - co-development with R&D institute (»access to knowledge about demands and potential business cases) ***market relation:*** - customer relations (»profit) ***informal networking*** - social business network (»gain access to business cases, spread knowledge about telemedicine)	▪ both knowledge exploiters (university hospital) and ▪ knowledge generater/diffuser (university, hospital)
Soventec (NSH)	*spillover/ externalities* - visit of Life Science Cluster in Copenhagen	*spillover/ externalities* - participation in CB twinning initiative of local entrepreneurs	***market relation*** - customer relation (»profit) ***informal networking*** - social business network (»gain access to knowledge about the market, and to business cases)	▪ knowledge exploiters – customers (life science and medical engineering firms)
Sanitätshaus Thiel und Scheld (NSH)	none	*market relation:* - private customers (patients) *spillovers/externalities* - listed as potential supplier at the SD municipalities	(maintain custumer relations, »profit)	(knowledge exploiters – customers: patients)
Vendlet (SD)	*formal networking:* - recently initiated R&D cooperation	*informal networking:* - social business network	***market relation*:** - customer relation (»profit) ***formal networking:*** - business alliance (»gain access to knowledge about and contact to German health market players) ***informal networking:*** - social business network (»gain access to business cases and spread the idea of modern care)	▪ knowledge exploiters – customers (hospitals, medical stores, home cares), collaborators (durable medical equipment firm) ▪ knowledge diffusers (Applied University Flensburg)

Note: Line coloured in grey = SD health business firms, Line coloured in white = NSH health business firms.

Appendix G: Detailed case study analysis of perceived level of proximities sorted by RIS (author's illustration, 2014)

(double low line = main differences forming obstacles)

case studies	interest in active engagement in further development of CB knowledge interactions	knowledge level about the CB area (SD-NSH)	CB business dimension	CB knowledge infrastructure dimension	CB policy dimension	CB formal socio-institutional context	CB informal socio-institutional context	CB spatial context
Eschweiler (NSH)	no, rather maintain supplier relation	○	○○ no potential entry into the SD market reasoned by dominant position of the most innovative competitor *(low functional proximity)*	○ no interest in linkages to SD knowledge generators/ diffusors, recently initiated regional R&D collaboration (path dependent behaviour)	no statement, no knowledge	no knowledge	+ similar culture, active communication through good english proficiency with Danish people *(high informal institutional and language proximity)*	+ beneficial for supplier relations (reduced transaction costs), else does not matter (neither barrier nor potential)
Frictionless (NSH)	no	○○	○○ no potential customers in SD due to strong differences in economic and knowledge specialisation *(low cognitive and functional proximity)*	○○ no potential R&D collaborators due to strong differences in knowledge specialisation *(low cognitive proximity)*	no statement, no knowledge	no knowledge	+ similar culture, active communication through good english proficiency with Danish *(high informal institutional and language proximity)*	does not matter for existing knowledge linkages (neither barrier nor potential)
Innovision (SD)	yes, primary market and informal networking relations to customers (hospitals and universities)	+	++ potential business opportunities due to demand for innovative medical devices (demographic change), potential customers in NSH *(high functional proximity)* ○ substantial difference in chosen technological trajectory, but also forming future potentials *(medium cognitive proximity)*	○○ no interest in linkages to knowledge generators/diffusors in SD as there are no world leading experts (low cognitive proximity)	no statement, no knowledge	minor differences regarding the taxation system (no perceived impact)	○ need for routine change of doctor's in medical examination *(low informal institutional proximity)*, ++ active communication through German sales man *(high language proximity)*	no particular favouring impact on intensity of knowledge linkages

case studies	interest in active engagement in further development of CB knowledge interactions	knowledge level about the CB area (SD-NSH)	CB business dimension	CB knowledge infrastructure dimension	CB policy dimension	CB formal socio-institutional context	CB informal socio-institutional context	CB spatial context
Medisat (SD)	yes, with university hospitals acting both as knowledge generator/diffuser in collaboration linkages and as knowledge exploiter in customer relations	+	++ potential business opportunities, cost reduction in hospitals, demand for telemedicin products (demographic change), potential customers in NSH *(high functional proximity)* O moderate differences in telemedicin knowledge, but potential synergies *(medium cognitive proximity)*	O moderate differences in telemedicin knowledge, but potential synergies *(medium cognitive proximity)*	O substantial differences in health care politics, Danish government supports telemedicin strongly, might be introduced in Germany soon (low formal institutional proximity)	OO strong differences between the Danish and German health care and reimbursement system *(low formal institutional proximity)*	O need for routine change of doctor's in medical examination *(low informal institutional proximity),* some difficulties in active communication through German's deficiencies in English *(medium language proximity)*	+ supports face-to-face meetings on occasion
Soventec (NSH)	yes, with actors of business dimension (medical engineering and life science firms)	OO	++ potential business opportunities, assumed demand for custom-tailored software solutions *(high functional proximity)* ++ assumed complementary knowledge stock of Danish business environment *(high cognitive proximity)*	no interest in linkages to knowledge generators/diffusors, recently initiated regional R&D collaboration (path dependent behavior)	no statement, no knowledge	no knowledge	O sligth differences in business culture, communication via english feasible *(medium informal institutional and language proximity)*	+ supports face-to-face meetings on occasion
Sanitätshaus Thiel und Scheld (NSH)	no, rather maintain customer relations (patients)	+	++ potential business opportunities due to price-assymetries, demand for qualitative service in SD *(high functional proximity)*	no interest in linkages to knowledge generators/diffusors	no statement, no knowledge	OO strong differences between the Danish and German institutional set-up of medical stores *(low formal institutional proximity)*	+ no significant differences, active communication through Danish speaking employees *(high informal institutional and language proximity)*	OO regional geographical level is perceived as too distant for required face-to-face interactions, as local level is most important for market relations (low geographical proximity)

case studies	interest in active engagement in further development of CB knowledge interactions	knowledge level about the CB area (SD-NSH)	CB business dimension	CB knowledge infrastructure dimension	CB policy dimension	CB formal socio-institutional context	CB informal socio-institutional context	CB spatial context
Vendlet (SD)	yes, with both knowledge exploiters (customer and collaborator linkages) and knowledge diffusers (informal networking)	+ +	++ potential business opportunities due to demographic change and need for qualitative care products, potential buyers in NSH *(high functional proximity)* 〇 moderate difference in knowledge stock of care professionals in care homes and hospitals *(medium cognitive proximity)*	+ complementary knowledge about German health care market and system *(high cognitive proximity)*	no statement	〇〇 strong differences between the Danish and German health care and reimbursement system *(low formal institutional proximity)*	〇〇 strong differences in health care culture, but also regulations *(low informal institutional proximity)* ++ active communication due to German speaking business manager *(high language proximity)*	+ enables increased informal networking, meetings on occasion