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Interorganisational collaboration in Academic Health Science Centre: A case study on King's Health Partnership

by

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Abstract

Facing the challenges of providing high-quality and cost-effective healthcare and the rise of chronic and degenerative diseases, the government has become increasingly interested in encouraging the translation of research into the practical use.   Academic Health Partnership Science Centre (AHSC) is an initiative to address this. It is a collaborative university-hospital partnership between NHS organisations, academic institutions, and private industry. One of the goals is to ensure that medical research breakthroughs could lead to direct clinical benefits for patients. The biomedical innovations developed in AHSCs are often widely disseminated through the research community, but less is known about how these organisations work together collaboratively to overcome traditional boundaries to translate research into patient care. This paper uses the proximity approach as the theoretical framework to explore the interorganisational collaboration phenomenon in university-hospital partnership. This paper examines how different proximity dimensions; such as cognitive, organisational, social and geographical proximity affect how clinical and scientific actors collaborate. A single case study methodology was used, with primary data gathered from 11 semi-structured interviews with three professional groups within King's Health Partnership.   This study makes several important contributions to knowledge and understanding of research relationship between university and hospital. It contributes to the proximity literature by analyzing how clinical and scientific actors in AHSC leverage different proximity dimensions in translational research.

Keywords: interorganisation collaboration, interdisciplinary science collaboration, translational research, Academic Health Science Centre, National Health Services, cognitive proximity, social proximity, geographical proximity, organisational proximity

1. Introduction

Research collaboration has been identified as a key mechanism for knowledge production in the science and technology arena (Ahuja, 2000; Hagedoorn et al., 2000; Powell et al., 2005). Universities perform a key role in societies by generating knowledge through academic research. Biomedical research is a broad area of research that supports the development of knowledge in the field of medicine, which involves collaboration across established professional, occupational and organisation boundaries. It operates in a non-linear and dynamic fashion, which involves both basic inquiry (discovery) and practical application (utility).

Academic Health Partnership Science Centre (AHSC) is a collaborative university-hospital partnership between National Health Service (NHS) organisations, academic institutions, and private industry. The defining feature of AHSC is the commitment of pursuing a tripartite mission of (1) achieving high standards of clinical care, (2) leading clinical and laboratory research and (3) educating doctors and other health professionals. One of their key objectives is to improve clinical quality and health outcomes, informed by excellent research and education. Biomedical innovations developed in AHSCs are often widely disseminated through the research community, but less is known about how these organisations work together collaboratively in translating research into patient care.

While the innovation system and collaboration between universities and industry and the commercial translation of academic discoveries have been well studied, the literature on the connection between university and hospital is not as developed because it is harder to measure due to its non-commercial nature (Hopkin, 2006). AHSC offers a unique research context because it brings clinical and scientific actors together in order to improve health outcomes[1], through building the foundation of basic science and experimental medicine and translating them across its clinical services. Collaboration between clinical and scientific actors is considered as essential in translational research because they can apply and combine their expertise and diverse perspective to solve complex inter-disciplinary medical problems. An emerging body of literature based on the concept of proximity has been identified as relevant in the study of the facilitation of interorganisational collaboration and innovation (Boschma, 2005; Knoben & Oerlemans, 2006). Hence, this paper seeks to address the following research question, **'How do different dimensions of proximity affect clinical and scientific actors in engaging collaboration in a university-hospital partnership?'** by using a single case study methodology.

This paper proceeds as follows. The next section presents the literature review that critically assesses and distinguishes different forms of proximity relevant to interorganisational collaboration.

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Section 3 explains the research strategy and data collection method. Section 4 discusses the results using the data and insights gathered from analysis. Section 5 and 6 will discuss and conclude what value has this study added to our understanding of interorganisational collaboration in university-hospital partnership and recommendation for future research.

2. Theoretical Framework

2.1 The proximity perspective

It has been well documented that medical innovations have depended heavily on breaking down barriers because innovation in medical research do not operate in a linear fashion. In AHSC, by forming partnerships of hospitals and universities, as opposed to a single entity or complex series of contractual arrangement, it is intended that this approach could mobilise effort and resources to deliver changes across the health and academic system. It is intended to mimic the 'cluster' of interconnected organisations within one industry (e.g. biotech in Boston), thus driving innovation and performance through simultaneous collaboration and competition (Fish et al., 2013).

Interorganisational co-operation and collaboration is complex phenomenon. For one, according to Axelsson et al (2006), collaboration can be defined as a form of integration based on a willingness to work together and it may be implemented through intensive contacts and communications between the different organisations (Alter and Hage, 1993). Interorganisational collaboration could lead to various benefits with respect to information diffusion, resource sharing, access to specialized assets, and interorganisational learning (Powell and Grodal, 2006).

The concept of proximity has been identified as relevant in the study of interorganisational collaboration and innovation (Boschma, 2005; Knoben & Oerlemans, 2006) and it is a relevant starting point to examine how barriers can be overcome. Proximity describes the degree of closeness between actors; such as sharing similar attributes in thinking style, educational background, or shared experience (Knoben & Oerlemans, 2006). Proximity has also been theorized as crucial for knowledge transfer and interaction during collaboration because it promotes trust and understanding in complex and high-risk innovation projects (Menzel, 2008).

2.2 Cognitive Proximity

Nooteboom (1992) first introduced the concept of cognitive distance (or cognitive proximity) between people, resulting from differences in their knowledge bases, thus their differences in their absorptive capacities in understanding and applying knowledge (Cohen & Levinthal, 1990). Cognitive proximity refers to similarities in the way that actors absorb, interpret, and categorise knowledge into

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mental models (Nooteboom et al., 2007). Thus in order to communicate and transfer knowledge effectively, actors require similar frames of reference (Knoben & Oerlemans, 2006). Cognitive proximity could create opportunity for a novelty in cooperation, or potentially failure in creating a common understanding (Wyuts et al., 2005). The optimal level of proximity will allow individuals to create common understanding while the different knowledge bases will enable new combinations and learning (Nooteboom et al., 2007).

2.3 Social Proximity

Collaboration is fundamentally a social activity, requiring interaction between two or more individuals. Since collaboration depends on the willingness to work together, it therefore relies on relationships between individuals. Social relations often involve trust based on friendship and common experience (Boschma, 2005) and it has been theorized as important for the diffusion of informal knowledge, thus facilitating collaboration (Boschma & Frenken, 2009). The idea is that collaboration for innovation often include the diffusion of tacit (or more precisely, secret) knowledge, therefore individuals need to be able to trust their collaborator in disclosing secret knowledge. Interpersonal channels such as professional acquaintances, friendship and labour mobility promote knowledge diffusion (Agrawal et al., 2006, 2008). Hence individuals embedded in a social network could increase their accessibility to information exchange or technical advice (Breschi & Lissoni, 2009; Grossetti & Bes, 2001).

Having strong social relations or network represent a form of social capital that allows individuals to find working partners more easily, which enable easier access to knowledge. It could also facilitate better communication, better interaction learning, which may increase innovative performance (Cassi & Plunket, 2014; Ter Wal, 2014). Past collaborations and repeated contacts between partners are important ways for building up reputation and trust (Balland, 2011). Trust has been identified as one of the strongest mechanisms for lowering the barriers to interaction between universities and industry in interorganisational activity since firms and universities often need to share commercially sensitive information (Bruneel et al., 2010; Santoro & Saparito, 2003). Partners are less likely to be proactive in sharing knowledge if it is characterised by low level of trust, thus hindering collaboration (Inkpen &Tsang, 2005). Collaboration is possible only when individuals have trust in each other's competencies and ability to assume responsibilities, therefore trust reduce uncertainty (D'Amour et al., 2008).

2.4 Geographical Proximity

Geographical proximity refers to the spatial or physical distance between actors (Boschma, 2005)

and it has been theorized as having an indirect role in promoting the transfer of knowledge and innovation because it facilitates face-to-face interactions which in turn strengthen social relations between actors and trust building (Knoben & Oerlemans, 2006). Furthermore, tacit knowledge, which has been perceived as 'sticky' but vital for innovation, is less likely to be transferred when there is considerable distance between actors (Howells, 2002). In another word, geographical proximity plays a 'subtle and indirect role' in increasing the probability of knowledge exchange and collaboration. Geographic proximity, professional group membership and prior history of collaboration are important factors that influence formation of collaboration ties in translational research network (Long et al., 2014). Geographical proximity plays a complementary role in building and strengthening relationship in collaboration and is a way of overcoming the institutional differences between organisations (Ponds et al., 2007).

2.5 Organisation Proximity

Organisational proximity refers to shared relations or the degree of strategic independence between organisations, which has been theorised as important for supporting innovation networks as it could reduce uncertainty (Boschma, 2005). Organisational proximity is also defined as 'actors whose interactions are facilitated by (explicit or implicit) rules and routines of behavior and that share a same system of representations, or set of beliefs' (Torre & Rallet, 2005). When organisational cultures are similar, the common interpretations and routines would allow organisations to interpret and give meaning to actions more easily (Knoben & Oerlemans, 2006), thus organisations are more likely to interact when they share high level of organisational proximity (D'Este et al., 2012). The concept of organisational proximity is highly relevant to AHSC since it is a partnership of different, distinctive organisations, each with their own mission. Having similarity in organisational 'behavior' could support mutual understanding and could lead to better results and efficiency (Torre & Rallet, 2005).

3. Methodology

3.1 Research Strategy

Qualitative research has been gaining popularity in health and medicine research with new found specialist journals such as Qualitative Health Research (Sbaraini et al., 2011). Qualitative research is as important as quantitative research, especially for research areas on health service provisions, policy setting, and health administrations (Leung, 2015). Qualitative research can show how and why things happen as it incorporates people's own motivation, emotion, prejudice and incidents of interpersonal cooperation and conflict (Charmaz, 1995, cited in Gray 2014), this is relevant for circumstances where relatively little is known about the phenomenon (Strauss and Corbin, 1990, cited in Gray 2014). Indeed,

AHSC is a relatively new organisational form in the UK; therefore using a qualitative research approach is highly appropriate. The use of theoretical literature will act as a framework for understanding the complexity of interorganisational collaboration, thus providing the analytical framework for analysis. A single, holistic case study design is chosen based on KHP because it is one of the five AHSC in UK and one, which has not been studied previously.   This design allows a single case to be examined at a holistic level.

Case Selection

KHP was established in 2009, it comprises of King's College London **(KCL),** Guy's and St Thomas' NHS Trust Foundation **(GSTT)**, King's College Hospital **(KCH),** and South London and Maudsley **(SLaM).** These organisations are based in South London, United Kingdom. Altogether this represents a £2.8bn partnership, with 31,000 staff and 25,000 students and 3.6m patient contacts annually across four separate organisations. These organisations are not structurally integrated and they operate under separate governance structure. Thus, the success of AHSCs depends on the working partnership between these organisations in integrating their roles in the co-production of knowledge for research, education, and patient care.

3.2 Data Collection Method

Since this study aims to explore interorganisational collaboration as a social phenomenon, the use of interview is the most appropriate because it allows the collection of rich data on experiences, views and attitude of the people in the partnership (Gray, 2014). Semi-structure interviews were used as it provided a flexible method for generating more empirical data as it allows researcher to probe for points of interest or clarification response or elicit a greater depth of response from participant. The interviews used in this study consisted a set of standardised open ended questions and in a semi-structured interview format. 11 in-depth interviews were completed. They were recorded and transcribed into written documents. Qualitative data were yielded from the interviews which offered many useful insights into stories, perception and feelings of individuals involved in the partnership of KHP.

3.3 Participants

The study operationalized three groups of actors (defined professional groups). Group (1) is scientific investigators such as academic scientist/researcher, research associate and research technician, who are mostly employed by KCL. Group (2) is clinical investigators such as clinical academic, clinician, consultant and clinical fellow, who are employed by KCH or jointly employed by KCH and KCL.

(1) Scientific investigator, i.e. academic scientist

(2) Clinical investigator, i.e. clinical academic and clinician

(3) Managerial actor, i.e. manager, clinical trial manager and university administrator

Standardised set of questions was prepared for the participants in group (1) and (2), which focused on four major research themes; cognitive proximity, social proximity; geographical proximity; and organisational proximity. Participants in group (1) and (2) were asked to discuss what factors they consider as vital when they form collaborative ties, especially across organisational boundary. Social and geographical proximity were discussed and what they meant for interorganisational collaboration. They were asked about what they thought about the organisational differences between the university and the hospital and whether they felt interorganisational collaboration is supported at all levels through organisational operating routine, system and structure. Participants in group (3) were only asked about their view on organisational proximity. Being the managers, they could provide their insights into the inner workings of university and hospital administration that support or hinder collaborative ties and learning amongst clinical and scientific investigators. Results from group (1) and (2) were triangulated with the result from group (3) in order to project a more accurate picture of the organisational proximity of different partners in KHP.

3.4 Data Analysis Approach

Most interview were audio recorded after participants had given their consent. After the interviews were conducted, they were transcribed immediately. Coding began immediately in order to extract key themes from the data as 'coding is the pivotal link between collecting data and developing an emergent theory to explain these data. The coding consisted of initial coding which was close reading and interrogation of the transcript of the interview where many ideas were inducted from the data. In focused coding, a selected set of central codes throughout the entire dataset was examined. Comparisons were made between data, cases and codes in order to find similarities and differences. Decisions were made about which initial codes and themes were most important and prevalent and which contributed to the analysis. The process of examining the initial and focused coding of participant's interviews regarding their views and perspective on interorganisational collaboration led to the emergence of key theoretical coding that best describe the data and relates them to one and another. This process of examining initial and focused coding led to the emergence of key theoretical coding which best summarise and describe the data in Table 3.1.

Table 3.1: Key theoretical coding that emerged from the coding process set against specific research area
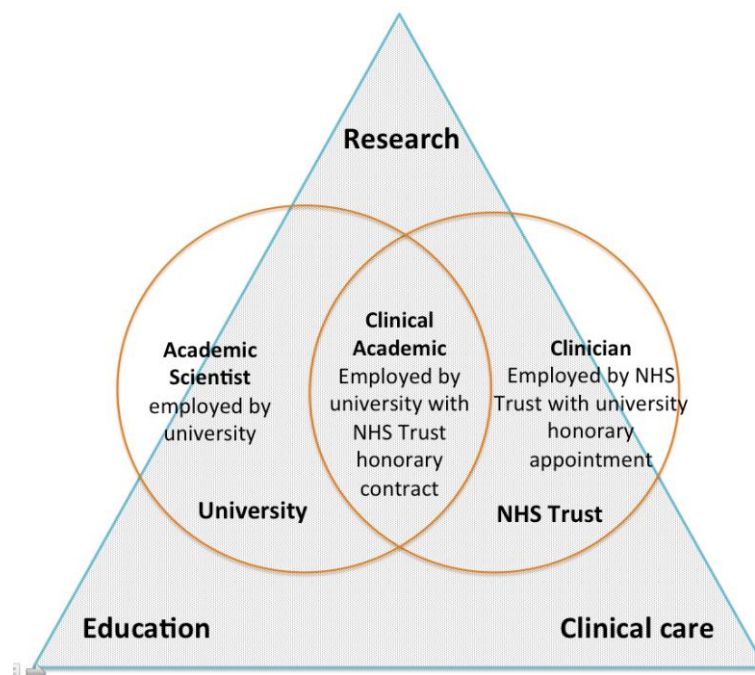
	Research area	Theoretical coding
INDIVIDUAL DIMENSION	Cognitive proximity	The process of forming collaboration ties is based on searching for complementary research interest and expertise, which must be non-rivalry. The process of forming collaboration ties between clinical and scientific investigators is based on sharing similar cognitive proximity and common understanding in the field of translational research. Investigators need to demonstrate the willingness to understand and adjust working approach and behavior to align with the needs and expectation of collaborator. The role of clinical academic (boundary spanner) is pivotal in translational research but they need to commit fully in order for collaboration to work.
	Social proximity	Trust is an important factor in collaboration, which is manifested in having shared ownership of a project with equal commitment in the form of investment of resources and personnel from each collaborator. Having shared ownership and equal commitment and input from different professional groups are vital for collaboration. Trust is not the only factor that investigators take into account when forming into collaboration teams. Collaboration is only possible when investigators have trust in their collaborator's competencies and assume responsibility especially across organisational boundary.
	Geographical proximity	Geographical proximity support relationship building and social interaction, which in turn promote collaboration, and to a degree trust, between investigators.
ORGANISATIONAL DIMENSION	Organisational proximity	There is a lack of connectivity and lack of central common administrative space that support investigators. Differences in job profiles and organisational priorities create considerable tension that damper interorganisational collaboration.

4. Results and Analysis

4.1 The role of cognitive proximity

KHP developed its unique Clinical Academic Group (CAG) model in order to pursue its 'tripartite mission' (research, education and clinical care). Its basic science and experimental medicine theme require close integration of clinical and scientific investigators working together collaboratively across organisational boundary (Figure 4.1).

Figure 4.1: The role of academic scientist, clinical academic and clinician set in AHSC under the tripartite mission of research, education, and clinical care

All participants discussed the importance of sharing similar knowledge base or common research interest with their collaborators. Investigators collaborate because they need to expand their research capacity by utilizing their collaborators' expertise or specific scientific models that they specialize in. By combining complementary knowledge and expertise, these could enhance investigators' capabilities to address and approach new research questions and to enter new thematic areas. Interestingly, all participants discussed the absolute need to avoid collaborating with groups that share the exact same research interest for fear of competition/rivalry. One participant highlighted the importance of the funding source, as biomedical research is often very costly and resource intensive, therefore investigators need to be tactical in framing their research approach and forming the right collaborative group in order to bid for funding.

Participants were asked about their experience collaborating with other investigators across organisational boundary, such as what do they look for and what are the differences working with someone who belongs to a different professional group. Participants outlined the importance of sharing similar research methodological norm and epistemic approach in translational research because these factors often define the 'rules' of research strategy, such as how the phenomena are measured, scientific standard of evidence, vision, standards of scientific proof, norms of accuracy and precision. For example, one participant said, *"how to reach patient benefit, the clinician see it in a different manner than a researcher, they have a different vision, different way to sort out problems, to address problems"*. One participant in group (3) pointed out that from his experience, there is not much collaboration between academic scientist and clinician because clinician prefer to work and collaborate amongst themselves rather than with academic scientist.
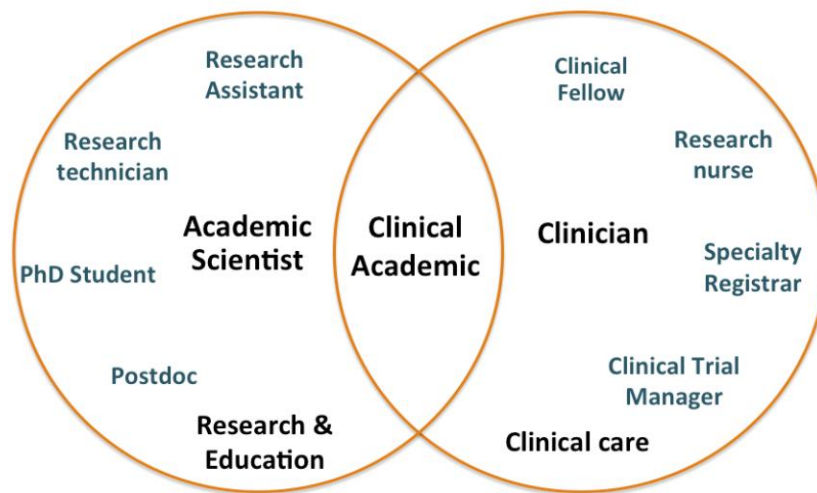
When prompted about what the participants feel could bridge the gap between the professional groups, participants highlighted the importance of having a *'middle ground'* of shared knowledge base with mutual or leveled interest. For example, clinician who have been exposed to *"full fledged research such as having obtained PhDs with years of research experience in the laboratory will have much more in common with academic scientist"*. Investigators from both groups need to adjust their behavior in order to meet 'half way' where they are willing to understand and adjust their research approach and attitude.

4.2 The role of boundary spanner in facilitating interorganisational collaboration

The role of boundary spanner was discussed extensively in the interviews and has been described as vital in bringing the two professional groups together, thus creating opportunity for cooperation by bridging the knowledge base. Indeed, clinical academic have been put into the position of leading AHSC because they can act as organisational, epistemic and professional boundary spanners in supporting knowledge translation across research and clinical boundary (French, 2014). Participants unanimously agreed that the role of clinical academic is pivotal in facilitating research as they can mediate the clinical and research goals of different stakeholders and they have the larger network of both clinical and research interface. The main reasons outlined included the collection of patient samples and allocation of hospital resources, which are both vital for translational research. For example, clinical academic has the authority to instruct and direct the clinical team in taking patient samples. Academic scientist, if awarded an honorary contract from NHS, only have very limited patient contact. They wouldn't be able to take bloods or biopsies. Clinical academic has better clinical network so they are able to locate critical resources for research and instruct their clinical teams to gather clinical evidence.

It was clear from the interviews that clinical actor participants showed great admiration towards their scientific collaborator. They admitted that sometimes they don't have the full expertise, time, and capacity to conduct the work alone; therefore they are reliant on their scientific collaborator's research team. Academic scientist, not only has greater in depth scientific basic knowledge and experience, they may have dedicated personnel in their research group. Figure 4.2 below illustrates a typical scientific and clinical team. One Clinical Fellow in group (2) admitted that he has great admiration for the research technician in his team who had comprehensive knowledge in a range of laboratory technique, which he lacks. One clinical academic participant discussed that he works with academic scientist because of their strength in basic scientific knowledge, *"otherwise what's the point of working with people who has poorer science base than me?"*

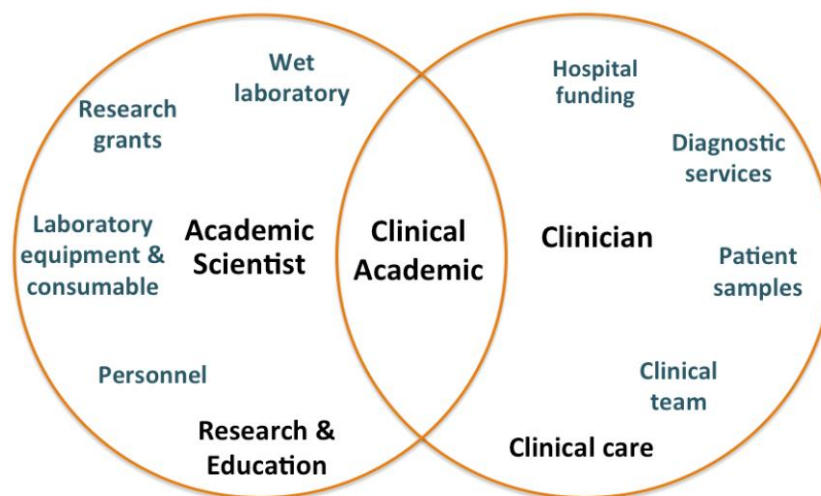*Figure 4.2: The team under clinical and scientific investigators*

4.3 Social relations and trust

Participants were asked about their opinion on the concept of trust and social relationships in collaboration. They unanimously agree that trust is a necessity for any collaboration but it is certainly not the only factor to consider. Participants discussed that they need to be able to trust their collaborators on a number of things. First, their collaborator's competencies, so for example, an academic scientist need to be able to trust their clinical collaborator in resolving clinical problems when they arise. Clinical trials contain certain risks, therefore clinician collaborator must be prepared to step in when issue arises and they have to be fully on board. Second, investigators need to be able to trust their collaborator in sharing and exchanging valuable knowledge and information because of fear of rivalry and competition.

Participants were asked how trust could be developed in particular across organisational

boundary and professions. One of the insights that participants offered were the significance of 'putting cash on the table' as a form of commitment in the collaboration. For example, contributing laboratory consumable money and dedicating personnel (such as research technician and research nurse) on a project have been perceived as tangible commitment. Figure 4.3 shows what academic scientist and clinician can offer in collaboration.   Furthermore, trust is manifested in having shared ownership of a project with equal commitment in the form of investment of resources and personnel from each collaborator with possible shared ownership in research outcome and publication.

Figure 4.3: Different forms of resources that clinical and scientific investigators can offer in collaboration

4.4 Geographical Proximity

All participants were clear in their responses that they felt that being geographically close is important for relationship building, which in turn promote collaboration. All participants in all groups unanimously agree that that collaboration tends to happen on the same site more often and face-to-face meeting is very important for *'talking about science'*.

4.5 Organisational proximity, professional and managerial relation

Differences in job profile

The participants discussed that there are fundamental differences between clinical and scientific investigators, in terms of their roles, priorities, culture and identity, which often cause tension, clash and disagreement when they collaborate. First, academic scientist work in an extremely competitive environment in obtaining grants, pursuing research, getting publications; otherwise *"their jobs will be on the line"*. On the other hand, clinician prioritise treating patients in hospital with erratic schedules. Second, their respective career path causes considerable strain. In academic scientist's view, clinician's

career paths are clearly mapped out; hence they pursue research on a discretionary basic, whereas academic scientist need to be constantly competing against each other, (i.e. Research Excellence Framework) so they must pursue research aggressively.   Therefore this brings considerable tension when academic scientist and clinician collaborate as they work with a different time scale under different incentive system.   Third, due to the differences in organisational workload and priorities, the actual distribution of workload between academic scientist and clinician in a collaboration is often imbalanced. One participant commented that, *"[academic scientist] appear to do all the work"* or being treated like *"research technician"* in research collaboration, simply because clinician doesn't have the time.

Participants in group (3) also highlighted that work priority is one of the main reason why working with clinical investigators is a challenge because they can be "unresponsive" due to their hectic schedule. For example, clinician is tied to fixed clinical timetable with scheduled programmed activities, so in general they have less flexibility. Hence that partly explains why collaboration tend to happen more often on the same site, due to convenience and being realistic about time constraint.

Differences in organisational priorities

It is clear from all participants that each partner in KHP has different institutional objectives, vision, priority and structure, hence arguably that there is a considerable organisational distance. For example, the participants highlighted that NHS is facing unprecedented financial challenges with raising demand for their service. Even though NHS is keen to promote and support research as one of their core activities, there is insufficient resource made available to support research and the capacity to undertake research varies across department. One participant discussed with the current funding cut and the rising demand for the NHS service, NHS is simply struggling to support the tripartite mission of KHP, hence research simply cannot be prioritized. Clinician will always "*prioritise their survival before collaboration; where most have already reached their maximum possible capacity doing ward rounds and out-patient*".

Shared organisational support and relation for interorganisational collaboration

There were mixed responses from the participants regarding whether the partners of KHP have developed or harmonized operating routines and structure to support interorganisational collaboration. The general consensus is that it takes a lot of willpower and effort to get any collaboration or project off the ground because of all the administrative obstacles from one organisation after the other, which add a lot of stress to already stressful funding bid.

What is clear from all participants is that there is no centrality or common administrative space

that support interorganisational collaboration in KHP. There is a lack of administrative connectivity between the university and the NHS trusts. There is minimal dedicated space, infrastructure, and research and administrative staff members that provide underpinning institutional support for interorganisational collaboration. Some services are duplicated, for example, each organisations in KHP have their own research and development offices where costings are prepared for grant application, however there is no 'joint research office' that offer 'holistic' support to investigators.

AHSC accreditation is expected to promote strategic alignment of medical schools and NHS partners and enhance the prestige of these organisations by attracting new research and health care innovation funding and high quality staff (Ovseiko, 2010). Since KHP does not offer any direct funding or line manage any partners' staff, it uses 'soft power' to persuade and encourage investigators to collaborate. AHSC like KHP provide very limited competitive direct additional funding, it is dependent on investigators working together to build project consortia that could compete collectively for third party funds.

In terms of operating routine and processes, participants in group (3) discussed the challenges of working with other partners. Managers don't particularly see a sense of unity and common purpose. For example, there is no joint brand identity or joint intranet that circulate joint information. However there have been new human resources procedures such as joint staff appraisals, which improve the link of joint appointments. There are other harmonized human resources processes that help staff to work across organisational boundary such as honorary contract and research passport for researchers who are not employed by the NHS trusts but whose research activity has a "direct bearing on the quality of patient care". Salary recharge agreement or service agreement is a form of financial agreement between the NHS Trust and the university that offer some flexibility for human resources management and joint appointment of certain roles to reflect senior management's commitment on collaboration.
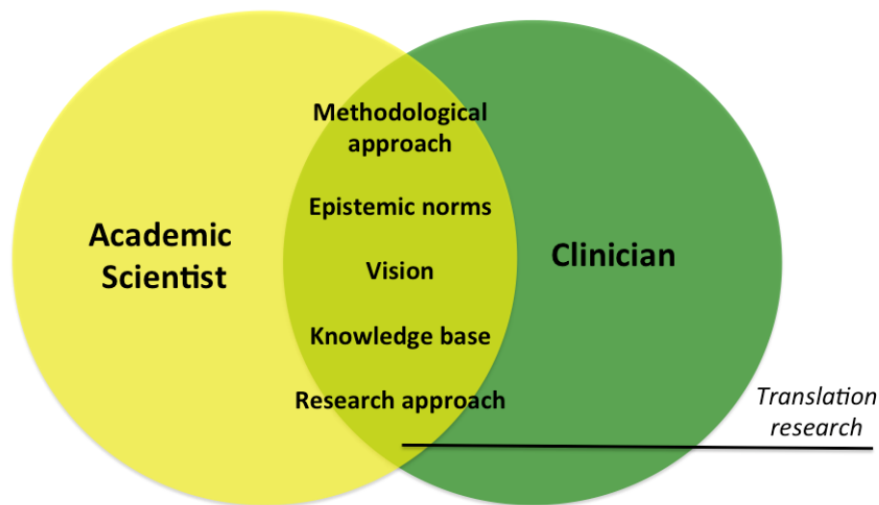
5. Discussion

This paper uses the proximity approach as the theoretical framework to explore the interorganisational research collaboration phenomenon in university-hospital partnership, in particular looking at how different dimensions of proximity affect clinical and scientific investigators in collaboration. The discussion provides a critical assessment of the findings extrapolated from the data and the potential implications for a collaborative approach in university-hospital partnership.

5.1 The role of cognitive proximity and university-hospital collaboration

This study shows that cognitive proximity plays a vital role in influencing investigators in forming interorganisational collaboration. Investigators need to share the optimal level of cognitive proximity in order to create common understanding on translational research while the different knowledge bases and expertise will enable new combinations and learning (Figure 5.1). When investigators bid for funding, they form into multidisciplinary working team bringing in different scientific, clinical and regulatory knowledge in building consortium, thus spanning their cognitive domains. Furthermore, the role of clinical academic as the 'boundary spanner' who could facilitate the transfer of knowledge across context has been highlighted as critical in bringing the two professional groups together, thus creating opportunity for cooperation by bridging the knowledge base. Clinical academic works on the interstices of science and clinical delivery, therefore they play an important role in the increasing of the 'absorptive capacity' of the research team, thus improving their ability to recognize new information and findings, assimilation and applications. This confirms just how important bridging a knowledge base is for interorganisational collaboration to flourish.

The objective of AHSC is to bring diverse groups of professional together in order to maximise cross-fertilization of ideas and transfer of knowledge in order to accelerate research. Therefore cognitive distance between different professional groups exists by default. The point is to ensure these groups which are being brought together can optimize and converge their knowledge base to the point where the optimal level of proximity will allow individuals to create common understanding while the different knowledge bases will enable new combinations and learning (Nooteboom et al., 2007). These professional groups need to share common knowledge base in understanding the principle and concepts of translational research in order to ensure meaningful collaborative ties could be established across professional groups. However sharing the right level of cognitive proximity is not the only factor that is sufficient to encourage collaboration because collaboration is essentially a social activity therefore we need to address the social dimension of collaboration.

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Figure 5.1: Cognitive proximity between clinical and scientific investigators - sharing the 'common knowledge base' on translational research
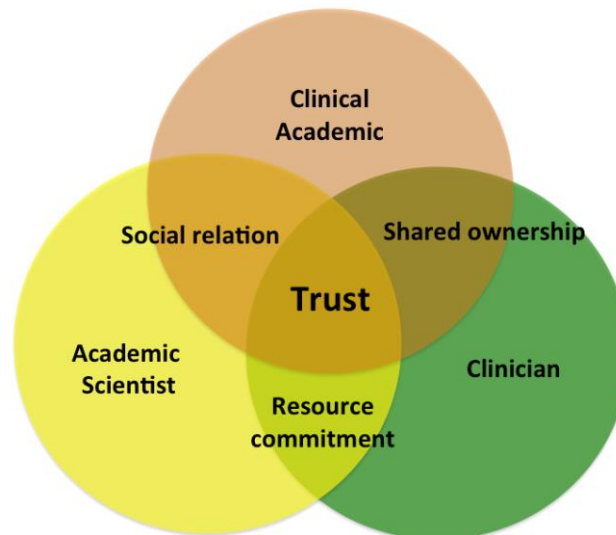

5.2 The importance of social relations and trust and university-hospital collaboration

The study confirms the importance of social proximity in the form of social relation and trust having an impact on investigators in forming collaborative ties across organisational boundary. This study highlighted the competitive research environment in academia where investigators compete in the same field where they could run into considerable risks linked to unintended spillovers to competitors. Hence investigators avoid collaborating with others whom they share too close cognitive proximity and research interest because of the fear of rivalry and unintended knowledge spillover (Boschma, 2005). Consequently, the degree of common relationship and trust between individual investigators become important because social relations could reduce the risk of opportunistic behavior. However too close social proximity could lock members of social networks into established ways of doing things at the expense of their own innovative and learning capacity, which may have an adverse impact on innovation (Boschma, 2005).

Trust has been shown in this study, as a prerequisite for facilitating the sharing and exchanges of valuable knowledge and information *before* collaboration, as investigators need to be able to trust their potential collaborative partners in sharing unpublished data and line of research enquiry. Investigators must be willing to commit in the collaboration, in the form of investment of laboratory, financial and personnel resources. Trust is manifested in having shared ownership of a project with equal commitment from each collaborator (Figure 5.2). *During* collaboration, investigators need to be able to trust their collaborator's competence and ability to assume responsibilities, especially those across organisational boundary. Everybody in the team need to be able to work together through thick and thin, resolving any

laboratory and clinical problems that arise, and demonstrates a willingness to understand and adjust behaviours to align with the needs and expectations of their collaborators.

Figure 4.2: Elements that contribute to the development of trust in collaboration

This study confirms that trust is an important factor that investigators consider when they collaborate, however it is not the only factor. Some investigator made the decision to collaborate is one of transaction cost economies, as they turn to collaboration to acquire resources, skills, and expertise to build consortia in order to compete for funding. Therefore they'd collaborate when the hazard of cooperation can be held to a tolerable level.

5.3 Geographical proximity and university-hospital collaboration

The study confirms that geographical proximity plays an important role in facilitating collaboration in this specific case study. This study shows investigators in this specific case study still prefer face-to-face interaction. It is fair to assume that this is due to the nature of 'stickiness' of tacit scientific knowledge, which is harder to transfer therefore investigators need to find whatever means to strengthen communication in ensuring complex information is communicated across. Based on this specific case study, it is reasonable to assume that geographical proximity does complement and strengthen social and cognitive proximity in enabling knowledge transfer (Boschma, 2005). It would be interesting to further explore whether geographical proximity could be a way of overcoming the institutional differences between partnerships rather than just purely for creating stimulating interaction as it is often assumed.

5.4 The importance of organisational proximity and university-hospital collaboration

Organisational proximity refers to shared relations within or between organisations and is supported by common rules and routines in organisations (Torre & Rallet, 2005), such as having similarity in organisational 'behavior' and it has been theorized that high level of organisational proximity should encourage more interaction amongst partners (D'Este et al., 2012). The scope of this study cannot confirm whether the partners of KHP share the *right* level of organisational proximity that supports interorganisational collaboration, as this area stretches to the hierarchical (bureaucratic) structure, legal accountability, professional framework and political agenda that govern each partner in AHSC. However, based on the available evidence from the participants' responses, it is clear that there is considerable organisational distance between the partners in KHP.

First, this study reveals the differences in the job profile of clinician and academic scientist, which create considerable tension amongst investigators when they form collaborative ties. AHSC aims to encourage new collaborative working practices to facilitate research and application, but this study shows that significant difference between clinical and scientific investigators due to their professional differences. This insight supports some existing literature. For example, professional groups in healthcare have been show as resistant to the development of new collaborative work practices because they do not like being intruded and having their status disrupted (Currie & White, 2012). This presents a challenge for AHSC in bringing the partners together, as it has been shown that it is a challenge to disrupt the institutional order of NHS, which is based on deeply embedded professional role division (Battilana, 2011).

Second, it has been acknowledged that NHS has been historically not particularly well aligned to academic medicine, so it does not come as a surprise when participants discussed the lack, or the perceived lack of shared relation between the partners. It is crucial to have an organisational structure and administrative mechanisms that supported the work of the collaboration without imposing an undue burden on partner resources (Corley et al., 2006; San Martın-Rodrıguez et al., 2005; Olsen et al., 2011). This study confirms that there is the general consensus that there is a lack of connectivity in the administrative space in supporting collaboration in this particular case study.
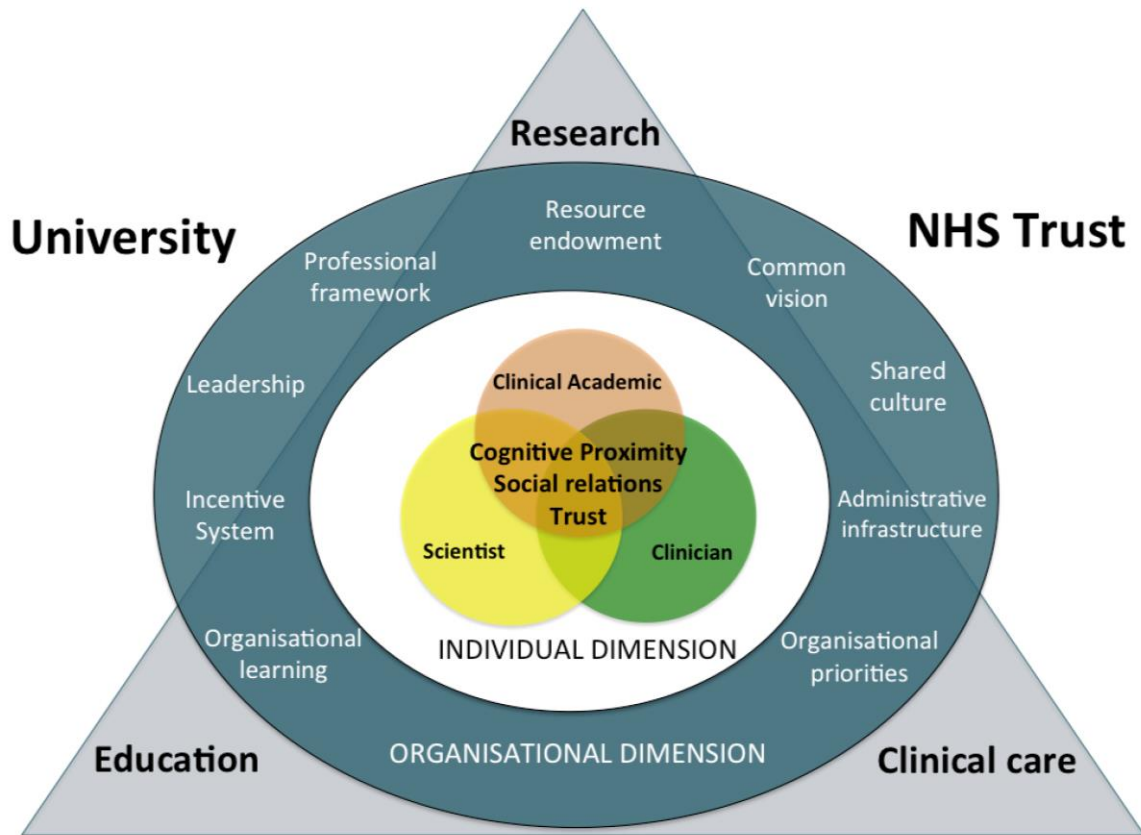
Third, in terms organisational priorities, we have to consider that each partner is funded by different funding bodies, hence they are accountable to their funder. NHS is almost entirely tax-funded and it is in chronic financial difficulty therefore they will always prioritise their primary mission of clinical delivery. It is not clear to what extent do each partner supports the others in the co-production of the tripartite mission. The fact that KHP does not offer any direct funding or having any formal authority,

limits its power in driving the momentum of collaboration, means that is reliant on the partners in building capability to work with each other.

In summary, KHP is based on a partnership model, where the partners are independent from each other and influenced by their regulatory and policy environments in which they are situated. Factors that contribute to the organisational distance include different job profiles of clinical and scientific investigators, different work priorities, work routine, organisational incentive system, and organisational priorities. Incompatible working routine and lack of interface management have negative impacts on investigators and thus reduce the opportunity for collaborative work across organisational boundary. This study highlighted that clinical and scientific investigators are bound by their respective organisational routine and incentive system, therefore they have different priorities when it comes to engaging translational research. Furthermore, their roles have different professional framework, which explains the cognitive distance that exist between the two professional groups by default. This study confirms the pivotal role of clinical academic in bringing together the two professional groups to create opportunity for cooperation by bridging the knowledge base.

The findings of the study is illustrated in Fig 5.3 which describes the individual dimension of cognitive proximity and social relations and trust as the 'core' factors under the individual domain that have most impact on investigators when they engage in interorganisational collaboration. However, investigators need to be supported by 'external' organisational factors, such as the level of organisational proximity in the form of shared relations between the organisations that they are situated in. There needs to be a degree of convergence in order to being the partners closer together in order to reduce organisational distance.

Fig 5.3 Factors that have an impact on investigators in engaging interorganisational collaboration in a university-hospital partnership

6. Conclusion

This paper has outlined how different dimensions of proximity affect clinical and scientific investigators in collaborating in a university-hospital partnership. Through the case study of KHP, we have developed a better understanding of AHSC as an organisational form in driving the development of knowledge and innovation in the field of biomedical/translational research. The study looked at different dimensions of proximity that influence interorganisational collaboration in this truly complex organisational model of AHSC. With this in mind, it is intended that this study can offer some insights in terms of what types of conditions can support collaboration across organisational boundaries, how innovation and learning could be diffused quickly at pace and scale, and what institutional framework could be in place to support translation of research into clinical practice. It is clear from the study that AHSC need to take a number of factors into account, this includes epistemic differences (different ways and vision in approaching clinical research), professional differences (academic and clinical profession) and organisational differences (between university and NHS Trusts).

Translational science spans the epistemic boundaries of science and medicine, therefore it requires collaboration between clinical and scientific investigators. One of the most striking factors to consider is the cognitive distance between these individuals and groups as it influences on their absorptive capacities or the ability to understand and apply knowledge (Cohen and Levinthal, 1990). This study discussed the fundamental differences in the knowledge base of clinical and scientific investigators. Therefore, the question is, what can be done to reduce cognitive distance between these professional groups when they are brought together to form collaboration that cut across established professional, occupational and organisational boundaries in AHSC? A key message from the study is to manage cognitive proximity between different professional groups carefully in order to create the optimal level of proximity. This way, AHSC can successfully bring diverse groups of professionals together to maximise cross-fertilisation of ideas and transfer of knowledge in order to accelerate research.

Furthermore, it would be useful to examine this in the context of UK's integrative capabilities (the ability to move between basic science and clinical development) (Owen-Smith et al., 2002). For example, what is the UK's institutional strategy in education systems, career development and labour market mobility compared to other countries (Whitley, 2003)? This might influence scientific collaboration in broad terms as it could influence innovation at project level through the career identities and values of clinical and scientific investigators, which could impact on their cognitive differences.

Social relations and trust have been shown to be prerequisite for collaboration because it involves the sharing and exchanges of valuable knowledge and information. The risk of undesirable

knowledge spillover is too high and detrimental to investigators, particularly when academia has been described as anti-collaborative in the study. The role of geographical proximity becomes important in this regard as it could stimulate social relations because shorter geographical distance support social interaction and trust building. The key message here is that we should not overlook the importance of social occasions, training activities and formal and informal information-exchange events. They are in fact opportunities that could foster knowledge sharing and promote collaborative ties. Training and scientific forum could help facilitate access, dissemination, exchange in scientific knowledge. Again, this also contributes to reducing cognitive distance between different professional groups, as this type of event creates a platform on forum where the professional groups are brought together to meaningfully share and discuss their area of expertise and interest. Training and networking opportunities are ways of creating meaningful learning opportunities for different professional groups, which give the teams a chance to reflect on their working approach and behaviour if they are keen to conduct translational research.

The study considered different dimensions of proximity as instrumental to interorganisational collaboration, however it has not looked at some disadvantages associated with proximity (Boschma, 2005; Cassi & Plunket, 2013). For example, social proximity might be detrimental due to lock-in and an under-estimated risk of opportunism (Bosma, 2005). Also, the closer organisational proximity with tighter and more related organisational arrangement might have a negative effect on flexibility and innovation (Frenken and Valente, 2002). We need to look at interplay between different types of proximity (Huber, 2011; Menzel, 2008) and to consider their strengths and weaknesses.

This study highlighted the difficulty in assessing the level of organisational proximity between different partners in university-hospital partnership as it has become apparent that this is an area, which is very difficult to operationalise. Different opinions from a selected few individuals could only offer their insights about what they perceive in terms of organisational proximity but they are insufficient for drawing any conclusion. What is clear is university and NHS Trust are bound by their respective regulatory and policy environment as well as their accountability to their funding bodies. Therefore, organisational distance exists by default and investigators are impacted, and in their view, negatively. There is no simple solution to this. AHSC is faced with the problem of "mission tensions" when pursuing their research, educational and clinical goals, which stem from a wide range of roles, cultures and identities within the clinical and academic professions that AHSC aims to bring together as well as from the regulatory framework that these organisations are part of within their respective industry (French et al., 2014).

The concept of organisational proximity emphasises the importance of shared relations between

organisations in supporting interorganisational collaboration, but we need to put it in context of the UK's relational capabilities, which refers to the ability of organisations within an innovation system to collaborate with other organisation (Owen-Smith et al., 2002). How well universities are working with NHS Trust in the UK could be impacted by factors such as political (e.g. policy initiative, regulations), social (e.g. relations between clinical and scientific labour market) and cultural (e.g. values regarding academic participation in clinical service delivery or vice versa) (Owen-Smith et al., 2002). Universities are funded through the Department for Business, Innovation and Skills' higher education and research funding councils whereas NHS Trust is almost entirely tax funded. This highlights their different hierarchical (bureaucratic), legal, professional and political accountabilities, which will have an impact on organisational proximity.

Based on this observation, policy initiative need to broaden the focus and include the organisational structure of university and hospital, as well as the individual embedded in them. If AHSC is proven as a successful organisational model in driving application of science to the population, then policy makers need to reform the existing accountability relationship to allow closer academic clinical integration. There needs to be a fundamental system redesign and convergence in organisational design that would support AHSC and it partners in pursuing their research priority. There needs to be an alignment of professional framework and development of shared expectation among stakeholders. Furthermore, policy makers need to align various funding steams, allocation of public funding, and incentive strategy to support translational research in university-hospital partnership.

This is an exploratory study using only one AHSC as a case study to examine university-hospital partnership, therefore findings cannot be generalised to other UK AHSC or reflect other AHSC development in the world. But the findings and emerging themes of this unique scenario are useful for theory development and in forming the basis of future research. It also raised some important questions for policy makers, which could serve as starting point for our understanding how macro capabilities may influence the innovation process in translational research.

References

Academic Health Sciences Centre –Full Stage Application (2013) Retrieved on 20.02.2017 from http://www.kingshealthpartners.org/assets/000/000/430/KHP_AHSC_FULL_STAGE_APPLICATION_2013_original.pdf

Ackerly, D., Udayakumar, K., Taber, R., Merson, M., & Dzau, V. (2011). Perspective: Global Medicine: Opportunities and Challenges for Academic Health Science Systems. *Academic Medicine, 86*(9), 1093-1099.

Ahuja, G. (2000). Collaboration networks, structural holes, and innovation: a longitudinal study. *Administrative Science Quarterly* 45 (3), 425–455.

Agrawal, A. (2001). University-to-industry knowledge transfer: Literature review and unanswered questions. *International Journal of Management Reviews*, 3, 285—302.

Agrawal, A., Cockburn, I., McHale, J. (2006). Gone but not forgotten: labor flows, knowledge spillovers, and enduring social capital. *Journey of Economic Geography* 6(5):571–591

Agrawal, A., Kapur, D., McHale, J. (2008). How do spatial and social proximity influence knowledge flows? Evidence from patent data. *Journey of Urban Economic* 64(2):258–269

Ambos, T.C., Ma̎kela̎, K., Birkinshaw, J., D'Este, P. (2008). When does university research get commercialized? Creating ambidexterity in research institutions. *Journal of Management Studies* 45, 1424–1447.

Ankrah, S., & AL-Tabbaa, O (2015). Universities–industry collaboration: A systematic review. *Scandinavian Journal of Management, 31*(3), 387-408.

Balland, P. (2011). Proximity and the evolution of collaboration networks: Evidence from research and development projects within the global navigation satellite system (GNSS) industry. *Regional Studies*, 46, 741–756.

Battilana, J. (2011). The enabling role of social position in diverging from the institutional status and Evidence from the UK National Health Service. *Organisation Science, 22,* 817-834

Ben-David, J. (1960). Roles and innovations in medicine. *The American Journal of Sociology*, 65(6), 557-568.

Boschma, R. (2005). Proximity and innovation: a critical assessment, *Regional Studies* 39, 61–74.

Boschma, R. & Frenken, K. (2009). The Spatial Evolution of Innovation Networks: A Proximity Perspective. Papers in Evolutionary Economic Geography Number 09-05. Section of Economic Geography, Utrecht University, Utrecht.

Breschi, S., Lissoni, F. (2001). Knowledge spillovers and local innovation systems: a critical survey. *Industrial and Corporate Change* Journal 10:975–1005

Broekel, T., & Boschma, R. (2012). Knowledge networks in the Dutch aviation industry: The proximity paradox. *Journal of Economic Geography*, 12, 409–433.

Bruneel, J., D'este, P., & Salter, A. (2010). Investigating the factors that diminish the barriers to university–industry collaboration. *Research Policy, 39*(7), 858-868

Bryman, A. (2012). Social research methods (4th ed.). Oxford: Oxford University Press.

Cassi, L., & Plunket, A. (2014). Proximity, network formation and inventive performance: In search of the proximity paradox. *The Annals of Regional Science,53*(2), 395-422.

Charmaz K (2006): Constructing Grounded Theory: A Practical Guide through Qualitative Analysis London: Sage

Chesbrough, H. (2003). The era of open innovation. *MIT Sloan Management Review, 44*(3), p.35-41.

Colombo, M. (2003). Alliance form: A test of the contractual and competence perspectives. *Strategic Management Journal*, 24, 1209–1229.

Cohen, W & Levinthal, D.A. (1990) Absorptive capacity: a new perspective on learning and innovation, *Administrative Science Quarterly* 35, 128–152

Corley, E., Boardman, P.C., & Bozeman, B. (2006). Design and the management of multi-institutional research collaborations: Theoretical implications from two case studies. *Research Policy* 35, 975–993.

Currie, G., & White, L. (2012). Inter-professional barriers and knowledge brokering in an organizational context: The case of healthcare. *Organisation Studies, 33*, 1333-1361

D'Amour, D., Ferrada-Videla, M., San Martin Rodriguez, L., & Beaulieu, M. (2005). The conceptual basis for interprofessional collaboration: Core concepts and theoretical frameworks. *Journal of Interprofessional Care, 19 Suppl 1*, 116-31.

Das, T., & Teng, B. (1999). Managing risks in strategic alliances. *The Academy of Management Executive*, 13(4), 50-62.

Das, T. & Teng, B. (2002). The dynamics of alliance conditions in the alliance development process. *Journal of Management Studies*, 39: 725-746.

D'este, P., Guy, F., & Iammarino, S. (2012). Shaping the formation of university–industry research collaborations: What type of proximity does really matter? *Journal of Economic Geography.*

D'este, P., & Patel, P. (2007). University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research Policy, 36*(9), 1295-1313.

D'Este, P. & Perkmann, M. (2011). Why do academics engage with industry? The entrepreneurial university and individual motivations. *The Journal of Technology Transfer* 36, 316–339.

Dzau, V., Ackerly, D., Sutton-Wallace, P., Merson, M., Williams, R., Krishnan, K., Taber, R., Califf, R. (2010) The role of academic health science systems in the transformation of medicine. *Lancet* 2009, 375(9718): 949–954.

Eisenhardt, K. (1989). Building theories from case-study research. *Academy of Management Review*, 14, 532–550.

French, C., Ferlie, E., Fulop, N. (2014). The international spread of academic health science centres: a scoping review and the case of policy transfer to England. *Health Policy* 117 (3), 382-391.

Fitzgerald, L. & Harvey, G. (2015). Translational networks in healthcare? Evidence on the design and initiation of organizational networks for knowledge mobilization. *Social Science & Medicine, 138*, 192-200.

Fish, D., Chantler, C., Kakkar, A., Trembath, R., & Tooke, J. (2013). Partnership Model for Academic Health Science Systems to Address the Continuum from Discovery to Care, at Scale. *Translational Medicine - What, Why and How: An International Perspective, 3*, 6-17.

Gray, D. E. (2014). '*Doing Research in the Real World'.* Los Angeles: SAGE.

Hagedoorn, J., Link, A.N., & Vonortas, N. (2000). Research partnerships. *Research Policy* 29, 567–586.

Hardy, C., Phillips, N., & Lawrence, T. (2003). Resources, Knowledge and Influence: The Organizational Effects of Interorganizational Collaboration*. *Journal of Management Studies, 40*(2), 321-347.

Harris, J., Provan, K., Johnson, K., & Leischow, S. (2012). Drawbacks and benefits associated with inter-organizational collaboration along the discovery-development-delivery continuum: A cancer research network case study. *Implementation Science : IS, 7*, 69.

Heinze, T., & Kuhlmann, S. (2008). Across institutional boundaries? Research collaboration in German public sector nanoscience. *Research Policy, 37*(5), 888.

Hopkins, M. (2006). The hidden research system: the evolution of cytogenetic testing in the National Health Service. *Science as Culture*, 15(3), 253-276.

Howells, J. (2002) Tacit knowledge, innovation and economic geography, *Urban Studies* 39, 871–884.

Inkpen, A., & Tsang, E., (2005). Social capital, networks, and knowledge transfer. *Academy of Management Review* 30, 146–165.

Katz, J., & Martin, B. (1997). What is research collaboration? *Research policy*, 26(1), 1-18.

Knoben, J. & Oerlemans, L. (2006) Proximity and inter-organizational collaboration: a literature review,

International Journal of Management Reviews 8, 71–89.

Kogut, B. (2000). The network as knowledge: generative rules and the emergence of structure. *Strategic Management Journal* 21, 405–425.

Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science* 3, 383–397.

Kozuch, B. & Sienkiewicz-Małyjurek, K. (2016) Key Factors of Inter-organisational Collaboration in the Public Sector and Their Strength. *International Journal of Contemporary Management* 15 3, 123–144.

Lander, B. & Atkinson-Grosjean, J. (2011). Translational science and the hidden research system in universities and academic hospitals: A case study. *Social Science & Medicine, 72*(4), 537-544.

Laudel, G. (2006). The art of getting funded: how scientists adapt to their funding conditions. *Science and Public Policy* 33, 489–504.

Laursen, K., & Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal* 27, 131–150.

Laursen, K., Reichstein, T., & Salter, A. (2010). Exploring the effect of geographical proximity and university quality on university–industry collaboration in the United Kingdom. *Regional Studies*, 45, 507–523.

Lawton Smith, H., Bagchi-Sen, S., & Edmunds, L. (2016) Innovation capacity in the healthcare sector and historical anchors: examples from the UK, Switzerland and the US. *Journal of Technology Transfer*, 41(6), 1420-1439

Long, J., Cunningham, F.C., Carswell, P. & Braithwaite, J. (2014). Patterns of collaboration in complex networks: the example of a translational research network. *BMC Health Serv. Res*. 14, 225.

Majchrzak, A., Jarvenpaa, S., & Bagherzadeh, M. (2015). A Review of Interorganizational Collaboration Dynamics. *Journal of Management, 41*(5), 1338-1360.

Martin-Misener, R., Valaitis, R., Wong, S., MacDonald, M., Meagher-Stewart, D., Kaczorowski, J., . . . Austin, P. (2012). A scoping literature review of collaboration between primary care and public health. *13*(4), 327-346.

Martín-Rodriguez, L., Labadie, J., Goulet, L., D'Amour, D. & Pineault, R. (2008). A model and typology of collaboration between professionals in healthcare organizations. *BMC Health Services Research, 8*(1), 188.

McEvily, B., Perrone, V., Zaheer, A. (2003). Trust as an organizing principle. *Organization Science* 14, 91–103.

Medical Research Council. (2010). MRC's translational research strategy. Retrieved on 21.02.17 from http:// www.mrc.ac.uk/Ourresearch/ResearchInitiatives/Translationalresearch/index.htm

Menze M. P. (2008) Dynamic Proximities: Changing Relations by Creating and Bridging Distances. Papers in Evolutionary Economic Geography Number 08-16. Section of Economic Geography, Utrecht University, Utrecht.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5, 14—37.

Nooteboom, B. (1992). Towards a dynamic theory of transactions. *Journal of Evolutionary Economics*, Vol. 2 No. 4, pp. 281-99.

Nooteboom, B. (2000) Learning by interaction, absorptive capacity, cognitive distance and governance, *Journal of Management and Governance* 4, 69–92.

Nooteboom, B., Vanhaverbeke. W., Duysters, G., Gilsing, V., & Van Den Oord, A. (2007) Optimal cognitive distance and absorptive capacity, *Research Policy* 36, 1016–1034.

Olson, C., Balmer, J., & Mejicano, G. (2011). Factors Contributing to Successful Interorganizational Collaboration: The Case of CS2day. *Journal of Continuing Education in the Health Professions, 31 Suppl 1*(S1), S3-S12.

Owen-Smith, J., Riccaboni, M., Pammolli, F., & Powell, W. (2002). A comparison of U.S. and European university–industry relations in the life sciences. *Management Science* 48 (1), 24–43.

Ovseiko, P., Davies, S., & Buchan, A. (2010). Organizational Models of Emerging Academic Health Science Centers in England. *Academic Medicine,85*(8), 1282-1289.

Ovseiko, P., Heitmueller, A., Davies, S., Wells, G., Ford, G., Darzi, A., Buchan, A. (2014). Improving accountability through alignment: The role of academic health science centres and networks in England. Bmc Health Services Research *14*(1), 24.

Ovseiko, P., O'Sullivan, C. & Powell, S. (2014). Implementation of collaborative governance in cross-sector innovation and education networks. *BMC Health Services Research* 11 (14), 552.

Ovseiko, P., Oancea, A., Buchan, A. (2012) Assessing research impact in academic clinical medicine: a study using Research Excellence Framework pilot impact indicators. *BMC Health Serv Res* 12(1):478.

Ovseiko, P., Davies, S., Buchan, A. (2010) Organizational models of emerging academic health science centers in England. *Acad Med* 85(8):1282–1289.

Ovseiko, P., Buchan, A. (2012) Organizational culture in an academic health center: an exploratory study using a competing values framework. *Acad Med* 87(6):709–718.

Majchrzak, A., Jarvenpaa, S., & Bagherzadeh, M. (2015). A Review of Interorganizational Collaboration Dynamics. *Journal of Management, 41*(5), 1338-1360.

Martin-Misener, R., Valaitis, R., Wong, S., MacDonald, M., Meagher-Stewart, D., Kaczorowski, J., O-mara, L., Savage, R., & Austin, P (2012). A scoping literature review of collaboration between primary care and public health. *Primary Health Care Research & Development 13*(4), 327-346.

Perkmann, M., Tartari,V., Mckelvey,M., Autio, E., Broström, A., D'este, P. (2013). Academic engagement and commercialisation: A review of the literature on university—industry relations. *Research Policy*, 42, 423—442.

Perkmann, M. & Walsh, K. (2007). University–industry relationships and open innovation: Towards a research agenda. *International Journal of Management Reviews*, 9, 259–280.

Perkmann, M. & Walsh, K., (2009). The two faces of collaboration: impacts of university–industry relations on public research. *Industrial and Corporate Change* 18, 1033–1065.

Ponds, R., Van Oort, F., Frenken, K. (2007). The geographical and institutional proximity of research collaboration. *Papers in Regional Science* 86(3):423–443

Powell, W., Koput, K., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, 41, 116—145.

Powell, W., White, D., Koput, K. & Owen-Smith, J. (2005) Network dynamics and field evolution: the growth of interorganizational collaboration in the life sciences, *American Journal of Sociology* 110, 1132–1205.

Rafols, I. & Meyer, M. (2007). How cross-disciplinary is bionanotechnology? Explorations in the specialty of molecular motors. *Scientometrics* 70, 633–650.

Rosenberg, N. (2009). Some critical episodes in the progress of medical innovation: an anglo-american perspective. Research Policy, 38, 234-242.

San Martín-Rodríguez, L., Beaulieu, M., D'Amour, D., & Ferrada-Videla, M. (2005). The determinants of successful collaboration: A review of theoretical and empirical studies. *Journal of Interprofessional Care, 19 Suppl 1*, 132-47.

Santoro, M. & Saparito, P. (2003). The firm's trust in its university partner as a key mediator in advancing knowledge and new technologies. *IEEE Transactions in Engineering Management* 50, 362–373.

Santoro, M., & Gopalakrishnan, S., (2001). Relationship dynamics between university research centers and industrial firms: their impact on technology transfer activities. *Journal of Technology Transfer* 26, 163–171.

Santos, F., & Eisenhardt, K. (2005). Organizational boundaries and theories of organization. *Organization Science* 16: 491–508.

Sbaraini, A., Carter, S., Evans, R., & Blinkhorn, A. (2011). How to do a grounded theory study: A worked example of a study of dental practices. *BMC Medical Research Methodology, 11*, 128.

Scarbrough, H., D'Andreta, D., Evans, S., Marabelli, M., Newell, S., Powell, J. & Swan, J. (2014). Networked innovation in the health sector: comparative qualitative study of the role of Collaborations for Leadership in Applied Health Research and Care in translating research into practice. *Health Serv. Deliv. Res*. 2 (13).

Schilling, M. A. & Phelps C. C. (2007) Interfirm collaboration networks: the impact of large scale network structure on firm innovation, *Management Science* 53, 1113–1126.

Shaw, S., Ashcroft, J., & Petchey, R. (2006). Barriers and opportunities for developing sustainable relationships for health improvement: The case of public health and primary care in the UK. *Critical Public Health, 16*(1), 73-88.

Slavtchev, V. (2013). Proximity and the transfer of academic knowledge: Evidence from the spatial pattern of industry collaborations of east German professors. *Regional Studies*, 47, 686–702.

Swan, J., Goussevskaia, A., Newell, S., Robertson, M., Bresnen, M., & Obembe, A. (2007). Modes of organizing biomedical innovation in the UK and US and the role of integrative and relational capabilities. *Research Policy*, 36, 529-547.

Ter Wal, A. (2014). The dynamics of the inventor network in German biotechnology: geographic proximity versus triadic closure. *Journal of Economic Geography* 14(3):589–620

Torre, A. (2008). On the role played by temporary geographical proximity in knowledge transmission, *Regional Studies* 42, 869–889.

Torre, A., & Rallet, A. (2005). Proximity and localization. *Regional Studies*, 39, 47–59.

Torre, A. & Gilly, J. (2000). On the analytical dimension of proximity dynamics. *Regional Studies*, 34(2), 169 –180.

Wuyts, S., Colomb, M., Dutta, S. & Nooteboom, B. (2005). Empirical tests of optimal cognitive distance. *Journal of Economic Behavior & Organization*, *58*(2), 277–302.

Yin, R. K. (2009). Case study research: Design and methods (4th Ed.). Thousand Oaks, CA: Sage