



UNIVERSITY OF
LINCOLN

MICROFOUNDATIONS OF
ACADEMICS' NETWORKS:
INITIATION, EVOLUTION AND
CONTEXT

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Doctor of Philosophy

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**MICROFOUNDATIONS OF ACADEMICS'
NETWORKS: INITIATION, EVOLUTION AND
CONTEXT**

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A thesis submitted in partial fulfilment of the requirements of the
University of Lincoln for the degree of Doctor of Philosophy

2020

DECLARATION

This is to certify that:

- I. this thesis represents work originally conducted by me towards the PhD;
- II. in instances where joint work is presented, due acknowledgement is offered in the text;
- III. all materials have been attributed due acknowledgement;
- IV. the thesis is less than 100,000 words in length, inclusive of tables, figures, bibliographies, appendices and footnotes.

Rhoda Ahoba-Sam

ABSTRACT

The world over, universities are increasingly challenged to make economic contributions to their host cities. Universities are particularly the target of this challenge because of the belief that knowledge intensive institutions are critical to the building of a knowledge-based economy and thus increasing regional competitiveness. Subsequently, the weight placed on universities has resulted in a stretch in universities' traditional missions of research and teaching to include a third mission. This so-called third mission is operationalised in universities' engagement with their communities as characterised by collaborations with industry partners, among others. It is understood that by establishing close ties with industry for instance, both entities could together improve the fortunes of their communities through problem solving and creativity that contribute to innovation. Simply, University-Industry Collaborations (UICs) play a key in the regional innovation process.

This thesis takes a determined stance. Where collaborations between universities and industry is concerned, individuals are the critical conduits for the process of knowledge exchange. Additionally, knowledge collaborations are embedded within networks stemming from both university and industry entities. Indeed, individuals who are critical to the competitiveness of their regions do not act in isolation – they network. Interestingly however, existing research on UICs is mainly focused on the organisational level. Also, while networking forms a critical aspect of the theories on regional innovation, networks are rarely the focus in studies on regional innovation. To that effect, this thesis focuses on the *networks of individuals* especially in university and industry collaborations.

The interest of this work is to explore foundational aspects of networks by placing the spotlight on individual academic scientists and their network ties. Consequently, the aim of this thesis is to investigate how individual contacts of a given academic could shape his knowledge exchange network. To achieve this aim, the study assumes a tripartite nature in which I explore the *initiation*, *evolution* and *context* of academics' networks. The analysis presented in this work draws upon 100 semi-structured interviews with academic scientists and other relevant stakeholders in the knowledge exchange process where an attempt is made to obtain insight into networking as embedded in academic engagement.

Overall, this thesis has yielded insight into i) how the personal networks of individual academics are built, especially from a geographic perspective where motivations are linked to regional and extra-regional incentives; ii) how the networks of individual academic scientists evolve over time and what factors influence this process and, iii) not least, the effect of the institutional and regional contexts on knowledge exchange processes as exemplified in academics' networks. The insights emerging from this thesis have interesting implications for policy making.

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O magnify the LORD with me and let us exalt His name together! (Ps. 34:3).

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LIST OF ABBREVIATIONS

SNT	Social Network Theory
SNA	Social Network Analysis
KE	Knowledge Exchange
SME	Small and Medium Enterprises
UIC	University-Industry Collaboration
HEI	Higher Education Institute
HE	Higher Education
STEM	Science, Technology, Engineering and Mathematics
RUNIN	The Role of Universities in Innovation and Regional Development

CHAPTER 1 - MICROFOUNDATIONS OF ACADEMICS' NETWORKS

The notion that individuals are embedded in thick webs of social relations and interactions is one of the most potent ideas in the social sciences (Borgatti et al., 2009, Granovetter, 1973). According to this concept, individuals are connected by invisible ties that make up webs of related individuals. *Networks* is a common *lingua* often adopted to describe the links that exist between individuals. (Scott, 1988) Subsequently, the theories of social network are founded on this ideology. Analyses emerging from these theories provide comprehension of how independent individuals come together to form functioning societies. Establishing the connections between individuals is achieved by mapping out the existing relationships between various individuals. Consequently, social network analysis, SNA, provides insight into a host of social phenomena, from individual creativity to corporate profitability, and has been applied in different fields of study to explain social mobility, migration and perceptions of social class, among others.

Traditionally, SNA has been employed severally for scrutinising the nature of our social environment (Friedkin, 1980, Borgatti et al., 2013). Typically, by attributing network characteristics in terms of nodes (i.e. individual actors, people, or things within the network) and the ties (i.e. relationships or interactions) that connect them, it is possible to map out the relationships that connect individuals within a certain context (Scott, 1988). In analysing social events this way, researchers are privy to information about which individuals are central and those who are peripheral in a whole network. Hence, it is possible to tell how the structure is altered by the presence and absence of specific individuals, and indeed over time, how a network evolves. Put together, SNA typically focuses on the *structure* of our social environment and provides rich data of how systems consisting of individuals interact and evolve.

Whilst SNA is insightful for explaining how social systems are organised, it mostly favours those scientists interested in societal issues occurring at the aggregate and structural levels, and may not be optimal for obtaining basic or micro foundational comprehension of individuals' relationships. For example, where evolution of networks are concerned, SNA provides information about how a whole network

evolves, which implies that little or no focus is placed on how individual ties within the entire structure are also evolving. This defines the point of departure of this thesis in which more weight is placed on individuals rather than the entire network. In this regard, a focus on microfoundations of networks as relevant for this thesis entails focus on the actual individuals whose ties constitute networks. This perspective is important for obtaining basic understanding of how networks function. Borgatti et al. (2009) also place weight on the importance of individuals' views by explaining that the measurement of person's perception of behaviour is a more useful predictor of behaviour than a measurement of their actual world – their context. Subsequently, this thesis focuses on individual academics to understand how they build their networks, how these networks evolve, and how the prevailing regional and institutional contexts affect their networks.

But, why academic scientists though? And, why a focus on their networks?

1.1 CONTEXTUALISATION OF THE RESEARCH

Over the last decades, universities as knowledge institutions have been increasingly perceived to play an instrumental role in the development of their regions (Charles, 2006, Arbo and Benneworth, 2007). This is particularly relevant for the development of a knowledge-based economy where the important role of universities as actors in knowledge creation and dissemination has been identified as key (Charles, 2006, Lambooy, 2004, Arbo and Benneworth, 2007). The role of universities, delivered further through the production of educated human capital fosters innovation and creativity (Florida, 1995), with the potential to bring about technological advancements (Charles, 2006, Lambooy, 2004). As organisations, universities are rightly perceived to be knowledge stores that contribute to the building of a knowledge-based economy.

Outside traditional teaching and research however, universities have been increasingly observed to contribute to the competitiveness of their communities through the pursuance of so-called third mission roles like industry engagement (Ankrah and Al-Tabbaa, 2015, Breznitz and Feldman, 2012). Engagement as used in this thesis refers to the *involvement of universities in partnerships, networks, collaborations and other relationships that seek to promote a third mission of being closer to their communities.*

These efforts are often characterised by varied types of co-operation with industry, government agencies and other organisations. The collaboration between Universities, Industry and Government is conceptualised as a triple-helix relationship - an analogy after the double-helix nature of DNA (Etzkowitz and Leydesdorff, 1998). By this, social scientists attribute a certain level of complexity to social relationships that surpasses that which is typically found occurring in nature.

Universities initiate and also partake in various partnerships including those with other universities to facilitate Knowledge Exchange (KE) both within their respective regions and internationally. These actions and contributions of universities are somewhat expected and, even required in response to the pressure from globalization, and the call to universities to deliver on their third mission towards regional economic development (Arbo and Benneworth, 2007). Evidently, the third mission role of universities is not performed in isolation. Universities deliver on their mandate in collaboration with different stakeholders (Breznitz and Feldman, 2012). In this regard, universities actively contribute through co-establishing business incubators, partnering in science-park and think tank projects, and the training that they offer to local Small and Medium Enterprises (SMEs). In doing this, they [universities] deliver competitiveness to their communities (Ankrah and Al-Tabbaa, 2015).

Owing to the importance of universities as a potent means of promoting regional development, Governments for many years have keenly encouraged University-Industry Collaborations (UICs). This is particularly so in those regions with a poor performance on innovation. (Charles, 2006) UICs as used here, refers specifically to *knowledge-exchange collaborations between university and industry entities – both at the individual and organisational level, and also institutionalised (more formalised arrangements) and non-institutionalised (non-formalised arrangements) forms*¹. It has been acknowledged that through knowledge-based collaborations for instance, universities can assist firms in bringing forward technological innovations in their regions (Sternberg, 2000, Gunasekara, 2006, Agrawal, 2001, Charles, 2006).

¹ Even though UICs may refer to individual and organisational level interactions between universities and Industry, this thesis focuses more on individual level interactions and will therefore make much reference to that level of interaction especially where this distinction is important to make more meaning.

In Norway, Sweden and the UK, as in many European countries, various reforms have increasingly led to the diminishing of the perceived boundaries between universities and their environment (Sataøen, 2018, Martin and Turner, 2010, Gulbrandsen and Nerdrum, 2007). By forging new and closer local relationships, universities can better contribute to the social and economic development of their regions (Trippel et al., 2012, Charles, 2006, Christopherson and Clark, 2010).

Universities are unique and all need to adapt specifically to their given context. This uniqueness of universities exists in terms of their mission focus, duration of existence (age) and management practices, among others. The case of rural and peripheral universities is particularly interesting to consider when assessing the roles and potential contributions universities make to their cities. This is because rural universities struggle with economies of scale and scope (Charles, 2016), and subsequently need to adapt to their specific context in delivering a ‘third role’ of engagement. Universities of peripheral location may also be disadvantaged by reason of accessibility imposing some difficulty in attracting prospective students and staff. Further, research focused on the contributions of universities to their host cities have conveniently focused on more centralised universities. Focusing on rural and peripheral universities, as has been done in this thesis, therefore provides new perspectives into understanding the phenomenon of universities’ engagement in knowledge exchange partnerships.

An important proposition based on which this thesis stands is that, *the ability to contribute to a knowledge-based economy depends largely on individuals in the university* (Coe and Bunnell, 2003, Henry and Pinch, 2000). This is because knowledge is often tacit and embodied in the capacity of individuals. Knowledge exchange therefore requires the deliberate effort of individuals to transfer it. (Lawson and Lorenz, 1999, Coe and Bunnell, 2003, Nonaka, 1994) ‘In this thesis, academics are defined as knowledgeable individuals with an involvement in learning (teaching) at universities or other educational institutions. By virtue of their role as scientific researchers advancing knowledge in an area of interest these academics are also conceptualised as academic scientists. Both ‘an Engineer developing robots for agricultural harvesting’ and ‘a Geographer researching the impacts of universities on socioeconomic development’ fit this profile.

The presence of individual academics who are believed to embody knowledge, coupled with their participation in regional processes is therefore required for the transfer of university-held knowledge. This is more so owing to the ‘sticky’ nature of knowledge; of being difficult to transfer, and requiring the intentional efforts of knowledgeable individuals to be transferred. (Lawson and Lorenz, 1999, Coe and Bunnell, 2003, Nonaka, 1994, Patariaia et al., 2014, Agrawal, 2001, Ramos-Vielba et al., 2010) In a regional setting, regional actors do not innovate in isolation but are embedded in interrelated and interactive regional innovation processes (Asheim et al., 2011, Stuck et al., 2016) through which knowledge exchange is enhanced. Similarly, academics’ engagement is embedded within social networks. From the perspectives that universities serve as knowledge nodes and the need for individuals’ actions to ensure the transfer of ‘tacit’ knowledge, the important role of individual academics is clear (Nonaka, 1994, Patariaia et al., 2014, Agrawal, 2001, Ramos-Vielba et al., 2010). Consequently, individual academic scientists are believed to embody knowledge and whose deliberate efforts result in knowledge transfer in University-Industry relationships is emphasized in this work.

Interestingly, research on regional development has primarily focused on organizations and institutions, and the impact of individuals’ engagement in UICs almost overlooked (Ankrah and Al-Tabbaa, 2015). Investigating this gap, especially from the individual level, is key to unearthing the potential value of university-industry linkages. Specifically, given that University-Industry relationships are built around, and facilitated by the actions of ‘knowledgeable’ individuals, it is important to appreciate the personal considerations made prior to collaborating and what practices the concerned individuals employ to ensure maximum and sustained contributions to regional development. An individual-level analysis of academics’ networks is key to deeper understanding of knowledge-exchange partnerships of academic scientists. Subsequently, the main focus of this thesis is placed on individuals in UICs and their contacts rather than on the organisational level – and thus the emphasis on microfoundations of academics’ networks.

1.1.1 Network Initiation

Interactions between individuals in university and industry entities is key to regional innovation (Coe and Bunnell, 2003). However, mere co-location is not a sufficient condition for individuals' collaboration. It is therefore important that common interests exist to facilitate establishment of network ties. In the literature, perception of a specific benefit within a relationship is considered an important driver for establishing a tie between individuals (D'Este and Perkmann, 2011, Perkmann and Walsh, 2007, Tartari et al., 2014, Perkmann et al., 2011, Perkmann et al., 2013). Accordingly, innovation performance depends largely on individuals, but how these interact is also very important. So while networks are developed and managed within the broader context of academic and economic pressures, they are operationalized within strategic relationships (Lowrie and McKnight, 2004). For example, because the specific ties formed between individuals to a large extent determines their research capacity (Ponomariov and Boardman, 2010) academics need to be strategic when forming ties with significant others.

Commonalities, complementarities and relatedness (Breschi et al., 2003; Boschma and Frenken, 2018) emerge as common literature descriptions of some of the determinants of human interaction that enable academic scientists pursue their research goals (D'Este and Perkmann, 2011, Perkmann and Walsh, 2007, Tartari et al., 2014, Perkmann et al., 2011, Perkmann et al., 2013). But how are the networks of academics actually established? And what are the underlying mechanisms? The existing literature insights, while they highlight why individual actors interact with each other, do not explain how they actually initiate their network ties and the thought processes that go into the decision-making. Additionally, as far as motivations are concerned, it remains to be understood how individual academics' motivations are influenced by their regional context. *To this end, it is interesting to obtain further insight into how academics' networks are initiated, and from a regional perspective – this gap is therefore explored in this thesis.*

1.1.2 Network Evolution

Personal relationships and networks are dynamic in nature. (McPherson et al., 2006). So once initiated, it can be expected that academic networks are also subject to change.

Network ties can be intentionally maintained, weakened and new ones can be forged over time. Even though academic engagement has been the focus of much research (Perkmann et al., 2013), how individuals' relationships change in the context of UICs has not been the focus of much scholarly work. *It is therefore a focus of this work to gain insight into how networks actually evolve over time.*

Also, where evolution of social networks have been studied, the studies have been conducted at a more structural or aggregate level, with the use of quantitative approaches (Mollenhorst et al., 2014). While such scholarly work are valued for contributing insights, in my view, they do not reveal much about the underlying factors that lead to evolution of individuals' relationships. Subsequently, in this thesis, more attention is therefore paid to the functional level of academics' networks in order to contribute to the existing literature on academics' networks by offering insights into how academics' networks evolve at the individual tie level. This assessment of evolution is based on changes in perception of tie importance. Studying evolution of academics' networks is key to understanding the dynamic nature of relationships underpinning our social environment

1.1.3 Context of Academics' Networks

Regardless of the agency individuals may exhibit in network initiation and evolution, context also exerts a very important influence on their network ties and the possible impact their networks could contribute to regional innovation. For example, the organisational context plays a critical role at articulating and amplifying the knowledge possessed and developed by individuals (Nonaka, 1994). Also, evidence of entrepreneurial academics, after the incidence of entrepreneurial university (Foss and Gibson, 2015, Vorley and Nelles, 2009) lends evidence to the effect of universities' institutional context on the identity of individual academics.

While individual academic scientists are central to the entrepreneurial and knowledge exchange activities of a university, top management may identify engagement as a key element of institutional strategies which direct the decisions of academics. Together, both universities and individual academic scientists are embedded within regional innovation systems and thus under the influence of regional economies. So while

emphasizing the important role of individuals in knowledge-exchange processes, it is also important to know that the context within which these exchanges occur is also significant. *To this end, further insight into how the institutional and regional contexts affect academics' networks is explored in this work.*

1.2 RESEARCH OBJECTIVES

The main research question of this thesis is:

How do the individual contacts of academic Scientists shape the nature and geography of their knowledge exchange networks?

By definition, this main question implies an expectation that the nature and geography of academics' networks is somewhat dependent on their various contacts. Simply, by identifying the individual ties of academic scientists, it is possible to gain insight into inherent features and qualities of academics' networks – knowledge exchange networks in particular, since I am interested in knowledge-based interactions between academic scientists and their personal contacts. The identification of network contacts, assuming one can find out their geographic location, also contributes understanding of the spatial distribution of ties.

The strategy adopted to answer the research question is tripartite in nature - in view of how academic networks are initiated, how they evolve and the effect of the institutional [university] and regional contexts on academics' networks. A common logic that runs through this thesis, based on network theory, is the embeddedness of individuals in webs of social relations and interactions (Borgatti et al., 2009, Granovetter, 1973) (Scott, 1988). For example, with each individual at the centre of his own universe (Wellman, 2007), we each know who our friends are, and their importance to us in terms of help, information and sociability (McPherson et al., 2006, Wellman, 2007). Accordingly, the collaborative efforts of individuals are embedded within their personal networks. By paying attention to important aspects of networks such as their initiation, evolution and context, it is possible to contribute insights into how the individuals' contacts shape his knowledge exchange efforts. The research question is thus further explored in the following sub-questions:

1. How do academic scientists build their networks and what motivates local and/or international networking?
2. How do academic networks evolve over time?
3. How does universities' institutional and regional context affect academics' knowledge exchange networks?

1.2.1 Project Context

The research work presented in this thesis was carried out under the broad individual project topic of 'Networks of individuals in University-Industry relationships' within the scope of the EU-funded 'RUNIN' project. RUNIN, the Role of Universities in Innovation and Regional Development is a European Training Network for Early-Stage Researchers (ESRs) in the field of science and innovation studies. With the increased focus on the instrumentalist position of universities as important drivers of regional development, the aim of the training programme is '*to equip a new generation of researchers who can work within this field in the academic world or as specialist policy makers at the regional, national or European level*'² Relatedly, the RUNIN project's main research question is focused on explaining how universities can contribute to innovation and regional development.

The aims and objectives of the RUNIN project are operationalised through four main themes: People and Networks, Policies and Interventions, Places and Territories, and Practices and Governance. As defined under the RUNIN project, my particular research was designed to examine networks of individuals as mechanisms for knowledge exchange, trying to track how individual contacts shape the geography of knowledge exchange networks. Designated as ESR2, my project was under the WP4 thematic group on People and Networks as shown in Figure 1.

² See the RUNIN project website (<https://runinproject.eu/>)

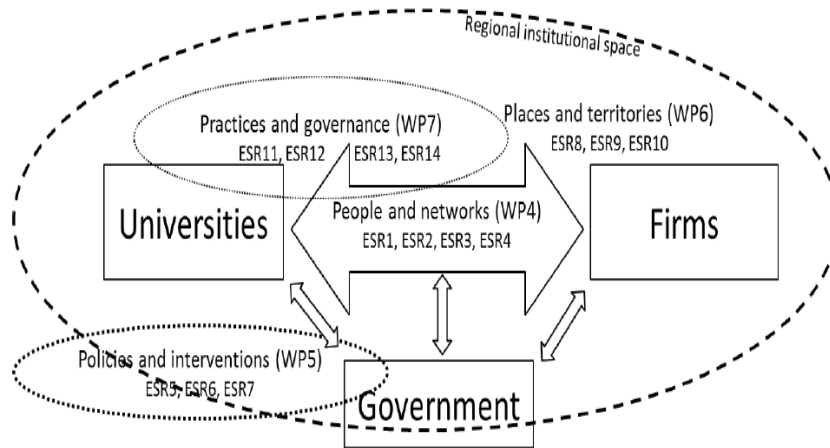


Figure 1: Research themes and individual projects under RUNIN³

While the focus of this thesis was initially defined by the framework of the RUNIN project and needed to fulfil its general contribution to the bigger picture, the actual cases chosen, methodologies employed, and other practical decisions have been decided on independently. For instance, since the project allowed some flexibility in the particular universities to include in the study, those presented in the study have been decided on in the course of developing the research work. Further, the particular angle of research chosen to address the aims of the study has been independently arrived at, and particularly allowed to evolve over the years of the project. In this way, scientific publications⁴ have been produced out of independently and jointly designed sub-studies deemed appropriate for developing this project work.

1.3 VALUE ADDITION OF THE THESIS

In order to research the micro-foundations of academics' networks, this thesis employs a qualitative approach and develops a methodology based on SNA which enabled access to specific examples of collaborators and thus the possibility to highlight the *sui generis* nature of individual connections. By focusing on individual level interactions, information about how relationships are initiated and how these change is explored through semi-structured interviews. While it is not the aim to construct the network structures of the interviewees, this work recognises that it is a misconception to think that a micro-foundational focus implies a rebuff of the role of structure and

³ sourced from the RUNIN project's proposal document to the EU

⁴ This thesis work is constituted five papers (3 published in peer-reviewed journals) which will be referred to where appropriate. See Appendix 7 for publications developed in the course of this work.

institutions. Subsequently, attention is also paid to the context under which these occur. Altogether, the above considerations have informed the title of this thesis: ‘Micro-foundations of academics’ networks: initiation, evolution and context’.

Indeed, the value obtained from this study has been dependent on the niche carved by the specific research gaps identified. By adapting a micro-level approach, this research differs from others which have rather focused on organisations when studying knowledge exchange relationships. Further, the contributions are inherent in the regional perspective employed which is usually not the focus when academics’ networks in particular, or networks in general have been studied. This thesis thus makes several contributions to existing knowledge as outlined in the following:

1. Initiation of personal networks

The work in this thesis highlights that academic scientists switch between different styles of decision-making logics when building their networks. It is particularly highlighted that, in so far as academic networks exhibit heterogeneous characteristics [of the nature of ties or relationships formed based on institutional types and geographical location] the greater the need to possess and exhibit the ability to swap between different decision-making tendencies. This adaptability enables academic scientists to initiate and maintain ties with different contacts. *In answer to the main research question of this study on ‘how the individual contacts of academic scientists shape the nature of their knowledge exchange networks’, it can be seen that the variety of types of contacts actually affects the decision-making approaches employed by academics when initiating their networks.*

2. Evolution of networks

Based on the idea that relationships are dynamic and evolve, this work explores the evolution of academics’ networks. The findings in this work present specific nuances related to how different linkages are formed and how they evolve have been exposed. Based on several evolution profiles isolated, various factors affecting academics’ relationships are presented in relation to careers, geography, initiation and regional path. Further the dependence of relationship success on individuals’ characteristics such as shared interests was also evident. *In this way, exploring the evolution of network ties addresses the main research question of this study on ‘how the individual*

contacts of academic scientists shape the nature of their knowledge exchange networks' by highlighting in which way different types of contacts direct network evolution.

3. Context

Academic scientists engage locally because they perceive the advantages that exist in their regions as relevant for pursuing their research agenda. Though, engaging locally is laden with challenges which require a concerted effort from all relevant regional stakeholders to address. As evident from top-down approaches and lack of consensus building and communication, coupled with the differences in organisational outlook compared to industry universities are often challenged on their efforts to successfully offer the support required for academics to network. Indeed, academic scientists alone are not able to address the issues challenging regional engagement if other provisions are not locally available. This emphasises that while individual's agency is necessary for academic engagement the contributions of various stakeholders is important for addressing challenges. In this way, the main research question of this study on *'how the individual contacts of academic scientists shape the nature of their knowledge exchange networks'* is addressed by the finding that the regional and institutional context, including the various stakeholders who constitute network ties, play a role in both the creation and resolution of the various factors that challenge academic networks.

1.4 SUMMARY OF THESIS STRUCTURE

After this introductory chapter, theory relevant to the study will be discussed (chapter 2). Here, the existing schools of thought on academics' engagement and networks are reviewed. Section 2.1 reviews the changing demands of universities, highlighting the increasing expectations of universities to take up a third role of engagement. Section 2.2, 2.3 and 2.4 evaluate existing knowledge on how individuals initiate their networks, networks evolve and how context affects networks.

Next comes the methodology section (chapter 3), where a description of the chosen methodology together with the literature supporting such choices is presented. Section 3.1 highlights the main philosophical foundations of the work presented in thesis,

mainly arguing for individual level analysis of social events. Section 3.2 presents the research design whereas section 3.3 highlights the step-wise strategy employed. Finally, the section 3.4 is focused on issues of reliability and ethics considered in the study.

The data and analysis section (chapter 4-8) for this thesis present the main data and findings. It illustrates consistency of the research enquiry in how the logic of the aims of the thesis feeds into the collected data, analysis and interpretation of findings. Chapter 4 presents the case countries and regions considered in the study and the importance of considering these as relevant cases for this thesis. The contribution of each of these cases to the thesis and, where and why they are employed to highlight the interests of the research is emphasized in terms of the universities' context and the regional context. Chapter 5 and 6 present findings on initiation of network. While Chapter 5 is focused on the decision making logic(s) that direct network initiation, Chapter 6 looks at the motivations to initiate networks from a regional perspective. In Chapter 7 findings on evolution of networks are presented and finally chapter 8 presents findings on the effects of context on academics' networks.

This thesis is finalised in chapter 9 with a presentation of the conclusions. The limitations and policy implications of the study are also outlined.

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CHAPTER 2 – LITERATURE SURVEY

In line with the aims of this thesis, a synopsis of the relevant literature is presented in this chapter. First, an overview of the changing demands on universities as knowledge institutions is presented in section 2.1. In the next sections, I narrow down on individual academic scientists as important actors in the knowledge exchange process, to explore existing knowledge on the initiation (section 2.2), evolution (section 2.3) and context of their networks (section 2.4). Accordingly, the existing gaps in the literature which motivated the various facets of this research and subsequently directed all the data collection efforts and analysis are highlighted.

2.1 THE CHANGING DEMANDS ON UNIVERSITIES

The desire to be differentiated and stay relevant in the face of global competition is increasingly prominent (Porter, 1998, Arbo and Benneworth, 2007). While the perceived boundaries between countries, regions, firms and individuals seemingly shrink in the face of globalization, these entities yet strive to be unique and a leader in particular sectors – all in the bid to set themselves apart from the rest of the world (Arbo and Benneworth, 2007). Global competition has among other developments, resulted in new and improved trends of technologies that challenge the developmental trajectories of various industries. In essence, innovating upon previous capabilities and offerings is important for remaining relevant (Kline and Rosenberg, 1986). In the wake of this competition, there has also been increasing pressure mounted on research and knowledge institutions. The realization is that, competitiveness lies in the development of a knowledge-based economy (Porter, 1998, Charles, 2006), for which reason different types and combinations of knowledge must emerge.

Knowledge institutions have subsequently been entrusted with a key mission - an expectation to not only conduct education and research, but also contribute actively to the development of their economic, social and cultural surroundings (Arbo and Benneworth, 2007). Universities in particular have been acknowledged as key actors in the development of a knowledge-based society (Shaw and Allison, 1999, Goddard and Chatterton, 1999, Vorley and Nelles, 2009). The world over, there has in particular been an increasing acknowledgement of universities as incubators of the capacity for social and economic growth (Arbo and Benneworth, 2007, Christopherson and Clark,

2010). This acknowledgement is evident in part from the pressure imposed on universities by policy-makers and other stakeholders to combine an emphasis on global research excellence with a contribution to the development of the knowledge economy in their host cities (Charles, 2011), and especially, to act as ‘economic engines’ (Christopherson and Clark, 2010). As economic engines, (research) universities are often pushed into assuming a very central role in the innovation process and somewhat supplanting the place of government in nurturing a healthy economy (Christopherson and Clark, 2010, Steenhuis and Gray, 2006).

In essence, universities which are traditionally established to conduct education and research are faced with a mission stretch to include a broader economic, social and cultural responsibility (Arbo and Benneworth, 2007, Christopherson and Clark, 2010, Shaw and Allison, 1999, Goddard and Chatterton, 1999, Vorley and Nelles, 2009, Bonaccorsi, 2017, OECD, 1999, OECD, 2007, Charles, 2006, Gunasekara, 2006, Breznitz and Feldman, 2012, Benner and Sandström, 2000).

2.1.1 Universities’ engagement and third mission roles

Supporting regional economic growth has meant that universities’ core activities transcend the conventional research and education. Relatedly, various governmental reforms have led to an increased focus on so-called third mission⁵ activities – also referred to as outreach or community service. Overall, these activities encapsulate efforts by universities that enable their non-traditional roles (Pinheiro et al., 2015, Sataøen, 2018, Gulbrandsen and Slipersæter, 2007, Jongbloed et al., 2008). Subsequently, these activities extend for example from mere research commercialization to a more general impact mandate. As knowledge institutions, the capacity of universities to deliver on a third role is embodied in their ability to contribute to the production and dissemination of new knowledge (Lambooy, 2004, Charles, 2006), as well as facilitate recombination of old forms of knowledge.

Universities have been observed to advocate collaboration with various stakeholders in their communities. This engaged outlook is undertaken both locally and

⁵ Universities’ third mission activities are defined generally by Gulbrandsen and Slipersæter (2007) as dissemination or outreach activities.

internationally (Trippel, 2013). By establishing and maintaining these glocal⁶ partnerships, the flow of knowledge can be ensured. Further, being linked to external partners suggests access to innovation and diversity which present as competitive advantages for the university and their host communities. Encouragement from stakeholders for these third mission activities is particularly typified in policies and research funding instruments (Vorley and Nelles, 2009), in which higher education is expected to take actions to facilitate entrepreneurship, technology transfer and interactive learning. This backing invariably promotes building of universities' third mission around their interaction with regional industry and society (Arbo and Benneworth, 2007). The call to universities to interact with public and private entities, to disseminate research both to the general public and in the creation of innovations and jobs can therefore also be understood as a political ambition for exploiting universities' potential.

For example, universities face pressure from policy-makers to combine an emphasis on global research excellence with a contribution to the development of the knowledge economy in their host cities (Charles, 2011, Bonaccorsi, 2017). Specifically, the UK government for instance is reported to have focused much effort to encouraging the economic engagement of universities (Regeneris Consulting, 2017, BIS, 2013). This political ambition is also in particular evident on a European level with a stronger focus on interaction in Horizon Europe and the introduction of Smart Specialisation Strategies (S3) into Cohesion policy (Kempton et al., 2014, Vallance et al., 2018). So while the definition of universities' third mission has focused on almost everything outside traditional teaching and research, it can more practically be considered as a policy-promoted phenomenon, in which universities are encouraged to realize their broader socio-economic potential through knowledge exchange and partnerships (Vorley and Nelles, 2009).

Universities' expected economic contributions are not seamlessly executed. For example, Franco and Haase (2015) explain that the legal frameworks, funding and funding mechanisms are often absent. Lundvall (2016) proposed that, universities can respond to the challenges related to globalization and to the growing role of knowledge

⁶ Glocal is used here in reference to both global and local

and learning in global competition by giving more attention to creativity and inclusion and subsequently avoiding polarization of societies. He posits further that creativity can be enhanced through the stimulation of new ideas from staff by university management and encouragement of students to play the role of university ambassadors through engagement with diverse users outside the university. Diversity is suggested to enhance creativity when the stock of scholars in the university have different background in terms of culture, gender and education.

As entities seeking to promote an agenda of impacting their local communities (Arbo and Benneworth, 2007, OECD, 1999, OECD, 2007) universities have taken on various identities relating to their particular engagement orientation. Among these, universities can be conceptualized as entrepreneurial (Foss and Gibson, 2015, Vorley and Nelles, 2009). According to Benner and Sandström (2000), there has been a transformation from the Humboldtian type to more entrepreneurial type universities. On one hand, the Humboldtian principle holds that teaching should be done alongside research. It posits that teaching should be accompanied by unbiased and current research which is driven by scientific curiosity and freedom rather than be market-driven. In this way, the Humboldtian view somehow reflects a restriction of the social mission of the entrepreneurial university, which by definition is expected to drive the innovation and entrepreneurship agendas of regions in partnership with government and the private sector - and thus enacting the triple helix model⁷ (Etzkowitz and Leydesdorff, 2000).

Foss and Gibson (2015) explain an entrepreneurial university as one which actively seeks to shift in organizational character so as to arrive at a more promising posture for the future. By so doing, these universities actually seek to become “stand-up” universities, which by this definition become significant actors on their own terms (Foss and Gibson, 2015). In being entrepreneurial, universities are also embedded within innovation systems thereby putting their host regions and nations in an advantageous position in a knowledge-intensive economy (Van Looy et al., 2011).

⁷The Triple Helix Model is a model of the knowledge-based economy of university–industry–government relations which states that the university can play an enhanced role in innovation in increasingly knowledge-based societies (Leydesdorff, 2012, Etzkowitz and Leydesdorff, 2000). The university, industry and government represent the three composite strands of the helix.

Generally, the perceived boundaries between universities and the market have diminished (Sataøen, 2018). Even as academia has become more and more integrated into the market (Vorley and Nelles, 2009, Etzkowitz, 2003, Youtie and Shapira, 2008), the forgoing image of universities as ivory towers has subsequently sunk (Etzkowitz, 2017).

Indeed, the entrepreneurial university (Vorley and Nelles, 2009, Foss and Gibson, 2015) is only one of various descriptions assumed by universities. The engaged universities (Uyarra, 2010, Bridger and Alter, 2006, Breznitz and Feldman, 2012), civic universities (Goddard et al., 2016) or anchor institutions (Birch et al., 2013) all exemplify situations in which universities capitalize on certain perceived (mutual) benefits with their regions as key actors in the regional development process. These concepts emphasize universities' involvement with non-educational institutions to contribute to regional development (Breznitz and Feldman, 2012). In pursuing a third mission of knowledge exchange partnerships, the role of universities have evidently evolved with closer ties being established with non-educational institutions.

The impact universities can make on multiple levels, as a consequence of engagement, has also garnered increased attention. For example, the REF in the UK and the Dutch SEP-system have introduced tools to measure universities' impact. But seemingly, there is neither a proven model for stimulating university interaction nor a 'silver bullet' for measuring the impact created (Ràfols, 2017). While universities employ various engagement models, it is important to note that each university is unique. In particular, rural and peripheral universities struggle with issues of scale and scope (Charles, 2016) which require that universities adapt differentiated mechanisms to make meaningful contributions to their communities. Also, as players in regional innovation ecosystems, universities need to assess their strengths and weaknesses in order to come up with the appropriate strategies that can benefit their respective missions. The relevance of the regional context and the place of universities in the regional innovation system are further expounded in the following sections.

2.1.2 University-Industry Collaborations

One important way universities respond to the call to deliver on a third mission is through University-Industry Collaborations (UICs). These collaborations are bi-directional linkages between the constituent university and industry entities (Plewa et al., 2013, Ankrah and Al-Tabbaa, 2015). UICs benefit from networks, both local and international, and through which innovative businesses have access to global information and knowledge networks (Sternberg, 2000). These linkages are important for knowledge transfer as well as knowledge creation. This importance is emphasized at the regional level for instance, where such knowledge exchanges enhance innovativeness and economic competitiveness (DTI, 2006, Martin and Turner, 2010, Ankrah and Al-Tabbaa, 2015) of a given region. Subsequently, there has been growing interest in U-I interactions, which are usually investigated from the perspectives of the firm or the university involved, and are manifest in various forms (Mora-Valentin et al., 2004, Bonaccorsi and Piccaluga, 1994, D'Este and Fontana, 2007, Giuliani et al., 2010).

Universities' interactive processes in particular are often complex and the knowledge forms and approaches varied (Jonsson et al., 2015). The variety of knowledge partners encountered by universities is further compounded by diverging cultures, motives standards and values (Plewa et al., 2013, Nooteboom, 2002) which requires strategizing to navigate. Particularly in the case of University-Industry collaboration, researchers and industrialists are aligned to different incentive structures, organizational environments and cultures (Bruneel et al., 2010, Jonsson et al., 2015). Bruneel et al. (2010) further explain the need to focus on the organizational provisions designed to enhance the work of research communities. This is especially relevant because while the number of projects traversing multi-disciplinary partners have markedly increased, no corresponding understanding of such new collaborative models has been realised to enhance management of collaborations (Corley et al., 2006, Muscio and Vallanti, 2014). Indeed, understanding the variety of drivers and barriers to universities' collaborations is key to successful knowledge transfer (Siegel et al., 2003, Plewa et al., 2013)

University-Industry collaborations are important for knowledge transfer as well as knowledge creation. While it is commonly accepted that universities are an important source of new knowledge, especially in the areas of science and technology; it is expedient that firms are connected to the open science community by being actively involved in sharing research results (e.g. through publishing) and engagement in research collaboration (Agrawal, 2001). This importance of UICs is emphasized at the regional level where such knowledge exchanges, which are reportedly as a result of pressure placed on both universities and industries (Arbo and Benneworth, 2007), lead to commercialization of ideas and enhance the innovativeness and economic competitiveness (Ankrah and Al-Tabbaa, 2015) of a given region.

For a firm to be embedded locally in the institutional tissue of social and transactional networks is considered as a competitive advantage (Taylor and Asheim, 2001). Cooperation in innovation between manufacturing firms, service firms and research institutions is important with respect to business success and the economic performance of a region- at least for some region types (Sternberg, 2000). According to Charles, regional development companies have duly recognized the economic importance of universities and tended to invest in them to promote high technology, innovation-led development (Charles, 2011).

Characteristic of firms that are integrated into networks is their interdependence coupled simultaneously with a form of autonomy. This can lead to greater cooperation despite intense competition. The participation of businesses in knowledge networks depends to a great extent on their absorptive capacity, which normally increases, when the businesses are innovative in the corresponding field or possess experience in manufacturing such products. The competitive position of individual industries is decreasing in importance for regional development since new technologies are promoting even closer ties in the networks between industries. The characteristic of 'soft' relationships or linkages as well as their redundancy is seen as necessary for innovative activities (Sternberg, 2000).

In the case of universities, the forms of knowledge demanded from universities are shifting from traditional disciplinary lines to new problem-focused themes in new centers and departments combining expertise that better maps onto employers' needs

(Benneworth et al., 2010). This suggests that the norms of an institution may have to be modified for successful partnerships to be formed. Where U-I cooperation is concerned for example, senior management of organizations have been observed to modify the positioning and core behaviors of their institutions to better align with regional needs (Gunasekara, 2006). What this implies is that both universities and firms tend to adapt their prevailing norms and culture in order to properly accommodate differences of their collaboration partners. This outcome can be prescribed as a highly necessary action should UICs succeed in their mandate.

There are differences in the degree to which firms are capable of effectively utilizing university research to their benefit and these differences vary systematically with the degree to which firms are connected to the university (Agrawal, 2001, Norn, 2016, Laursen et al., 2011). This capacity to take up university-generated knowledge refers to the firms' Absorptive Capacity. Absorptive Capacity is defined by Agrawal (2001) as "a firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends" as studied on individual, group, firm, and national levels. It has been suggested that absorptive capacity enhances the speed, frequency, and magnitude of innovation, which in turn may produce knowledge that becomes a part of a firm's future absorptive capacity (Fosfuri and Tribó, 2008). An absorptive capacity that is open to new ideas is essential for interactive learning.

While geographical proximity facilitates interactive learning, it is neither a necessary nor a sufficient condition for learning to take place. According to Boschma, transfer of knowledge across large distances requires other forms of proximity to be effective. For example, the capacity of actors to absorb new knowledge requires cognitive proximity i.e. their own cognitive base should be close enough to the new knowledge in order to communicate, understand and process it successfully. People sharing the same knowledge base and expertise may learn from each other – and, this is not a matter of speed and efficiency of knowledge acquisition of information, but also, and even more so, of extending the scope of cognition. It is implied that, proximity solves a co-ordination problem and that geographic proximity should be studied alongside the other forms of proximity. Too much proximity may also affect interactive learning and innovation due to the creation of a lock-in scenario. Next to simple co-location, it is important to stress the importance of networks as vehicles of knowledge creation

and diffusion. Since networks are defined and demarcated in a non-territorial way; it would be wrong and even misleading, to assume that knowledge spill overs are spatially bounded. (Boschma, 2005, Almeida and Kogut, 1999, Saxenian, 1994)

University-Industry linkages are not without challenges. Among many others, the difficulty of aligning universities' and industries' interests and lack of openness have been identified (Plewa et al., 2013, Norn, 2016). Bureaucracy, legal framework and lack of organizational support hinder UI interactions. Whereas inter-university agencies, local authorities, and professional associations enable UI cooperation (Franco and Haase, 2015). Time is also of the essence to allow trust to build between collaborating partners and that the projects collaborated on should be beneficial to both parties (Plewa et al., 2013, Pittz and Intindola, 2015). Promoting strategic understanding and facilitating co-creation have been suggested as ways to bridge the gap between universities and industry and thus improve on innovation efficiency (Wallin et al., 2014). Overall, the challenges UICs face in the quest to contribute to regional competitiveness call for leveraging on the benefits of such partnerships.

2.1.3 Universities and Regional Development

Universities have been depicted as a universal good which can bring a range of benefits to their host regions (OECD, 2007, Charles and Benneworth, 2001, Huggins and Johnston, 2009, Smith, 2007, Goddard and Vallance, 2013, Charles, 2011, Christopherson and Clark, 2010, Van Looy et al., 2011, Youtie and Shapira, 2008). Whilst traditionally seen as providers of education, universities also support the development of civic society (Arbo and Benneworth, 2007). For instance, in peripheral regions which often lack the advantages of urban agglomeration economies and the systemic effects of innovation ecosystems, a university may radically change the development trajectory through enhancing skills, stimulating local innovation and connecting the region with other centers of knowledge production. Subsequently, local interests have often lobbied for the establishment of new universities (Charles, 2016). Further, governments have sought to decentralise universities in order to promote regional development (Pinheiro et al., 2016).

The responses of universities to the pressure to engage are varied and unique with respect to their specific context. This has resulted in a need for an overall capacity to respond flexibly and selectively to change (Clark, 1998). According to Charles for example, the particular development needs of rural areas, in view of their struggles with economies of scale and scope, imply that the demands placed on rural campuses also have a specific character (Charles, 2016). Subsequently, alliances between regions and states, and universities may disrupt national university hierarchies and existing patterns of expenditure by national governments, with the competitiveness of the university being tied to the future aspirations of the region. There is therefore no standard recipe or package that can be recommended for an appropriate role or mechanism for universities in their specific and individual regional innovation systems. Different universities in different national and regional contexts with different governances and different innovation contexts will need to adopt different combinations. The central message is that the universities' roles in meeting local needs, need to evolve out of these contextual issues (Charles, 2006, Hassink, 2010).

In accordance, Boucher et al. (2003) explain further that the type of university and the type of region constitute the determinants of a universities' ability to engage with local stakeholders and regional systems. As a system, the ability of other players to amply respond to, and utilize the knowledge disseminated from universities is crucial for regional development (Breznitz and Feldman, 2012). Far from being only mechanistic, universities also serve to attract talent to regions (Bramwell and Wolfe, 2008). Florida (1995) adds that in playing the principal role of attracting talented or highly educated people to regions and producing talent that stays, universities are key to the construction of creative cities and regions since excellent universities attract talent and technology. Florida's (1995) argument is that getting high-ranked universities and having a diverse cultural life is the best way to create regional development, which emphasizes the quality of both the people and the organization. In essence, universities help regions find their way in the context of globalization.

Although universities' regional roles include the attraction of talented people, these objectives could be more difficult to realise in those regions where the Higher Education Institutions (HEIs) are challenged by the presence of a more diverse economic base, very small-scale businesses, a lower presence of other knowledge

institutions (Charles, 2016) and varying levels of articulated knowledge needs (Jongbloed et al., 2008). Such regions, which are usually characterized as rural and/or peripheral consequently face a decreased innovation potential. Overall, the third mission of universities as expressed uniquely in different regional contexts suggests a broader role of universities than mere institutional analysis could explain (Gunasekara, 2006). By being part of regional innovation⁸ systems, universities become important players in an ecosystem of knowledge transfer which is facilitated by flows at a sub-national level (Edquist and Johnson, 1997, Freeman, 1991, Freeman, 1995, Lundvall, 1992). As shown in Fig. 2 below, knowledge institutions of which universities form a part are mainly responsible for knowledge generation and diffusion. Through various interactions with the relevant stakeholders, this knowledge is applied and exploited for regional benefits. Ultimately, the regional system influences, and is also influenced by extra-regional factors.

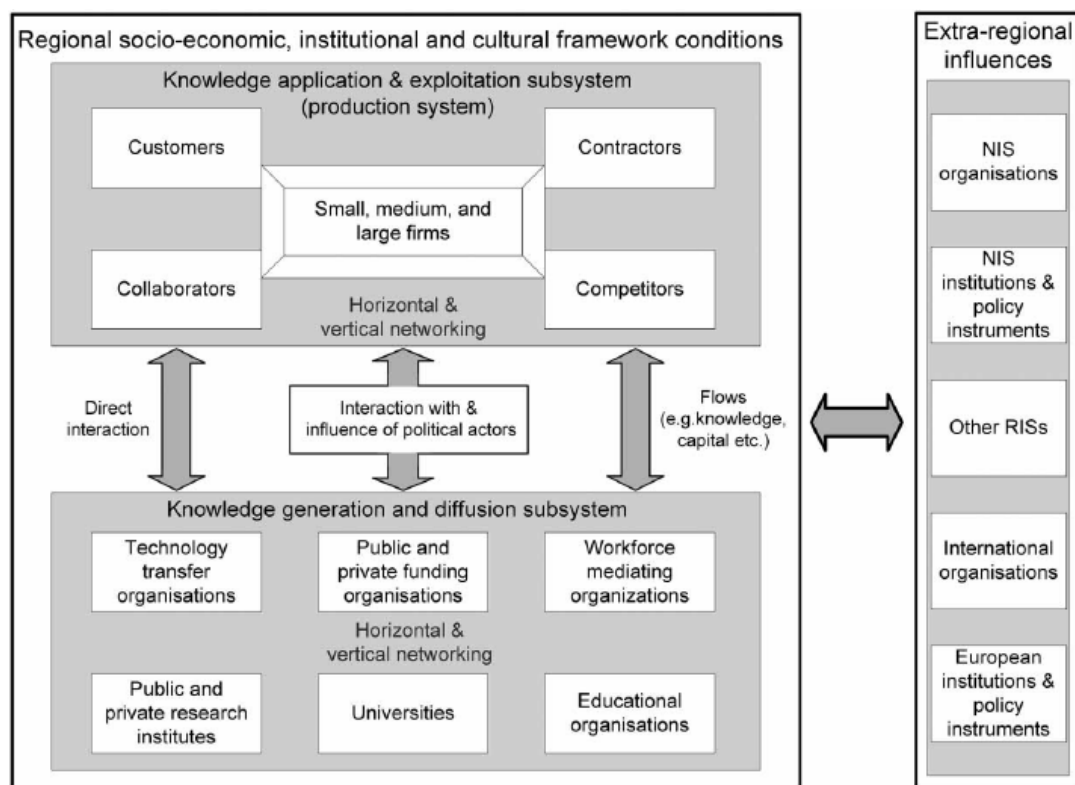


Figure 2: Regional Innovation systems - adopted from (Stuck et al., 2016)

⁸ According to Gunasekara (2006) regional innovation may be understood as innovation at a subnational level -Regional innovation systems represent the intersection of the systems of innovation approach with spatial agglomeration of industry in a geographically specific area.

2.1.4 Engagement and the regional advantage

The pursuance of third mission roles by universities lends well with the notion of ‘construction of regional advantage’ as posited by Cooke and Leydesdorff (2006). It is adduced that in the development of a knowledge-based economy there exist certain constructed and comparative advantages. While infrastructure and the value from knowledge relationships are cited as examples of constructed advantages, they suggest resource endowments as an example of a comparative advantage. This idea further projects that knowledge-based regional development draws upon the interfacing developments in various sectors such as economy and governance. Value, usually in the form of knowledge transfer, obtained from the interactions between knowledge institutions (science), the market and government in what is described as the triple – helix model is seen as a constructed advantage. On the other hand, non-constructed or comparative advantages, such as tradable initial resource endowments, have also been seen to contribute to the attractiveness of certain regions. (Cooke and Leydesdorff, 2006) In all, both constructed and non-constructed advantages serve as a source of regional competitiveness.

The concept of related diversity has been employed to explain regional diversification. The import of this notion is to emphasize that for the purpose of regional development it is beneficial when related industries in a region combine their knowledge for innovativeness. While the idea is not to encourage a lock-in (Nooteboom, 2000) of competencies in the region, too many unrelated industries is not beneficial for regional innovation. Combinations within knowledge bases, and assessing whether these various combinations provide learning opportunities and enhance the innovative performance of firms, industries and regions therefore is proposed as the laudable scenario for regional innovation (Neffke et al., 2011).

The notion of related variety as explained in Evolutionary Economic Geography (EEG) by Neffke et al. (2011) attaches great importance to knowledge spillovers across complementary sectors. The concept has also explained the path dependency of processes of knowledge creation and diffusion (Martin and Sunley, 2006). The literature is replete with perspectives that suggest a link between the types of knowledge exchanged and the pre-existing industries in the region. For instance, based

on a profiling of Swedish regions, Neffke et al. (2011) found evidence suggesting that the rise and fall of industries is strongly conditioned by industrial relatedness at the regional level. This implies that development within and between related industries is important for regional development.

This relatedness of industries and the complementarity existing between them is useful for explaining the trends of certain industries concentrating in certain regions and not in others. This occurrence has further been explained by the concept of ‘knowledge bases’. Differences in the underlying knowledge bases of industries shape their processes of learning and innovation (Asheim et al., 2007, Asheim and Gertler, 2006, Asheim and Coenen, 2005). To explain this, knowledge is categorised into ‘analytical’ (science based), ‘synthetic’ (engineering based) and ‘symbolic’ (artistic based) in nature, with different ‘virtual’ and real proximity mixes (Asheim et al., 2011).

For instance, it has been projected that, regions that are more reliant on synthetic knowledge would display a more path-dependent evolution of their regional economies, and would be less inclined to depart from established trajectories (Asheim and Hansen, 2009). Consequently, these regions, relying on synthetic knowledge, would mainly produce incremental innovations because the innovation process is primarily based on the application of existing knowledge or new combinations of knowledge. Because of that, such regions would normally not have an ability to change technological trajectories, which posed a serious threat to their long-term development (Asheim and Coenen, 2005). In contrast the analytical and symbolic knowledge bases are expected to rely less on established structures in regions; are more attracted to diversity in urban environments, and therefore more responsive to develop radical innovations, especially in industries based on analytical knowledge (Asheim and Gertler, 2006, Asheim and Hansen, 2009).

By defining related variety as sectors that are related in terms of shared or complementary knowledge bases and competencies it is implied that knowledge will only spill over from one sector to another when they are complementary in terms of knowledge bases and shared competences. Related variety is therefore needed to enable effective connections (Asheim et al., 2011). Some degree of proximity (i.e. cognitive) is thus required to ensure that effective regions are most likely to branch

into industries that are technologically related. Communication and interactive learning take place. Further, a balance in proximity is required as too much cognitive proximity risks cognitive lock-in (Boschma, 2005, Nooteboom, 2000)

To this end, the important and evolving role of universities in a globalizing world has been highlighted. Across sectors and industries, it is so far understood that related diversity is important for regional development and eventual diversification. However in the context of knowledge exchange, how does this translate to academics' networks and networking? How much relation between the competencies of a prospective partner is 'related' enough in order to pursue a relationship or collaboration? Further relevant to note for this thesis is that, the role of individual academic scientists have somewhat also evolved in the light of the changing role of universities. So it is theorized here that, where policy pressure is applied to universities, it is experienced on both the organizational and individual levels. Accordingly, where universities are supposed to interact and network regionally, it is indeed the individual academics who participate in the required networks. *This understanding defines the point of departure of this study which focuses on individual Academics' networks – particularly on how their individual contacts shape the nature and geography of their knowledge exchange networks.*

2.1.4.1 Emphasizing the individual's role in knowledge exchange

Given that much knowledge is "tacit", 'embodied in the capacities of individuals, rather than being easily codified and transferred' (Nonaka, 1994, Benneworth et al., 2010, Lawson and Lorenz, 1999), the knowledge exchanged in UICs require that a deliberate action is taken to enable knowledge transfer. While studying the microfoundations of knowledge communities for example, Henry and Pinch (2000) found it useful to track knowledge by literally embodying it as in a thinking, breathing body such as the engineer. Additionally, from a regional innovation systems perspective, as highlighted in Fig.2 of the previous section (2.1.3), such concepts as knowledge flows, interactions and networks are key features in an innovation system. These concepts emphasize the need for individuals' actions to ensure the transfer of knowledge – because individuals are the ones who network and interact. Subsequently, the important role of individual academics who are believed to embody

‘tacit’, non-codified knowledge, and whose deliberate efforts result in knowledge transfer in University-Industry relationships is emphasized (Nonaka, 1994, Pataraia et al., 2014, Agrawal, 2001, Ramos-Vielba et al., 2010).

Academics’ engagement is defined by Perkmann et al. (2013) as knowledge-related collaboration by academic researchers with non-academic organizations. Academic engagement is a multi-level concept (Perkmann et al., 2013), which assumes a variety of interaction channels which may be individual or institutional (D’Este and Patel, 2007). It may be pursued for the purpose of furthering their research rather than commercializing their knowledge (D’Este and Perkmann, 2011). Academic engagement is also not restricted to interactions with industry alone. For instance, academic scientists engage with either industry or government agencies depending on the type of partner agency and the academic’s motivation (Ramos-Vielba et al., 2016). Perkmann and his colleagues (2013) believe that academic engagement is closely aligned with traditional academic research activities. It is pursued by academics to access resources to support their research agendas. Further, the phenomenon tends to be driven by individuals and teams with little central support, on the institutional level, and is strongly associated with affiliation to engineering and applied sciences. They propose that analysis of academic engagement should therefore be done on individual researchers because the decision to engage is taken on an individual level (Perkmann et al., 2013), and usually showing no *a priori* reasons not to engage (Van Dierdonck et al., 1990) .

Academic engagement is positively correlated with individual characteristics that define senior, scientifically productive individuals, indicating that it is in line with furthering their academic research activities. It is less organizationally embedded than commercialization activities, and is more autonomously driven by individuals. Moreover, engagement is reported to be an effective tool for mobilizing resources, and may function as a substitute for generous resource endowments at highly ranked institutions. (Perkmann et al., 2013). It has also been reported that peers influence the industry engagement by academic scientists; with peer effects stronger for early career individuals and weaker for star scientists, suggesting the incidence of social comparison (Tartari et al., 2014).

Pataria et al. (2014) emphasize that academics' learning is not restricted to formalized structures and informal relationships are also significant in shaping their professional practice. Personal learning networks provided new insights and stimulated self-reflection regarding teaching practices, whereas advice networks facilitated the practicalities of teaching. Informal learning and serendipitous acquisition of different types of knowledge and advice related to teaching were evident, suggesting that personal learning networks support incidental learning. In their paper, Tartari et al. (2014) examined the influence of peers on academics and found that, peer effects are stronger for early career individuals and weaker for star scientists, suggesting the incidence of social comparison. This implies that an academic who is 'accomplished' in his area of expertise is less likely to be influenced by peer pressure.

Ideally, knowledge should not be constrained to geographic boundaries. It should be fluid and not bounded. However, from the examples we have from places like Silicon Valley, knowledge is regional. (Saxenian, 1994) A good reason for this occurrence is because it is held tacitly by skilled individuals who remain in certain regions (Almeida and Kogut, 1999). Deliberate action is a driver of innovation. This is because knowledge is often tacit and embodied in the capacities of individuals rather than being easily codified (Nonaka, 1994, Benneworth et al., 2010, Lawson and Lorenz, 1999). While studying knowledge communities for example, it proved useful to track knowledge by embodying it as a 'thinking, breathing body' such as the engineer (Henry and Pinch, 2000). Without a regional capacity to absorb technological innovations and support new firms, university innovations will be developed and commercialized by firms outside the region or not at all. Furthermore, without the commitment to the development of a broadly skilled workforce, the region's innovative capacity remains largely unchanged. (Christopherson and Clark, 2010) This calls for the building of capacity to drive innovation.

So far, the important and evolving role of universities has been highlighted. It has been stressed that policy makers are especially interested that universities actively take up more meaningful space in the knowledge-based regional economic development process. And while this external encouragement is not always perfectly executed, universities have adopted various engagement profiles towards achieving a third mission, in addition to the traditional teaching and research roles. Interestingly,

research on university-led regional economic contributions is too often focused on the organizational and institutional level without much focus to the individual stakeholders involved, and especially the mechanisms through which their contributions are offered. Research on regional development for instance, has almost overlooked the impact of academic engagement in university-industry collaborations (Ankrah and Al-Tabbaa, 2015). Investigating this gap, may be key to unearthing the potential value of university-industry linkages.

Additionally, though interactive learning and inter-organizational relations are the fundamental building blocks in regional innovation systems (RIS) theory, the framework is rarely related to investigations of regional knowledge network structures. (Stuck et al., 2016, Henry and Pinch, 2000). It may be revealing then that within the RIS framework, engaged academics are studied within the context of their personal contacts, which may imply paying attention to both the individual as well as their personal contacts. It is thus worthwhile to place the spotlight on the individual and the networks he forms, and to consider these networks in relation to the personality and ambitions of the individual academics (Lowrie and McKnight, 2004, Norn, 2016) and by extension the considerations that lead to potentially strategic networks with industry partners. Specifically, given that UICs are built around, and facilitated by the actions of ‘knowledgeable’ individuals, it is interesting to appreciate the personal considerations made prior to collaborating, the individual and institutional factors that affect this decision and what practices the concerned individuals employ to ensure maximum and sustained contributions to regional development. Drawing from this understanding, this thesis focuses on individual academic scientists and their place in enacting universities’ third mission through their networks. By taking a close look at individuals’ network contacts, it is expected that insights into the nature and spread of their relationships could be obtained. The question of focus in this entire thesis is, ***how do the individual contacts of academic scientists shape the nature and geography of their knowledge exchange networks?***

2.2 INITIATION OF ACADEMICS' NETWORKS

According to Edquist and Johnson (1997), Innovation is important to the competitiveness of regions, and learning is crucial to innovation. Accordingly, innovation performance depends largely on individuals, but how these interact is also very important. Where there are interactions, the role of institutions are apparent; to reduce uncertainty by providing information (e.g. patent laws and other intellectual property right), to manage conflicts and cooperation (e.g. channels of communication and the established patterns of cooperation) and to provide incentives (Edquist and Johnson, 1997). Connections between institutions and innovation exist at many levels e.g. at the level of the firm where institutions affect the relations between R&D, production, and marketing-relations which strongly influence innovation (Edquist and Johnson, 1997). It is therefore important that the use of collective resources to support 'innovation systems' benefit the wider regional economy and workforce by including a varied spectrum of persons in regional innovation projects.

Innovation is increasingly dependent on knowledge-based network relations across the various facets of the triple helix (Asheim et al., 2007), where the concern is with the practices that the process of networking creates; engagement, alignment & imagination (Coe and Bunnell, 2003). Accordingly, the scientific and technical human capital perspective emphasizes individual-level research capacity and how it may be affected by professional linkages and network ties. (Ponomariov and Boardman, 2010). Indeed, the impact of academic research on regional innovation is not only mediated by geographical proximity but also by networks stemming from university–industry collaboration. (Ponds et al., 2010). Innovation is enacted through 'networks of social relations between actors in, and across particular spaces' (Coe and Bunnell, 2003) also referred to as communities of practice (Gertner et al., 2011). Research contributes to innovation via social networks in which effects are not linear and causality cannot be attributed to single factors, but to complex interactions in networks (Freeman, 1991). So while networks are developed and managed within the broader context of academic and economic pressures, they are operationalized within strategic relationships (Lowrie and McKnight, 2004). But how are the networks of academics actually established? And what are the underlying mechanisms? *To this end, it is interesting to obtain further insight into how academics' networks are developed.*

Individual academic scientists require complementarity in their prospective partners. When individuals interact with others similar to themselves, it is known as homophily. In the case of cooperative relationships, individuals may be embedded within wider local ties and engage with friends of other friends in a process known as triadic closure. Further, they [individuals] may seek to access novel information and resources through other connections known as bridges outside their usual circle of acquaintances and thus spanning structural holes (Kossinets and Watts, 2006). Indeed, whether networks are personal or aggregated into extended networks (Doeringer, 1971), they are central to the entrepreneurial identity of an individual (Dubini, 1991). Based on their systematic literature review, Ankrah and Al-Tabbaa (2015) explained that access to complementary expertise, state-of-the art equipment and facilities are important conditions for university-industry collaborations (UICs). Individual academic scientists who are major actors in UICs require for example that the subject area specialism of their prospective partners whether industrial or also in academia lends well with their area of research. Since a major motivation for academics is to promote their research agenda (D'Este and Perkmann, 2011, Perkmann et al., 2013) complementarity is easily explored when there are common research interests.

An important area of complementarity with academics network is in the area of their personalities. For example, certain individuals are better able to work with others who embody similar attitudes and behaviours whereas others prefer individuals of differing values. Academic scientists network with a varied group of people. The preference is to collaborate within their area of expertise. In other words, there should be a notion of relatedness to facilitate collaboration with prospective partners. They would choose a partner who would bring something on board their network (i.e. variety), rather than to select an exact copy of themselves. In this way, innovation is enacted by having a diversity of actors. But while this diversity is the case, it can be expected that these individuals must have enough potentially related interests to elicit a successful collaborative work. As posited in the literature on related diversity, actors are more likely to be successful in terms of diversification when they build on related capabilities (Breschi et al., 2003), and when they share related capabilities with agents in their networks (Boschma and Frenken, 2018). This point on shared capabilities lends well with the process of selecting prospective partners by academics.

However, when academics seek to do something novel, such as exploitation of research capabilities and results to obtain patents, it can be expected that they could choose partners from different academic fields. The import here is that relations or relatedness for that matter may not exist on obvious scales when networking is involved. Some areas may be more related than others, or rather, the possibility of relations are much more easily perceived in certain instances. As explained, in the literature about departing from knowledge bases (Asheim et al., 2011, Asheim and Coenen, 2005), academic scientists can be expected to collaborate with others within their knowledge bases to explore complementarities. It is however suspected that, complementarity exists as a continuum of possibilities ranging from easy to identify to completely evasive opportunities. Most important for networking is that these partnering individuals can accommodate the excesses of each other to work amicably. When this is achieved, trust is established and the exchange of tacit knowledge facilitated. In this way, the existence of trust seems to be as important as the subject area specialism of individuals involved in networking (D' Este et al., 2012, Kogut and Zander, 1992).

Academic scientists' perceptions of the costs and benefits are crucial to their willingness to participate in knowledge transfer activities (Owen-Smith and Powell, 2001). Given that the decision to engage lies with individual academics who have to weigh the costs and benefits of collaboration (Tartari et al., 2014, Perkmann et al., 2013, D'Este and Perkmann, 2011). For instance, based on opinions of costs and benefits, individuals may either embark on network broadening (aimed at adding new contacts) or deepening actions (managing existing contacts) (Vissa, 2012). Personal and trust-based relationships between university scientists and industrial partners are crucial for the effectiveness of knowledge transfer activities. Interactions between university scientists and industry partners often involve commercialising research where the commitment of both sides is instrumental for the success of the endeavour (Thursby et al., 2001, Dechenaux et al., 2009). In this context, trust-based relationships are particularly important to facilitate the exchange of difficult-to-codify knowledge and information (D' Este et al., 2012, Kogut and Zander, 1992).

Development of high-technology industries that can contribute meaningfully to regional development often requires multidisciplinary knowledge. Thus it is necessary to bring together many experts from different fields who would promote the articulation and recombination of knowledge (Lawson and Lorenz, 1999). In agreement, Descrochers borrows from an ecological example and explains that, the diversity of an ecosystem is central to its sustainability, and that the more connections in existence, the more stable and resilient an ecosystem is likely to be (Descrochers, 2001). In exploring diverse partners, academic scientists tend to be cosmopolitan (collaborate mostly with those around them) or seek more distant partners in terms of geography and institutional types (Bozeman and Corley, 2004). From a regional perspective, it is important to determine what share of the interacting partners operate inside and what share operate outside the region. This interplay between various participants inside and outside a region is the focal point of the innovative milieu concept of the innovation network theory (Malecki, 2010, Sternberg, 2000). For example, while all participants benefit from the advantages of regional networks; the greatest utility is achieved by small businesses since they face the greatest impediments to innovation stemming from business size. Relevant to this thesis, is the question of the spatial distribution of the network contacts of a given academic and the perceived role this placement imposes. Subsequently, the present work places much focus on the geographical location of academics' network contacts. For initiating their networks therefore, the lens is placed on *how [do] academic scientists build their networks and what motivates local and/or International networking?* (RQ1)

Academic scientists are important for both the dissemination of new knowledge and identifying opportunities (Fernández-Pérez et al., 2015) through which knowledge could be converted into commercial form (Perkmann et al., 2011). Consequently, their experience makes these academics likely partners for companies seeking to commercialize acquired knowledge (Siegel et al., 2007) at both regional and extra-regional levels (Trippel, 2013, Mahroum, 2000). However, the process of knowledge creation and diffusion (Martin and Sunley, 2006), is perceived to be imperfect, as actors have no full access nor a perfect ability to respond to external information. This flaw in the knowledge exchange process warrants the need for academic scientists to be connected to other relevant individuals who could potentially contribute to their

own knowledge. Subsequently, Academic scientists advance their research through networks of multidisciplinary individuals (Stuck et al., 2016, Henry and Pinch, 2000, Perkmann and Walsh, 2007). For instance, academics engage with industry or government agencies (Ramos-Vielba et al., 2016), and network for the purpose of exchanging knowledge (Lam, 2007, Stuck et al., 2016, Patariaia et al., 2014, Patariaia et al., 2015, Lowrie and McKnight, 2004).

Interestingly, while the fact of academics' networking is widely known, and the benefits of such engagements subsequently paid much attention – it remains under-researched the actual means through which these networks are initiated or built with respect to the motivations in selecting collaborating partners coupled with the underlying decision-making logic that leads to the establishment of the relevant networks. It is therefore worth paying attention to *how academic scientists build their networks in relation to the decision-making logics that might characterize such a process*.

2.2.1 Applying causation and effectuation to academics' network initiation

As highlighted in the previous section (2.1), certain universities have assumed an entrepreneurial model (Gulbrandsen and Slipersæter, 2007, Foss and Gibson, 2015, Van Looy et al., 2011) in response to the pressure from their respective governments to be actively involved in the regional development process. Similarly, given the key role of individual actors in knowledge exchange processes (Henry and Pinch, 2000, Nonaka, 1994, Almeida and Kogut, 1999), individual academics have been reported to also assume entrepreneurial roles. Individual academics exhibit entrepreneurial traits to varying degrees while they engage with industry and other stakeholders. Several studies have developed entrepreneurial profiles of academic scientists depending on the specific engagement mode identified. Two of these profiles are Academic entrepreneurs and entrepreneurial academics. By definition, 'Academic Entrepreneurs' are those academics looking to commercialise academic intellectual property – these academics essentially act as entrepreneurs. On the other hand, 'Entrepreneurial Academics' are those academics who act entrepreneurially in order to accomplish their academic jobs. (Miller et al., 2018, Nyeko and Sing, 2015, Jain et

al., 2009, Meyer, 2003) These profiles encompass teaching and building of entrepreneurial competency as well as creating new ventures.

Table 1: Entrepreneurial profiles of academic scientists

Academic	Related entrepreneurial activities
Academic entrepreneur (more formal, transactional, contracting-style engagement)	<ol style="list-style-type: none"> 1. Contract research and consultancy for industry 2. Partnering with industry to invest in developing and operating equipment or a facility 3. Joint ventures with industry (without creation of a new company) 4. Contributing to the formation of one or more new spin-off companies 5. Patenting and licensing of knowledge or know-how together with a commercial partner
Entrepreneurial academic (informal, relational, partnering-style engagement)	<ol style="list-style-type: none"> 1. Collaborative research with commercial and academic partners for problem-solving or developing new knowledge 2. Joint supervision of research together with industrialists 3. Research-based consultancy for industry through the university 4. Conduct education/teaching for commercial partners on new developments to bridge their professional knowledge gap 5. Involvement in industrial secondments, student placements and graduate employment

Source: own emphasis after Miller et al. (2018)

Indeed, academic entrepreneurship is conceptualised as encompassing a wider range of engagement activities than only commercialisation. (Jain et al., 2009) as shown in Table 1. Subsequently, contrary to the definition of academic engagement by Perkmann et al. (2013) being somewhat non-inclusive of commercialization, *Academic engagement in this thesis is inclusive of the types of commercial activities academic scientist partake in.* Accordingly, efforts that encourage the building of entrepreneurial capacities within universities are also considered entrepreneurial (Klofsten and Jones-Evans, 2000, Altmann and Ebersberger, 2013). To the extent that research groups within universities have been described to function as ‘quasi’ firms

(Etzkowitz, 2003), it can be inferred that academics may act in an entrepreneurial manner when pursuing the development of research networks and building research teams.

Engel et al. (2017) who studied traditional entrepreneurs explain that the process of networking is one of uncertainty where outcomes cannot always be assessed from the onset. Relatedly, Effectuation theory with its focus on non-goal driven logic, improvisation and leveraging contingencies (Sarasvathy, 2005, Sarasvathy, 2001a), has great potential to explain the undirected aspect of networking (Engel et al., 2017). Expert entrepreneurs make decisions in a non-predictive manner by employing five principles, characterised as: bird-in-hand, affordable loss, lemonade, patchwork quilt and pilot-in-the-plane (Sarasvathy, 2005) as elaborated in Table 2. Causation, in contrast to effectuation rests on the logic of prediction and demands that the entrepreneur makes an analysis of the future on the basis of which a decision can be made, i.e. where knowledge thrives. The logic for using the causation processes is, to the extent that we foresee the future, we can control it whereas that for effectuation is, to the extent that we can work with things within our control, we don't need to predict the future. (Sarasvathy, 2001a)

Table 2: Emphasizing the principles of Effectuation

Principle	Effectuation	Causation
Bird-in-hand	Create opportunities and perform actions based on the resources available here and now; i.e. who you are, what you know and whom you know	Have a predetermined goal or a pre-envisioned opportunity
affordable loss	You should only invest what you are willing to lose	Venture must maximise risk-adjusted return
lemonade	Mistakes and surprises are inevitable and can be used to look for new opportunities	Planning and focusing on goals help to avoid contingencies
patchwork quilt	Entering into new partnerships can bring the project new funds and new directions.	Focus on competitors rather than partnerships,
pilot-in-the-plane	Co-create the future with things within your control and with self-selected partners	Future environment is given, forecasts help to adapt to it

Source: Own emphasis based on (Sarasvathy, 2005, Sarasvathy, 2001a)

The effectual and causal approaches adopted while networking have been operationalised as elaborated in Table 3. Causation employs a goal-directed approach whereas effectuation employs an emergent and unordered approach focused on co-creation (Sarasvathy, 2005). Causal thinkers intend from the outset to achieve a specific goal while effectuators leverage the effect of circumstances and unexpected surprises while networking (Engel et al., 2017, Sarasvathy, 2005). While effectual thinkers may not have a specific purpose for establishing a network, causators approach networking by taking deliberate actions concerning who to collaborate with and what needs to be achieved (Engel et al., 2017).

While not being goal-specific, effectuators have a broader perspective of networking and objectives in mind. The focus is placed on generating unexpected contingencies through meeting new people and discovering new facets in existing ties. Typically, effectual thinkers pursue goals based on an assessment of what is already available within their means following the ‘bird-in-hand’ principle (Sarasvathy, 2005). Effectuators do not pursue random interests but what they consider to be worthwhile.

In contrast, a narrow approach employed by causators is focused on meeting the right people and reaching them efficiently (Engel et al., 2017)

It has been suggested that entrepreneurs are able to shift between the use of effectuation and causation (Schreier and Senn, 2018, Andersson, 2011). The effectual approach to network-building has been explained to be positively associated with initial entry speed and international scope speed while a causal approach is negatively associated with initial entry speed and international scope speed (Prashantham et al., 2018). Galkina and Chetty (2015) also show that entrepreneurs of small and medium enterprises network with interested partners, instead of carefully selecting international partners according to predefined network goals. In the case of opportunity recognition it has been further highlighted that self-efficacy, entrepreneurial cognitive activities and access to specific resources (means at hand) are determinants for international new ventures to materialize (Hannibal et al., 2016, Andersson and Evers, 2015). These studies show that both endogenous and exogenous factors influence the usage of either effectuation or causation.

The concept of causation and effectuation fit well with the concepts of exploitation and exploration described by (March, 1991). Sarasvathy (2005) highlights this by explaining the causal approach of exploiting pre-existing knowledge as opposed to the effectual tendency to explore new ideas. While the returns of exploitation are usually positive, proximate, and predictable, the essence of exploration is experimentation with new alternatives (March, 1991). This implies that exploitation, because it is action based on existing facts, most likely yields expected outcomes. In contrast, exploration results in unexpected and serendipitous outcomes.

Table 3: Contrasting goal-directed and effectual networking

	Effectual networking	Causal networking
Venture objectives are	Emergent, flexible, and unordered (i.e., networking determines venture goals through co-creation)	Given and fixed, preferences are clearly ordered (i.e., venture goals determine networking goals)
Networking objectives are	Not available and in some cases not knowable (i.e., uncertainty)	Available to some extent but largely unpredictable (i.e., risk)
Networking is motivated by	Both self- and collective interests with predominantly developmental motives (e.g., “what can we do together?”)	Rational self-interest with predominantly instrumental motives (e.g., “what can I get from you?”)
Networking begins with	Existing and predominantly strong ties (as part of initial assessment of currently available means within the network)	Both new and existing ties, whether they are weak or strong (as part of resource seeking activities to satisfy projected future needs)
Networking search scope is	Broad, directed at generating unexpected contingencies (i.e., focused on meeting new people or discovering new facets in existing ties)	Narrow, directed at specific predetermined targets (i.e., focused on meeting the “right” people and reaching them efficiently)
Tie interaction is	Primarily based on intelligent altruism and relational embedding (i.e., “if I commit to help others, they are more likely to reciprocate”)	Primarily calculative and transactional (i.e., “how should I protect myself from opportunistic behaviour of others?”)
Tie selection is	Based on self-selection (ties self-select based on what they can afford to commit in advance)	Based on given objectives (ties are selected for their future expected value)
Eventual network change leads to	Serendipitous outcomes involving resources, ideas, or both, which result in new or modified venture goals	Securing needed resources and progressing toward given venture goals

Source: Adopted from Engel et al. (2017)

Following from the increasing entrepreneurial identity assumed by academics therefore, it appears that the decision-making process of entrepreneurial academics could be compared to that of traditional entrepreneurs. Particularly based on research by Engel et al. (2017) , it is argued that the process of building new networks by entrepreneurs is a form of entrepreneurial activity in itself that involves

unpredictability and often, goal ambiguity. Theorising that the actions of individual academics, when the outcomes of networking cannot be identified in advance, are comparable to the decision-making approaches employed by traditional entrepreneurs faced by uncertainty seems useful for gaining useful insight into how individual academics build their networks. *The theories of effectuation (i.e. flexible and non-goal directed decision-making) and causation (i.e. goal-directed decision-making)* (Sarasvathy, 2005, Sarasvathy, 2001a, Sarasvathy and Dew, 2011, Engel et al., 2017) *are thus employed in this thesis to examine how network ties of academics are initiated.*

Knowing the approach employed by academics is key to understanding the possible outcomes of their social networks with respect to opportunity discovery (Sarasvathy, 2005). Simply, by employing the entrepreneurial theories of causation and effectuation, it is possible to contribute to a potentially under-researched aspect of the literature on how academics build their networks. Subsequently, the relationship between the approach employed by academics, the type of tie (i.e. industry or academia) to be established and the geography of those networks are also explored. *For examining the nature and geography of academics' personal networks therefore, applying the theories of causation and effectuation proves essential for understanding academics' network initiation based on which underlying entrepreneurial decision-making logic, and how this could possibly influence the patterns of University-Industry linkages.*

2.2.2 Applying a regional perspective to academics' network initiation

Just like mere collocation of firms or companies does not dictate that they would collaborate, interactions and collaborations do not necessarily occur just by putting people in the same room with one another; there must exist certain mutual interests before collaborations can occur (Melin, 2000, Ponomariov and Boardman, 2010, Boschma, 2005, Almeida and Kogut, 1999, Plewa et al., 2013). As explained by Sternberg, specific conditions must be met as a prerequisite for the development of innovation networks. These include complementary assets of the participants, close and personal relationships between the participants, economic instability, technological uncertainty and rapid changes in consumer demand, which require

speedy reactions and reciprocity and trust in potential partners, who can place their trust in sanctions for opportunistic behaviour. (Sternberg, 2000)

Additionally, choosing a collaborator is influenced by several factors including economic dependence, mutual intellectual influence, social influence, mutual benefit and the prospect of exchanging knowledge and maintenance of the reputation of each other when a partner of equal intelligence is selected (Hossain and Fazio, 2009). Patariaia *et. al.* reported that the formation of network linkages tended to be also the function of close personal relationships, shared attributes (organizational affiliation and academic profession) and trust developed with respect to connections' expertise (Patariaia et al., 2014). A generous amount of time should also usually be allowed for trust to build so that projects collaborated on should be beneficial to all parties (Plewa et al., 2013).

Among other motivations, increasing their publishing productivity is a good motivation for academics to collaborate (Ponomariov and Boardman, 2010). Considering networks in relation to the personality and ambitions of individual academics, Guerrilla (consisting of an individual in control of the network), equilateral (consisting of equally included individuals) and nuclear (centrally administered) network relationship types have been identified (Lowrie and McKnight, 2004). The social interactions of individuals are known to facilitate learning and since much knowledge is tacit, and often conceptualized in terms of know-how, know-who, learning-by-doing and learning-by-copying (Asheim and Isaksen, 1997), social relations and context are important (Benneworth et al., 2010, Taylor and Asheim, 2001). This suggests that absorptive capacity could be enhanced through networking where various forms of proximity are encouraged (Boschma, 2005).

Indeed, actors tend to search locally in cognitive terms (cognitive proximity) and geographical terms (geographical proximity) (Boschma, 2005), and are also more likely to exchange knowledge and collaborate in R&D with other actors in these same two dimensions. Individual academics also apply these dimensions of proximity when networking. To be able to capitalize on common competencies, cognitive proximity is important. However, it is possible that in certain instances, a wider gap in cognition would be preferred in order to obtain a diversity of actors that leads to the creation of

novelties. Consequently these are most conveniently realised within the same knowledge bases (Asheim and Coenen, 2005, Asheim and Gertler, 2006). It is however unclear if collaborations across knowledge bases are even possible; and if these would better lead to novel discoveries and which combinations are required. It only remains to prove this empirically and thus bridge the gap on the absence of an individual level focus in the RIS theory (Asheim et al., 2011).

From the literature above, it is evident that Academics' motivations for initiating networks and collaborating in general has been the focus of much scholarly activity. Interestingly however, these research have rarely considered academics' motivations from a regional perspective. As hinted in the literature, appreciating the geography of the individual contacts and whether they operate within or outside a given region is essential for understanding networks from a regional perspective (Malecki, 2010), and to appreciate the factors affecting these networks. Understanding specifically the influence of the regional context on academics' motivations to collaborate is a gap worth paying attention to, especially considering the regionally-bounded nature of knowledge (Almeida and Kogut, 1999, Saxenian, 1994). *From a regional perspective therefore, this thesis continues to address the question of how academic scientists initiate their networks.* On the whole, it is of interest to gain a deeper understanding of the mechanisms that underlie the formation and maintenance of networks.

2.3 EVOLUTION OF ACADEMICS' NETWORKS

2.3.1 The nature of personal relationships

Networks have been increasingly acknowledged to play a key role in innovation processes both from an individual and organizational point of view (Boschma and Frenken, 2009, Freeman, 1991, Hagedoorn and Duysters, 2002). Formal and informal relationships among research institutions and organisations have subsequently resulted, and markedly increased due to the pressure to innovate (Perkmann and Walsh, 2007, Christopherson and Clark, 2010). Networks are encouraged for various purposes, and with individual actors also nursing particular intentions (Doreian and Stokman, 1997). For example, Laumann (1973) explains that relationships develop from a priori considerations of consensual beliefs of politics, religion and ethnic

beliefs. This points to the fact that individuals' involvement in networks is aided by the presence of potential benefits they stand to gain or also contribute.

Seminal work established in social theory and network theory (Granovetter, 1973, Merton, 1957) have shown that having a varied group of contacts is important for innovation. This is especially because of the various benefits a heterogeneous group of contacts presents, such as access to diverse information, resources and further contacts. On the personal level, networks have been explained to consist of all those persons with whom a person has direct relations with. According to Powell et al. (2005) however, these relationships extend for some purposes to indirect relations via direct relations as observed from the organisational level. Subsequently for entrepreneurs, one could think of partners, suppliers, customers, venture capitalists, bankers, other creditors, distributors, trade associations, and family members as relations on the personal level (Dubini, 1991).

From a social capital perspective, Burt (2005) employs the concepts of Brokerage and Closure to explain the pros and cons of focusing on a small group as opposed to bridging gaps to extend existing networks. Accordingly, brokerage, because it is more focused on establishment of new contacts with potentially new competence makes way for informal networks. Additionally, the broker, who extends an existing network is able to identify new opportunities of relevance to the smaller groups/networks he transcends. Conversely, closure which refers to concentrating on a smaller group is important for preserving the status quo. The returns of brokerage and closure when applied together are argued as important for ensuring the preservation of a groups' homogeneity while maintaining the possibility of instilling creativity and innovation in a group. (Burt, 2005, Granovetter, 1973, Stovel and Shaw, 2012)

Generally, much research has focused on understanding the types of networks that exist (Kossinets and Watts, 2006). These classifications are based on various criteria including i) formal vs informal networks, ii) duration and stability of networks, iii) forged to accomplish a specific task, iv) evolve out of pre-existing bonds or associations, v) Short-term projects and long-term relationships, vi) Hierarchical (with a central governance body) and heterarchical (self-organising) (Doreian and Stokman, 1997). Granovetter (1973) also focuses on the concepts of strong and weak ties.

Accordingly, a person relates with a strong tie more often whereas a weak tie is only an acquaintance or a friend of a friend. Usually, strong ties which are based on common interests are good for social support. Whilst exchanging information generally re-enforces network ties, much of the novelty comes from the weak ties. (Granovetter, 1973)

Additionally, Wellman and Berkowitz (1988) present a description of *networks of networks*, which refer to networks that can be nested within broader networks. In particular, the structures and modes through which university-industry collaborations are practiced are different in many respects. This is due in part because University-Industry interactions are heterogeneous, produce diverse outcomes and are contingent upon many non-linear relations (Gulbrandsen et al., 2011). In more broad terms, two types of inclusion in networks are described by Doreian and Stokman (1997) namely a *collectivity to collectivity* relation and an *individual to individual* relation. Networks can thus be considered in levels or aggregates of different levels of relationships (multiple levels of networks). Grabher and Powell (2004) explain further categories of networks for organisations; informal (based on shared experience), project networks (short-term combinations to accomplish specific tasks), regional networks (where spatial propinquity helps to sustain a common community) and business networks (purposive, strategic alliances between two parties). Furthermore, different types of networks based on contractual or market considerations exist - those based on less formal and more primordial relationships (e.g. membership in a technological community or a regional economy)

Personal relationships and networks are dynamic in nature. (McPherson et al., 2006, Kossinets and Watts, 2006) Unlike in unstructured populations where natural selection is usually considered the norm, evolution of social networks cannot simply be attributed to random occurrences. Network ties can be intentionally maintained, weakened and new ones can be forged over time. For example, the emergence of network ties has been shown to be dependent on social context. According to Mollenhorst et al. (2014), a path-dependent use of social contexts makes new relationships more likely to emerge in a specific context if existing network members are already met in that context. This explains the unlikeliness of forging new ties outside one's usual social context of work, school, etc. It follows then that if an

existing network tie moves out of the usual social context, the relationship is weakened. Accordingly, a major reason for relationship discontinuation is a lack of meeting opportunities. (Mollenhorst et al., 2014) Rather than discrete one-way transfer of knowledge, University-Industry interactions are better viewed as strategic collaborations (Barnes et al., 2002, Mora-Valentin et al., 2004); relationships and not just links. In these relationships, the separate partners engage in joint tasks but each with their independent objectives creating a high level of reliance on each other (the partners involved in a given U-I relationship) to build a networked organizational structure. (Perkmann and Walsh, 2007, Mora-Valentin et al., 2004).

The success of network interactions can therefore be perceived as dependent on relational factors embedded within individual actors (Bush et al., 2001, Cunningham and Link, 2015, Santoro and Chakrabarti, 2002). Based on the important and unique role of individual actors as network anchors, the resulting relationships also tend to be unique in complexity (Plewa et al., 2013). Consequently, the importance of a contextual understanding of these relationships cannot be overemphasized. On a more individual level, networks of academic ties can be examined to understand how researchers correlate with each other as well as their preferences of universities and nations to study and work at. (Arslan et al., 2011, Doreian and Stokman, 1997) Much is still unclear about network evolution. For example, it is unclear whether the same factors drive success throughout the lifecycle of networks. This is despite several indications in the literature that temporal dimensions influence relationship success, such that studying them can provide additional insights related to the cause and effect dynamics (Santoro and Gopalakrishnan, 2000) and deepen our understanding of University Industry relationships. (Plewa et al., 2013)

Knowledge of the structure of a network enables us to gain insight into how rapidly information may spread through the network, the resilience of it to attacks, and the social role of individual entities in forming it. Even though academic engagement and academic networks have been the focus of much research (Perkmann et al., 2013), the study on network evolution is still in a premature phase (Powell et al., 2005), and it remains of interest how these networks actually evolve over time. Further, where evolution of social networks have been studied, this has usually been done at the structural level (Perkmann and Walsh, 2007, Mora-Valentin et al., 2004). In this thesis

therefore, attention is paid to the functional level of academics' networks. Specifically, this thesis seeks to contribute to the existing literature on academics' networks by offering insights into how academics' networks evolve at the individual tie level by simply considering the question of *how do academic networks evolve over time?* (RQ2) Studying evolution of academics' networks is key to understanding the nature of relationships underpinning our social environment.

2.3.2 Evolution of network ties

Network processes are a series of events that create, sustain and dissolve social structures. Events at one point in time are explained to be conditioned or influenced by those events that went before them. Simply, networks evolve. Interestingly, specifying how this occurs and the mechanisms involved remains a difficult set of tasks. While it is straightforward to define and describe social network structures, the task of describing social network processes is much harder. Social network processes seem more elusive for formal modelling – to get the idea of social processes we look closely at each term (a course of events or time, a series of events with definable outcomes, a series of changes). Additionally, the description of any network at a single point in time does not describe status. The form of the network is relevant for its own evolution – in a specific empirical context, there will be a sequence of network events which can be viewed as stemming from a network process (Doreian and Stokman, 1997).

Social networks are dynamic processes in which individuals alter the structure of their networks through creation and deactivation of social ties (Kossinets and Watts, 2006). The separate and joint actions of two persons affect the quality of their lives and the survival of their relationship (Thibaut, 2017, Lambe et al., 2001)- this implies that the outcomes of an initial or preceding interaction exerts some influence on future interactions. If trust for example has been built or perceived from an initial contact, continued interaction is more likely to occur. Further, relational benefits vary from person to person, as well as with the same person over time (Grayson and Ambler, 1999, Cannon and Homburg, 2001) - relationships are subject to change (Egan, 2008, Christopher et al., 1991, Kossinets and Watts, 2006), and all in unique courses (Tikkanen and Tuominen, 2000, Grayson and Ambler, 1999). *This point on relational*

benefits implies that the individuals would continue to engage in a relationship that they perceive as being of continued importance and could sever those relationships that are perceived as non-beneficial. Based on this understanding of evolving importance of network relations, it appears possible and logical to assess evolution based on changes in perception of tie importance. Subsequently, *I capitalise on this understanding to explore the perceptions of network tie importance on the evolution of networks.*

Relationships are complex and unpredictable in the sense that they can transition and dissolve in unpredictable ways. So whilst the stage theorists predict a linear evolution of relationships (Grayson and Ambler, 1999, Filieri et al., 2014, Christopher et al., 1991), the state theorists are inclined to nonlinear dynamics of unique evolutions or register none at all over time (Rao and Perry, 2002). According to Kossinets and Watts (2006), shared activities and affiliations of their members and similarity of individuals' attributes drive the evolution of social networks over time. They found that network evolution is dominated by a combination of effects arising from network topology itself and the organizational structure in which the network is embedded. In the absence of global perturbations, average network properties appear to approach an equilibrium state, whereas individual properties are unstable (Kossinets and Watts, 2006), and thus emphasizing the uniqueness and importance of individual level analysis.

In the case of firms, resource challenges at the emergence and early growth phase lead to an evolution of identity-based, path-dependent networks to a more calculative, intentional network (Hite and Hesterly, 2001). Simply, a scarcity of resources requires that resources are more intentionally managed. This suggests that a shift in the nature of relationships may represent a strategic move in the face of changing context and an adaptation to a more or less exploitative or, explorative approach of networking (Burt, 1992, Rowley et al., 2000). In essence, the direction of evolution is also dependent on the availability or scarcity of resources based on which relationships must necessarily thrive.

Agrawal et al. (2006) discovered from their study of the relationship between inventors and their prior location that, flows to an inventor's prior location are approximately

50% greater than if they had never lived there. This finding emphasizes the importance of social relationships over mere physical proximity. Further, they discovered that a large portion of this social effect is mediated by institutional links of personal relationships formed through co-location within an institutional context that endure over time, space, and organizational boundaries. They posit that geographic proximity works to overcome social distance and, once relationships are established, individuals can remain socially close even when they become geographically separated (Agrawal et al., 2006).

2.3.2.1 Mobility and evolution of network ties

Knowledge, because it is essentially not constrained to material content should the least be considered spatially-bounded. Contrary to this expectation however, it has been reported that mobility influences the local transfer of knowledge (Almeida and Kogut, 1999, Trippl, 2013, Lawson and Lorenz, 1999). From their study of the movement of patent engineers for instance, Almeida and Kogut (1999) conclude that the flow of knowledge is embedded in regional labour networks. By this they emphasize the role of the individual as active agents in the creation and spatial diffusion of knowledge through the movement of these individuals.

Where inter-regional networks of individuals are concerned, there is also the spill-over of knowledge across regional boundaries. For instance, academic scientists tend to be highly mobile at an international scale and their movements can involve a substantial transfer of knowledge and expertise (Trippl, 2013). To this end, both regional and international mobility of academics matter whether they are temporary stays or more permanent and lasting a couple of years. The effects of mobility can also be better understood within the contexts of existing networks of academics. While scientists may retain a link to their home countries while on migration, they continue to have knowledge related interactions with their home regions. Also by interacting with and creating new networks in their new locations they tend to be propagators of further knowledge in both directions.

According to Lawson and Lorenz, accidental meetings and labour mobility result in the assembling of individuals with different expertise for the development of high-

technology industries (Lawson and Lorenz, 1999). These meetings are thus crucial for the generation and exchange of innovative ideas. When scientists move to different locations with their prior knowledge, they also acquire new knowledge which results in the combination of knowledge (Laudel, 2003). This recombination of knowledge is important for generating further innovative ideas. It has long been believed that the international mobility of scientists fits the concept of ‘brain drain’ from the sending region or country and ‘brain gain’ by the receiving region or country. But with the prospect of being able to recombine knowledge, the concept of ‘brain circulation’ is applicable (Trippel, 2013).

On the effect of mobility on networks Cachia and Jariego found that, different types of mobility are reflected in the personal networks of individuals; where they settled in a city, whether they are at home or in a host location, their itinerant mobility profile, subculture they belonged to, etc. Integration in the host location follows a different pattern to other settled individuals, due to community-specific connections. Further, the time spent in a city seemed to affect the degree of settlement observed which, is also invariably affected by ‘the time expected to live in the city’ (Cachia and Isidro, 2017). A high expectancy of mobility, whether in the future or imminent was therefore perceived to sustain strong ties with the transnational.

It can be inferred from the above that, mobility is an important factor to consider in the evolution of networks. This is the case even though some researchers tend to deem the incidence of international mobility as exaggerated, citing that fewer scientists are mobile compared to those who remain (Williams et al., 2004). However, since mobility influences the formation and maintenance of networks (Cachia and Isidro, 2017) and impacts the geography of knowledge exchange (Trippel, 2013, Lawson and Lorenz, 1999, Laudel, 2003), it is considered in this thesis as an important determinant of network evolution. *It remains interesting however to understand the effect mobility has on networks and especially to decipher the underlying mechanisms through which this is evident. In the same light, it is worth probing the factors that promote academic mobility and how these influence the resulting networks or collaborations.* While it is possible to quantitatively map the flows of knowledge resulting from mobility, as has been the focus of previous studies, qualitative approaches are required to explore the

impact of these movements on the quality and nature of research and knowledge exchange.

2.4 CONTEXT OF ACADEMICS' NETWORKS

2.4.1 The Institutional Context and academics' networks

Universities are often depicted as a standardized set of entities with common aims, markets and operations. However, far from being homogeneous, universities vary in size, focus and target. Additionally, their locations impose contextually dissimilar characteristics and outlook on third mission activities. (Martin and Turner, 2010, Charles, 2016) Indeed, fostering cooperation both within and outside universities' environment depends on unique invisible issues, relationships, internal politics and the organizational culture. (HEFCE, 2009, Calori and Sarnin, 1991) Interestingly, though several studies (Etzkowitz and Leydesdorff, 1998, Giuliani et al., 2010) adopt the institutional approach to explain the formation of linkages through the context in which they are embedded – i.e. the type of organization, the culture and the environment in which research is undertaken, most of them pay little attention to the third mission's impact on the soft issues at the individual level. There is therefore the need for insights into how universities as institutions respond to third mission roles in relation to how this response affects the institutional culture. Indeed, *applying a universal model to universities in rural or small towns without minding the context may lead to slow progress and misplaced investment of public funds for promoting engagement* (Jacob et al., 2003). Hence, it is also important to consider *how institutional level factors affect academics' networks*.

Universities' intentions to collaborate or embark on third mission activities is often signalled by their mission statements, business development teams and knowledge transfer (KT) structures (Martin and Turner, 2010). The institution's status is also an important determinant of the number of interactions with more established universities mostly likely to foster more external relations (Huggins et al., 2012). However in practise, individuals' responses to embarking on a third role in terms of attitudes and resistance to change may suggest that operational practices and day-to-day realities offer different indicators in terms of how universities' intentions are achieved. On one hand, whilst top management may identify engagement as a key element of

institutional strategies, individual academic scientists are considered central to the entrepreneurial and knowledge exchange activities of a university, and it is individuals that have to lead on implementation. This role of individuals is especially necessary as much knowledge is tacit and embedded within the capacity of individuals. To that effect, the contribution of universities to knowledge transfer to external partners as required of engagement results from the combination of institutional strategies and structures, and the actions of individual scientists (Martin and Turner, 2010).

In delivering on an agenda of engagement, a disparity is evident. Universities and individual academics do not always work together in the most optimum way. In fact, the efforts of the university, related to coordinating the efforts of individual academics, can sometimes be viewed as disjointed. According to Martin and Turner (2010) the day-to-day experience of developing the third mission is faced with tensions, and this makes execution of the third mission disjointed. Accordingly, whatever the reputation or quality of the research and teaching base of a university, the lack of a collaborative internal culture and support for engaged staff would impact on external collaboration - and those working to support these third role processes might find their efforts thwarted (Martin and Turner, 2010).

Universities have often seemed to some of their academics to be somewhat distant from their individual efforts or are felt to struggle to contribute to the knowledge exchange activities of academic scientists- thus making the individual academics' agency all-the-more important for university-industry linkage (Perkmann et al., 2011, Franco and Haase, 2015, Perkmann et al., 2013). This tension between individual and institutional agency creates a non-optimum environment for stimulating knowledge exchange. *This occurrence calls for more insight into the effect of the universities' context on knowledge exchange processes and what efforts could be focused into bridging the gap between the efforts by individuals and universities in enacting their third mission roles.*

2.4.2 The Regional Context and academics' networks

According to Huggins et al. (2012), the knowledge transfer networking capacity of universities is found to be associated with the regional business environment within

which they are situated. Academic Engagement in particular has been highlighted to contribute to the competitiveness of regions. Through the establishment of knowledge-based links, academic scientists can contribute to the development and transmission of knowledge, and ultimately facilitate technological advancement through research and innovation. Academic engagement has been shown to be enacted through various networks stemming from university and industry entities for example. Admittedly, social networks underpin academic engagement. (Lam, 2007, Stuck et al., 2016, Granovetter, 1973) As an important area of competitive strength for regional development, social network research is important for understanding innovation partnerships and personal relationships amongst various stakeholders.

Huggins et al. (2012) report at the institutional level that more established universities are likely to have a more diverse range of organisations with which they interact, as well as a higher number of non-local interactions. In terms of location, they find that universities within lagging regions tend to have more locally focused networks than universities in more leading regions. Additionally, more established, research focussed, universities are more likely to form part of wider, and possibly even more globalised, knowledge networks. They conclude that both the flow and stock of knowledge within regions is likely to be influenced by the networks formed by its universities, which has implications for both regional innovation capability and regional competitiveness. (Huggins et al., 2012) In line with these findings, it can thus be inferred that, networks of individual academics scientists may follow a similar trend as their host universities, with academics in lagging regions less likely to have extended global networks and more localised networks for instance. Of interest therefore, this thesis explores further the issue of the spatial location of networks by placing focus on *how the regional context affects academics' networks*.

Altogether, RQ3 is therefore formulated as '*how does the university's institutional and regional context affect academics' knowledge exchange networks?*'

2.4.2.1 Facilitating graduate retention: a benefit of academics' networks?

As far as higher education and regional development is concerned, most regions – especially the rural and peripherally placed ones - are faced with a problem. This issue concerns the retention of graduates within the regions. (Corcoran and Faggian, 2017) With the democratization of higher education in the past century, there has been an increasing supply of highly-educated workers on the labour market (Auriol, 2010, Auriol et al., 2013, OECD 2016 OECD Science, 2016). This phenomenon goes along with the shift towards a knowledge-based economy in the European Union, and consequently increasing demand for such a workforce (Lisbon European Council, 2000).

Doctorate holders in particular, who are traditionally educated to conduct research in the area within which they have become experts and teach their knowledge in higher education institutions (The Group of Eight, 2013) are increasingly faced with an issue of unemployment. Even though an increasing number of university students has created a larger demand for doctorate holders in the academic labour market, the growth in the number of doctoral students seems to have exceeded this demand. This imbalance in the demand and supply has led to a bottleneck in the progression of the academic careers of PhD holders for example (Andalib et al., 2018, Etmanski et al., 2017, Larson et al., 2014, Neumann and Tan, 2011). Subsequently, there has been an increasing trend of doctorate holders leaving academia after graduation - and in most cases, to work in industry (Bloch et al., 2015 , Herrera and Nieto, 2013). Of interest, this exit from academia is often also characterised by an exit from their host regions in search of employment opportunities (Corcoran et al., 2010, Stockdale, 2006).

As doctorate holders are the most educated workforce (EHEA, 2018), one might have expected a privileged access to the industrial labour market in knowledge-based economies. This is however not the case. Mismatches are observed on the non-academic labour market for doctorate holders (CEDEFOP, 2016 , Gaeta et al., 2016, Allen and van der Velden, 2001) pertaining to skills mismatch, field-of-study mismatch, qualification mismatch (Corcoran and Faggian, 2017) though over-education, or qualification mismatch, is most discussed when it comes to university

graduates (Green and McIntosh, 2007 , McGuinness and Byrne, 2015, McGowan and Andrews, 2015).

Rural and peripherally located universities, because they are faced with different agglomeration economies may particularly face this issue of graduate retention occurring at various levels to a much greater extent. These regions especially face pressures to attract human capital for such reasons as helping to replenish ageing populations and the resultant labour gaps and thus stimulating economic development (Corcoran et al., 2010, Stockdale, 2006). This directly contrasts the experience of more metropolitan areas, like London (Hoare and Corver, 2010), which are more successful in winning human capital. In a survey study based in North East of England for instance, Johnson et al. (1993) explain that although many graduates expect to leave the regions in search of jobs they would in fact prefer to stay given the opportunity. This finding has direct implications on the regional economy when skilled persons who could contribute to regional innovation tend to leave (Corcoran and Faggian, 2017, Hoare and Corver, 2010, Venhorst et al., 2010).

In doctoral programs the transferable skill of developing networks has received increasing attention over time. This focus is especially beneficial since networking is a skill that can also be applied in a wider context than the specific scientific area wherein the doctoral student has become an expert and that can thereby increase their employability (Sinche et al., 2017, Kyvik and Olsen, 2012). In addition, industry partners are increasingly involved in doctoral education, mostly by funding and hosting doctoral students through industrial PhD programmes (Roberts, 2018, Benito and Romera, 2013, Wallgren and Dahlgren, 2005). The concept of collaborative PhDs is one example through which PhDs interact with industry, apart from merely having industry involvement in university research⁹.

This involvement of industry in the training of PhDs in academia contributes towards fostering networks on the university-industry interface and arguably, plays a role in

⁹Collaborative PhD programmes are partnerships between heritage organisations (e.g. industry) and Higher Education institutions. Each student has at least one supervisor at either organisations. As well as working within their host heritage organisations, the students have a chance to get to know the wider heritage sector and extend their networks.

facilitating the matching of the very specific PhD skills with the demands of industry. So while individual academics' efforts in enacting third mission roles may be influenced by context, it can be expected that their actions also invariably affect their context. As extensively researched for instance, the actions of academic scientists together with their relevant contacts lead to innovation on different levels - often felt at the regional level (Saxenian, 1994, Almeida and Kogut, 1999). It is therefore suspected that networks traversing the university-industry interface *may be key to enhancing the transition of doctorate holders to industry, and perhaps facilitate the job-matching process for graduates on the regional level.*

The transition from academia to industry could be viewed as a move from the academic internal labour market to an industrial internal labour market. Internal labour markets (ILM) are the institutional rules and procedures that govern the employment relationship within an organisation, such as recruitment, training, and the price of labour (Doeringer, 1971). ILM are hence distinguished from the external labour market (ELM) which is directly affected by macro-economic variables. However, ILM and ELM can be combined to form an extended internal labour market when, for example, recruitment channels deploy employees' networks to recruit additional workforce (Manwaring, 1984). This tendency to rely on internal networks is in line with March's (1991) argument that organizations, when looking for new resources or markets, prefer to exploit internal resources they already have access to instead of exploring new ones.

Lam (2007) studying employment at the university-industry interface took this concept a step further by arguing that ILMs' boundaries between two sets of organizations become blur when career and knowledge flows across them are supported through the creation of an overlapping space (Lam, 2007), i.e. the concept of overlapping internal labour markets (OILM, see figure 3).

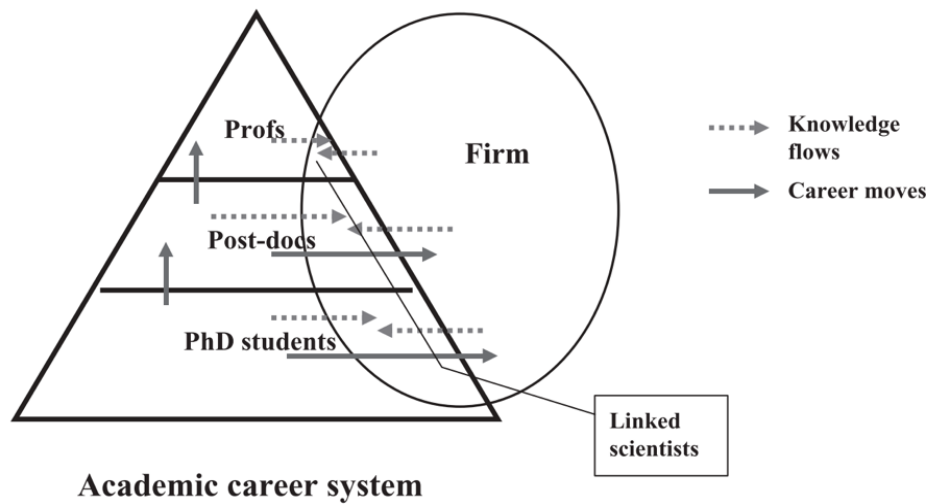


Figure 3: Career and knowledge flows across academia-industry boundary.

Source: Lam (2007).

The OILM concept explains the forms of career models emerging from the industry-university R&D collaborations, such as hybrid careers (Cañibano et al., 2018). ‘Linked scientists’ are researchers whose work roles and careers straddle firms and universities; entrepreneurial professors, post-doctoral researchers who play a major role in collaborative projects, and doctoral students who are jointly trained by universities and firms through varying arrangements. OILM can help firms in their selection and screening of the scientists involved for possible recruitment (Lam, 2007). It is the use of a pool of linked scientists by firms which leads to the formation of OILMs: “The idea behind this concept builds on that of a firm’s internal labour market, and how it may be extended beyond the boundary of the firm following established recruitment channels and social networks” (Lam, 2007, p. 1011).

Career trajectories of doctorate holders have been extensively studied (Mangematin, 2000, Cañibano et al., 2018). Both internal factors, such as personal preferences, characteristics of the study and network opportunities (Mangematin, 2000, Jackson and Michelson, 2015); and external factors, such as the labour market demand (Bloch et al., 2015) have been reviewed. However, the actual means used by doctorate holders to find a job outside academia have received little attention. Though Granovetter (1974) stressed the importance of networks as a means to enable labour market matching processes, this knowledge has not been linked to the particular case

of university-industry transition of graduates –PhD graduates in particular. (Lam, 2007)

Granovetter's work (1973), explains the importance of networks as an enabler of labour market matching processes by reducing the search costs and uncertainty involved. Based on this background, it could be projected that *network connections with industry actors might fulfil a similar important role in the job search of doctorate holders, especially since more and more PhD studies transcend academic and industrial settings* (Wallgren and Dahlgren, 2007, Thune, 2009), *offering opportunities to develop these ties* (Lam, 2007). *Additionally, there is some research suggesting that PhDs in some cases could benefit from their supervisors' networks* (Bøgelund, 2015). So while there are reasons to expect an important role of university-industry connections in the labour market matching process of PhD graduates, there is little research on the importance of these networks for PhD graduates entering into industry. The increasing trend of PhD graduates moving to industry, either by preference or due to external factors such as labour market conditions, asks for a deeper understanding of the university-to-industry transition process. Hence, the *need to explore the role university-industry networks play in the transition of PhD graduates to industry.*

In complement to research on PhDs' employability and graduates' regional retention, it is argued that an in-depth understanding of the current processes of how PhD graduates obtain their employment is necessary. Further, PhD students constitute an important group of academics who despite their large numbers and potential impact on the future of universities are often overlooked in studies of academic entrepreneurship (Bienkowska et al., 2016). Considering this group of academics/students is therefore insightful. Further, existing knowledge is mostly focused on the destination of doctorate holders (Auriol, 2007, Drejer and Østergaard, 2016) with little insight into the actual transition process between academia and industry (Manathunga et al., 2009, Cruz-Castro and Sanz-Menéndez, 2005).

Simply, since building of a knowledge-based economy invariably requires the availability of knowledgeable individuals, a possible area where the impact of academics networks could be felt is at the university-industry interface where the

actions of the relevant stakeholders could aid the transition of PhD graduates into industry positions and possibly facilitate their retention in the regions. Subsequently, while trying to assess the effect of context of academics' networks, this thesis briefly considers the issue of *how academics' networks are evident in the transition of PhD graduates to the non-academic job market, and how this transition reflects on the region's ability to retain knowledgeable individuals such as PhD graduates.*

2. 5 SUMMARY

In the various sections of this chapter, the relevant literatures have been employed to highlight existing knowledge on academics' engagement as facilitated by their networking with various stakeholders. Concurrently, the existing gaps in the literature which motivated this study have also been pointed out. Indeed, the proposed worth of this thesis is founded on the main gaps identified in the literature. In the first place, there is a lack of adequate micro-level analysis of the networks of individuals involved in UICs. Even though there is a wide acknowledgement that UICs are key to regional development and the construction of a knowledge-based economy, research is laden with much focus on the organisations and institutions that facilitate such interactions to the neglect of individual actors. Throughout this work, I employ the particular case of academic scientists to explore various aspects of individuals' networks.

Motivations of academics to engage has been largely studied in the literature. However, these studies lack a regional perspective in spelling out the motivations of academic scientists' engagement. This is surprising given the regional dimension of global competition. The thesis therefore explores the issue of academics' motivations with a regional lens, as detailed in Chapter 6. Relatedly, a lack of insight exists in the literature concerning the decision-making processes that shape academics' efforts to build their networks. This thesis therefore presents insight into how academic scientists build their networks employing the entrepreneurial decision-making logics of causation and effectuation as lenses. This analysis is detailed in Chapter 5. Together, by considering motivations to engage and the decision-making logic that direct the process of network building, this thesis answers RQ1; *'How do academic scientists build their networks and what motivates local and/or international networking?'*

In network studies, analysis is usually carried out at the structural level. Further, based on the idea that relationships are dynamic, most scholarly enquiries which have focused on network evolution have also done so on the structural level to tell how an entire network evolves. Based on the literature reviewed, a gap therefore exists pertaining to a lack of knowledge of how academics' networks evolve on the tie-level. The thesis thus explores network tie evolution from the perspective of academic scientists. This gap is explored in chapter 7 of this thesis which looks at RQ2; *'How do academic networks evolve over time?'*

Lastly, the literature survey reveals a lack of adequate insight into the issue of context with respect to academics' networks. Additionally, the impact of networks on the regional ecosystem is a large landscape that requires further focusing on. The thesis therefore places emphasis on the regional and institutional context to explore their influence on academics' networks and from the reverse, the impacts of academics' engagement on their regions. This theme is explored in Chapter 8 which answers RQ3 on *'How does the university's institutional and regional context affect academics' knowledge exchange networks?'*

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CHAPTER 3 - RESEARCH DESIGN AND METHODS

This thesis has focused efforts into understanding, analysing and interpreting the knowledge exchange processes occurring within the networks of individual academics in university and industry collaborations. This has particularly been explored through the question ‘*How do the individual contacts of academic scientists shape the nature and geography of their knowledge exchange networks?*’ Consequently, particular attention has been paid to the networks of academic scientists. In the context of this work, academic scientists have been conceptualised as ‘knowledgeable individuals’ who serve as conduits for knowledge exchange and whose participation in regional economies is key to competitiveness. Specifically, the research focuses on the initiation, evolution and context of academics’ networks and further explores the individual and institutional factors affecting these networks. Employing a microfoundational approach implies interest in obtaining basic understanding of these networks, the network ties. For this reason individuals as opposed to groups or organisations are studied and hence the topic, ‘micro-foundations of academics’ networks: initiation, evolution and context’. This chapter outlines the necessary methods undertaken to provide a microfoundational understanding of academics’ knowledge exchange networks and explains the various reasons for the choices made.

Unlike in seemingly unstructured populations such as the animal kingdom, social relationships of humans tend to be comparatively more intentionally dynamic. For example, while natural selection is the usual accredited norm in unstructured populations, random occurrences do not accurately explain evolution of human social relationships. Personal relationships [of humans] are built and evolve based on specific actions of individuals [and organisations]. Network ties can thus be deliberately maintained, weakened and new ones can be forged over time. Further, the emergence of network ties have been shown to be dependent on social context. However, the motivations for such networks are not always apparent, and neither are the various factors that influence their initiation and progression. This lack describes the exact contention of this thesis aimed at understanding how networks originate, progress over time and the circumstances under which these occur.

In order to address the aim of this thesis while ensuring openness and clarity of the research, the methods employed are clearly outlined. Accordingly, the methodology adopted and presented in this chapter therefore lends well with the research phenomenon understudied, selection of research approach and analytic strategy - ensuring that a similar logic flows through the entire thesis. The main philosophical considerations, emphasizing the epistemological and ontological positions of the study, are explained in section 3.1. The philosophy of the research emphasizes the choice of methods employed in the study and why. These also spell-out some of the main theoretical assumptions upon which this research is based. Section 3.2 describes the research design employed. This section defines the chosen approach to deliver on the main question of the thesis work and the theoretical justifications for these choices are provided. Next, the specific stepwise strategies employed to answer the objectives are expounded in section 3.3. Here the data collection approach (interviewing) and the analytic strategy (thematic analysis) are especially explained. Finally, section 3.4 exposes the reliability and ethical considerations of the study.

3.1 RESEARCH PHILOSOPHY

According to Bryman (1984), the choice of a method for studying a phenomenon relies on the appropriate foundation of the study of society and its manifestations. That is to say, the given epistemological base – i.e. the theory of knowledge, especially with regard to its methods, validity, and scope, and the distinction between justified belief and opinion - leads to the choice of a method. Consequently, this research is aligned to the idea that a chosen method be appropriately linked to the phenomenon and the manner in which it is expressed. For this study, much interest is placed on the belief that the forces that move human beings are also meaningful – internal ideas, feelings and motives (Douglas, 1970b). Simply, the phenomenon understudied in this thesis relates to knowledge-based network ties of academic scientists, a social occurrence that requires the study of the individuals involved in the actual processes, to gain further insight. Accordingly, the entire research presented in this thesis adopts a rather phenomenologist¹⁰ view that seeks to gain understanding through the qualitative method of in-depth interviewing to yield descriptive data (Taylor and Bogdan, 1984).

¹⁰ Phenomenology is the philosophical tradition that aligns with the belief that, understanding the world is achieved through directly experiencing the phenomena of interest.

Interpretivists posit that to comprehend others is to understand the meaning of what they do. Further, to understand this meaning is to simply understand them [others] in their own terms. (Chowdhury, 2014) On one hand, quantitative methods emphasize objectivity and probably more accurately answer the direction of causality based on operationalised concepts. However, to mitigate the disadvantages of operationalising social events, or to potentially attribute a system of 'one size fits all', qualitative methods are preferred. This means that while qualitative research takes the point of view of the actor as the empirical finding, the quantitative typically takes a certain cluster of views as the world view and may miss the contextual meanings. Suffice to say, taking the view of the actor offers a more contextual understanding of society, while offering more flexibility and emphasizing discovery of novel or unanticipated findings. This research therefore identifies as qualitative, and mainly draws on interview data for understanding the knowledge exchange processes of academics' networks. Additionally, this chosen interpretivist approach allowed for enquiry into the context of the individuals of interest, thus yielding a holistic understanding into the networks of academic scientists.

Zahle (2016) argues that the individual makes up the whole and thereby holds information about the entire population. Additionally, from Cartwright and Montuschi (2014), we learn that the purpose of society-based research is for the purpose of offering an explanation of action in terms of attitudes. These attitudes referred to, are subjective in nature, and only individuals as opposed to groups are the loci of subjective attitudes. (Cartwright and Montuschi, 2014, Gorton, 2014) In other words, appropriate explanations for social events should be based on outcomes - in terms of the individuals involved and their reactions based on processes internal to the individual (Cartwright and Montuschi, 2014). Consequently, individuals' accounts are the main focus of data collection in this thesis.

Cartwright and Montuschi (2014) explain for example that, while population-level approaches of research could operate neutral to individual-level factors it may yet be argued that population-level factors interact with those affecting society at the individual-level. This implies that, individual-level studies need to take structure into account since individual level factors tend to be more compatible with population-level factors. (Cartwright and Montuschi, 2014). It is posited that the individual is

often able to resist, deny and even transcend their context (Zahle, 2016). This seems to suggest that the individual level approach is more beneficial for studying societies and may serve as a good foundation for understanding populations.

In general, the idea of focusing on individuals for societal studies lends well with this particular study in which individuals are perceived as important for the process of building a knowledge-based economy. Even though organizations and firms provide the structure and context for knowledge exchange, it is understood that these exchanges actually occur between individuals. So, while focused on individual accounts, this study also acknowledges that relationships do exist between different individuals. Accordingly, the research recognizes the systemic view that all individuals are interrelated and subscribes to the notion that there are no relations without *relata*. (Bunge, 2000, Granovetter, 1973). Overall, this thesis rests on the study of the phenomenon of academics' networking -it takes an interpretivist position and draws on the qualitative study of individuals.

3.2 RESEARCH DESIGN: QUALITATIVE CASE STUDY

This research employs a qualitative approach (Strauss and Corbin, 1998, Patton, 2002), to explore '*How the individual contacts of academics shape the geography of knowledge exchange networks?*' This approach provided the tools to contribute systematic empirical data to existing knowledge. According to Kvale and Nielsen (2008), adapting a qualitative stance allows for a description of a phenomenon before they can be theorized, understood before they are explained and seen as concrete qualities rather than abstract quantities. For the given exploration, a qualitative approach was beneficial for obtaining in-depth insight (Yin, 1984). Further, qualitative methods have been projected to be useful for understanding the complexity of University-Industry relationships especially as the information is likely to vary considerably in each unique linkage/relationship (Plewa et al., 2013).

In the quest to understand, analyse and interpret the knowledge exchange processes within academic networks, individuals' accounts and perceptions are crucial for gaining the necessary insight. Given the research question, this study is integrally based on a social phenomenon with a foundational focus that required an

understanding of individuals' motivations and decision-making processes that lead to the initiation of networks. In that case, the quality of information gathered is hence deemed more potentially rewarding than the quantity. Further, the study of social phenomena requires that the subjects are individuals (Bryman, 1984), and to really understand what they [individuals] do is to understand them in their own words (Chowdhury, 2014). Following from the research question therefore, a qualitative approach is most suited for this study - to probe answers to questions on experience, meaning and perspective, from the standpoint of the participants (Hammarberg et al., 2016).

The study also adopted a multiple case study approach for the enquiry (Yin, 1984, Yin, 2002, Yin, 2016, Eisenhardt, 1989) which enabled data collection from different contexts. The main considerations that should lead to a research methodology are; i) the type of research question posed, ii) the extent of control an investigator has over actual behavioural events, and iii) degree of focus on contemporary as opposed to historical events (Yin, 2002). Consequently, typical case study enquiries are framed as 'why' and 'how' questions (Yin, 2002, Wilson, 2014) However, in order to avoid a 'force-fit' of research enquiries and methodology, it is advocated that further analysis of the research question in conjunction with the research objectives should lead to the chosen methodology (National Research Council, 2002).

Case studies provide a means of contextual analysis and understanding of complex social phenomena (Saunders et al., 2016, Eisenhardt, 1989, Denzin and Lincoln, 2005), in which the focus is placed on the 'case' and not on generalization of findings (Stake, 2005). Conducting a case study requires access to sufficient and multiple sources of information to develop converging lines of inquiry (Yin, 2002, Jick, 1979). Accordingly, a multiple case-study research approach with embedded units of analysis was employed for this study. In this thesis, a set of case study universities with a selection of case subjects within the selected universities or related to each (in the case of industry contacts and other external connections) were selected as opposed to randomly selecting academics across a wider set of universities. This was done for both practical and theoretical reasons that relate to each other. Practically, choosing case universities that were accessible (for example, being part of my PhD project's host and secondment institutions) enabled me achieve the theoretical aim of face-to-

face interviews within which I could dig deeper into my cases while learning a lot from the gestures and mannerisms of interviewees. Employing multiple case studies was advantageous in general for the following reasons: to 1) identify similarities and differences, 2) identify and explain patterns of phenomena and behaviour and 3) predict the outcome of other cases not yet observed, and thus *attempt* to construct generalizations for *related contexts* and phenomena (Yin, 2016, Eisenhardt, 1989).

3.3 RESEARCH STRATEGY

Having decided on the above methodological approach, a step-wise strategy was devised to carry out the research. As is prevalent for case studies, these plans were not stringent but rather served as guides that allowed for enough flexibility in data collection. The main steps are outlined in the following:

- i) Guided by the pre-view of existing literature, the research question was further broken down into sub-questions to guide data collection. While the over-arching research question was almost decided from the start of the research within the context of the RUNIN project, the literature review served to highlight the gaps in existing knowledge and therefore guided the final focus of the research enquiry.
- ii) A conceptual framework was designed to emphasize the main focus of the research. The design of the conceptual framework was done concurrently with the review of literature and modified as the study evolved.
- iii) A sampling plan for selecting cases and informants was prepared for interviews.
- iv) An Interview guide was prepared for the interviews. This document was dynamic and evolved as the data collection proceeded.
 - a. The interview guide was supplemented by a ‘network table’ which was designed to obtain specific examples of network ties. This table also allowed for understanding the context of interviewees’ networks.
- v) Interviews were conducted alongside preliminary data analysis. This way, new information received during interviews was readily picked up. When there was genuinely no new information coming in, it was obvious that data saturation had been reached for a particular case.

- a. After all the data had been collected, there was a second and more detailed analysis of the entire data set.
- vi) All the interviews were recorded and transcribed into easily analysable form
- vii) In essence, analysis started during the interviews as further questioning was guarded by the themes arising, with constant comparison and development of the case framework of ideas
 - a. Individual analysis of interviews was conducted alongside scrutiny of the specific network data collected.

3.3.1 Definition of Research Objectives

To allow for a stepwise exploration and understanding of the immediate research themes and outcomes, the research question was further expressed in terms of the following sub-objectives.

1. *How do academic scientists build their networks and what motivates local and/or international networking?*

It was of interest to understand how the networks of academics develop, and how this influences the patterns of university-Industry linkages. Motivations for networking were central to this enquiry such that dissecting those motivations specific for regional or extra-regional networks was important – also to appreciate the perceived value obtained from these collaborations. In doing so, measures needed at the regional level to foster more localised networks (should this be the way to go) and how these are influenced by the regional context could be reflected upon. This question was explored in Chapters 5 and 6 of this thesis.

2. *How do academic networks evolve over time?*

The factors that lead to the evolution of academics' network ties was analysed. Among others, the effect of mobility (career and geographical) on networks was explored - especially the effect of mobility (career and geographic) on the engagement patterns of individual academics. This enquiry was carried out based on individual academic's perceptions of network tie importance. This question was particularly explored in Chapter 7 of this thesis.

3. *How does the university and regional context affect academics' knowledge exchange networks?*

Together with the impact of the regional context, it was of interest to explore the individual and institutional factors influencing the individual's networks and their subsequent development. Subsequently, a comparison was made between the individual and institutional level factors and how they drive the direction of networks. It was interesting to understand the impact academics' networks could also have on their host regions. This question was explored in Chapter 8 of this thesis.

3.3.2 Conceptual Framework

While academic scientists are involved in various types of relationships, the focus of this study was on university-industry relationships and not other types of connections such as university-government relations, etc. This was particularly the focus as university-industry relations are interesting when understudying regional innovation (Sternberg, 2000, Ankrah and Al-Tabbaa, 2015, Christopherson and Clark, 2010). So while some of the network ties encountered in the course of this study did not fall under this focus area (e.g. contacts/ties from research institutes and government agencies), they shed light on the existence of a variety of network ties of academic scientists. Additionally, having conceptualized academicians as knowledgeable and key in building of a knowledge-based economy, the perceptions of academics were especially solicited with regards to; how they initiate their networks, how the networks evolve and the context surrounding these. In parts of this study, other informants within industry and university entities were also included in order to triangulate on the collected data and obtain a contextual overview of the engagement and networking processes – where this was the case, the purpose for their inclusion is duly highlighted.

The conceptual framework in Figure 4 shows the analytical tool used for this research. In the first place, this tool served to provide an overall picture of the several variations and contexts embedded within this study as synthesized from the literature review. Putting the key elements of the research into this form enabled an easy way to organize the main ideas of the study and also make distinctions among the key features. In this

way, the conceptual framework was useful for organizing the subsequent chapters of the thesis in a more focused way. Because the conceptual framework is often emergent from the literature review, what is shown here is only the final version reached after several modifications. Further, the framework served somewhat as a template for the overall analysis of the data collected. Indeed, it is a culmination of the main ideas of the individual sub-studies conducted within this thesis. Thus the framework provides the logical connection between the sub-questions of the study and the main research question, the answer to which provides the main output of the thesis.

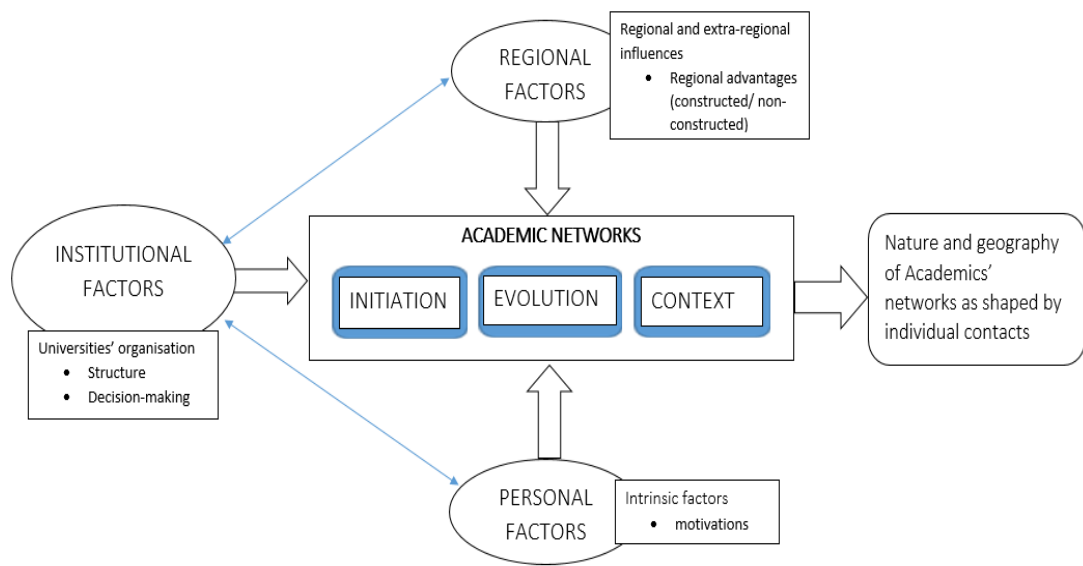


Figure 4: Conceptual Framework

As gathered from the literature review, the gaps identified based on which the research objectives were framed are highlighted. With the focus placed on academics' networks, the three main areas of interest are initiation, evolution and context. Even though academics' networks have been the focus of a significant number of studies, individual level factors are often not the focal point. Subsequently, the role of macro-level units such as organisations are usually considered. This gap, as highlighted in Chapter 2, emerged as an interesting area to explore within the framework of this thesis.

Additionally, the lack of focus in the existing literature on how academic networks are built and how they evolve is highlighted. Further, the effects of individual and institutional factors is stressed. In this thesis, elucidating the motivations of academics

to engage is of key interest. While several studies have looked at motivations, they do not focus on the regional perspective. Indeed, with the option to engage locally or internationally, it remains a puzzle why regional engagements could be of interest to academics who seek to remain globally relevant. Subsequently, the effects of the regional context with regard to both constructed and non-constructed advantages are paid attention to. Another contextual area is with the university as an organization. While individual academics are deemed key to the engagement process, the institutional context of the university is believed to exert some influence on their efforts to engage. Subsequently, the role of the university's context in promoting and/or mitigating knowledge exchange of academic scientists is explored, particularly with regards to structure and decision-making processes.

3.3.3 Sampling

A '*conceptually driven sequential sampling*' logic was employed for the study. As emphasized by Miles et al. (2014), this implies that '*the initial choices of participants lead to similar and different ones; observing one class of events invites comparison with another; and understanding one key relationship in the setting reveals facets to be studied in others*' (pg. 31) In practical sense, this implies that after interviewing the initial set of interviewees, the subsequent interviewees, and cases, were selected in a way that mirrored the initial choices or contrasted them. For example, while the initial plan of this thesis was to include only three case universities (Lincoln, Stavanger and Linköping), the two others (i.e. Chalmers Technology University and Loughborough University) were selected in variance to the original cases. Consequently, for added reasons of access and convenience, the selection process was purposive and yet evolved once the field work progressed.

3.3.3.1 Case Sampling

The selected case countries were Norway, Sweden and the U.K¹¹. This selection gave an international perspective to the study and provided a means to compare different

¹¹ The selection of case countries was based on a research rotation plan of the 'RUNIN' project (The Role of Universities in Innovation and Regional Development) of which this research was part. While the PhD was based at the University of Lincoln in the UK, there was also the opportunity for data collection at the secondment destinations of University of Stavanger, Norway and University of

contexts. Additionally, while the research question is focused on how the individual contacts of academics shape their knowledge exchange networks, the selection was done in a way that allowed for comparison between academics in peripherally located universities and those in more centralized university cities. The main case universities- University of Stavanger in Norway, University of Linköping in Sweden and the University of Lincoln, UK were based on a common logic of being peripherally located. However, with an interest in unpacking the influence of the regional context on academics' engagement/networking, an additional university each was analysed in Sweden (Chalmers Technology University) and the U.K (Loughborough University) for their relatively more centralized locations. In that way, the addition of Loughborough and Chalmers could be considered more serendipitous and emerging from the research through sense making and assessing data collection practicalities.



*Figure 5: Map showing geographic distribution (countries) of selected cases¹²
(Lincoln - square, Loughborough - pentagon, Stavanger - diamond, Gothenburg – circle and Linköping - triangle)*

Linköping, Sweden. Chalmers University of Technology, Sweden and Loughborough University, U.K were added cases for drawing insights from different contexts.

¹²Credits to <https://yourfreetemplates.com/europe/> for the provision of an editable map template

While being able to compare similar characteristics across the three case countries, there was yet an added opportunity to conduct detailed exploration of specific themes in the given locations in order to answer the research objectives. For example, while investigating the nature and geography of academics' networks was paramount in all case samples, the Norway case pays particular focus to the regional context. This was especially beneficial given the strong regional embeddedness of the University in its region of Rogaland and the thriving oil industry there. In Sweden, much focus was placed on the institutional context. Including interviews from the Chalmers Technology University to those from the University of Linköping was useful for exploring institutional differences as impacting academic engagement and networking. Employing the specific example of the relationship managers, so called Collaboration co-ordinators – '*Samverkskordinators*' as used in the Swedish context was useful for gaining more insights into how institutions play a role in the (il)legitimization of academic engagement. Finally, the U.K. case(s) served to emphasize previous findings on the nature and geography of academic engagement. However, further nuances were exposed: unlike Chalmers which was a centrally placed university by virtue of industrial activity in comparison to Linköping, Loughborough was more centrally placed in comparison to Lincoln in terms of accessibility (transport). These differences provided further interesting basis to draw further insight from the given cases.

Table 4: Details on selected cases¹³

Case University	General University location	Description of Geographical	Case contribution to thesis
University of Stavanger, Norway	This university is peripherally located in the Rogaland region of Norway – and houses the country's oil hub and major oil companies. The university has been in existence since 2005 (i.e. 15 years).		Interviews employed in Chapter 5 and 6 to explain the initiation of academics' networks Also employed in Chapter 7 on evolution of network ties
University of Linköping, Sweden	Peripherally located in the Swedish city of Linköping in the Östergötland region. Many car manufacturing companies are located here. The university has been in existence since 1969 (i.e. 51 years).		Interviews employed in Chapter 7 to explore the evolution of academics' networks Interviews employed in chapter 8 to explain the role of context on academics' networks
Chalmers Technology University, Sweden	Located in the Swedish city of Gothenburg of the <i>Västergötland</i> region – more central compared to the city of Linköping. Major car manufacturing industries are located. The university positions itself as a technical university and has been in existence since 1829 (i.e. 191 years).		Interviews employed in Chapter 7 to explore the evolution of academics' networks
University of Lincoln, UK	A young university of about 20 years located in the Rural <i>Lincolnshire</i> city of Lincoln in the East Midlands county of the U.K. Region is agricultural and houses many engineering-based companies.		Interviews employed in Chapter 7 to explore the evolution of academics' networks Interviews employed in chapter 8 to explain the role of context on academics' networks
Loughborough University, UK	Located in the East midlands county of <i>Leicestershire</i> – more centrally located in comparison to Lincoln (Lincolnshire) in terms of transport (rail) connectivity. It has been in existence since 1909 (i.e. 111 years)		Interviews employed in Chapter 7 to explore the evolution of academics' networks

¹³ Further details of the case contexts appear in the following chapter (4).

3.3.3.2 Interviewee Sampling

For a study focused on networks of academic scientists, concentrating on the perspectives of academic scientists was a natural course to follow. This was especially beneficial given that the academic scientists are believed to embody knowledge and are key for the transfer of knowledge - especially when this knowledge is tacit (Nonaka, 1994, Stuck et al., 2016). The academics' views were complemented by the views of their industry partners, institutional/university engagement managers and other stakeholders (*see Table 4 above on details of selected cases*) to obtain further insight into the academics' institutional context, and to build a well-rounded view.

The concept of engaged academics (Perkmann et al., 2013), was applied in the selection of academic subjects whose personal networks would be examined. In contrast to the definition by Perkmann et al. (2013) however, where only 'knowledge-related collaboration by academic researchers with non-academic organizations' is considered academic engagement, I took the wider stance of academic engagement involving collaborations with both academic and non-academic organisations. By so doing, those collaborations that lead to commercialization as well as those resulting in student exchange between institutions for the purpose of secondments are also captured as engagement activities. In this thesis, focus was placed on STEM academics as these have prior been reported as depicting a higher tendency to engage (Perkmann et al., 2013). However, for the purposes of comparing and contrasting, an unengaged STEM¹⁴ academic has also been interviewed.

The following selection criteria was applied for choosing engaged academics:

- 1) at the time of the study, the individual academics chosen were engaged in an on-going project that involved industry partners (in addition to their usual research and teaching engagements);
- 2) the activities of the academics were perceived to have a certain potential impact to their regions. In most cases this potential 'impact' was assessed through a reliance on the universities' internal impact assessment.

¹⁴ The unengaged academic in the context of this study had no industry collaborations in addition to their usual teaching engagements. While this unit of analysis was not the focus of the research, it served as 'blank' experiment to verify or disprove conclusions from the main case units.

To explain, it was possible in the case of Lincoln and Stavanger to obtain a list of engaged academics from the central administration of these universities. When this document was not available, a screening of the engagement activities as published on the universities' websites was conducted to verify the activities of individual academics and their potential contribution or impact. Where the results from the universities' impact study was available, the idea of 'most engaged' was applied for the selection of academics. For instance, when I was spoilt for choice between two academics, I would base my selection of an interview on the one with the highest recorded number of individual external engagements. While this selection based on the number of engagements may not fully justify the 'quality' of engagements of these academics, what is most relevant for the study was the presence of engagement and not the degree of engagement. This selection criterion of quantity of engagements was therefore essentially applied in order to narrow down the number of respondents to a relevant number of academics who could be both available and conveniently interviewed for the study.

The use of multiple sources of data and/or multiple research methods to provide varying viewpoints on a phenomenon of interest as well as validate study findings during data analysis is known as triangulation (Yin, 2002, Jick, 1979). Obtaining evidence from multiple cases served the purpose of strengthening the reported findings by either reinforcing or contradicting observations. Triangulation therefore served to enrich understanding by allowing for the emergence of new and deeper dimensions (Jick, 1979). In all cases, there was an opportunity to reflect and propose explanations for the observed similarities and differences. Having multiple sources of evidences in informants and cases invariable served to increase the robustness of findings (Yin, 2016, Eisenhardt, 1989).

Overall, the reason for the sampling of cases and interviewees transcends mere triangulation based on numbers but rather to present diversity and explore how different contexts affect academic engagement. This provided an opportunity to compare and contrast cases from different regional and institutional settings.

3.3.4 Data Collection

Empirical data was collected through semi-structured interviews which allowed for flexibility in data collection. Additionally, the semi-structured nature of interviews was useful for obtaining in-depth understanding of the cases reviewed (Yin, 2002, Hammarberg et al., 2016, Wilson, 2014). Interviews were recorded with the permission of interviewees. The data collected was transcribed and subsequently coded (Yin, 1984), which ultimately led to the emergence of common themes and patterns for discussion.

Including certain key stakeholders and obtaining supporting information from the university and firms' websites helped with data triangulation. For this thesis, 100¹⁵ interviews have been conducted, each lasting between 45-90 mins¹⁶. These have been based mainly on academic interviews from different universities; attention has been paid to different regional and institutional settings in the selection of such cases. Table 5 below provides some details of the informants and some justification for including them in the study sample.

Table 5: Details on selected sample – Informants

Case Country	Case university	Interviewee classifications	Number of interviews	Purpose for selection
Norway	UiS (23 interviews)	Engaged academics in STEM	16	Investigate the nature and geography of networks. Explore the effect of the regional context
		Non-engaged academic in STEM	1	Explore/verify personal factors to influence engagement/networking
		Firm contacts	4	Explore the perceptions of industry contacts?
		Regional collaborator with university	1	Explore the effects of the regional context

¹⁵ The number 100 reflects the independent interviews conducted in the research project. So in the case of some joint publications/work (see Appendix 7), the total number of interviews for a case may be higher (than presented here) as other authors contributed their own interviews. The additional interviews are excluded from the findings and analysis presented in this thesis – the difference in numbers presents no qualitative influence on the results herein presented.

¹⁶ The interviews with PhD graduates were much shorter and lasting about 45mins on average.

		University external relation officer	1	Understand presence or absence of institutional factors affecting academic engagement
Sweden	University of Linköping (30 interviewees)	Engaged academics in/outside STEM	8	Investigate the nature and geography of networks. Explore the effect of the regional context
		Impact exercise academics	3	Exploration of engagement legitimization efforts of the university
		Collaboration coordinators	8	Exploration of engagement legitimization efforts of the university
		PhD graduates	9	Explore how university-industry networks affect the industry employability of PhD students
		Leaders of strategic partnerships	2	Exploration of engagement legitimization efforts of the university
	Chalmers Technology University (11 interviewees)	Engaged academics in STEM	8	Investigate the nature and geography of networks. Explore the effect of the regional context
		Leaders of strategic partnerships	2	Exploration of engagement legitimization efforts of the university – how does the university support academic engagement?
		Director of external relations	1	Exploration of engagement legitimization efforts of the university - how does the university support academic engagement?
UK	University of Lincoln (25 interviewees)	Engaged academics in STEM	12	Investigate the nature and geography of networks. Explore the effect of the regional context
		Firm partners	4	Explore industry perspectives of academic engagement and regional engagement

	Relationship manager(s)	2	Explore and understand the institutional efforts and provisions in place to support academic/ university engagement
	Graduate students	2	Explore the issue of graduate retention in Lincolnshire and overcoming the challenge
	PhD students	5	Explore how university-industry networks affect the industry employability of PhD students
	Engaged academics in STEM	7	Investigate the nature and geography of networks. Explore the effect of the regional context
	Relationship managers	1	Explore and understand the institutional efforts and provisions in place to support academic/ university engagement
University of Loughborough (11 interviews)	PhD graduates	3	Explore how university-industry networks affect the industry employability of PhD students

3.3.4.1 Interviewing

Empirical data was collected through interviews. The interviews were of a semi-structured nature and directed towards understanding informants in their own works (Taylor and Bogdan, 1984). Consequently interviewees were probed for the details of their experiences as well as the meanings they attach to them. Both purposeful and snowballing techniques were used in selection of informants.

Based on the objectives of the study and existing literature, an interview guide was prepared for the interviews (see Appendix 1). The Interview guide, rather than a strict and structured protocol, was used as a list of general areas to cover with informants. As emphasized by Taylor and Bogdan (1984), ‘the interviewer, not the interview protocol is the research tool – the role of [interviewer] entails not merely asking questions, but learning what questions to ask and how to ask them’. The interview guide was accordingly expanded and revised as additional interviews were conducted.

Descriptive questioning was used to start all interviews as suggested by (Taylor and Bogdan, 1984). Typically, informants were invited to ‘tell about themselves’ at the start of interviews. This technique helped to obtain a preliminary understanding of how informants understand and categorize events, and also to avoid pushing the research agenda too early in the interview. Additionally, to understand the nature and geography of the academics’ networks, the engaged scientists in the sample were encouraged to list examples of their network contacts based on which discussions on events and experiences. This exercise was conducted based on the idea of ego network analysis (Borgatti et al., 2013). For this purpose, a table for extracting details on the network of the informants was prepared (this is elaborated in the following section). This exercise enabled interviewees relate to specific events and was useful for drawing on personal experiences.

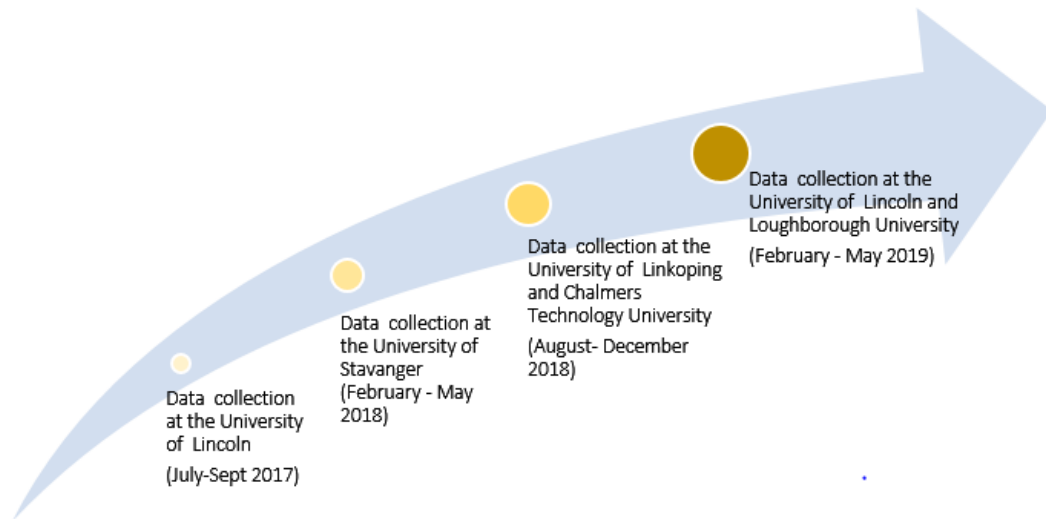
Generally, there is a lack of consensus on the number of interviews that should constitute a qualitative study. This study aligns with the concept of reaching a theoretical saturation as an indication of when to pull the plug on interviewing. At the theoretical saturation, emergent concepts were well-developed and continued sampling and analyzing data lead to no new insights (Taylor and Bogdan, 1984, Strauss and Corbin, 1998, Creswell, 1998, Mason, 2010) Further, unlike in the case of quantitative study, the frequency of an occurrence is usually irrelevant to the story behind it. Because qualitative research is concerned with meaning rather than generalisation of findings, a single incidence is as useful as many in understanding the underlying mechanisms. (Mason, 2010, Crouch and McKenzie, 2006). Accordingly, interviewing typically stopped at the point when interviews with additional people yielded no genuinely new insights.

The data collected from the University of Lincoln were collected in two main phases; i) July-September 2017 and ii) Feb – May 2019. In the first phase which actually was also the first data collection activity of the research at the University of Lincoln, focus was placed on the motivations of academics to collaborate with Industry partners. The challenges faced while collaborating from both the academics’ and industry collaborators’ perspectives were examined. The academics for these interviews were chosen from the Engineering School and the National Centre for food Manufacturing (NCFM) based on their engagement in high impact projects with industry as seen from

the University of Lincoln's internal impact assessment. The industry partners were interviewed following the recommendations from their university contacts. In this way, both purposeful and snowballing techniques were used for the selection of interviewees. These interviews exposed certain institutional and personal factors that moderate the decision of academics to engage. The second half of data collection in the U.K. consisted of interviews at both Lincoln and Loughborough

While exploring the motivations of academics to collaborate, much attention was paid to the regional and institutional context of the collaborations. At this stage, certain clear differences could already be seen between the University of Lincoln case and the University of Stavanger cases, especially suggesting that the mix of regional industries has an influence on the motivations of academics in a particular research area to collaborate externally, and often locally. Further, these questions have been asked at a very specific level where academics have had to list 10 of their personal network contacts and in a table to describe the relationships that exist. This exercise on network contacts was useful for understanding the geography of individuals' contacts (international, national or regional) and the factors that influence the importance attached to a particular relationship.

A similar plan for data collection to the Stavanger case was followed for Sweden – Linköping University and Chalmers Technology University during the period August - December 2018. In addition to collecting network data especially on the evolution of academics' networks, this period was used focused on understanding the effect of the university's context on academic engagement through the case of Collaboration Co-ordinators at Linköping.



*Figure 5: Progression of data collection
(July 2017 –May 2019)*

3.3.4.2 Extracting Network Data

Social network analysis (SNA) measures and maps the flow of relationships between various entities. SNA structure is made up of node entities, such as humans, and ties, such as relationships. Most SNA studies are focused particularly on the structural properties and changes in networks. In these studies, the interest is usually on which people are central to the network, who the brokers are, etc. (Granovetter, 1973, Friedkin, 1980, Burt, 2005). However, the structure of the networks has not been the focus of this study, because the interest is on microfoundations of academics' networks –how individuals initiate and build their networks, how these networks evolve and the factors affecting such evolution, and the context in which these occur. Consequently, the network analysis carried out in this study has not followed the conventional method of SNA.

The concept of 'ego' network analysis lends well to this thesis and the subsequent methodology adopted. Ego networks consist of the central or focal individual (or ego) and the alters who are those people to who the ego relates directly (Borgatti et al., 2013). When building of ego networks via the personal network design approach, three distinct steps are involved;

1. Generation of names of contacts (alters) based on simple open-ended questions

2. Interpretation of names where the respondent is asked about each name mentioned
3. Name Interrelation, where the respondent is asked about the ties between alters.

According to Borgatti et al. (2013), it is not required that a network be connected nor to have any ties at all, especially at its initiation. For this reason, it is possible to have an ego network without necessarily emphasizing the connections between them. Additionally, connecting ties would amount to constructing and laying emphasis on the structure of the networks studied – this, was not the focus of the study. Accordingly, the third step of ‘name interrelation’ was omitted in this study. In certain instances though, information on the existence of connections between alters was volunteered by informants while they explained their relationship to the relevant network ties.

A ‘network table’ based on the idea of constructing ego networks was designed for collecting network data of interviewees. This table (6), as shown below was an essential tool for obtaining specific examples of network ties and also allowed for understanding the context of interviewees’ networks¹⁷.

Table 6: Network Information Sheet

Name (pseudo)	Geography	Academia/Industry /other	Closeness	Closeness (-2)	Closeness (-4)
1					
2					
...					
10					

Just as is done for construction of ego networks, informants were required to mention examples of their network contacts. Most interviewees mentioned up to 10 ties. To

¹⁷ Interviewees filled up the form themselves in the presence of the interviewer. Also, not every informant filled this form citing personal reasons.

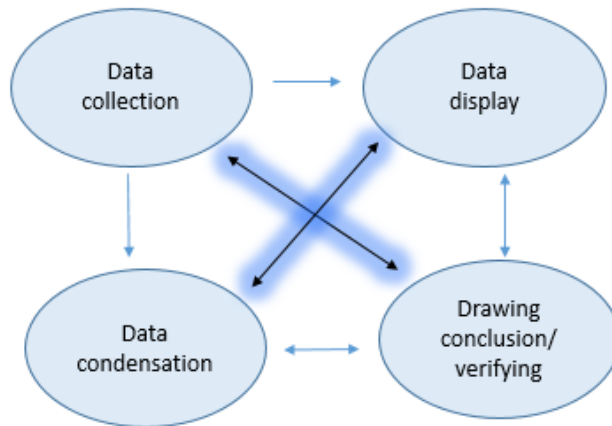
avoid ambiguity and to ensure comparison across cases, informants were asked to *'give names of individuals who are important to their professional work'*. The definition of 'importance' was left to the discretion of each informant for generation of the list. Later, the definition of importance was solicited from interviewees, and was also apparent in later discussions on what each interviewee viewed as important for their work.

Next, interviewees supplied the location of their contacts under the category labelled 'Geography'. In the next column, they filled out whether the contact was in industry, academia, etc. Even though the interest of this study is mainly on U-I networks, informants were not restricted to only these networks. So while the majority of the ties mentioned were U-I (as influenced from the interviewee sampling), some ties did not fall under university or industry entities. Already, from the first two columns, it was possible to know the geographical nature of the university and industry linkages of interviewees.

The last three columns were focused on studying the evolution of each linkage. In the first of these labelled 'closeness' the interviewees were asked to rank each tie on a scale of 1-10 of how important each tie was to them, with 1 being most important and 10 being less important. In the column labelled 'closeness -2', interviewees were asked to rank the same ties, 'for 2 years ago'. In the last labelled 'closeness -4' interviewees did the ranking for 4 years ago. This exercise required that interviewees reflected on how their relationships had changed over the years. It is important to note that the ranking of closeness was not a comparison of which of the ties mentioned on the list was more valued as important. Rather the ranking was to show how each of these ties evolved over the period of 4 years in this instance. The data was collected for up to 4 years back because of the knowledge that most academic projects stay within the span of 3-4 years. This time span was especially apparent from the lists of externally engaged academics received from the universities' administration. This decision therefore allowed for the opportunity to assess both new (on projects just beginning) and old ties (on projects ending), as well as non-project-dependent ties.

3.3.5 Data Analysis Plan

Data analysis is an on-going process in qualitative research. Researchers keep track of emerging themes, read through transcripts, and develop concepts and propositions to begin to make sense of the data. (Taylor and Bogdan, 1984) Consequently, data collection and analysis went hand-in-hand for this research work. The data collected was analysed with reference to the conceptual framework (Gale et al., 2013, Ritchie and Lewis, 2003). This ideology allows logical data analysis where the research question directly links to the title of the study and from which the aim of the study is developed. As for this thesis, the research question and the resulting sub-objectives are all connected. Following this reasoning, the data was analysed with the major aspects of the framework in mind.



*Figure 6: Interplay between the features of data collection and processing
based on Miles and Huberman (1994)*

In practise, the nature in which I collected the data affected analysis and its subsequent presentation in the thesis. For instance, I collected the Stavanger data at the early stage of the thesis where I focused on initiation of networks. This first part of the data was analysed and processed, and through which two academic papers emerged in 2019. These publications form the basis for Chapter 5 and 6 of this thesis. Subsequently, I analysed the in-coming views of interviewees in the subsequent interviews and compared to those analysed earlier on. The findings here, as far as the focus of my initial enquiries are concerned were not qualitatively different from that which was already present. In that case, Chapter 5 and 6 have fewer number of interviews as compared to the entire number of interviews conducted. Other chapters follow this

trend in employing only those interviews that served for answering the relevant research question.

The process of data analysis was therefore a continuous, interactive and cyclical one consisting of data condensation (e.g. coding), data display and drawing preliminary conclusions alongside the actual data collection (Miles and Huberman, 1994). Data collected was transcribed and emerging themes coded. An inductive approach to analysis was employed to ensure that all relevant emerging information were considered. From the coded data, patterns and implications were drawn (Wilson, 2014), and discussed in comparison with literature and other data sources such as document and website information. From these, inferences, conclusions and recommendations were made.

Data analysis was conducted with the use of Nvivo software and excel in a thematic analysis process. Firstly, the emerging themes were isolated. Later, these terms were compounded and condensed into categories. This invariably led to the formation of concepts based on which thick or detailed descriptions (Geertz, 1973) were drawn. A sample of the data analysis process is shown in the appendix 6.

3.4 RELIABILITY AND ETHICAL CONSIDERATIONS

The step by step description of the methodology followed in this thesis is strategic. It was specifically to provide openness to the research and expose the logic flowing through from the framing of the research questions, to data collection and right down to the conclusions. This stepwise description also ensures that the research could be repeated to obtain the same or similar results. At the onset of data collection (July 2017), an ethical approval form was filled out highlighting the major ethical considerations of the project.¹⁸ This document was reviewed as required by the University's procedures in January 2018. Given that no remarkable changes had been made since initiation of data collection, no changes were applied to the document. Major aspects of this document are as follows:

¹⁸ See Appendix 3 for the ethical approval form.

1. Even though informants were contacted based on a sampling plan, they reserved their rights to opt-out of the study at any time. It was explained to informants that, they could contact me (the investigator) if they no longer wanted their information used for the research. None of the informants opted-out of the research after interviews had been conducted. However a couple of those contacted could not partake in the study for various reasons such as time constraints and/or lack of interest in the study.
2. Further, to ensure safety of both interviewee and interviewer, interviews were conducted in the normal place of work of interviewees or in other appropriate public places.
3. All interviews were recorded with the permission of informants. To avoid wrong handling of the collected data that could cause humiliation to subjects, the interview audios and transcripts were stored as coded files to amply conceal the identities of informants. Subjects were informed of the possibility of using direct quotes from interviews- these were supplied as ‘coded’ quotes. In one instance, an informant took a copy of the interview audio for his own storage.
4. Further steps were taken to avoid embarrassment to the institutions (universities) in the study. For practical reasons, I decided not to obscure the identity of the Universities because they would be easily identifiable anyway. Further, hiding the identities of the universities would take away the contextual perspectives of the study, and thus dilute the impact of the thesis. The data presented have been presented most accurately to ensure reliability and accuracy and to avoid causing any distress to the involved institutions.
5. Accordingly, the data presented in this thesis has been de-identified to avoid recognition of informants. The interviewee data has also been securely stored throughout the course of this research work.

A consent form (as shown in the Appendix 2) has been used for interviews. This form served as an information sheet for the interviewees on the research project, and offered some contextual background to get the interviews started. Information on how the data would be treated was included and permission was sought for recording all interviews. The earliest interviews (7 at UoL) were conducted without the use of the consent forms though the same details were discussed with the interviewees prior to interviewing. However, using the consent form for the remaining interviews afforded the

opportunity to document the willingness and agreement of the informants to partake in the research. Accuracy of data was enhanced by avoiding leading questions during the interviews and listening with open mindedness while interviewees spoke.

A third party transcription company, GoTranscript (<https://gotranscript.com/>) was contracted for transcription of some of the interviews. The interview audios were coded to anonymise them before uploading them for the third-party service. Additionally, a two-way confidentiality agreement¹⁹ was signed detailing treatment of the audio files. This was a further step to ensure that the data was properly handled. A transcript copy from the third is provided as appendix 5. While self-transcribing allowed the opportunity to get closer to the collected data, it proved time-saving to hire some help. Typically, the transcripts from GoTranscript were further cleaned and corrected, given that some words and phrases were not known or decipherable to the transcriptionists. Cleaning these files mitigated the missed opportunity of self-transcribing, and indeed served as a first stage of data analysis.

¹⁹ See appendix 4 for a copy of the confidentiality note

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CHAPTER 4 - OVERVIEW OF EMPIRICAL CONTEXT

In this chapter, an overall description of the thesis context is presented. As earlier mentioned, the data presented in the thesis were collected from the UK, Sweden and Norway. These countries formed part of the RUNIN project, making them both applicable and accessible given that they were host (UK), and secondment (Sweden & Norway) destinations for the RUNIN project. Specifically, the Universities of Lincoln (UK), Linköping (Sweden) and Stavanger (Norway) are academic partners of the project. It was therefore convenient to explore the questions in this thesis at these universities. Just like the majority of universities partnering in the project, the selected universities are all relatively young universities and peripheral in their respective countries. This topographically peripheral nature of the universities was an important determinant of their inclusion in the RUNIN project, which was focused on contributing knowledge on how peripheral and (therefore) also potentially disadvantaged universities (Charles, 2016), could contribute to the economic development of their regions. The peripheral nature of the universities also provided an edge for this thesis given that they [these peripheral universities] have rarely been the focus of studies on regional development.

The Universities of Loughborough (UK) and Chalmers (Sweden) on the other hand emerged as significant for the analysis of this thesis for a couple of reasons. In the first instance, these two universities were considered as more central to the other universities selected, i.e. Lincoln and Linköping in this instance. Compared to Lincoln for example, Loughborough is more central in terms of accessibility. For instance, the Grade II-rated train station in Loughborough offers more connections considering the rail network of the UK compared to Lincoln's. On the other hand, Chalmers located in Gothenburg is also considered more central and accessible compared to Linköping which lies in the peripheral region of Östergötland. Additionally, after conducting the case study in Stavanger (Norway) and pre-analysing the data, the question of whether or not a more central location would impact the data/findings arose. Consequently, there was a need to provide a means in the data to address this query. In short, the selection of centrally located institutions would serve as a control and potentially help to isolate region-specific characteristics of academics' networks.

Indeed, the selection of the cases in this thesis is purposefully executed for exploring and ultimately isolating region-specific nuances of academics' networking when possible. As emphasized in the literature (Chapter 2), the regional context exerts some unique modalities on Academic engagement. This uniqueness presents a good opportunity to explore the effects or role of context in the networks of academic scientists. In the next sections of this chapter, details of the selected institutions would be presented. Of relevance to this thesis, the facts about the case countries, and institutions would be described in terms of their identity as Higher Education Institutes (HEIs), engagement and the regional context. The chapter would conclude with a summary of the implications of the specific universities' context in interpreting the data collected in this thesis.

4.1 THE UK CONTEXT - HEIs AND ACADEMIC ENGAGEMENT

In the UK, like in many other countries, the importance of Higher Education Institutions is apparent. It has been acknowledged that attaining a competitive edge for the country would require development of world leadership in the most technologically intensive and science based industries and services (Calvert and Patel, 2003), and to move into high-value goods, services and industries by capitalizing on the research base fundamental to this aim (Martin and Turner, 2010, DTI, 2006). Subsequently, UK universities are ever more encouraged to assume their place in the socioeconomic context (HEFCE, 2007) by adding a third mission to their research and teaching missions.

Reportedly, close to £600 million was put into Higher Education (HE) between 1998 and 2007, mainly through the Higher Education Innovation Fund (HEIF). An evaluation of the HEIF suggested an estimated return of between £2.9 and £4.2 billion in value, together with progress in culture change in HE to embrace third stream working (Martin and Turner, 2010, Galsworthy, 2007). Indeed, pursuant of a third mission would require a cultural shift and a mission stretch for universities as organisations.

In the midst of all the encouragement for universities' involvement in providing competitiveness, it is worth the while to note that, different universities address their

third mission roles differently. Consequently, policy makers need to address the heterogeneity of the higher education sector if they are to achieve success with regard to UK competitiveness (Martin and Turner, 2010). Researching the institutional and regional contexts of HEIs with regard to engagement/third mission activities may be key to unearthing the existent heterogeneity in the sector and thus designing more fit-to-purpose policies that promote competitiveness. Subsequently, I take a closer look at the contexts of the University of Lincoln and Loughborough in the East Midlands of the UK to explore the distinctions between differently placed and/or constituted HEIs.



Figure 7: Map of the UK East Midlands²⁰

²⁰ Source: https://www2.le.ac.uk/departments/emfpu/pathology/MAP.gif/image_view_fullscreen (accessed 22/10/19)

4.1.1 The Lincoln Case

4.1.1.1 The University

The University of Lincoln (UoL) is a relatively young university located in Lincolnshire in the East Midlands of England. Lincoln is an unusual case as its origins do not lie in the rural environment of Lincolnshire but rather, in the urban location of Hull. The University started as a series of small colleges based in Hull which came together to form the Hull College of Higher Education in 1976. The main campus was eventually moved to its present location of Lincoln in the 1990s, after a series of restructuring and moves. These moves and changes were initiated and shaped by local interests. Indeed, these interested locals developed a new campus and invited a university to set up a satellite operation which then became the primary campus. The origin of the university in Lincoln was thus evidently, a culmination of active lobbying and funding from the County Council and other local business interests. Today, UoL operates as a full-range university (Charles, 2016) from three campus sites; Brayford Pool (main campus), Holbeach and Riseholme. The universities' main location at the Brayford Pool campus in a sense is ironic as the university is only in Lincoln because it was footloose in the first place.

In terms of supporting the local economy the university has always assumed a mission as an anchor institution (Birch et al., 2013, UoL, 2016b). This anchoring role is partly evident in the heavy investment in the new campus in Lincoln. For example, Since the University of Lincoln's Brayford Pool Campus was opened by Her Majesty Queen Elizabeth II in 1996, more than £350 million has been invested in the buildings and facilities.²¹ Further, the university has sought to develop broad and deep relationships with the city and region. Various partnerships with businesses and other key stakeholders also illustrate some of the key efforts of the university in linking regional engagement to the university's core functions. Evidently, the university has sought to fully embed itself in the locality.

The genesis of the university has played a significant role in the manner in which the university has sought to engage with the community. The subsequent expansion of the

²¹ <https://www.timeshighereducation.com/world-university-rankings/university-lincoln#survey-answer> (accessed 22/10/19)

university and its creation of new schools, such as for engineering, has involved considerable local partnership building and input. During its twenty years of existence, the University of Lincoln has grown from a branch campus to a full-range university, currently responding to regional economic needs by collaborating with local businesses and employers, such as Siemens, and serving the large regional food manufacturing sector through the National Centre for Food Manufacturing (NCFM) at the Holbeach campus in the south of Lincolnshire. The University has also had a major impact on the physical form of the city. In the early 1990s the Brayford Pool area, close to the centre of the city, was a large area of derelict land, with old industrial property and railway yards. The Pool itself was an ancient port originally developed by the Romans and linked by canal to the wider English waterway system. According to Regeneris Consulting (2017), *‘there is universal recognition that the university has changed Lincoln, as a small city, for the better, and that the university is a positive asset to the city and an exemplary case of a successful campus based in a small city in a rural region that has to cope with significant economic, social and environmental diversity’*.

4.1.1.2 The Institutional context

The University of Lincoln is a community of scholars from across the world. It revels in a good global reputation with more than half of its submitted research rated as internationally excellent or world-leading in the UK's 2014 assessment of university research standards, the 2014 Research Excellence Framework (REF)²². It earned gold in the Teaching Excellence Framework (TEF 2017) and is ranked 43rd in the UK by the Times, 42nd by Complete, and 17th by the Guardian in the 2020 rankings. In 2017, the University of Lincoln ranked 8 in Agriculture & Forestry, and 2nd in Business & Economics in The Complete University Guide rankings²³. The university markets itself as a top 20 UK university and subsequently promises award-winning teaching, world-leading research and excellent graduate prospects²⁴.

²² With around £2 billion worth of funding awarded to UK universities each year by the major research councils, the REF is a key indicator of where funding is focused to maintain an internationally competitive research sector which makes a major contribution to the global economy, wellbeing, and expansion of knowledge (<https://www.lincoln.ac.uk/home/researchatlincoln/>) (accessed 22/10/19)

²³ https://en.wikipedia.org/wiki/University_of_Lincoln#Organisation_and_administration (accessed 22/10/19)

²⁴ <https://www.lincoln.ac.uk/home/> (accessed 22/10/19)

UoL is structured as a college based system with each college led by a Pro Vice Chancellor. The colleges of study are namely; the colleges of Science, Social Science, Art and newly made an independent college, the Lincoln International Business School (LIBS). The colleges comprise schools, institutes and research centres. The university runs a central governance system with Mary Stuart as Vice-Chancellor, and has for Chancellor Victor Adebawale, Baron Adebawale. With the Vice-Chancellor considered for a national award which honours higher education's most inspirational leaders²⁵ and the winner of this year's Lincoln Civic Award by the City of Lincoln Council²⁶, the success of the university could in part to be attributed to good leadership. Whereas in theory, teaching and research are acclaimed the primary reasons for a university's success, good management and leadership can provide the conducive atmosphere for this success to be realised over time (Shattock, 2003).

Research conducted at UoL is considered cutting-edge and leading in the various disciplines, from developing new antibiotics and more effective cancer treatments, to tackling the digital divide and preserving historical artefacts. Some of the world's most challenging problems, including drug-resistant bacteria, cancer diagnosis, and mitigating the impact of climate change are carried out at the university. Research projects taking place at the University of Lincoln are making a real impact and bringing direct, positive benefits to society across wide range of sectors, from developing new medical technologies to preserving rare architectural treasures.²⁷ The research and scholarly contributions of the university are recognised nationally and internationally.

Considerable investment has targeted the provision of state-of-the-art research facilities that have contributed to the University's success- in attracting high-quality staff, creative and productive students, and successful business collaborations. According to Professor Andrew Hunter, Deputy Vice Chancellor, *'The University is committed to developing research and scholarship that fosters a vibrant culture in which to work and study. As this dynamic culture grows, research begins to infiltrate*

²⁵ <https://www.lincoln.ac.uk/news/2013/01/626.asp> (accessed 22/10/19)

²⁶ <https://www.lincoln.ac.uk/news/2019/04/1526.asp> (accessed 22/10/19)

²⁷ <https://www.lincoln.ac.uk/home/researchatlincoln/researchshowcase/> (accessed 22/10/19)

*everything we do –enhancing partnerships, improving interdisciplinary thinking and, in turn, making a visible contribution to wider society*²⁸

4.1.1.3 The regional context

Lincoln is a small historic city at the centre of the large rural county of Lincolnshire – one of the main centres of agricultural production in the UK. Lincolnshire is known mainly as an agricultural county, with a primary focus on arable farming and related food processing. Much of the county is relatively flat with rich soils and moderate rainfall, and is devoted to large scale arable farming of cereals and vegetables. With the exception of Lincoln and an area to the north, the settlement form is largely of small villages and market towns, with an economic base of very small firms. The Northern strip of the county along the Humber Estuary is somewhat different with Scunthorpe as an industrial town built around its steelworks and Grimsby as a port and fisheries centre. These areas of North and North East Lincolnshire have the character of old industrial areas with concomitantly high levels of unemployment. Another distinct area is the coastline with a strip of low-budget holiday resorts, focused on Skegness, areas with relatively low paid seasonal jobs around a limited set of tourism-related sectors.

Lincolnshire has experienced continual low levels of GDP. In 2005 the per capita GDP figure was €29,100 compared with €39,030 for the UK. Only 7 NUTS II regions in the UK such as Tees Valley, Cornwall and Northern Ireland were lower²⁹. The business environment in the wider East Midlands is characterised by micro-enterprises. In 2015, the region had 133,055 businesses employing only 0-9 workers corresponding to 87.7% of the area's employers. Small businesses (10-49 employees) share was significantly lower, 15,445 (10.2%) but still ahead of the national average (9.6%). Though there are only 605 large businesses (250+ employees) in the region, their share of 0.4% corresponds to UK as a whole. This also decreases innovation potential in rural areas, as the potential for innovation is likely to increase with the size of the business (GLLEP, 2014).

²⁸ <https://www.lincoln.ac.uk/home/researchatlincoln/researchenvironment/> (accessed 22/10/19)

²⁹ See <https://ec.europa.eu/eurostat/documents/2995521/9618249/1-26022019-AP-EN.pdf/f765d183-c3d2-4e2f-9256-cc6665909c80>

The whole East Midlands struggles with a relatively weaker skills base than the rest of the UK. At the beginning of the 21st century, the region was 3-5% behind of the rest of the country (UUK, 2001), and there has not been any significant improvement since: only 31.8% of the East Midlands population has a degree qualification, compared with 36.8% in England as a whole. The lack of highly skilled workforce has even led to difficulties in finding suitable candidates for open vacancies. According to a 2014/2015 graduate destination survey of University of Lincoln (UoL, 2016a), 42.7% of graduates stayed in the East Midlands and 13.4% in the adjacent East region of England. The East Midlands breakdown shows that Lincoln is the most popular destination (40.5%), followed by North Kesteven (10.0%) and Nottingham (8.0%). The survey's results also demonstrate that University of Lincoln's graduates have good prospects after completing the studies: 95% of the graduates had either employment or pursued their studies after 6 months of finishing their degrees, even though the region is struggling to retain the graduates.

Despite the growth of the city of Lincoln in recent times, many regional problems remain from health issues to problems in the living environment. Additionally, the rising number of students and migrant workers imposes considerable pressure on the infrastructure to keep up with the fast growth. Lincoln's role as the major centre of employment in Lincolnshire needs to be supported with policies aiming to foster a wider range of employment opportunities, and support both existing and new companies in order to attract new investments to the area. The policies should also reinforce Lincoln as provider of innovative employment possibilities. Thus, universities' role as key drivers of economic growth and providers of further development is acknowledged also in Lincolnshire.

4.1.1.4 Engagement

Partnerships in Lincoln operate at three main levels. Firstly, there are some strategic relationships involving the university, public sector and business. A second layer of partnerships link the university with individual large organisations such as the County Council, or Siemens and are focused around specific objectives and relatively long-term projects. A third level of partnerships concern shorter term links with a wider range of businesses and organisations including SMEs and the voluntary sector and

across a wide range of topics. Two collaborations which have been highlighted nationally as good practices in recent higher education policy documents are the link with Siemens and the Sparkhouse incubator (BIS, 2013). The Siemens collaboration, which secured the establishment of the Engineering School demonstrates how long-term, strategic university-industry partnership can have multiple benefits to both parties. The University has also been developing a new science park project with the Lincolnshire Co-op to build on the experience of Sparkhouse which is the business support centre, and the Think tank incubator.

UoL has always responded to supporting the local economy in terms of its mission as an anchor institution. The university is well-connected to the society, and according to Regeneris Consulting (2017), the university supports more than 5% of all jobs in Lincoln, and more than 1 in every 6 working age residents in the city is either a student, a direct employee or their job is indirectly linked to the University. The university plays an important role in the regional innovation process and responds to regional economic needs through collaborating with local businesses such as Siemens, and serving the large regional food manufacturing sector through the National Centre for Food Manufacturing (NCFM) at the Holbeach campus. (Birch et al., 2013) This is buttressed as follows; *‘The Unique relationships with companies such as Siemens and the Lincolnshire Co-op demonstrate the universities innovative industry-engaged approach’*³⁰

The university prides itself in the ability to understand and respond to the needs of business through engaging with industry experts to address specific skills gaps by launching new academic programmes and pursuing cutting-edge research to solve real-world commercial challenges. In 2017, Lincoln was one of only eight UK universities to be commended by the Higher Education Funding Council for England for its strategic approach to knowledge exchange³¹

^{30,8} <https://www.lincoln.ac.uk/home/businessengagement/industrylinks/> (accessed 22/10/19)

4.1.2 The Loughborough Case

4.1.2.1 The University

Loughborough University is a public research university also located in the East Midlands of England, specifically in Loughborough, Leicestershire. The University traces its origins to 1909 when Loughborough College was founded but has only been a university since 1966. The College provided production-based training in a small former munitions factory acquired by the College Principal, Herbert Schofield. In 1977 it amalgamated with the former Loughborough College of Education and was joined in 1998 with Loughborough College of Art and Design. While the overall proportion of UK students applying to do science and engineering subjects at University level has been declining, Loughborough has managed to buck the trend by receiving increasing numbers of applications in engineering. About 14% of the University's students are from overseas.³² (Arnold et al., 2006)

The University, while it was yet a Technical Institute had a focus on skills and knowledge which would be directly applicable in the wider world. In March 2013, the university announced it had acquired the former broadcast centre at the Queen Elizabeth Olympic Park which opened as a second campus in 2015. This was followed by a period of rapid expansion during which the institute was renamed Loughborough College and thence the beginning of development of the present campus. The annual income of the institution for 2016–17 was £293.7 million of which £43.3 million was from research grants and contracts, with an expenditure of £272.1 million³³.

4.1.2.2 The institutional context

With a strong teaching and technical focus, LOU has increasingly gained international reputation for being research-led in key industrial fields. The university is reputed as a top five UK university in comparison to UoL which is in the top 20 rank. LOU is also 4th in the Guardian university league and 5th in the Times and Sunday Times good university guide³⁴. Loughborough is renowned in the UK for its sports provisions and is home to the world's largest university-based sports technology research group,

^{32,14} https://en.wikipedia.org/wiki/Loughborough_University (accessed 03.04.20)

³³ <https://www.globalgradshow.com/universities/loughborough-university/> (accessed 03.04.20)

³⁴ <https://www.lboro.ac.uk/> (accessed 03.04.20)

which is part of the Sports Technology Institute. SportPark³⁵, based at the university provides a home for national sporting bodies including Youth Sport Trust, British Swimming and several other national governing bodies. Loughborough Students have performed well in the BUCS Overall Championship for more than forty years, winning the overall trophy for 40 successive years³⁶.

The University has three faculties namely; Science, Engineering, Social Sciences and Humanities. Within the faculties sit 24 Departments which are divided by disciplines in a traditional academic structure that enables teaching and research. Arnold et al. (2006) found out that, the Faculty boundaries are fast dissolving and cross-disciplinary collaborations already flourish. Additionally, the University has 5 interdisciplinary Research Schools: Health & Life Sciences (established 2005), Informatics (established 2004), and Materials, Science & Engineering (established in 2006), Sustainability (established in 2006) and Systems Engineering established 2005. Suffice to say, facilitating an internal engagement appears to be important at LOU.

There are 8 Research Institutes, for example the Institute of Surface Science Technology (ISST), which can spring up across or within Departments around specific research areas. These are bottom up research groups that have a Director that is appointed by the Head of Department to which the Institute most obviously belongs. On a smaller scale there are 36 Research Centres. The Institutes and Centres do not necessarily undertake specific teaching activities (this may be line-managed through the departments) but are financially supervised and supported by the Head of Departments. Research Schools however are pan-faculty and tend to be bigger and broader than the institutes. The University Planning and Resources Team rather than the individual departments must approve their business plans.

³⁵ Home to many of the country's top sports governing bodies and national sports organisations, SportPark Loughborough University is a £15m development that opened its doors in January 2010 and is a brand new concept in sports working (<http://www.sportpark.org.uk/>, accessed 07.04.20)

4.1.2.3 The regional context

Leicestershire located in the East Midlands is a landlocked county which borders Nottinghamshire to the north, Lincolnshire to the north-east, Rutland to the east, Northamptonshire to the south-east, Warwickshire to the south-west, Staffordshire to the west, and Derbyshire to the north-west (see Fig. 7).

From the bell-making John Taylor Bellfounders of the 14th century to the sand cast sheet-making Norman & Underwood of the 19th century among other long-lasting institutions, engineering has long been an important part of the economy of Leicestershire. Nowadays, the engineering landscape is characterised by firms such as sports car makers Noble Automotive Ltd in Barwell and Ultima Sports Ltd in Hinckley, Triumph Motorcycles in Hinckley, Jones & Shipman (machine tools), Caterpillar Redford (Plant machinery), Plant manufacturers Metalfacture Ltd (sheet metal work), Richards Engineering (foundry equipment), Transmon Engineering (materials handling equipment), Trelleborg Industrial AVS in Beaumont Leys (industrial suspension components), Parker Plant (quarrying equipment), Aggregate Industries UK (construction materials), Infotec in Ashby-de-la-Zouch (electronic information display boards), Alstec in Whetstone, Leicestershire (airport baggage handling systems), and Brush Traction (railway locomotives) in Loughborough. (Arnold et al., 2006) *It appears that even though Loughborough enjoys a somewhat central location in the midlands with better rail connectivity, it does not necessarily house the majority of the engineering firms.*

The Engineering Loughborough University, together with the engineering departments at Leicester University, De Montfort University hold apprenticeship schemes with local companies, and academic-industrial connections. The Systems Engineering Innovation Centre and Centre for Excellence for low carbon and fuel cell technologies are both based at Loughborough University. These show the local commitment of LOU to its region.

4.1.2.4 Engagement

Industrially relevant training remains the life-blood of LOU, and working alongside industry, is at the heart of what Loughborough does. According to Arnold et al. (2006),

the University's mature industrial links help it more easily find student placements and to develop industry-relevant curricula. 38% of undergraduate students undertake a full sandwich-year work placement in industry as part of their studies, putting Loughborough well above the national average in most fields. The University's international reputation is especially strong in manufacturing engineering (aeronautics and automotive), social science and sport science. The applied culture of the University has posed a challenge for the University's ability to retain high quality graduates for post-graduate research and increase its research focus. In 2004-2005, the University's total turnover was £155 million, of which £120 million were generated from academic activity: 40% (£56m) from research and 60% (£64m) from teaching. (Arnold et al., 2006)

Loughborough University's close engagement with local industry is operationalised through research projects, course attendance and single project collaboration. The 2003 Lambert review praised the efforts of institutions such as Loughborough for enhancing the employability of its graduates and working closely with industry through its sandwich courses. (Arnold et al., 2006) The university also prides in so-called strategic partnerships. These are win-win partnerships which extend beyond basic customer-supplier relationships to one where the university and a company or organisation undertake to work together in a sustained and mutually beneficial way. The University's main industrial partners are Ford, BAe Systems, Rolls-Royce and most of the large banks and construction companies. A concrete demonstration of these partnerships is the Henry Ford College based on the university campus representing Ford's largest single investment in training outside the USA. (Arnold et al., 2006) This college was as at 2016 merged with the Ford Technical Training Centre to form the Ford Academic in Daventry. The Academy provides training for technicians, sales staff and management throughout Ford's national dealer network.³⁷

Loughborough University Enterprises Ltd (LUEL), the University's main commercialisation vehicle combines all outward-facing aspects of the University's services. LUEL is committed to encouraging entrepreneurship and nurturing high-

³⁷ <https://www.themanufacturer.com/articles/henry-ford-academy-officially-opened-in-daventry/> (accessed 07.04.20)

growth business. LUEL demonstrates a proven track record in commercialising the University's research through licensing and the formation of companies and in helping businesses of all sizes to generate step changes in their evolution through accessing the universities' research capabilities.³⁸

From the interviews and secondary data analysed in Loughborough and Lincoln, it is evident that both universities have stamped their influence on their local economy as a magnet for human capital for various purposes, most markedly the educational purposes. Just like in the case of Lincoln (Regeneris Consulting, 2017), LOU is the largest single employer in Loughborough (Arnold et al., 2006).

4.2 THE SWEDISH CONTEXT - HEIs AND ACADEMIC ENGAGEMENT

The research landscape in the Swedish context has undergone rapid change since the 1990s, which marked the assumption of power by the conservative government of the time. The pre-1990 period was characterised by university based basic research with a few independent state funded industrial research institutes. (Odén, 1991, Elzinga, 1980, Jacob et al., 2003) Subsequently, reforms focused on the reorganisation of the research terrain were instituted resulting in a clear redefinition of strategic research. The funding framework was also restructured where small to medium sized research councils were mandated to fund basic, sectoral and strategic research. (Jacob et al., 2003) In line with the reforms, a third task apart from research and education was defined obliging universities to actively engage with other societal actors. Previously, strategic research had been taken to mean research where researchers and the research councils were defined to have some long term future potential for application.

In order to support universities' engagement efforts, the Swedish state introduced a new class of institutions known as the technology bridge foundations (*Teknikbrostiftelser*) organised on a regional level with each foundation having some degree of autonomy in defining its mission so as to ensure that region specific needs can be met. Additionally, a new government agency was created which was specifically charged with the promotion of innovation, the Swedish agency for

³⁸ <https://www.lboro.ac.uk/enterprise/consultancy/luel/> (accessed 07.04.20)

innovation systems (VINNOVA). The creation of a special agency for innovation as well as the concentration of resources on mechanisms for facilitating commercialisation and commodification of university based knowledge suggest that despite its broad formulation as interaction with the rest of the society, there is a growing tendency towards interpreting the third task as being essentially about commercialising and commodifying university knowledge. (Jacob et al., 2003)

In 2009, the university mission in the Higher Education Act was amended to include a third mission. The purpose of this additional mission was to promote the dissemination of research results from the university to the public good. According to some scholars like Wahlbin and Wigren (2007), calling this added role a third mission may have divorced it from the traditional roles of teaching and researching and thus created the impression that this was something new that should be added to the traditional tasks of education and research. Somehow, this understanding of the third mission has hindered the intended interaction of universities with society. With the Swedish HEIs Linköping University (Östergötland) and Chalmers University of Technology (Västergötland) included as cases in this thesis, the next sections will now look at their context especially in relation to third mission activities. Fig. 8 below shows these two regions of interest together with other regions of Sweden.



Figure 8: Map of Sweden showing the historical provinces³⁹

4.2.1 The Linköping Case

4.2.1.1 The University

The University of Linköping (aka *Linköpings universitet*; LiU) is located in the Östergötland region of Sweden. Linköping, a small city (population 150,000) approximately 200 km south of Stockholm, the capital of Sweden. The campus was established in the 1960's as a branch campus of Stockholm University. However in

³⁹https://en.wikipedia.org/wiki/Culture_of_Sweden#/media/File:Fred-Chess_-_Landskap_Sweden,_text-color.png (accessed 07.04.20)

1975, campus Linköping attained its independence and is today made up of four campuses; Campus Valla, Campus US, Campus Norrköping, Campus Lidingö. Linköping is recognized as the Swedish aviation capital and for its entrepreneurial spirit (Fredin, 2014).

LiU has always had strongly-rooted industrial connections. According to Fredin (2014), the company SAAB is accredited an important role in bringing the university to Linköping in 1969. Reportedly, while LiU's establishment was made possible by a national decision which was beyond the control of the local and regional authorities, several local interests in developing such a local institution influenced the university's beginnings. Due to the baby boom after the Second World War, and the subsequent increase in the student population in the 1960s, the Swedish government embarked on establishing more higher education institutions. Many municipalities tried to attract such an establishment. Linköping was not an exception to these widespread efforts. The SAAB director at the time, Lars Brising and civil servant Samuel Bergbäck suggested the establishment of a technical college with strong links to the regional industries. And in deed, LiU was first established as a technical college and later granted full university status in 1975. (Fredin, 2014)

Though at the time the pre-dominant agreement in Swedish academia was that academia and industry should be kept apart, SAABs important role in the university's establishment indicated that LiU's success would be dependent on close collaboration with the company. The vice-chancellor of the time, Hans Meijer strived for this LiU-SAAB collaboration. Subsequently, he recruited new staff who were known for their relations to industry. These employees came mainly from established universities, such as from Stockholm, Uppsala and Lund (Fredin, 2014). From that perspective, it is clearly evident that LiU has an old tradition of engagement.

4.2.1.2 The institutional context

The university pursues research and postgraduate studies in fields such as technology, medicine, and humanities, natural, educational, social and behavioural sciences. LiU is particularly acclaimed for its multidisciplinary research and was as from 1980, the first Swedish University to introduce interdisciplinary thematic research at the Faculty of Arts and Sciences, and a cross-subject, interdisciplinary perspective in graduate

schools for PhD students.⁴⁰ LiU offers 27 international master's programmes taught entirely in English, in various subject areas. There are 12 large departments including those on electrical engineering, thematic studies, culture and communication, Mathematics and Management and Engineering. These departments combine knowledge from several disciplines and often belonging under more than one faculty exist to facilitate interdisciplinary work.⁴¹ It is often emphasized that the success of the educational framework in LiU largely rests on its boundary-less disciplines that enhances interdisciplinarity.

The university is distinguished in materials science, IT and hearing. Subsequently, it's close collaboration with the business world and society in world-leading, boundary-crossing research is focused on these fields. In the same spirit, the university offers many innovative educational programmes, many of them with a clear vocational focus, leading to qualification as, for example, teachers, economists and engineers. Additionally, the university conducts strategic research in the fields of IT and mobile communication, materials science and security and emergency management.⁴²

LiU is ranked among the world's top 30 young universities in the QS Top 50 under 50, and is also among the global top 400 of the QS World University Rankings 2019. LiU's broad range of subject strengths is reflected in the QS World University Rankings by Subject, where it is featured among the world's best for computer science, electrical engineering, physics, sociology and medicine, amongst others. While the main language of instruction is Swedish, the university offers over 25 international programmes taught entirely in English. International students account for 7% of students, representing over 50 nationalities⁴³

4.2.1.3 The regional context

Östergötland is one of the traditional provinces of Sweden in the south of Sweden. It borders Småland, Västergötland, Närke, Södermanland and the Baltic Sea. The corresponding administrative county, Östergötland County, covers the entire province

⁴⁰ Facts about LiU collected from University's website at <https://liu.se/en/about-liu> (accessed 08.04.20)

⁴¹ https://en.wikipedia.org/wiki/Link%C3%B6ping_University (accessed 08.04.20)

⁴² <https://liu.se/en/research> (accessed 08.04.20)

⁴³ <https://www.topuniversities.com/universities/linkoping-university> (accessed 08.04.20)

and parts of neighbouring provinces. Traditionally, the region is divided into two halves, east and west of the river Stångån (Östanstång and Västanstång respectively, which flows from the south into Lake Roxen at Linköping. Industry was formerly most significant in the cities of Norrköping (industries include Ericsson), Linköping (where SAAB has aircraft factories where the Gripen fighter is produced), Finspång (metal works), and Motala (mechanical industries)⁴⁴. (Germain-Alarmatine, 2018)

Though the Östergötland region is largely agricultural, its two main cities of Linköping and Norrköping, have in particular successfully attracted important and diverse industrial activities and knowledge-intensive companies (Germain-Alarmatine, 2018). Notable of the industries located in Linköping are Saab AB and Ericsson. In close proximity to the LiU campus at Valla is the Science Park Mjärdevi, which houses a community of university collaborators and is an important source of innovation to the region (Feldman, 2007, Hommen et al., 2006).

4.2.1.4 Engagement

Collaboration is not a strange concept to LiU. In fact, the university prides itself of a reputation of engagement which is often described to be engraved in the universities' DNA. Specifically, Peter Värbrand (Deputy Vice-Chancellor for External Relations and Innovation) explains,

*'Collaboration is a crucial factor for our success and a means to make research and education even more competitive: it is a part of LiU's soul'*⁴⁵

Reportedly, the university is central to the development of the region such that it is often cited as an exemplary case across Europe (Klofsten et al., 1999). The universities' contributions are achieved in collaboration with other key actors such as Ericsson, SAAB, Business Development in Linköping (SMIL) and other public entities such as the Mjardevi and Berzelius Science parks. While most of the institutions for regional development existed prior to the university's establishment, their joint effect was only felt with the establishment of the university. This idea invariably cements the place of LIU as the driving force of innovation and regional development in the region. (Klofsten et al., 1999)

⁴⁴ <https://en.wikipedia.org/wiki/%C3%96sterg%C3%B6tland> (accessed 18.10.19)

⁴⁵ <https://liu.se/en/collaboration> (accessed 18.10.19)

By way of partnerships, the University as an organisation, has established partnerships with several of the companies. Notable of these are the so-called ‘Strategic partners’. These partners are long trusted companies and public bodies with whom the university has entered into agreements, intending to deepen collaboration. The aim here is to strategically ‘secure future needs for expertise, and create benefit through collaboration in research and innovation’⁴⁶. According to Jan Axelsson (Director of Collaboration, Linköping University),

‘The ultimate goal of our education and research is to promote the development of society. A highly developed strategy for collaboration is one of the conditions required for this to happen.’⁴⁷

According to Jones-Evans and Klofsten (1998) there exists a close interaction between the small technology-based firms (represented by Business Development in Linköping - SMIL), and the university (represented by The Centre for Innovation and Entrepreneurship – CIE). CIE conducts tailored activities intended to stimulate the growth and development of technology-based firms targeted at various stages of the firms’ development. Arguably, the University of Linköping has been distinguished as a major catalyst in the growth of technological firms in the Linköping area as a direct result of the technological environment created by the university. (Jones-Evans and Klofsten, 1997)

4.2.2 The Chalmers Case

4.2.2.1 The University

Chalmers University of Technology, henceforth referred to as Chalmers, is located in Gothenburg in the Västergötland region of Sweden. Though the university is privately owned, it has for long exhibited a market orientation (Kwiek, 2008), which is often characteristic of public universities who are increasingly encouraged by the governments to engage more and more with industry. (Nielsen and Cappelen, 2014)

^{4,47} <https://liu.se/en/collaboration/strategic-collaboration> (accessed 18.10.19)

The university was founded in 1829 and intended to be an ‘industrial school’. Being a technical university, many areas of its research and education have been traditionally linked very strongly to industry. (Jacob et al., 2003) In 1937, the school moved from the city center to the new Gibraltar Campus, named after the mansion which owned the grounds, where it is now located. The Lindholmen College Campus was created in the early 1990s and is located on the island Hisingen. Campus Johanneberg and Campus Lindholmen, as they are now called, are connected by bus lines.

The journey towards an entrepreneurial university has been long in taking off. This journey has been facilitated by the determination of some pioneers whose efforts cleared the way and set the standard by linking the university and industry. Chief of these contributors are William Chalmers the institutions’ founder, the very first president Carl Palmstedt, Sven Olving, Torkel Wallmark, Sören Sjölander, Mats Lundqvist and Olle Stenberg. Altogether, the interest of these forerunners in cementing industry collaboration into the culture of the institution has undoubtedly greatly influenced the present openness of the university to external engagement.

According to Berggren (2011), an active use of alumni is part of the culture at Chalmers, not only when it comes to appointing leading positions in the innovation system but as natural partners in Chalmers’ extensive interaction with industry and society. Many former Chalmers students have prominent positions in society, which gives access to useful resources. The device “Once a Chalmerist always a Chalmerist”, used by Chalmers Ingenjörssförening (Chalmers’ Alumni Association, founded in 1907) with over 35,000 members, symbolises the Chalmers spirit and the unique strong bonding. (Berggren, 2011)

4.2.2.2 The institutional context

With a long reputation for commercial activity, Chalmers was at least formally better equipped to transform into an entrepreneurial university, compared to other Swedish universities (Jacob et al., 2003). Jacob et al. suggest that this transformation was an internally driven process explained by the culture of an engineering school. Chalmers’ unique culture and ongoing efforts to develop a system for the commercialisation of knowledge can be summarised in the three main arguments for becoming a private foundation: the Chalmers spirit, which was characterised by a strong alumni network

that linked both staff and former students, open and trust-based relations; a long tradition of organisational innovativeness flexibility, service-mindedness in administration and a flexible appointments system; and the importance of Chalmers to the Gothenburg region (Berggren, 2011, Jacob et al., 2003).

Focused on research and education in technology, natural science, architecture and other management areas, Chalmers is home to eight Areas of Advance and six national competence centers in key fields such as materials, mathematical modelling, environmental science, and vehicle safety.⁴⁸ The university has five faculties; Faculties of medicine, Odontology, Arts and Fine Arts, Social Sciences and Science. Research is conducted in the main engineering sciences as well as in technology-related mathematical and natural sciences. Approximately 40% of Sweden's graduate engineers and architects are educated at Chalmers.

Each year, around 250 post graduate degrees are awarded as well as 850 graduate degrees. About 1,000 post-graduate students attend programmes at the university, and many students are taking Master of Science engineering programmes and the Master of Architecture programme. As a result of the adaptation to the Bologna process that started in 2004 at Chalmers (as the first technical university in Sweden), all master's programmes have been taught in English for both national and international students since 2007. This amendment has in part been responsible for the internationalization of the university.

4.2.2.3 The regional context

Gothenburg is the second largest city in Sweden. It has the largest port in the Nordic Region and has strong traditions to trade and industry. It is also known as the city highly regarded as a venue for major sporting events, entertainment and culture. A former industrial city, Gothenburg evolved into a city of creation and innovation and now in to a city of commerce and education.⁴⁹ Gothenburg has for many years been known for trade, entrepreneurship, and industry. Chalmers' location is characterised by many industries of interest such as ABB Volvo, Ericsson, SKF, and AstraZeneca

⁴⁸ https://en.wikipedia.org/wiki/Chalmers_University_of_Technology (accessed 08.04.20)

⁴⁹ <http://www.travability.travel/blogs/gothenburg-launches-accessibility-brochure.html> (accessed 08.04.20)

and Göteborg Energi AB that drive the region to be among the most R&D intense per capita in the EU. Evidently, there has also been a conscious effort since the mid- 1990s at Chalmers to build more growth- oriented venture creation capabilities (Jacob et al., 2003; Berggren, 2011).

There is a high degree of expertise in companies specializing in medical technology, telecommunications, information technology, industrial electronics and automotive industry. And according to Dahlstrand (1999), local spin-offs, and the transfer of entrepreneurs and knowledge from well-established organization into a new independent enterprise seems to be one of the main processes of interregional learning in Gothenburg. Accordingly, they find that almost all new entrepreneurs come from within the region or are former students returning to the region. A tenth of the firms were direct spin-offs from Chalmers and another 21% were indirect university spin-offs in that they were based on university research, but not established until the founder(s) had gained additional knowledge in a private employment. Hence, for about one-third of the technology-based start-ups, Dahlstrand (1999) concluded on the existence of a clear relation between university research and firm formation which had a strong spatial dimension in that firms were spun off locally.

Chalmers' graduates serve as a local labour source for new technology-based firms. For example, the extent of the local availability of specialised labour, e.g. electronic engineers in microwave technology, has a direct bearing on the size of industrial activities in fields demanding such specialised labour (Dahlstrand, 1999). This idea suggests a strong dependability of the success of local industry on the presence of a local stock of skilled individuals. As a source of the needed skilled labour, it could be said that universities, Chalmers in this case exert a strong influence on the labour market and the potential number of technology-based entrepreneurs.

4.2.2.4 Engagement

Considering its long tradition of cooperation with industry and society, engagement for Chalmers could be described as business as usual. The history of the university provides relatively long-term data of academic entrepreneurship and an impressively close collaboration between the university and the business world. The Chalmers

School of Entrepreneurship (CSE) has for example been acknowledged as being front line in Sweden. Chalmers also has a long history of renowned technological research spawning good opportunities for commercialisation. (Berggren, 2011). The mission of the university stands to produce and spread knowledge, expertise and solutions that benefit everyone: both individuals and society⁵⁰. Based on this, the university is focused on working with others to make a real difference for a sustainable future by targeting gaps that can be filled to satisfy a need in industry and elsewhere.

Through the research institutes at Chalmers, the university provides services that solve problems in industry and in the society at large. The Chalmers Industriteknik foundation (ICT) is a research department that offers support services for industrial development processes and works in all knowledge areas that Chalmers represents. SSPA owned by the Chalmers University of Technology Foundation, offers a wide range of maritime services -from ship design, energy optimisation and finding the most effective ways of interacting with other modes of transport to implementing infrastructure analyses and risk assessments in the maritime environment and safety. The Fraunhofer-Chalmers Centre for Industrial Mathematics (FCC), founded by Chalmers and the German Fraunhofer-Gesellschaft functions as a commercial, non-profit Swedish foundation for developing and adapting mathematical methods to industry.⁵¹

Just like in the case of Linköping, Chalmers has a number of partnerships labelled Strategic Partnerships. In essence, these partnerships are long-term and large-scale investments, often running over many years, involving Chalmers as a whole. This enables Chalmers and the external partners to understand each other's operations, and the conditions needed for them to contribute to growth and competitiveness.⁵² The Strategic partners of Chalmers include ABB, CEVT, Ericsson, Göteborg Energi, HSB Living Lab, IKEA, IVL Swedish Environmental Research Institute, Nouryon, Preem, RISE, RUAG, Saab, Norwegian Public Roads Administration, Stora Enso, Volvo Cars and Volvo Group.

⁵⁰ <https://www.chalmers.se/en/collaboration/Pages/default.aspx> (accessed 08.04.20)

⁵¹ <https://www.chalmers.se/en/collaboration/Collaboration%20on%20research%20and%20development/Pages/default.aspx> (accessed 08.04.20)

⁵² <https://www.chalmers.se/en/collaboration/strategic-partnerships/Pages/default.aspx> (accessed 08.04.20)

The strategic partnerships enable a link between management-level collaborations and concrete projects and thereby allowing sharing of overall knowledge and needs. This is invariably believed to lay the groundwork for Chalmers and company managements to form common agendas. One advantage of this provision is that Chalmers students can feel confident to get relevant jobs after graduation seeing that their skills are clearly in demand. Further, staff members at Chalmers and the partner companies can work together for the relevant frame of time required for the joint-work at hand. Chalmers also has certain Areas of Advance which are based on excellent scientific depth, but work in breadth across Chalmers' disciplines. The Areas of Advance host the strategic partnerships and the provision is reminiscent of the interdisciplinarity promoted in Linköping University. For Chalmers, successful collaborations create good conditions for attracting international expertise to Sweden.

4.3 THE NORWEGIAN CONTEXT - HEIs AND THE ACADEMIC ENGAGEMENT

The Higher education institutions (HEIs) in Norway have not been spared by the heightened interest of governments in third mission activities. Accordingly, HEIs in Norway have been subjected to several reforms in recent decades. (Sataøen, 2018) These transformations have been focused on improved relationships between institutions and their environment. In deed because higher education institutions, among research institutions distinguish themselves as embodying knowledge, they have been a key target of these efforts.

According to Gulbrandsen and Nerdrum (2007), policy discussions to facilitate university industry relations are not recent. The beginning of the 20th century was marked with a concern among policy-makers, industrialists and university professors to facilitate the diffusion of the existing barrier(s) between HEIs and industry. In 2003, Norway followed the example of others like Denmark, Germany, Belgium and the Netherlands putting in place concrete provisions to facilitate this process. Generally, the timing of these discussions in Norway mirror the trajectory of events in many other countries and have similarly been marked largely by outcomes such as reduced basic funding, increased Accountability and standardisation (Bologna process) in HEIs.



*Figure 9: Map of Norway showing the various regions*⁵³

⁵³ Source: https://www.familysearch.org/wiki/en/img_auth.php/d/df/Norway_Counties_2020.jpg (accessed 08/04/20)

4.3.1 The Stavanger Case

4.3.1.1 The University

The University of Stavanger (UiS), Stavanger is located in the Rogaland region of Norway. UiS provides a unique story as compared to the usual, given that it is industry that has fuelled the university's growth (Ofteidal and Lakovleva, 2015). Ideas for establishing the university were birthed much earlier (in 1956) than the date of its actual establishment would suggest. The city of Tromsø had recently benefited from a new university, leaving little funds for academic development in Stavanger. Already having big universities in Oslo, Trondheim, Tromsø and Bergen, the government of Norway kicked against having an additional university in the country. Another argument was that Norway was too small a country to have that many universities. This was the case in spite of strong internal support.

Events however took a dramatic turn in 1973 with the oil sector becoming the city's new economic platform and the subsequent need for new competence. In 1986 the Rogaland University Center was established, which included Regional College and Stavanger Engineering College. A Stavanger College of Nursing was established 1988, which included Sanitar Union Nursing School and Red Cross Nursing School and in 1994, Stavanger University College (HiS). HiS was established through a merger of six public colleges and one private college in Stavanger, including Rogaland University Centre, Norwegian School of Hotel Management, Stavanger Teacher College Conservatory of Music, Social Stavanger College, Stavanger College of Nursing, and the Norwegian Church Congregation College. (Ofteidal and Lakovleva, 2015)

The forerunners continued to pursue the goal of attaining university status, and in August 2004 a commission announced approval of university status. In January 2005, a whole 40 years after the initiative had begun, the University of Stavanger (UiS) was launched by the king of Norway. Reportedly, the discovery of oil in the off-shore reserves deepened the claim for a university in the region which was finally endorsed by the government. This turn of events also led to the formation of a new academic environment built around the petroleum sector. Overall, it took a long struggle – academically, politically, and financially – to realize the university's launch in 2005.

(Ofstedal and Lakovleva, 2015) In this way, the establishment of UiS is complementary to the discovery of oil, and together these events have transformed a once largely rural region into one of the economically important regions in Norway.

4.3.1.2 The institutional context

The university has about 10,100 students and 1,350 administration, faculty, and service staff that serve three faculties. These are the Faculty of Social Sciences (FSS), the Faculty of Science and Technology (FST), and the Faculty of Arts and Education (FAE). Apart from NORCE – Norwegian Research Centre, the university also hosts several research centres including the Norwegian Reading Centre, Synapse Lab, Centre for Learning Environment, SHARE-centre for Resilience in Healthcare and CIPSI- centre for IP-based Service Innovation. Furthermore UiS is a partner in other research centres such as COREC – Center for Oil Recovery, DrillWell – Drilling and Well Centre for Improved Recovery, and knowledge clusters such as Norway Pumps and Pipes and CIAM – Cluster on Industrial Asset Management. UiS is also hosting two national competence centres namely The Reading Centre and the Centre for learning and behavioural research.⁵⁴

The study structure at UiS is deeply industry focused that not surprisingly, 94 per cent of UiS students reportedly find relevant work within six months (Ofstedal and Lakovleva, 2015). This is important for local industry, and UiS (as an important supplier of a competent labour force in the region) has a recruiting effect. Further, UiS has built strong links towards external institutions such as the International Research Institute of Stavanger (IRIS) and Stavanger University Hospital (SUS) for both research and commercialization purposes. The external collaborations and partnerships coupled with the hosting of important and relevant centres for the region somehow reflect the quality of research output of the university.

4.3.2.3 The regional context

Stavanger, and Rogaland by extension, is famous for the Oil and Gas Industry. Accordingly, the establishment of UiS has its roots in the discovery of oil in the 1960's. Having been supported by the development of the oil industry, UiS maintains

⁵⁴ <https://www.uis.no/research-and-phd-studies/research-centres/> (accessed 08.04.20)

strong links to industry. These links are evident in the educational programmes offered at the institution which are targeted towards meeting industry needs for special competences. Industry and university cooperation is important in delivering competitiveness of this ‘peripheral’ region of Norway. Further, these links translate into regional career opportunities and imply relative ease for university students in finding jobs.

The Stavanger region is internationally oriented, and has traditionally prided itself on its entrepreneurial culture. From a history of an economy based on the herring industry, to canning industry to shipbuilding industry Rogaland has undergone various transformations. Agriculture and aquaculture however remain important aspects of the region’s economy. Stavanger is the centre of the Norwegian oil and gas industry and so unsurprisingly, this continues to be the most important industry to the city’s economy.

Stavanger has and continues to serve as a home base to International offshore oil exploration companies. Subsequently, with multinational oil production and service companies established in the region, the city has realised growth in its population over the years. Stavanger is the global headquarters for Statoil, the Norwegian national oil company responsible for the main source of national income now called Equinor. This company played an important role in stimulating local industrial innovation and the development of innovative supplier firms. (Ofstedal and Lakovleva, 2015) Stavanger is therefore an important global arena for petroleum- based industry. Finally, Hydro power, food, aquaculture, and the financial sector stemming from the oil industry also add to Rogaland’s importance.

4.3.2.4 Engagement

The University of Stavanger has established three main strategic areas for research and development in energy, technology, and environment; security and management of risk globally and professional areas such as science of education, health- related areas, and tourism. The majority of externally financed research activities occur in cooperation with the research institute that is partly owned by UiS, International Research Institute of Stavanger (IRIS). Another main research partner is the

University Hospital (SUS), UiS also works on occasion with other regional institutions and colleges such as Business School BI Stavanger, the Norwegian School of Veterinary Science, and Diakonhjemmet Collegde Rogaland.

As reflected through individual collaborations of the academic staff, UiS is engaged with several regional and extra-regional partners. These engagements invariably contribute competitiveness to the region as a whole. Certain of these enagements over the years have been with Conoco Phillips, Statoil (Equinor), Subsea 7 and Laerdal Medical among many others. On top of the universities' efforts, the Greater Stavanger, Chamber of Commerce, Nettverk Stavanger and Skape facilitate a dynamic and vibrant environment that stimulates new ideas, projects, and entrepreneurship in the region. (Ofteidal and Lakovleva, 2015)

4.4 SUMMARY

The overview of cases presented in this chapter goes a long way to show that third mission activities are akin to the main focus areas of all the 5 universities captured in this theses. Conducting interviews in all locations and interacting with individual stakeholders across the various institutions has revealed a strong commitment on various levels and in varying degrees for promoting third stream activities. Though this is not always faultlessly enacted, there is none-the-less strong commitment towards the cause. The universities in the sample have focused missions towards engaging with their local communities by capitalising on the industry presence in their cities. Even though the literature stresses the challenges of rural and peripheral cities in operationalising third mission roles, there is evidently strong commitment to doing so. Practically all of the universities and their regions have a strong heritage of entrepreneurship which seems to have facilitated the definition and operationalisation of the third mission. It is also positive to note the presence of so-called 'strategic collaborations' in the universities. Designed as long-term relationships with industry partners, these collaborations indicate the intention of continued links within industry for many years to come.

While this chapter has explored the institutional and regional contexts of the chosen cases, it also highlights the particular and unique characteristics of these cases and

thereby sets the stage for later comparing findings in the light of their context. For example, as would later be explored as part of examining the networks of individual academics while engaging, do regional peculiarities exert any special character on the networks of academic scientists? And in which way are these differences evident?

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CHAPTER 5 - BUILDING ACADEMICS' NETWORKS: AN ANALYSIS BASED ON CAUSATION AND EFFECTUATION THEORY⁵⁵

5.1 INTRODUCTION

From the literature surveyed in Chapter 2, it is suggested that while networking has increasingly been observed as important for academics' engagement, little attention has been paid to how these networks are actually initiated. In this chapter, empirical findings on how academic scientists build their networks are presented. Specifically, I employ the theories of causation and effectuation to gain better insight into the individual decision-making processes that lead to the establishment of network ties. The non-goal-directed decision-making tendency of causators as opposed to the goal-directed decision-making tendency of effectuators presents a possibility to analyse academic scientists' decision-making when building their networks. Additionally, knowing the approach employed by academics is key to understanding the possible outcomes of their social networks with respect to opportunity discovery. Simply, by employing the entrepreneurial theories of causation and effectuation, I contribute to a potentially under-researched aspect of the literature on how academics build their networks. Subsequently, how the approach employed (i.e. effectuation or causation) relates to the type of tie (i.e. industry or academia) to be established and the geography of the related network ties are explored.

5.2 DATA

The data presented in this chapter are based on 12 interviews from the University of Stavanger, Norway. An adaptation of the Table 6, as shown below in Table 7 was utilised in order to obtain insight into how individual network ties of the interviewees were established.

⁵⁵A major part of this chapter has been published as a journal article in *Review of Regional Research* (2019) 39: 143 with inputs from David Charles. The article is available at <https://doi.org/10.1007/s10037-019-00134-2>

Table 7: Table for generating data on network ties

Name (or pseudonym)	Geography	Academia/ Industry
1.		
2		
3		
4.		
5.		
.....		
10.		

Generally, the process of collecting network data followed the process described in chapter 3 (section 3.3.4.2). In this case, a list of 8-12 network contacts was generated for each of the 12 interviewees in the sample. This resulted in 118 observations which were analysed to gain insight into how academic scientists establish their network ties. The data presented here reflects the views of selected academics from the Engineering Faculty of the University of Stavanger (UiS), specifically from the Centre for Risk Management and Societal Safety (SEROS), and the departments of Electrical Engineering and Computer Science, Energy and Petroleum Engineering, Mathematics and Physics, and Energy Resources of the UiS Engineering faculty.

Evidence was collected during the period of March–May 2018. All interviewees were of post-graduate level and aged between 35–65 years. Four were women, with the remaining 8 being men. 3 of them were of expatriate origin whereas 9 were Norwegians. From an original list containing ~204 academics recognised to be externally engaged, a selection was made based on on-going industry projects under the faculty of engineering (~67). From a total of 15 engaged academics who accepted to be interviewed, only the 12 interviewees represented here consented to sharing specific examples of their personal network contacts. Overall, the questions discussed were focused on understanding how the academics' networks were established.

As emphasized in Table 8 below, the entrepreneurial relationships of the academic scientists were analysed on two levels; Project level collaborations and Individual level collaborations. Project level in this case refers to more formal collaborations that

were identified as usually institutionalised or recognised by the host institutions of the collaborating academic scientists. Individual level collaborations, on the other hand, refer to less formal collaborations that were usually based on more personal initiatives. Given that they (the individual level collaborations) are usually not strictly funded, they were as well not institutionalised by the host institutions of the academic scientists. These individual level collaborations, as explained by interviewees appeared more explorative and often not rigidly defined from the outset.

Table 8: Entrepreneurial profiles of academic scientists

Main entrepreneurial activities observed	Interviewees (coded)	Relationship level involvement
Collaboration with industry through joint research projects	All (UiSACA01-UiSACA12)	Project level, individual level
Acquiring research funding (grants) from government, non-governmental or international bodies (with or without collaboration with industry)	All (UiSACA01-UiSACA12)	Project level, individual level
Inter-academic collaborations (with or without industry involvement)	All (UiSACA01-UiSACA12)	Project level, individual level
Contributing to the formation of one or more new spin-off companies	UiSACA04	Individual Level
The formation of joint venture/(s) privately through collaborating with industry links	UiSACA04	Individual Level
Research-based consultancy privately (but without forming a company)	All (UiSACA01-UiSACA12)	Individual level

Table 8 below shows the constitution of academics' networks and distribution of individual ties. In terms of geography, the network ties were observed as regional (i.e. located within the same administrative region of the country), National (i.e. other regions within the same country) and International (i.e. located outside the host country of the academic scientist).

Table 9: Constitution of academics' networks and distribution of individual ties

		International	National	Regional						
Interviewee	Number of Contacts analysed	Academic contacts	Industry Contacts	Others (Gov, R.I, Service company)	Academic contacts	Industry Contacts	Others (Gov, R.I, Service company)	Academic contacts	Industry Contacts	Others (Gov, R.I, Service company)
A1	8	2	0	0	0	0	0	2	4	0
A2	10	0	2	1	1	2	4	0	0	0
A3	10	1	4	0	0	1	0	3	1	0
A4	12	3	3	2	0	1	0	0	3	0
A5	8	3	0	1	1	0	0	0	1	2
A6	10	4	0	1	1	0	2	1	1	0
A7	11	2	2	0	0	1	0	4	2	0
A8	9	5	1	0	1	0	0	0	2	0
A9	10	3	1	1	1	0	1	1	1	1
A10	10	4	0	0	1	0	3	0	0	2
A11	10	3	4	0	0	0	0	1	2	0
A12	10	1	0	0	5	0	1	0	0	3
	118	31	17	6	11	5	11	12	17	8

5.3 ANALYSIS – HOW DO ACADEMIC SCIENTISTS BUILD THEIR NETWORKS?

Since 118 observation points were made, some general description of the collected data is first presented. Next, details on the approaches employed to build the academics' networks are presented in line with the dimensions presented in Chapter 2 (Table 3 on *contrasting goal-directed and effectual networking*) namely; venture and networking objectives, networking motivation, networking situation, interactions and selections, networking search scope and outcome of network change. Additionally,

relevant quotes from the interviewees are also supplied where necessary to further emphasize findings.

5.3.1 General description of networks

The personal network ties of the academic scientists were constituted by individuals of varied backgrounds. Specifically, as shown in Fig 10, the largest group of personal contacts identified were other academics at 45%. Industry contacts made second place at 33%. Clearly, the academics interviewed appeared to be most engaged with their fellow academic scientists rather than with industry partners. Individuals from Research institutes, Governmental agencies and other forms of related professionals made up the remaining 22%.

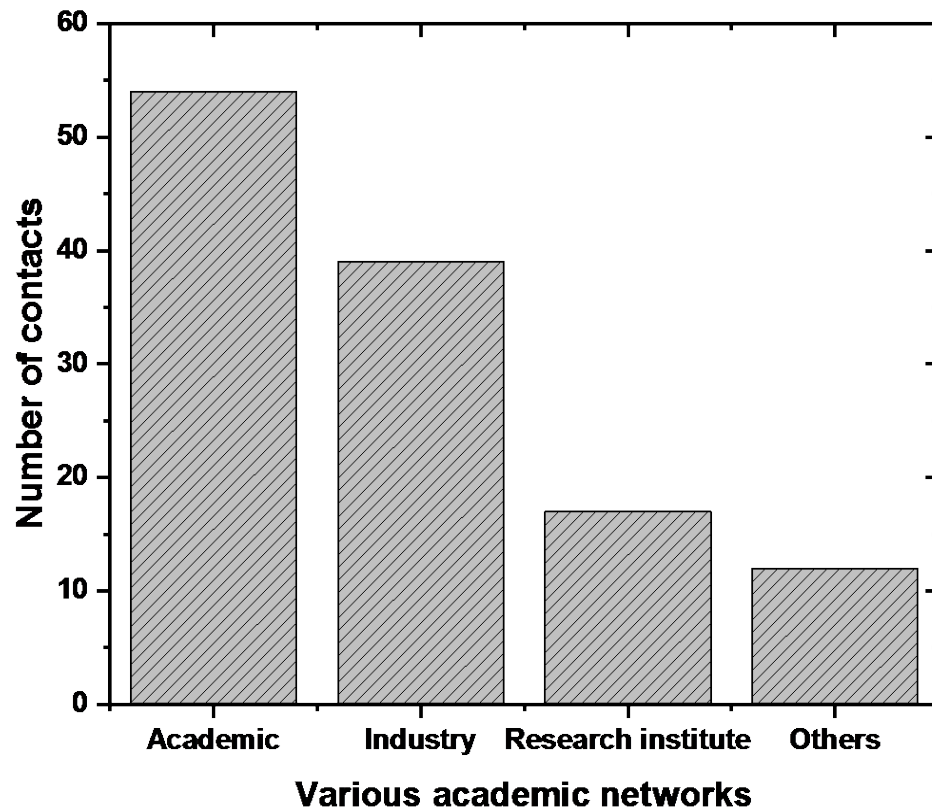


Figure 10: Constitution of academics' networks

Further, the network ties analysed were spread across geographical boundaries. They included regional (33%), national (17%) and international (51%) ties for university-industry linkages as shown in Fig 2. Focusing only on university and industry linkages, it was observed that 64% of the international ties were established with other

academics whereas the remaining 35% were industry ties. For the regional networks, 41% were academics whereas the remaining 58% were industry links. At the national level, more academic contacts (68%) were observed than industry contacts (31%) indicating a similar trend as observed for the international level. Almost all the academics mentioned network contacts⁵⁶ across the different geographical levels assessed (except for interviewees UiSACA01 and UiSACA11 who mentioned no national contacts, and UiSACA02 who mentioned no regional contacts).

The number of industry linkages observed was similar for both the international and regional levels at 18% each. International linkages on the other hand were found to usually be with other academics at 33% (as highlighted in the cases of interviewees UiSACA04, UiSACA05, UiSACA06, UiSACA08, UiSACA09, UiSACA10, UiSACA11 and UiSACA12). In explaining the choice of an international academic tie, interviewee A4 explained, '*there are very few people in Norway who can do what I am doing or even locally here in Stavanger, so I have had to go international to get the best*'. This explanation suggested that, the absence of the required suitable local partners was a reason for academic scientists to seek international partnerships.

⁵⁶ See Table 9 for details on the distribution (organisational and geographic) of network contacts

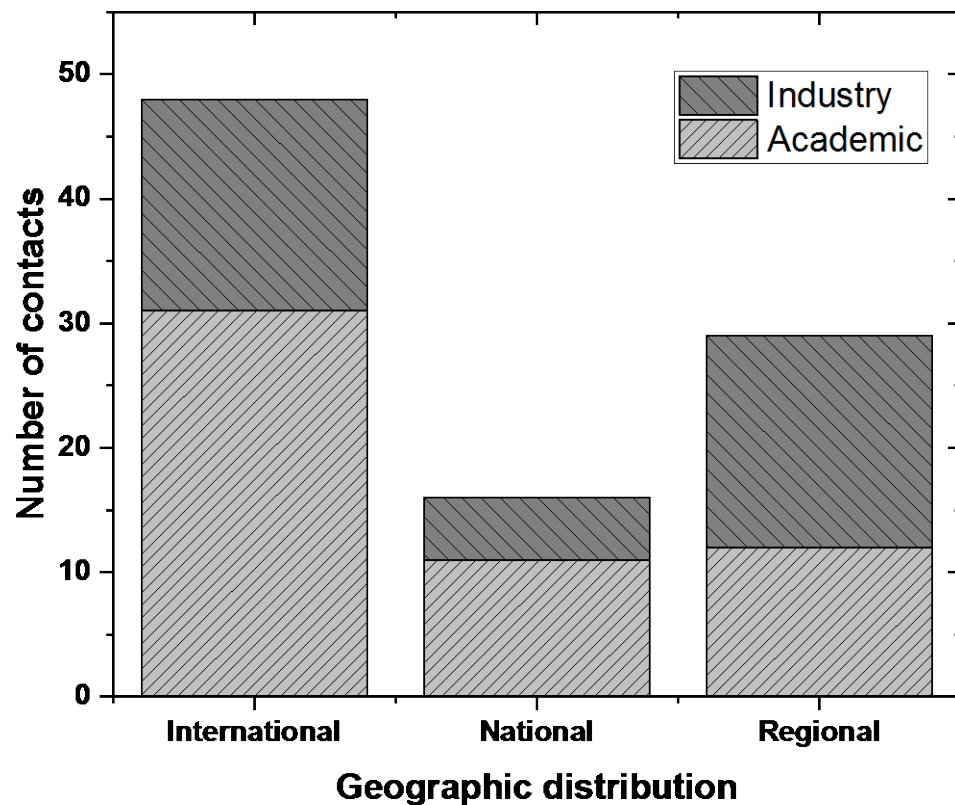


Figure 11: Geographical distribution of collaborators

Another interesting trend was that industry ties were usually non-individual specific. In fact, linkages were not established solely based on the individual in question but rather because of the ‘position’ they occupied making them suitable contact persons within a specific firm (this was highlighted in the case of interviewees UiSACA01, UiSACA03, UiSACA04, UiSACA08, UiSACA09, UiSACA11 and UiSACA12). Consequently, as the industry projects progressed, new ties were by necessity established within the same firm with changing employee roles. In contrast, ties in academia were made at a more individual level. This was highlighted by interviewee UiSACA03; ‘*within academia, it is more or less linked to the individual person and their knowledge*’. Consequently, more project level ties were identified for industry networks whereas individual level ties were mostly observed for academic network ties.

5.3.2 Contrasting causal and effectual networking

5.3.2.1 Venture and networking Objectives

Both effectual and causal approaches were employed by all the interviewees for setting objectives for networking. It was however evident that the approach employed depended heavily on whether the prospective linkage was to be made on the individual or project level. For instance, interviewee UiSACA02 explained that for embarking on projects involving industry, there was a need to prepare a proposal, *'Yeah for some projects you have to send a proposal and they have to agree on that'*. Further, singling out networking specific to industry, Interviewee UiSACA01 added that *'for the industry side, you need to have a project idea that you know is an industry need'*. These suggest a causal approach of having fixed and ordered goals in place prior to the actual networking.

On the individual level, a more effectual approach was observed for setting networking objectives. As indicated by UiSACA04, *'I meet them at conferences sometimes and we sit to have a cup of coffee, we chat a bit and we discuss the latest things happening in our research areas...and we might get together and brainstorm once a year. And I might send them a mail about [hey] have you seen this research paper? Or I have got some results I don't quite understand...do you mind, what do you think? You know? Or do you have any research money available for doing this? Those are the things that happen'*. This was also reiterated by interviewees UiSACA06 and UiSACA11 as an approach consistent with networking with other academics rather than with industry.

As the network became more established however, more focus was introduced towards objective setting as exemplified in the following: 'UiSACA02: *'later on I think you are more focused on getting projects which are relevant and making them into publications'*. Additionally interviewee UiSACA04 explained, *'I am quite conscious about trying to get the goals or purpose of the project and doing everything correctly.... I don't want to waste the collaboration in a sense'*.

5.3.2.1 Networking Motivation

None of the interviewees' exhibited a purely causal mind-set for networking with other academic partners. For example, in line with an effectual mind set interviewee UiSACA11 explained that, '*I have to establish that I can contribute in the project with my experience and knowledge*'. This implied that being able to contribute with their own knowledge is an important factor when building networks on the project level which emphasizes the bird-in-hand principle.

Further, the focus was on the ability to build something together capitalising on both self and collective interests. Interviewee UiSACA04 explained about establishing a network with an international academic as follows; '*I am a chemist and I do know how to make a lot of chemicals but I don't always have the best equipment for it, so actually I read a lot of literature. And this guy 'X' I have just mentioned, months ago I just read one of his papers andI wrote him and said do you mind sending me a sample and we will test it and do a joint paper together if it looks interesting and he said sure*'. Additionally, interviewee UiSACA02 explained that, '*I think you often make collaborations between colleagues, so if you are joining a project you can work together on issues and have common papers with them*'

Further where networking was in order to obtain access to funding of their research projects it appeared that a more causal approach was employed. This was explained by interviewee UiSACA09, '*whenever there is money involved, there is a report due...*' Further, concerning industry in particular, interviewee UiSACA02 explained, '*they (industry) are more selective of what kind of projects they are running and often, short time projects with short perspective because that is what is paying back*'. By these it was understood that the causal approach was also utilised as a means to meet an external requirement rather than it being a personal orientation or approach.

5.3.2.2 Networking situation, Interactions & Selections

Of the interviewed academics, interviewees UiSACA01, UiSACA04 and UiSACA06 were expatriates working in the UiS and had to establish their local/regional networks from scratch. A deliberate effort towards setting up of a local network was therefore necessary in integrating themselves into the local community at the initial stages.

According to UiSACA01 for instance on building his local network, *'you know it's like anything else when you move to a new country, you need to start making friends and neighbours, and that takes time so, at that time, my network was very limited...I took my PowerPoint, took my bike went and visited companies... it was kind of a new territory so that took a while to build up'*.

Concerning specific projects pitched to companies, UiSACA01 also made a comment consistent with effectual reasoning: *'we talked about what the project is, probably more questions than answers a lot of naivety but you know people were interested'*. As the project progressed however, there was the need to assume a more causal approach to ensure a selection of the right ties; UiSACA01: *'I may have some contacts from my standing point of view and then you try to bring them on board when there is an expertise'*

5.3.2.3 Networking Search scope

Among the interviewees, a mixture of effectuation and causation was employed relating to the networking search scope. On one hand, the approach was narrow and directed, focused on meeting the right people. As stated by interviewee UiSACA03, *'I could collaborate with other people at the university here but if they don't have any chemical knowledge, why should I collaborate with them? They will just slow me down most likely. They just want me to contribute but they are not able to contribute to improvement for my own research. So, in a way you have to choose your friends.'* In this case, interviewee UiSACA03 explained that the absence of colleagues who were equally knowledgeable in his specific research area influenced his decision to seek international scholars who fit a certain useful profile for his research activities.

Interviewee UiSACA01 explained that the requirements of certain projects indirectly dictated the scope of networking search; *'the project at the moment is the budget design, so everything at the moment boils down to economics. So, to start this project we need 3 companies...right, so we start in-house, if we get more companies, the project can grow...so which companies are we interested in?'* Further interviewee UiSACA03 explained with regards to national funding requirements and the influence they have on the search scope as follows; *'if I have a funding from someone...from the*

Norwegian research council or from others, they would like me to have a collaboration but they don't like me to spend money overseas'

5.3.2.4 Outcome of Network Change

In accordance with effectual networking, eventual network change leads to serendipitous outcomes resulting in modified venture goals. Networking resulted in publications, access to infrastructure for students' practical work as highlighted in the cases of interviewees UiSACA01, UiSACA04, UiSACA06, UiSACA07, UiSACA08, UiSACA09, UiSACA11 and UiSACA12. As explicitly explained by interviewee A6 referring to an international educational network, *'So we started from just having a little exchange of small dialogue about meeting in conferences and we see what we can do together for these educational projects, research projects...now we have students going up and down. So that was very good....'*

It was also interesting to find an example highlighting how further network ties emerge out of industry projects. As in the case of interviewee UiSACA07, *'when you have meetings with people in industry on one project, then you meet others from other companies coming in...you talk to them and then you expand your network'*. This implies that while industry networks have been explained to be more goal directed, they could span other ties that have no initial network objectives.

On the other hand, causal networking led to securing needed resources and progressing toward given venture goals. Interviewee UiSACA01 explained about an industry project that emerged from a previous one, *'we created a new project... the [previous] project became smaller and it became a different focus. So it is basically a continuation of this...but it doesn't mean we are touching all the topics that we were aiming to...it's now more specific topics but in the oil industry case, these have decreased, and we didn't need all of the [previous] expertise anymore. So we are just pointing to people'*

Academics were observed to switch between being causal or effectual when building their network ties. Causation was found to be consistent with project level ties where goals of networking needed to be fixed or clearly ordered from the beginning. On the

individual level however, a more effectual approach was observed. Here, there was no need to have already focused ideas prior to networking. This approach of effectuation was also consistent with ties established with other academics on the individual level. When operating in project mode, whether networking with academics or industry contacts, a more causal approach was observed.

5.4 DISCUSSIONS

This chapter of the thesis has shown that academic scientists use both effectuation and causation to build their networks. This implies that, depending on the particular circumstance, establishing networks could either be a goal-directed or non-goal directed activity for academic scientists. Particularly, this study identifies causation as consistent with Industry tie-formation, regional and project level networks. On the other hand, effectuation was found consistent with tie-formation within academia, international and individual-level networking.

Additionally, the approach (i.e. causation or effectuation) employed by the academics studied was observed to be affected by both endogenous and exogenous factors. For instance, the choice of which approach to use was not necessarily always dependent on the academic's personal preference. It was evident that external pressures such as the requirements of funding bodies were likely to influence a causal approach in networking rather than a more effectual approach. To this end, causation was observed more with industry networking. It can thus further be inferred that the choice of which approach to employ is also linked to the motivation to network – for if the initiation of the network is externally motivated (e.g. to access funding), there is the likelihood to employ a causal approach rather than if it is a personal motivation such as exchanging research ideas with another academic with less instrumental objectives.

Contrary to the finding by Schreier and Senn (2018) on expatriate entrepreneurs, the expatriate academics mostly employed a causal approach for building their industry networks. This was especially the case as proposals and research ideas were needed to get industry interested in academics' work having moved into new territory. While describing how their various networks were initiated however, it was evident that neither causation nor effectuation uniquely identified with the initiation stages of a tie.

It all depended on differing factors such as the type of tie (i.e. industry or academia) and at what level the tie was being initiated (i.e. project level or individual level). Further, the swap between the two reasoning approaches was portrayed in a non-linear fashion. For example, a tie could start off as effectual and become more causal when the research objectives were decided, but once objectives were achieved it was possible to revert to the more explorative approach consistent with effectual reasoning for finding additional areas to research.

Complementary to above findings, the study has also shown the usage of opportunity exploration and exploitation tendencies when initiating contacts across geographical (regional or international) and institutional (industry or academia) types. To the extent that most of the international networks of academics are with other academic scientists, effectuation was apparent. These networks were usually explorative in nature where intersections in research interests were sought between collaborating academics to explore new ideas (Sarasvathy 2005, March 1991). On the regional level, a mixture of the two approaches was observed. With the balance of collaborators tilted more to the industry side, a higher tendency to employ a causal rather than an effectual approach to exploit opportunities for enhancing academics' research objectives was observed.

The usage of a more causal approach at the regional level may be viewed as mitigating to the potentials of UICs. Whereas a causal approach to networking is projected to lead to securing the needed resources for achieving given venture goals, effectual approaches lead to more serendipitous outcomes that result in new or modified goals (Engel et. al, 2017). The contributions of universities to regional innovation may therefore be mitigated if regional networks assume a purely causal form. For the purpose of regional innovation it would appear that effectual processes that promote more emergent and unordered networking approaches focused on co-creation (Sarasvathy, 2005) need to be encouraged. This is important for leveraging the effect of circumstances and unexpected surprises when networking (Engel et. al, 2017) and would allow for identification of new ideas and opportunities. For the specific case of oil-rich Stavanger, more effectual processes that promote serendipitous outcomes involving resources and ideas are key to exploring new paths relevant for the oil industry.

As further evidenced from this study, academic scientists exhibited an ambidextrous capacity to swap between effectuation and causation depending on the particular circumstance. This capacity seems to have been necessitated by the heterogeneous makeup of their network ties, being: level of ties (individual or project-based), type of ties (industry or academic) and geography of ties (local or international). It is argued that, in as much as academic networks exhibit heterogeneous characteristics (of the nature of ties formed), the greater the need to possess and exhibit the ability to swap between causal and effectual tendencies. This adaptability enables academic scientists to initiate and maintain ties with different contacts.

The findings of this study also offer some evidential support to the propositions made by Engel et al. (2017) about entrepreneurial networking. Engel et al.'s (2017, 44) proposition 1 states that, 'under uncertainty entrepreneurial networking is driven by an assessment of available means within the network as carried out through repeated interactions with both existing and new network ties'. It is evident in this study that the academics' networking was driven by the means at hand especially with regards to their competences and capabilities prior to embarking on various collaborations. However, because the focus of this study has been on the initiation stages of the networks analysed, whether they used 'existing or new' ties was not evident – suffice to say, in this study each network tie was analysed *as if* new.

Proposition 2 by Engel et al. (2017) states that, 'under uncertainty, negotiations over pre-commitments are informed by entrepreneurs' networking actions as driven by both collective and self-interest and as restricted by a predetermined level of affordable loss'. This was also evident in our study given that the academics' focus was on the ability to build something together capitalising on both self and collective interests. Proposition 3 states that 'under uncertainty, effectual networking changes the portfolio of ties who commit to co-create the venture, thereby generating unexpected contingencies and enabling the serendipitous emergence of new entrepreneurial goals' (Engel et al. 2017, 47). This was also evident in the data with effectual approaches leading to exploration of new ideas. Though not explored in this study, it was suggested that as the network evolved, the tendency to be causal was more prominent as more intentional and directed decisions were made.

The findings presented in this chapter have certain theoretical implications. Academic scientists can be effectual in situations that require this - or causal in others that require a more causal approach. The usage of both effectuation and causation suggests that the two reasoning logics are not mutually exclusive to the individual academic scientists. In fact, the presence of both logics are important for delivering on the expectations of the variety of relationships that academic scientists have. Though causation is understood as non-serendipitous and often perceived subordinate to effectuation for facilitating innovation purposes, its usage is indeed necessary for certain engagements requiring this – i.e. for simply moving from point A to point B.

For regional networks, the added ability to swap between logics further provides the inherent capacity to yet be serendipitous within a causal disposition. In order to encourage more effectual reasoning in industry collaborations, which have been evident to be usually causal, it is important that much flexibility is allowed in pre-defined goals to allow academic scientists infuse as much innovation as they possibly could. Policymakers could also take advantage of this knowledge on flexibility to avoid formulation of overly structured policies, and rather take advantage of the spontaneous decision-making tendencies in which academia sometimes operates.

From the findings presented in this chapter, it is apparent that building of academics' networks is somewhat linked to motivations. For example external funding, was seen to exert some influence on decision-making processes towards building of networks – to the extent that regional network tie-formation was more likely to be causal (as these tended to be part of industry-funded collaborations). To this end, it appears important to explore motivations from a regional perspective, especially also as regional collaborations are increasingly policy-driven. As a consequence of the apparent importance of the regional context to engagement, the next Chapter (6) further examines the link between motivations and the regional context.

In the light of the findings presented in this chapter, a next step could be to compare the reported findings with other groups of academics from different contexts (e.g. academic backgrounds and countries). Selecting cases from different regional settings would also be important for examining the effect of the regional context on the

approach taken by academics when networking. Further, because of the strong linkages of UiS to the oil industry, most of the academics' industry networks were linked to oil firms. Would different types of firms impose a different kind of effect on the choice between effectuation and causation? The data presented in the following empirical chapters thus focus on obtaining a broader range of evidence based on different contexts especially as would be observed in Chapters 7 and 8.

5.5 SUMMARY

This chapter has been focused on how academic scientists build their networks. Further, I analysed the network building decision-making process to decipher whether academics were causal or effectual in building their networks. It was found that academics swap between the two decision-making logics. A closer analysis revealed the inherent patterns especially in relation to the type of contacts (industry or academia), and the geography of the contacts. Having unearthed much heterogeneity in the network types, it was not surprising then that different decision-making logics appeared consistent with a particular type of network tie. I conclude that, in so far as academic networks exhibit heterogeneous characteristics (of the nature of ties formed), the greater the need to possess and exhibit the ability to swap between causal and effectual tendencies. This adaptability enables academic scientists to initiate and maintain ties with different contacts. With reference to question of how the individual network contacts of academic scientists could shape the nature and geography of their knowledge-exchange networks, it can be inferred from the findings presented in this chapter that the heterogeneous make-up of an individual's network influences their decision-making.

CHAPTER 6 – WHY DO ACADEMICS ENGAGE LOCALLY?⁵⁷

6.1 INTRODUCTION

In the previous chapter, attention was paid to how individual academic scientists build their networks. In addition to the gap identified in the literature on a lack of regional-perspective in studying academics' motivations to engage, two interesting observations were made that lend well with this chapter. Firstly, it was suggested that, the absence of the required suitable local partners was a reason for academic scientists to seek international partnerships. It was also inferred from the data that, the choice of which approach to employ when initiating network ties is also linked to the motivation to network – specifically, *'if the initiation of the network is externally motivated (e.g. to access funding), there is the likelihood to employ a causal approach rather than if it is a personal motivation such as exchanging research ideas with another academic with less instrumental objectives'*. These two points somewhat echo the importance of motivation to engagement and thus provide a relevant link between how academic scientists build their networks and the motivations to so.

Consequently, this chapter specifically presents empirical findings on why academic scientists engage locally? As emphasized in Chapter 2, the value of such an enquiry resides in the logic that though academics' motivations have been extensively researched, they have rarely been undertaken from the regional perspective. Here, academics' motivation is therefore considered a necessary precursor for engagement - underpinned by social networks. Precisely, the view is that certain factors should be prevalent for academics to engage with regional stakeholders. Deciphering these local drivers enables a better understanding of local (and potentially, extra-local) motivations for academics' initiating and engaging in networks.

⁵⁷ The majority of data and arguments presented in this chapter have also been disseminated through publication in *Regional Studies, Regional Science* (2019), 6: 250. (available at <https://doi.org/10.1080/21681376.2019.1583600>)

6.2 DATA

Since the case study in Stavanger was particularly aimed at understanding how academic scientists initiate their networks, it is again selected to illustrate motivations for local engagement. Following the methodology described in chapter 3, the data presented here were obtained through semi-structured interviews with selected engaged academics from the University of Stavanger, Norway. This chapter uses the same interviews as in the previous chapter. The additional 4 interviews presented here are excluded from the earlier data set because they did not consent to filling out the table of network ties. Subsequently, while the data in Chapter 5 is based on 12 interviews, the facts presented here are based on 16 interviews.

Overall, the questions asked were focused on understanding the following: who the academics engaged with, the geography of their collaborators (regional or extra-regional) and why the decision to pursue those linkages, particularly the local ones? Industry contacts of these academics were also interviewed on their experience in collaborating with the local university, to better understand the context of academics' engagement in the region. Having co-evolved with the economy of its region, UiS provided an interesting context for this study (see Chapter 4).

The inclusion of a non-engaged academic in the interviews for this analysis and supporting information obtained from the university and firms' websites helped with data triangulation. The semi-structured nature of interviews was useful for obtaining in-depth understanding of the case (Hammarberg, Kirkman, & De Lacey, 2016; Wilson, 2014; Yin, 2002).

6.3 ANALYSIS – LOCAL ACADEMIC ENGAGEMENT

Despite individual differences of the selected interviewees and their specific areas of research interest, similar themes emerged; regarding their motivations to engage locally and their perceived effect of the institutional and regional context on their motivations. In the first instance, the academics interviewed mainly expressed personal motivations for collaborating and cited a lack of formal requirement from the UiS for academics to collaborate. Interviewee UiSACA03 explained, '*I think the university is not interested in who we collaborate with or if we actually do*'. Further,

there was also no claim across the interviews to suggest that the university had an influence on the motivation to collaborate, signifying that personal characteristics outweighed the organizational influence for academic engagement.

While the motivations of the academic scientists to collaborate with local industry were mainly personal, certain regional advantages appeared to further drive the motivations. Particularly, academics whose research fields were more related to the oil and gas industry, the biggest industry in Stavanger, seemed to be more driven to engage locally. For example, an academic interviewed from the department of Mathematics and Physics, though locally engaged, expressed that their *'research areas were not directly applicable to the local industry'* (Interviewee UiSACA12), and this reportedly hindered local engagement. On the other hand, the non-engaged academic from the department of Energy and Petroleum engineering, and whose research was directly relevant to the local oil industry had resorted to *'purely teaching'* and explained that *'he was not a people-person, liked to get things done on his own and didn't believe in the values of industry'* (Interviewee UiSACA16). These suggested that while a mix of the relevant local industries was a driver for local collaborations, a personal drive is also required.

The data presented in the following sections expand on individual motivations as being central for local collaborations, which are further driven by regional incentives.

6.3.1 Personal motivations to engage locally

The academics interviewed explained that applying acquired knowledge to solve problems in industry was a reason for engaging locally rather than for assessing new knowledge. As elaborated by one of the engaged academics, *'In the region you are often solving a problem for people, you have a project to find something...for the international, maybe even national you collaborate in an area where you both can contribute...so you are more of researching together'* (Interviewee UiSACA06).

Accordingly, an interesting trend observed while probing the geography of collaboration partners of interviewees showed that regional collaboration partners tended to be from industry whereas extra-regional partners tended to be mostly from

academia. For acquiring knowledge, it appeared that the academics were inclined to access extra-regional colleagues but would mainly engage with local industry to apply their research know-how in problem-solving efforts.

In an attempt to explain the reason for having more local collaborators from industry than from academia, one academic scientist explained, *'well in this region there is only one university and me...so if we are talking from the research point of view, I mean in the Rogaland area.... it's just us for the Petroleum geology academic staff. The rest is service companies and Industry'* (Interviewee UiSACA03). By this, the academics suggested that having specific research interests to be significantly different from those of other academics within UiS left them little option than to explore collaborations outside the university. These external collaborations tended to be mainly with regional industries or with other academic scientists outside the regions for the interviewed academics.

Individual academics were also understood to collaborate locally primarily based on their personal interests and aspirations within their given fields. Their collaborations were inspired by their career trajectory and the prospect of advancing their research. For the purpose of advancing their personal careers for example, academics tended to collaborate with partners who could offer the required support. In explaining a financial motivation for collaborating with local industry, an academic explained that, *'it (industry) is perhaps where the finance is. Because they are financing research you are drawn towards industry, and it is interesting because then you can solve problems for the industry'* (Interviewee UiSACA01). Further, it was explained that while the source of funds could also be extra-regional, the local industry is particularly targeted because funds are easier to obtain from local industries rather than national and international funds (Interviewee UiSACA03).

An added advantage for engaging locally for some of these academic scientists was the opportunity to offer some industrial experience to their students either at bachelors or masters level. It was explicitly explained by interviewees that local industrial collaborations provided access to in-kind-resources, like laboratory equipment to enrich students' experience. This was highlighted as follows: *'I remember being a student myself, it is inspiring for the students to work with real cases, to solve problems*

that is beneficial for the companies. It is also exciting for the companies. I got used to it myself as a student and it is normal for me as a Professor to do the same for my students' (Interviewee UiSACA04)

Academics also collaborated locally based on their subject area specialism. On collaborating with local industry for instance, it was explained by one interviewee that since *'they (industry) were working within those fields that were interesting and that could bring competence to my research'* (Interviewee UiSACA01) he was drawn to collaborate with those industries. The evidence here also suggested that academics are self-critical. In exploring desirable qualities of competence in prospective partners, they seemed to explore similar qualities in themselves to justify their inclusion in a partnership. To this end, the academics looked for synergy within their subject area to be able to contribute meaningfully to their collaborations. The academics collaborated not only for what they stood to gain, but also for what they could offer industry. According to the un-engaged academic scientist included in this study, it is a deterrent to collaboration when industry makes academics feel that, they (academics) have nothing to offer industry, as highlighted as follows: *'I have tried it many years ago but the response was very negative. It is like I am asking for something and I do not have anything to give in return'* (Interviewee UiSACA16)

Prior industry experience was observed to drive UILs as suggested by some of the engaged academics in the study. It was suggested by the academics that industry experience seemed to have equipped them with the skills required to work with industry and to manage the different culture of work encountered while working with industry. For instance, one interviewee explained that, *'I worked with the industry before and so I picked up some points.... So that is really the motivation that my plans are based on....Of course we like to have industry to be involved because it adds to the quality'* (Interviewee UiSACA02).

Academics were also understood to collaborate based on trust that has been established over the years, success experienced and the ability to get along with persons previously collaborated with. The academics' perception of success for this study were marked by the publication of a joint paper, obtaining the funding pursued and achieving the goals of a project embarked on. It was explained that, experiencing success with

certain collaborators heightened the prospect of collaborating again with those partners. While these factors of trust, success and getting-along are dependent on past encounters, it appeared that there were sometimes no prior relations leading up to the collaboration. Collaborations could also be purely birthed out of mere interest in a given industry and approaching them for the required assistance. These collaborations resulting from a necessity could be viewed as complementary to the academic's existing pool of collaborators and essential for widening the academic's network.

Trust was also explained by some of the interviewees to be partly developed based on having a similar culture, and living closer to people, *in the same region* for example, that made it relatively easy to understand and get to know each other better. As particularly buttressed in one of the interviews, *'Well you know the research environment varies so much so it doesn't mean that in Norway I find Norwegians and it doesn't mean that abroad I find persons from the other countries....let's say that when it is regional like Stavanger, it is easier because you can actually meet people in person and you can have the same challenge when it comes to administration for example, that's easier to understand sometimes or you hit a wall together at least'* (Interviewee UiSACA14).

6.3.2 Beyond personal motivations: regional incentives

The interviewed academics with research interests of relevance to the oil and gas industry (UiS) appeared to have relatively more opportunity for applying their research outputs locally. Hence, they were further encouraged to collaborate locally as compared to those from other specialties whose research fields are not the popularity of the region. This view was supported in all interviews as for example, *'if the industries of interest to me were not present in the region, I would probably not have as many local collaborations as I do'* (Interviewee UISACA15). Though quite intuitive, it was interesting to find that the presence of these local industries drives academic collaborations. This is more so especially as the industry mix of the Rogaland region was also observed to be related to the resource endowments of the region – a hub of oil companies and related firms in a region endowed with oil and gas.

The provision of a place where academics could apply their research further was observed to influence academics' mobility to the region. This was re-iterated in the interviews as exemplified in the following, *'I collaborate within Stavanger because many of the oil industries are positioned within Stavanger'* (Interviewee UiSACA04). This implied that certain academics decided to move to the university (UiS) because their *'expertise could be used in those region'* (interviewee UiSACA10). In so doing, the region was seen to offer validation of the importance of the research fields of these engaged academics, by providing of an opportunity to be directly involved in solving industry problems in companies within their research area.

Additionally, the regional relevance provided appeared to shape the academics' area of further research specialization to solve industry challenges in the region. This point is explicitly suggested in an example of an engineer with no chemistry background, but who shifted his specialty to a chemistry approach to address a gap in industry.

'..if you think about what a reservoir consists of, ...it consists of minerals and mineral surfaces a lot of different organic components, even polar organic components that can have surface reactivity, that is chemistry! And classical engineering, they don't look at chemistry at all! So they have only a physical approach to the problem. So we are trying to know and twist a little bit on that. We are trying to use the chemistry approach to understand 'wetting' and wettability of curation processes in porous media' (Interviewee UiSACA08)

Based on the data collected, the motivation of academics to engage locally is understood to assume a non-linear form where the initial personal drive of an academic is further spurred by other factors present in the regions (Figure 12). As evidenced in this study for example, the engagement would typically begin as purposeful collaborations encouraged by the personal drive of the academic scientists. Purposeful collaborations here imply being focused on obtaining financial support, applying their knowledge in solving an industry need, etc. The success of these collaborations with industry, measured on the basis of achieving the specific set goals for collaboration, would also serve as a drive to explore more avenues for further collaboration. In the region, it is also argued from the evidence collected that the success of these collaborations is enhanced due to proximity (both cognitive and geographic) where

trust was claimed to be developed more easily within the region between collaborating partners. The region, Rogaland in this case, provided the related advantages and opportunities within which academics' research work received relevance and applicability. Together, personal and regionally embedded factors were evident as driving local engagement for the academics interviewed.

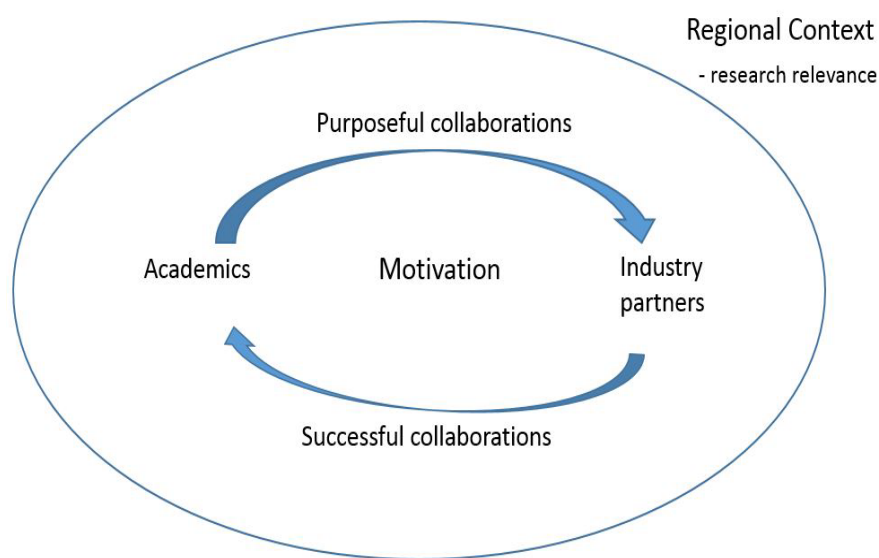


Figure 12: A motivation cycle for local academic engagement

6.3.3 Beyond regional incentives?

The data collected on the incentives for local engagement also indicate and reflect the motivations for international or extra-regional network initiation. While localised networks are indeed very important for a given region, international networks also contribute significantly as a source of new knowledge. In a peripheral region such as Stavanger, it appeared that academic scientists were more likely to struggle with making and maintaining industry networks if the relevant industries or the field-relevant persons were not present locally. Relevance of the academics' research to the existing industries in the region was thus a very prominent determinant of the geographic location of their network partners.

Interestingly, the academic scientists in the sample were unable to attribute absolute importance to either local or international networks – as these networks served

different purposes and could not be compared. In the local networks, academics attributed proximity to collaborators and a context for application of their expertise. For initiating international networks, academics prided themselves in the opportunity to obtain new and diverse kinds of knowledge. Accordingly, these benefits were important for different situations.

An interdependence of local networks and international networks was therefore evident – since the knowledge obtained from international networks appeared to require the local networks in order to be embedded and utilised for a relevant course. Conversely, the localised networks appeared to require the added value of a fresh perspective from international networks.

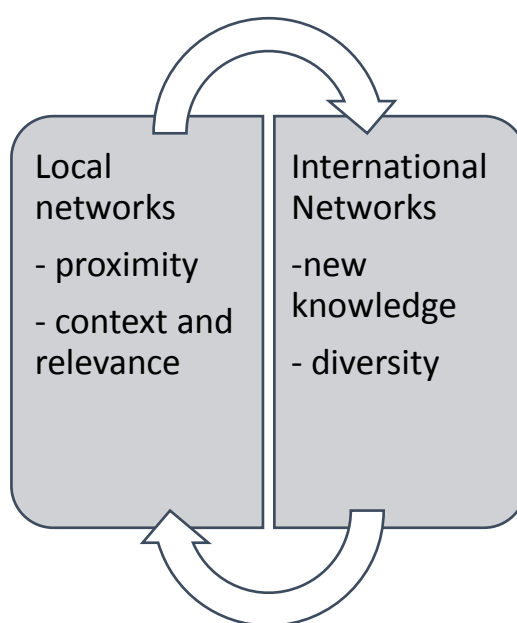


Figure 13: An emphasis on the interdependence of local and international networks

6.3.4 Local academic engagement: A hindsight comparison

Given that engagement is a central theme in this thesis, academic interviewees in the other case regions/universities buttressed many of the points that emerged from the data shared above. An important and relevant point that resounded in this regard was that on the link between academics' engagement and the regional resource capacity or regional industrial relevance. As evidenced in section 6.3.1.2 above, academic scientists with research of relevance to the oil and gas industry (at UiS) received

relatively more ‘*vent*’ for their research outputs and were thus further encouraged to collaborate locally as compared to the other specialties whose research fields are not the popularity of the region.

In the case of the University of Lincoln (UoL) for example, where the regional relevance of UICs lies primarily in the agricultural sector, the academics (food engineers) in the National Center for Food Manufacturing (NCFM) appeared to find more relevance and applicability for their engagement activities than did the other engineers who mainly had expertise in robotics. It was observed that when there was interdisciplinary collaboration between these engineers (i.e. from robotics and NCFM in this case), it was mainly around the provision of automation for the agricultural sector. This observation supports the understanding that regional collaborations are founded on regional advantages as exemplified in the prevalent industries. Hence, academics’ motivation to ‘*solve a problem*’, ‘*make a difference*’, ‘*conduct research that impacts society*’ was evident. The link between academics’ motivations and regional industries is illustrated in Figure 14 below:

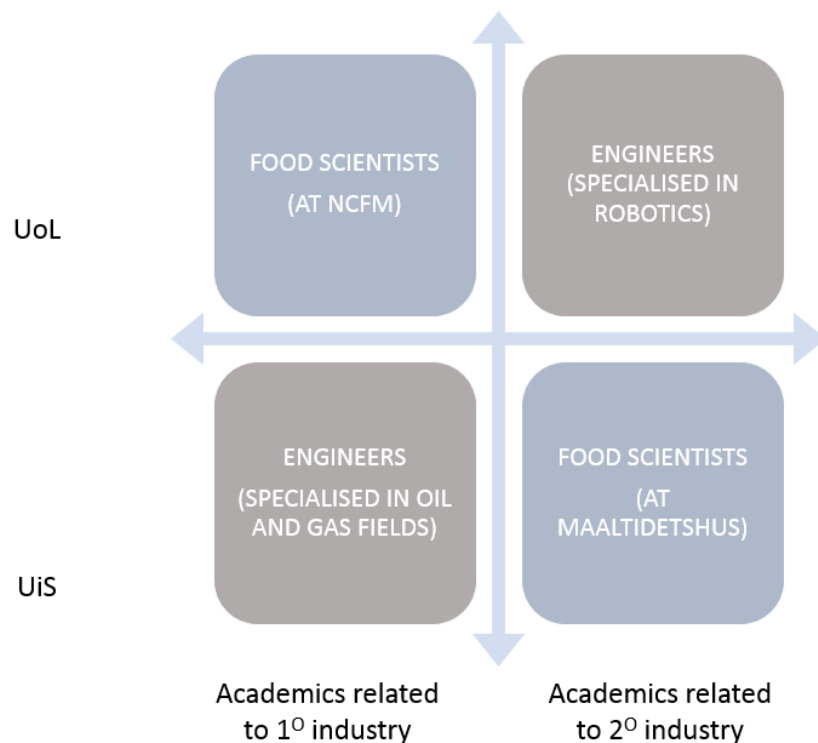


Figure 14: Comparing the link between academics' motivations and regional industries
(Emphasizing the example of academic scientists in UoS and UoL)

6.4 DISCUSSIONS

Regional actors, including individual academics, fulfil their regional duties not as single performers (Stuck et al., 2016) but rather in conjunction with other actors towards fulfilling a certain purpose. The interactions that occur between academics and their industry partners are of great importance to regional innovation, given that these interactions form the platform for ‘knowledgeable’ individuals to interact (Henry and Pinch, 2000). These collaborations form the foundation of regionally-based networks which offer local, innovative small businesses access to global information and knowledge networks (Sternberg, 2000). While academic engagement is not restricted to only the local, this study set out to explore the motivations for academics to engage locally. This is essential given the key role academics play in knowledge exchange partnerships.

Previous studies have focused largely on what academics stand to gain from their prospective partners as a source of motivation for collaborating (Norn, 2016, Perkmann et al., 2013). For instance, as also observed in this study, access to funding and in-kind-resources for their research activities are examples of such gains. It is interesting to report that the motivations of academics are also inward looking. That is, the question of what they (academics) can also offer to their collaborators is also an important motivation. It is therefore argued that, the fact that the academic has something to offer in a partnership is an important motivation to collaborate. This also serves as a good incentive that makes academics value the competences in others.

This study underlines the fact that while the motivations to collaborate is based on clear-cut criteria such as trust and the ability to work together (Hossain and Fazio, 2009, Pataria et al., 2015), there is also a constant assessment made prior to the choice of a partner. What is taken into consideration at each time is based on the specific context that elicits the need to collaborate. It was evident that the motivations of an academic to collaborate are also a function of his past, present and future aspirations. Firstly, the imprint of the academic’s past on his decision to engage with industry is reflected in his prior industry knowledge. The fact that an academic had worked in industry prior to academia seems to spur him to engage with industry having gained an understanding of how industry works. Also, the fact that their personal inclination

(not applicable for the non-engaged academic interviewed) was to apply research influenced their interest in engaging with industry. Secondly, the present, as reflected in the research field of the academic seemed to drive his engagement with industry, especially when this is deemed as a means to advance their research agenda. Thirdly, the academic's future aspirations as regarding his personal and professional advancement spurs him to engage with industry (with an emphasis on leaving a legacy for the next generation through linking students to local industry).

According to Perkmann et al. (2013), the characteristics of engagement is constituted of the individual, institutional and organizational factors, making academic engagement rightly described as a multi-level phenomenon. It appears from the findings that motivation to engage is also a multi-level phenomenon occurring at complementary levels to academic engagement, which for this study have been consistent with the individual and regional levels. Others have shown quantitatively that compared to individual factors, the institutional factors exert a lower influence to the academics motivations (Ramos-Vielba et al., 2016, Thune et al., 2016, D'Este and Patel, 2007). It is argued based on the data that, while the individual's institution provides some context, no evidence suggests that the institutional context was critical for engagement. Thune et al. (2016) and her colleagues reported a similar finding. This lack of evidence is also consistent with the finding by Perkmann et al. (2013) that academic engagement is pursued by academics with little institutional support. It appears then that little or a lack of institutional support probably drives academics to seek support from elsewhere. Further work is suggested to confirm this assertion.

UICs serve as platforms where individuals and teams from academic and industrial contexts work together on specific projects to produce common outputs (Perkmann and Walsh, 2007). From the above definition, it is consistent that academics are driven towards collaborations in order to achieve a common purpose as highlighted from the problem-solving focus of collaborations reviewed in this study. The motivations to engage in these collaborations have also been explained to be in line with the research interests of the collaborating partners. This is further enacted among partners who are able to work well together, with the success of previous collaborations serving as a basis to explore further collaborations in the future.

Because solving industry problems is an important motivation for academic engagement, the regional context is important for local collaborations. While these interactions occur within the region, certain regional advantages serve as drivers for further collaboration. From the perspective of academics, local engagements may provide access to more culturally-alike individuals who facilitate projects. This is important for understanding each other and indulging in projects that are important to all parties. On the other hand, where geographical proximity is important, collaborating locally affords the opportunity to realize the results of a project. These arguments on cultural and geographical closeness is reminiscent of Boschma's (2005) arguments on different types of proximity, and how other types of proximity could compensate for geographical proximity. On the point of cognitive proximity and the perception that previous successful engagements heightened the likelihood for further collaboration, it would be interesting for other studies interested in UICs from the firm's perspective to examine how firms' absorptive capacity (AC) plays in this scenario. Though it is suspected that AC would improve with continued exposure to these engaged academics making successive knowledge exchange easier and easier.

Also, while the impact of collaborations on regional development is often the focus, I argue here that the region in itself also influences the motivation of academics to engage locally. For the example of oil-rich Stavanger for instance, the academics whose research fields are related to the oil and gas industry expressed much value in being able to readily apply their expertise in the region. This was observed to have influenced the reason why certain of the academics moved to the University of Stavanger (because their expertise is valuable there), and the decision of others to specialize in oil and gas relevant fields. In this way, the region seems to provide relevance for their research areas and provided a platform to engage in problem-solving efforts with regional industries.

This claim of regionally-embedded advantages lends well with the view put forward by Cooke and Leydesdorff (2006) on the construction of advantage. In this way, the argument maintains that the motivation of academics to engage locally is driven by both constructed and non-constructed regional advantages. In the given case, the personal motivations would be in reference to the regionally constructed advantages stemming from knowledge partnerships. Conversely, the natural provision of oil and

gas in a region for instance, would be an example of non-constructed advantage that provides relevance for local engagement. Overall, it is projected that these non-constructed advantages set regions apart and attract human capital.

Regions are competitive when their prosperity depends on region-specific intangible assets that are hard to transfer or replicate in other places (Boschma, 2004). It is argued that these region-specific advantages present the primary distinction between researchers who are motivated specifically for regional engagement and those who are not. Regional actors who find these advantages irrelevant as far as their interests go may seek partnerships elsewhere (extra-regionally) while those who find these advantages relevant are motivated to engage locally. For instance, the literature on scientific researchers' engagement in general attribute academic scientists' motivations for UICs to be for furthering their research agenda rather than commercializing their knowledge (D'Este and Perkmann, 2011, Perkmann et al., 2013). While these views are supported by the present study, the added perspective is that academic scientists engage locally because they perceive the advantages that exist in their regions as relevant for pursuing their research agenda.

The findings presented in this chapter support the importance of context for academics' engagement. The importance of the regional context and its relatedness or relevance to the academic's research field appeared key for local engagement. The importance of the regional context appeared even more relevant in relation to the right mix of regional industries as necessary for problem solving. Based on this importance, it would indeed be interesting to gather evidence from different regional settings with varying industry types to assess possible impact on individuals' engagement. As hinted in Chapter 5, Chapters 6 and 7 would focus on a wider range of evidences. Indeed, further enquiry would provide some additional insights into how academic engagement is impacted by the regional context and the challenges that are encountered.

Another dimension of context which has not been in focus so far is the institutional context of the universities in which the academics' work. It appears from the present chapter that the little or a lack of institutional support for engagement probably drives academics to seek support from elsewhere, usually in industry. This finding however

remains somewhat of a black box that requires additional explanations into which dynamics of the institutional context could be improved to enhance academics' networking. Further work is suggested to better establish the link between academics' engagement and the institutional context.

From the above analysis and discussions in line with the literature, it is apparent that local engagements are important for obtaining certain benefits that are relevant for the engaged academic scientists. In other words, the particular advantages obtainable from a particular region present as unique selling points for encouraging local engagements. On the other hand, international engagement also present certain benefits that seem to enrich the local experience. So, even though policies advocate for regionally embedded networks, the international networks also serve a purpose. Regional networks should therefore not be encouraged to the detriment of the international networks. As evidenced from this study, local and international networks are actually interconnected, and policy push to contribute locally is actually optimized and fulfilled when the engaged academics actually also have global links.

The reasoning above is consistent with the returns inherent in the concepts of Brokerage and Closure as emphasized in the literature (Burt, 2005, Granovetter, 1973, Stovel and Shaw, 2012). When individuals are focused only on building their local networks, the concept of closure is applicable whereas building of international networks could be consistent with brokerage. Indeed, as evident from the findings presented in this chapter, placing emphasis on the interdependence of the two (i.e. brokerage and closure) is important for preserving local capabilities and competitive advantages while ensuring that new knowledge and creativity could be introduced into the mix.

These insights specify a 'double-edged' role for both university and regional administrations -to implement measures that would foster more localised networks but not to the detriment of extra-regional networks. Policies should be geared at promoting both regional and extra-regional networks but even more so, ensure that they are linked.

6.5 SUMMARY

This chapter has been focused on how academic scientists build their networks. Particularly, the study places value in the exploration of academics' motivations from a regional perspective and isolating motivations specific for local, and consequently extra-local engagement. Firstly, the motivations of academics to engage and initiate their network ties have been considered. Here it was found that, individual academics are personally motivated to engage – in other words, more weight is placed on the intrinsic factors than extrinsic ones -this was evident in the particular case of the unengaged academic, who despite having the same circumstances as his engaged colleague, decided not to build his industry network due to a personal disposition.

Academic scientists form networks across university and industry entities to promote their research agenda whether locally or internationally depending on the returns available. On a continuous assessment basis, the relevance of these engagements to the academic are an important determinant to initiating a particular collaboration, wherever it may lie. If the required advantages lie regionally, academics take advantage of this – otherwise they seek these out extra-regionally. On the other hand, if these lie in academia, they take advantage of this and would also go to industry to seek out other relevant purposes. The motivations for academics' engagement are therefore very contextual and require careful study to fully understand various nuances.

CHAPTER 7 – PERCEPTIONS OF TIE IMPORTANCE AND EVOLUTION OF ACADEMICS’ NETWORKS

7.1 INTRODUCTION

In this chapter, an assessment of the evolution of individual network ties of academic scientists is presented. From the literature survey, it is apparent that social networks are dynamic processes that can be created and deactivated through the separate and/or joint actions of the persons involved (Thibaut, 2017, Lambe et al., 2001) – with the various actions of networked individuals affecting the quality of their lives and the survival of their relationships. While networks of academic ties can be examined to understand how researchers interact with each other as well as their various preferences (Arslan et al., 2011), there is little previous literature on what factors actually drive the evolution of networks. This gap warrants further enquiry into the factors responsible for the evolution of the network ties of individuals and particularly of interest to this thesis, academics’ networks. Researching evolution of academics’ networks is worthwhile given that individual academics are key actors in the innovation process and particularly UICs. And, understanding which factors drive the evolution of their networks presents the possibility to nurture conditions that promote the success of their relationship ties at the regional and extra-regional levels.

7.2 DATA

As shown in table 7.1 below, the data in this chapter are based on a sample of 42 interviewees from the 5 universities included in this thesis namely; the University of Stavanger, Norway, Linköping University and Chalmers Technology University in Sweden, and the University of Lincoln and Loughborough University in the UK. Selections were made based on reasons of accessibility and convenience. During the interviews, STEM academics were asked questions focused on understanding how their relationships with their various personal contacts had developed and changed over time.

Table 10: Distribution of interviewees: evolution of academics' network ties

Case country	Case University	Number of Interviewees (STEM Academics)
Norway	University of Stavanger	12
Sweden	Linköping University	8
	Chalmers Technology University	8
United Kingdom	University of Lincoln	7
	Loughborough University	7

The ego-network approach (Borgatti et al., 2013) of analysing individuals' networks was employed and adapted to generate specific examples of linkages from the interviewees as described in chapter 3. Accordingly, Table 6 (in Chapter 3) was utilised to obtain examples of network ties and their evolution. Perceptions of importance, as used for assessing evolution, was employed based on the idea that individual academics indulge in networking based on perceived benefits on which they place a certain amount of importance.

The data obtained was analysed within the embedded cases and subsequently synthesised. This was essentially a qualitative process, where the table with links was a mechanism to promote discussion of how links developed. The individual motivations for networking coupled with the specific modes of network initiation were also identified. Further, by particularly assessing the linkages at three stages of the evolution of the relationships examined, insight was gained into how academic networks evolve (for different types of linkages) and what factors influence their evolution. Finally, having looked at different regional contexts, an assessment of the regional impact on networking was also possible.

7.3 ANALYSIS

The purpose of this Chapter is to examine evolution of academics' network ties based on perceptions of importance and their subsequent evolution. Characterisation of importance by the interviewees therefore set the stage for understanding the motivations for initiating a network tie. Because the definition of 'important contacts'

as requested during the interview exercise was not specified, but rather left to interviewees' own understanding, various considerations were made leading to different types of network ties emerging as important for academics. Following from the network table utilised (Table 6), the categories of ties obtained were those from Academia, Industry, Research Institutes, Government Institutions, etc. Given the particular interest in University and industry linkages as contained within UICs, the following classifications were further extracted to extricate the nuances of our study; International and local ties (also including university colleagues, research group members), and academic and industry ties.

The data collected was in the form of interview transcripts and network data pertaining to the usage of Table 3.3 for the 42 interviewees sampled. Given that interviewees mentioned between 2 to 12 network ties each, this exercise (of extracting network data) yielded about 332 unique network ties whose evolution could be analysed. Of these ties, about 30% of them were industry ties whereas approximately 53% were academic ties. The remaining 17% were constituted by ties from government institutions, research institutes and service companies among others. Further, approximately 27% of the overall ties analysed were regional ties, and about 73% were extra-regional. Evidently, the networks of academic scientists are mostly constituted by fellow academics and industry partners with a majority of them being extra-regional collaborators. The distribution trend of the network ties is also reminiscent of the data presented in Chapter 5, where the majority of international network ties of academic scientists were other academicians.⁵⁸

7.3.1 Perceptions of importance

The academic scientists perceived different factors as important for their networking. Based on these perceptions of importance a potential connection was pursued or avoided. According to the data, various conditions posed as important for academics' networking. When asked to list important contacts, interviewees mainly considered the following parameters: involvement in on-going engagements, contribution to research goals and proximity in cognition as shown in the figure below.

⁵⁸ The data in Chapter 6 are captured in this larger sample exploring evolution of academic network ties

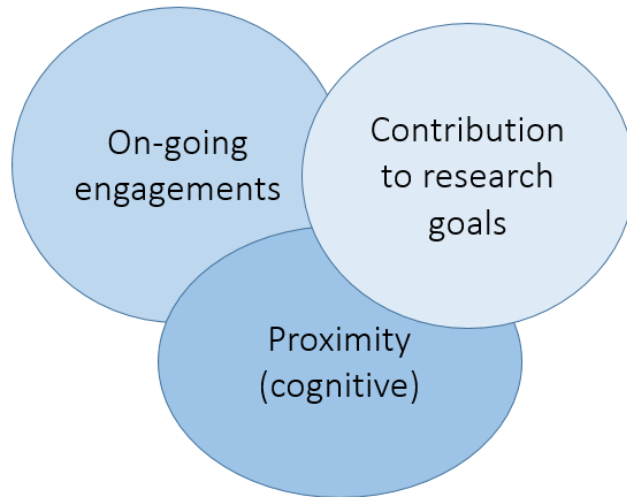


Figure 15: Academics' perceptions of importance of their individual network ties

7.3.1.1 On-going engagements

The academic scientists in this study were more likely to mention a contact who was involved in an on-going collaboration rather than another who was considered more of a dormant connection. Whether the objective of the relationship was being executed on an individual or personal level, it was as valued as another on a project level. Similarly, inactive industry connections were less likely to be included when compared to active academic ties, and vice versa. This implies that, some older connections were also not mentioned when newer ties were considered more active and of timely relevance. As observed from the data, importance was therefore placed on those activities which take the time and effort of academics rather than on seemingly latent connections. Referring to a former masters student who was mentioned as an important connection, interviewee UiSACA02 buttressed the importance of being an active collaborator by explaining, '*...I didn't have any contact with him [previous masters student] really, I would never have put him on the list two or four years ago, but now lately we have had a lot of things to do with them*'

The concreteness of existing relationships as expressed through active connections also suggested the need to intentionally maintain network connections. When asked about maintaining network ties interviewee UiSACA04 explained further citing an example of a connection he had recently lost contact with, '*...I think it's very important that you have something concrete to work on....because, you know you go to*

conferences, you meet a lot of interesting people. But usually, if you don't have anything concrete [for which reason] to see them, then it will just be persons that you talk to in a way. So you need some kind of collaboration that is either doing research together, or writing something together. I think because that is the thing with the person that I kind of lost contact with. We did a lot of reports and so on together, and then we talked with each other every day, but then it's very recently, this year I have a lot of things to do.'

7.3.1.2 Contribution to research goals

Whether for advice, joint publications or research, a contact was mentioned as important if they influenced the research goals of the academic scientist. Consequently, industry contacts were not perceived as more valuable than academic contacts or vice versa. What mattered to the academic was advancing research goals – and if a particular link satisfied this criteria, they were more likely to be perceived as important.

Interviewee LOUACA02 emphasized the importance of meeting goals through collaborations, when explaining the importance of a network tie, '*...we are currently supervising a PhD student. We are in a consultancy project together....we are probably within the next month [submitting] our research grant together'*. The likelihood of meeting research goals was also linked to having common interests as collaborators. Interviewee LOUACA02 further emphasized this by citing the example of a collaborator who took the initial step to initiate contact, '*we found the topic interesting. He was really interested in doing that [developing materials] and then it just started like a month ago'*

7.3.2.3 Proximity

Cognitive, rather than geographical proximity was cited as an important element in academics' relationships. In this way, international contacts were not perceived more valuable than local contacts, or vice versa. What mattered in the academics' view was that ties were formed with people of the same or similar knowledge base rather than being merely co-located partners.

Further discussions on perceived importance showed that complementarity in skills were highly valued as the interviewed academics simply did not want another copy of themselves. Emphasizing the importance of complementary skills, interviewee LOUACA02 expounded, *‘someone that can complement or my background.....my experience is not as vast or extends as his is. He can provide expertise. It is in the same area, but he has more on that part. I can provide another experience. I would say it definitely will depend on the topics. I would say someone that can contribute in a way and can complement’* LOUACA02

7.3.2 Evolution of networks

The data point to a repertoire of factors that affect evolution of networks. For the three-point analysis; now (being the time of interview), 2 years prior and 4 years prior, 15 different patterns of evolution were observed for the network ties examined. These profiles are shown in the Figure 16⁵⁹. For instance, if for the time marks; now, 2 years ago and 4 years ago an interviewed scored the rating 1, 1 and 1 respectively for a particular tie, the evolution profile projected was an unchanging one, and so on. All the evolution profiles emerging from data collection were analysed in like manner resulting in six main classifications as shown in Figure 16.

⁵⁹ A sample analysis based on which the profiles were specifically generated is shown in the Appendix 6.

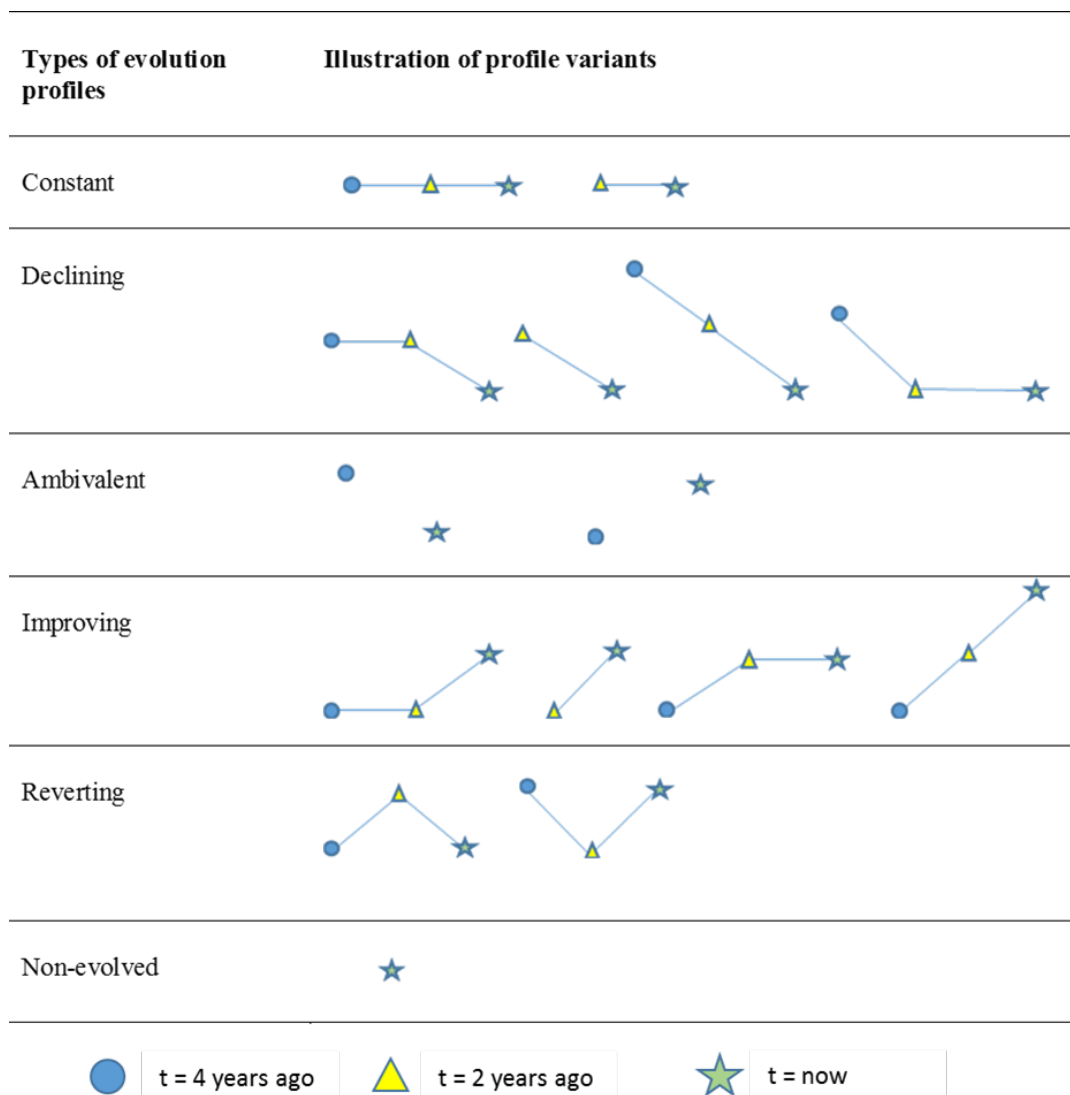


Figure 16: Evolution Profiles of Academics' Networks (own emphasis)

Consequently, as visualised, some of the ties remained of **constant** importance over the time period reviewed. This implies that the interviewees perceived these connections of the same level of importance for the three time points considered. As can be expected, a couple of them **declined** in importance while others **improved** in importance according to the views of the academics interviewed. Some ties were characterised by a period of **ambivalence**, during which time it was difficult for the interviewee to attribute importance for a particular time, t. This was interesting to observe and somehow emphasized the previous point made on the necessity of concreteness in collaborating with others. By inference, it was challenging for interviewees to attribute a score to a network tie for a period of inactivity. Some ties were observed to **revert** towards their initial low or high level of importance. In these

periods, the frequency of contact with ties changed based on the particular need of their collaboration at the time and thus affected the perceptions of importance. A last batch of network ties, because they were fairly new links which had lasted for less than 2 years, were **non-evolved** at the time of the interviews.

Various factors were observed as affecting the evolution of academics' networks and responsible for the evolution profiles shown in the Figure 16. The main factors elucidated were career-, geography-, initiation- and regional path dependent, as presented in Figure 17.

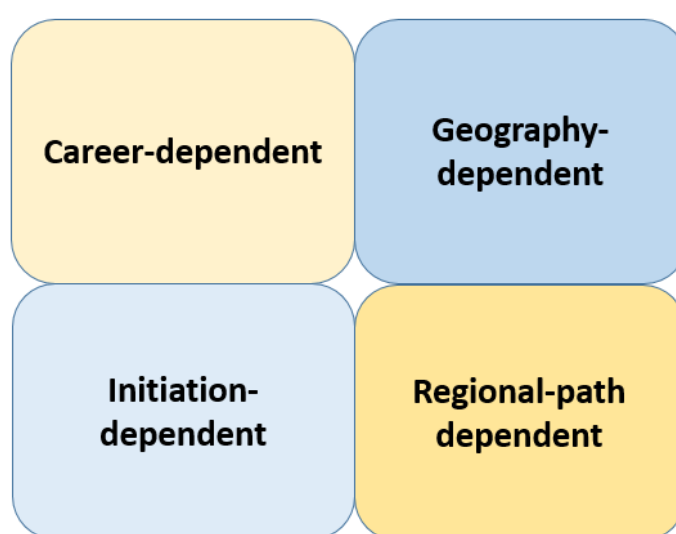


Figure 17: Factors affecting the evolution of network ties

7.3.2.1 Career-dependent evolution

With a change in career interests, the perceived importance of contacts was also affected. The importance of a change in career interests was explained as detrimental to cognitive proximity as each partner tended to specialise in a different field. Specifically, if contacts strayed into different scientific fields of interest that differed from that of the focal academic, perceived importance of ties declined. In contrast, working in closer fields usually encouraged further work and continued perceived importance. Interviewee UiSACA01 explained a decline in a connection as follows *‘she has this very same background as me, so she did join all my projects as the international collaborator. But then it has been less and less because she's not that into [a field of] research anymore. That's the only reason more or less’*

Further, career mobility resulted in a change in the nature in which existing relationships were previously expressed. In the particular case of interviewee CHAACA01, his move from industry into academia seemed to have affected his previous relationship with his industry colleagues considering a change in priorities and the demands of academia. He explained, *'we knew each other then and had a relation, but it changed when I went into academia.....We changed it to [a more] academic relation instead of a more practical one.'*

Where career-dependent evolution was concerned, the evolution of academic contacts seemed to be more or less based on an individual basis when contrasted with the nature of evolution of industry contacts which appeared to be more project- and position-based. This appears to be the case as the majority of industry ties were merely 'industry contacts' rather than self-chosen collaborators. Interviewee UiSACA01 shed more light on this point as follows; *'There's a very big difference here. He could have been the number one if we had been working together, but he has a different role and I never work with him, he's not my contact person'*

7.3.2.2 Geography-dependent evolution

Tie relations were observed to be affected by geographic mobility. In the first instance, when a tie who was once geographically proximate ended up relocating, relationships tended to suffer. Serendipitous meetings declined and a lack of meeting opportunities gradually affected the importance of ties. In this way, the importance of geographical proximity in the evolution of academics' networks was seen in both contrasting cases of moving closer or moving away. Interviewee CHAACA01 when asked directly how a 'constant' tie might have looked in the event of a geographical re-location admitted the importance of geographic proximity by saying, *'If he had moved, we wouldn't have that much of a relation'*

Further, Interviewee UiSACA04 stated the specific effects of geographical re-location on a relationship that had declined by explaining, *'.... but he has moved from Norway and I don't see him as often as I kind of used to. So I don't think our relationship really has changed, I just think that other people have become more important to me, to be*

honest. By this, Interviewee UiSACA04 as well emphasized the importance of ‘meetingness’ for collaborating partners.

It is note-worthy that this effect of geographic proximity was not always obvious even to the academics. When asked the effect of geographical proximity on their networks, the academics always cited it as being negligible or absent. However when questioned about the factors that had led to the change in importance and evolution of a particular network contact, the importance of geographical proximity was apparent.

7.3.2.3 Initiation-dependent evolution

From the data, it was also possible to assess the original motivations that led to the initiation of the network ties. For both academic scientists and industry contacts established, the prospect of knowledge transfer, access to financial and in-kind assistance among others were major incentives for establishing contacts. Generally, the perceived importance of contacts weakened when these inducements declined or were no longer accessible. Citing a common project as an inducement for establishing ties with a particular contact, UiSACA02 alluded to the fact that the absence of such an initial reason to collaborate had resulted in declination of a particular relationship with a contact. It was explained, *‘she’s [now] involved in a project where I’m not involved in anymore....I think it’s more that she’s moved on academically....as at least a different focus for me. She’s working on something I’m not working on’*

7.3.2.4 Regional-path dependence

The networks assessed were constituted of both regional and extra-regional contacts. This distinction presented some further nuances in understanding the evolution of networks. From the interviews, it appeared that those collaborations that were linked to the relevant regional industries were favoured over those that were not. For example, funding for collaborations that are interesting to regional industries were easier to obtain. To that effect, because the mix of regional industries affected the interest of academics in pursuing a particular research area, a regional-path dependence was apparent.

In essence, the factors identified for network evolution did not differ for academic scientists simply because they were from rural or central regions. Rather than mere location, what was interesting to note of the regional context was the presence of related knowledge bases and relevance of research interests that presented networking opportunities. It can thus be inferred that regional capabilities are an important basis for the formation of network ties. Additionally, whether in a rural or urban region, the relatedness of the regional knowledge base and subsequently available industrial firms directed the evolution of academic's interests and thereby, their networking.

7.4 DISCUSSIONS

In this chapter, changing perceptions of importance of ties has been used as the basis for comprehending and isolating the various factors responsible for the evolution of network relations. It was found that important ties were perceived by the focal academics as those involved in on-going collaborations, contributing to the research goals of the academic and those that were considered close in cognition. Additionally, specific nuances related to how different linkages are formed (i.e. based on perceived importance) and how they evolve have been exposed. Based on several evolution profiles isolated, it was discovered that evolution was career-, geography-, initiation and regional path-dependent. These findings are reminiscent of Gulbrandsen et al. (2011)'s postulation that interactions of universities and industries are heterogeneous, produce diverse outcomes and are contingent upon many non-linear relations.

The data presented in this Chapter supports the notion that personal relationships and networks are dynamic in nature (McPherson et al., 2006). Relationships generally improved or declined based on the actions and/or inactions of collaborating partners (Kossinets and Watts, 2006, Thibaut, 2017, Lambe et al., 2001). Shared activities were important for continued relations with network ties. It was also evident from the data and analysis that relationships were often formed within the context of the academic's social environment mostly characterised by other academic scientists and industry contacts. Further, when a contact moved out of this context the relationship was altered. A lack of meeting opportunities also seemed important for the identified changes in perceptions of tie importance.

A period of ambivalence which characterised the evolution of certain of the relationships seems to suggest that dormant relationships can be revived when they become necessary for fulfilling an important agenda for the academic scientist involved. Further, the identified ambivalence also suggests that relationships are multifaceted and erratic sometimes and could thus transition unpredictably. Understanding relationships is therefore more revealing when carried out on the individual level. In line with this, no two relationships in the study could necessarily be said to have evolved in exactly the same way. Even when similar evolution profiles were identified, these were caused by varying reasons - even for the same interviewee.

The data lends well with the claims made by Mollenhorst et al. (2014) on the dependence of relationships on social context, in which case an alteration in academics' social setting led to the evolution of their relationships. Further, the findings support the idea that social effect is mediated by institutional links of personal relationships formed through co-location within an institutional context that endure over time, space, and organizational boundaries (Agrawal et al., 2006). It was evident that though interviewees were generally quick to dismiss the effects of geographical proximity on the evolution of their relationships, this was indeed an important factor. This finding also magnifies the importance of the regional context in facilitating networking among the relevant persons. The regional context has been understood (e.g. from Chapter 6 of this thesis) to direct the establishment of strong regional networks in fields of relevance to existing regional advantages. The results show that the evolution of both rural and urban networks of academic scientists are influenced by the regional context. Particularly, the relevance of the regional context in promoting the research agenda of academics presents a direct link for delivering the competitive strength of academics' networks for the region's benefit.

Notably, geographic propinquity, as emphasized by the importance of meeting opportunities (e.g. workplace, and the neighbourhood) was emphasized (Mollenhorst et al., 2014). Particularly, the regional nature of networks where spatial propinquity helps to sustain a common community was essential for the continuance of network relations. Similar observations are recorded in literature (Grabher, 2004, Grabher and Powell, 2004). Relatedly, an initial mapping of the relationships in the sample showed a strong trend between the geography of network contacts and the type of contact (i.e.

university and industry). Interestingly, most international contacts of the academics were other academic scientists which is consistent with the findings presented in Chapter 5 of this thesis.

Overall, the evidence presented provides the possibility to nurture conditions that promote the success of knowledge-based relationships of academic scientists – both at the regional and extra-regional levels. A region may lose skills and information inflow when relevant relationship ties sever and, in the reverse gain skills and information when relevant relationships are forged and sustained.

Social network research has often looked at structural evolution of networks to the neglect of the functional. Exploring evolution from a micro-foundational level has been valuable for exposing some functional insights of academics' social network linkages as seen from this study. This chapter could be considered limited by the scope of data collected (e.g. time of observation and number of observations). However by investigating individual ties, this study is yet critical for a deeper understanding of the development and optimization of social networks. The benefit in studying the evolution of networks the way it has been done in this study is that it offers insight into the underlying mechanism for tie evolution and not the network structure.

Another possible limitation is that the interviewees might have been influenced by hindsight in stating the importance of each contact mentioned as perceived by the academics. This implies that, perceptions of importance at the time of interviewing may have been influenced by other events following the period of interest. One way to have conducted this study might have been to actually conduct the study over 4 years to track the relationships. However, given the dynamic nature of academic ties and the finding of periods of ambivalence in this study, I might have been faced with a different set of 'important ties' on each visit over a four year period. This might have posed challenges in actually tracking the evolution of a particular network tie.

The findings presented show the uniqueness of individual relationship ties in terms of their importance and evolution. Even for a particular person interviewed, their various ties evolved differently. This shows that generic approaches to enhancing networking are not suitable. Various interventions that could focus on promoting the success of

academics' relationships in particular need to be more tailored to the specific contexts. Suffice to say, the distinctiveness of individual relationships require specific focus in nurturing their success. In the case of policy interventions that promote UICs for example, a one-size-fits all approach would therefore not be beneficial for capitalising on the knowledge of the conditions that lead to successful relationships of academic scientists and their various connections. However, while policies should not be one-size fitting all, they also cannot be made for individuals, rather for various subsets of academic scientists. Policy makers and other relationship managers can take advantage of the common factors that affect the formation and evolution of networks to strengthen regional innovation in a balanced fashion.

The finding that the regional context, with respect to the presence of the related knowledge bases and relevance of individuals' research interests that presented networking opportunities, affected the evolution of network ties, provides a basis for strengthening regional competencies for encouraging local network formation. Particularly from the side of universities, research focus could be placed on the advantages present and/or related to existing regional industries. Further, the relevant regional industries should be encouraged and incentivised to innovate in closer collaboration with universities' scientists and other relevant researchers. In essence, the relatedness of network evolution to regional advantages suggests that U-I networks should not be enhanced independently from the promotion of regional businesses and vice versa. Regional policy might be directed toward the enhancement of U-I networks in particular and not mere business formation in general, so that these regional networks of academics evolve together with regional firms and not independently of them.

According to Hagedoorn et al. (2000), Governments have promoted and supported research partnerships in order to correct market failures in R&D investment, speed up technological innovation, and increase technological information exchange among firms, universities, public research institutes. Knowing what factors are important to collaborating actors, such as academic scientists, and how their relationships could be altered given the absence or presence of certain conditions is key to realising the expected information exchange among universities' researchers and other relevant actors. Additionally, university management and regional stakeholders can contribute

by capitalising on the knowledge of these factors (affecting the evolution of academics' networks at the functional level) to, for example, facilitate meeting opportunities for regionally-based networks.

7.5 SUMMARY

In this chapter, focus has been placed on the evolution of academics' networks as based on individual academics' perceptions of network tie importance. From the study, it was apparent that academic networks are dynamic and evolve uniquely such that no two ties (even for the same focal person) are same. Academic scientists perceive important ties to be those that are active, contribute to their research agenda and close in cognition. It was also observed that evolution of networks were career-, initiation-, geography- and regional path- dependent. Interestingly, cognitive proximity (and not geographic proximity) was perceived as important for networking while the evolution profiles extracted from the network data showed geographical proximity as important. Further, the evolution of both rural and urban networks of academic scientists were influenced by the regional context.

The relevance of the regional context in promoting the research agenda of academics presents a direct link for delivering the competitive strength of academics' networks for the region's benefit. Understanding which factors drive the evolution of networks presents the possibility to nurture conditions that promote the success of these network ties. Regional policies focus on business formation separately from the regional networks that impact them. Given that networks evolve in line with regional comparative advantages, it is important to promote regional policies that might promote the co-evolution of regional networks and business formation

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CHAPTER 8 - INVESTIGATING THE EFFECT OF *CONTEXT* ON ACADEMICS' ENGAGEMENT

8.1 INTRODUCTION

In the preceding empirical chapters, the importance of context to academics' engagement was apparent. Right from Chapter 5, on how academics build their networks, the importance of context was already looming as it was discovered that the nature of the regional industrial milieu (*as in the case of Stavanger in the Rogaland region of Norway*) instigated academic scientists to adapt a more causal decision-making approach when initiating their networks. This point on the relevance of context was buttressed in Chapter 6, where it was found that the 'regional context' in itself served as a motivation for academics' local engagement. In Chapter 5 and 6, both based on the Stavanger case, the importance of the universities' institutional context was mentioned where claims of a lack of, or little support for academics' engagement from their host institutions were made. Finally in Chapter 7, drawing on interviews from Norway, Sweden and the UK, it was observed that the evolution of academics' networks exhibited a regional path-dependence in which case individual's network ties evolved alongside evolving regional institutions. Altogether, these findings point to the importance of context for the initiation and evolution of academics' networks.

In this chapter attention is more closely paid to the effect of context on academics' engagement from both a regional and institutional (organisational) perspective. This analysis is also made even more necessary from the perspective of existing literature as highlighted in Chapter 2. While context is acclaimed as important to academics' engagement, there is still lack of adequate empirical evidence showing how this significance is manifest. To this effect, an analysis of the influence of universities' institutional context on academic engagement is first presented in section 8.3.1. After this, reflections of the challenges to regional engagement and how to overcome the identified challenges would be presented in section 8.3.2. The potential impact of academic engagement on regional innovation are explored through a case analysis of the role academics' networks could play in the regional retention of graduates.

8.2 DATA

The findings presented in this Chapter draw from case studies conducted at the University of Lincoln, UK and Linköping University, Sweden and follows the methodology detailed in chapter 3. Specifically, empirical data was obtained through semi-structured interviews with selected academic scientists, collaboration staff, industry partners and alumni from the University of Lincoln, UK and University of Linköping, Sweden. In all, 50 interviews were carried out as shown in the Table 11. 23 of them were from the UK whereas the remaining 21 were from Sweden. Most interviews took up to 45 minutes and were recorded with the permission of interviewees. Of the Swedish sample, 8 interviewees were academic scientists whereas the remaining 19 were collaboration staff⁶⁰ with 2 of them being top management personnel. 12 academic scientists, 4 industrialists and 2 collaboration staff made up the UK sample. In this chapter, 14 of the PhD graduates who were interviewed on the issue of graduate retention in the regions are also included. Academic Scientists, including the PhD graduates, were all selected from STEM disciplines; where engagement is prevalent (Perkmann et al., 2013).

Table 11: Constitution of Interviewees

Country	University	Interviewee description	Number interviewed
Sweden 27	University of Linköping (21 interviewees)	Engaged academic scientists in STEM	8
		Collaboration staff	10
		STEM PhD graduates	9
UK 23	University of Lincoln (18 interviewees)	Engaged academics in STEM	12
		Firm partners	4
		Collaboration staff	2
		STEM PhD graduates	5

⁶⁰ Collaboration staff as used in the Swedish sample refers particularly to the members of the team of ‘Collaboration-Co-ordinators’, also *Samverkanskoordinators* (in Swedish).

Generally, the interviews were focused on understanding collaboration from the university context. The academics in the interview sample were asked questions about their collaboration practices (especially with industry partners) and the support provided by their institutions. The institutional requirements for third mission activities, the types of collaborators they interacted with and if those contacts were institutionalised were probed. For the collaboration staff, I tried to understand their role in supporting third mission activities and what challenges they faced. Because interviews were typically semi-structured, interviewees were allowed to speak broadly on the subject of collaboration from their own experiences. The data collected was later transcribed and analysed. In order to obtain a holistic view for the given context, interviews were analysed singularly and later synthesized. Interviewees in this narration have been coded to protect their anonymity.

8.3 ANALYSIS

8.3.1 The effect of the Universities' Institutional context on engagement⁶¹

The cases from Lincoln and Linköping rather than forming a basis for comparison, are presented as case examples of the university context. Together, the two cases contribute a deeper understanding of how universities' systems could promote or mitigate the possible exploitation of knowledge exchange processes. While the particular case of Lincoln is used to demonstrate the effects of universities' structural context, the case of Linköping emphasises more the effect of the functional context. The two cases were interesting choices for this study based on their common characteristics of being young and peripherally located and thus presented a unique perspective for studying regional engagement. Further these cases were accessible to me.

The data collected from both Linköping and Lincoln show that some academics perceive a lack in the institutional support provided for their external engagement, and therefore call for greater and more tailored support. Even though universities have increasingly shown interest in engagement, and actually expect academic scientists to

⁶¹ The data on the effect of the universities' institutional context is included in a RUNIN project working paper with input from Andrea Caputo, David Charles and Rebecca Herron (available at https://ris.utwente.nl/ws/portalfiles/portal/168160726/01_2020_Ahoba_Sam_et_al.pdf)

engage, individuals often act independently. This point suggests that those academic scientists who find engagement appealing do so more out of intrinsic rather than extrinsic reasons. As explained by academics in this study, even though their institutions have a history of engagement, support for their external engagement could be further developed. For example;

'[....] I cannot say that I get any active support [.....], I cannot say that the university is actively helping us to have a broader network. They are more expecting us to do it but they're not giving us any actual resources to'

Interviewee LiUACA04

'[.....] but there's no time allocated for writing the grants, there's no budget put together for writing the grants. You are expected to do it along with all the teaching'. (Interviewee UoLACA02)

Further, it was apparent that efforts of university leaders to engage externally were sometimes carried out without the knowledge or support of academics who might actually be required to nurture the successfully established relationships. This phenomenon was articulated as in the following: *'But now they are running around talking with the industry, and sometimes it becomes [a] little bit embarrassing because they have been out discussing about collaboration with companies that we already collaborate with'* Interviewee LiUACA04

This issue clearly shows that universities' actors are not concerted in their efforts when collaborating with industry.

Another observation made was that, decisions were often made in a 'top-down' fashion that did not always reflect academics' preferred modes of engagement. When the support was offered, it was not extended in the right way as perceived by some individual academic scientists. Rather than the preferred '*facilitator* role', the universities' management appeared to assume a '*lead*' role in the engagement efforts. Academics were thus reluctant to share their contacts, or important contacts for fear of the university '*messing up*' their contacts. The academics argued that, '*Contacts can be shared, but not relationships*'. In essence, their industry linkages were more than mere contacts built over the years, these were relationships that had stood the test of time. The Academic scientists interviewed argued that it was necessary for trust to

be established between universities' management and individual academic scientist. But would academics share their individual contacts? When asked this, a typical response was this - *'It depends on the way they're asking it. I mean if they're just coming and asking we would like to have a contact persons, NO. [But instead....] If we can have a discussion and they're asking "How can we support it? What can we do for you? Then we can build up trust'* Interviewee LiUACA04

As seen from the data collected, the kind of support required by Academic Scientists may not be those offered by the University -in which case there is a perceived lack of support. An interviewee (LiUACA03) highlighted needed support in *'basic things'* such as *'or-organizing meetings with companies and...support writing applications with companies'*. This was also emphasized in the following: *'But in order to get a good industry collaboration between university and industry you need to have more bottom-up, so maybe what universities should focus on is not try to take, they should instead facilitate; [.....] because maybe they're running around meeting some companies, but they should be more focusing on going and walking around in the corridors, asking and discussing with us what need and do you have any need for collaboration or how can we support your collaboration?'* Interviewee LiUACA04

8.3.1.1 Facilitating UICs

One way the University of Lincoln encourages engagement with industry is by creating platforms through which academic scientists and industrialists can work together. Such platforms range from informal networking events to structured committee memberships. The *'LIBS Connect Event and Ignite'*⁶² are examples of such opportunities to bring both university staff and external collaborators together. The Connect event is aimed at facilitating interactions between the business community and the team at the Lincoln International Business School. Ignite, which is hosted by Sparkhouse, the University's incubation centre for start-up companies provides a range of opportunities to engage with small businesses.

⁶² <https://www.lincoln.ac.uk/home/businessengagement/networkingandevents/> (accessed 22/10/19)

Another type of platform is the inclusion of industry partners in the university's various committees and steering groups. The Industry Digitalisation⁶³ agenda of the University is one example of such platforms that brought together both academic staff and industrialists – this time, with the aim of developing a new digital skills curriculum to serve the innovation needs of major industries ranging from food manufacturing to renewable energy. According to Professor Libby John, Pro Vice Chancellor and Head of the College of Science at the University of Lincoln,

‘Society is in the midst of a Fourth Industrial Revolution and those economies which thrive in the 21st Century will be those that embrace digitally enabled technologies, such as robotics, machine learning, the Internet of Things and big data analytics’; ‘Lincolnshire is in prime position to build on its strengths in sectors such as food and farming, engineering and tourism - if we can establish the infrastructure needed to realise the full potential of digital to enhance productivity and deliver real innovation. Digital literacy of the current and future workforce will be a crucial component and this project directly addresses that need, working hand-in-hand with employers’

The Industry Digitalisation steering group⁶⁴, served as a first-hand experience at how universities and industry can come together for a common aim. However, even for a university that is closely knit to the local society, there are challenges in facilitating UICs. Some of these challenges are highlighted in the next section.

8.3.1.2 Effect of Institutional Context: Facilitating UICs

The Lincoln case highlights how the ‘structural’ context of the university could affect knowledge exchange processes. The organisation of universities into different faculties and colleges is, at best, a strategic decision which enables easy management and co-ordination. However, placed under the lens of knowledge exchange processes, universities’ structures may sometimes deter knowledge exchange.

Internally, the decided location of academic scientists is a determinant of who they [academics] could possibly collaborate with. Placement of academics in different

⁶³ <https://www.lincoln.ac.uk/news/2018/01/1429.asp> (accessed 22/10/19)

⁶⁴ I observed a meeting of the Industry Digitalisation Steering Group, and interacted with its members on 09.04.19.

colleges, schools or faculties mediated their engagement opportunities. As highlighted by an interviewee,

‘The university decides on the structure of the departments and where the departments lie, both geographically and administratively (bureaucratically).....so it is difficult to know what another reality would look like...for instance if a person from architecture held a place in this department, maybe as a structural engineer I would know that person, would know their capabilities and would make a great relationship with them, but you just never know’. Interviewee UoLACA06

A possible way to counteract the effect of this compartmentalisation is the presentation of meeting opportunities for staff across the universities. However, the present efforts were considered ill-mediated and not well-structured opportunities. This was emphasized as follows: *‘[....] if the university wanted to help us meet people, then they would think more structurally about what is the research group, who works in the research group, what does the research group look like from the outside, how can the research group be more visible, how can the research group influence other ‘departments’ of the university more, doesn’t mean we have to change our structure.....’* Interviewee UoLACA6

Externally, the university structure is perceived by some industry partners as a ‘silo-structured’, contrasting the typical hierarchical structure of industry. This silo situation makes contacting the right person for a particular collaboration difficult. This was supported in the following quote about the digitalisation steering group;

‘That one (the digitalisation steering group) has gone across the University campus more than others, but it’s quite a thin link. I now know some people. I barely know what most of them do, apart from the ones I already knew. We don’t meet very often and when we do, we’ve got a particular intent, which is around a core activity of industrial digitalization. I’m happy to help with that....I’m interested in it because it will impact on our business but in terms of a networking opportunity. It’s not a great networking opportunity’. Interviewee UoLACA15

Further, external collaborators are burdened with the problem of who to contact for a particular assistance due to the university’s structure. An academic researcher highlighted this issue on the difficulties encountered by prospective external links

while suggesting an improvement in the university's marketing strategy, '[.....] When you hear 250 companies and see a maximum of 10, there are lots of missing ones. I think it's a missed opportunity [...]' Interviewee UoLACA01

Being on university's committees is seen as a good means of facilitating knowledge exchange. However, because industry research is of a more 'transdisciplinary' type, industrialists end up sitting on too many university committees which end up being 'time-consuming'.

In all, promoting meeting opportunities for university staff could be a good way of overcoming internally-faced structural challenges to knowledge exchange. If these provisions can be successfully extended to university-wide, interdisciplinary events that attract potential external [industry] partners, as well as existing external partners, as highlighted in Figure 18 below, the challenges presented by the university structure could be mitigated.

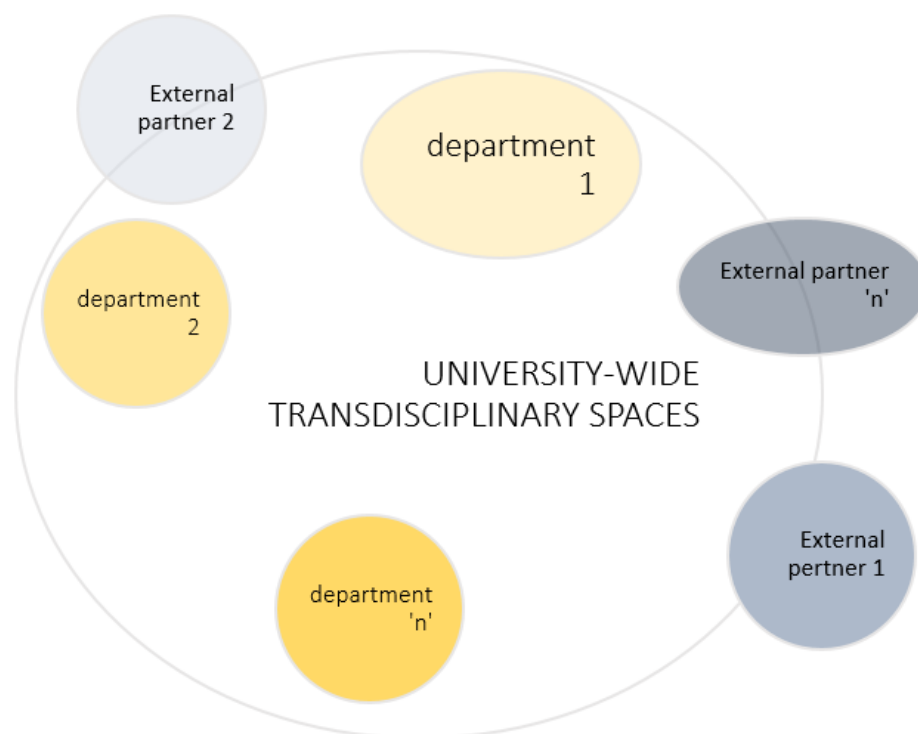


Figure 18: Promotion of university-wide transdisciplinary space opportunities for knowledge exchange

The need for such transdisciplinary spaces has been identified by the university centrally and discussed at meetings of the university professoriate, but it has proved difficult to develop new cross faculty/cross school institutes. Identifying themes around which academics can coalesce is one problem, but then the identification of leadership and resourcing such institutes is an additional problem.

8.3.1.3 Co-ordinating Collaboration

In 2014, LiU initiated an exercise to collect and document impact cases across the university. This exercise was linked to some state funding accessed through VINNOVA, the state's research institute. This exercise was understood by many as similar to the UK's REF format of assessing research impact through collection of impact cases. The management staff in charge of this exercise decided to document academic engagement across the university - however for LiU, this was a new initiative that would take time to develop and perfect. The project was rolled out by appointing some staff into the role of 'Collaboration co-ordinators' (CCs), as translated from the original Swedish title of '*Samverkanskoordinators*'.

The CCs, were selected from across the universities' various departments and faculties. Further, most of them were academic scientists at varying levels in their academic careers. Though the specific requirements for inclusion are quite unclear, being a researcher or academic was not necessarily a *prima facie* for one's selection. Indeed, staff availability and interest in participating, seem to have received much consideration. Though from the onset the specific role was not explicitly explained to the selected collaboration staff,

'It [the role] was not so well defined for me uh, as I recall. I think that the persons that suggested me and asked me if I wanted to be the representative for this department, probably didn't know so much about what it would entail. When we started it, I don't think it was so clear for the persons that were organizing it either'.

Interviewee LiUSAM08

Among the CCs, *documenting academic impact cases*, was indeed the general understanding of the purpose of the appointment. The CCs therefore went about exploring the role in different ways, as for example:

'And so what we started out was apart from informing a little bit at the department. And we started out mainly by trying to find these impact cases and to come up with a pool of impact cases for the university that were representative for what we were doing. So we spent most of our time doing that actually during the first period maybe, I don't know, one and a half years or so.' Interviewee LiUSAM01

Initiating the CCs role was probably a good way to create awareness of research impact across the universities. In some departments, where collaboration was already more pronounced, the CCs were more easily able to document impact cases. In those departments of more *theoretical* focus, there was more challenge in assessing impact- some of the academics here perceived impact to be most relevant with industry collaborations and would not consider other forms of collaborations relevant for the exercise. Some academics were also careful not to say too much about their collaborators. Further, even though some of the CCs had entered the role with some ideas to develop the role for the benefit of the University, the universities' management seemingly did not take advantage of these views.

Subsequently, it appeared that the role was only initiated in fulfilment of a funding requirement such that, after collection of the cases, the fate of the group of CCs was uncertain. This is exemplified as follows;

'It felt like this is another report that they should use so they were asking for this kind of impacts projects -projects with impact. So okay let's provide some information to them and then it's done. I mean we provide different kinds of reports to the financier over and over again. And I know it was some kind of information needed by the university and it's done' Interviewee LiUSAM09

Indeed, while LiU is a university of a long tradition of collaboration, universities face some inherent challenges in initiating, managing and co-ordinating collaboration and knowledge exchange-activities. Those identified challenges linked to the case of the CCs would especially be discussed in the next section.

8.3.1.4 Effect of Institutional Context: Co-ordinating Collaboration

The case of collaboration management in Linköping offered some insight into how decision-making within universities could enhance or deter knowledge exchange. Though setting up a group of staff in the name of collaboration co-ordinators held much potential, the group's potential was probably not maximised. The staff, because they belonged to the same role, formed a network of individuals across the university who were interested in engagement and lessons from across the university were shared across the board and carried back to the respective departments. This network was in many respects crucial for internal development of the knowledge-exchange capacity of the university. Despite a good initiative, some challenges were evident

In the first instance, it emphasizes the top-down decision-making tendency of university management as emphasized in a top management decision of how to roll-out and facilitate collection of impact cases, and an unclear role for the selected co-ordinators. As explained, *'[the role] has changed a lot.....when we started it was not clear from the start what we were going to do. So we had to develop the role while working on different things'*. Interview LiUSAM01

Top management decision-making on issues of engagement is not necessarily wrong. However at a point, it is beneficial that the views of individuals involved in these processes are solicited. According to the senior management staff who spear-headed the exercise, there was indeed uncertainty at the beginning of the exercise *'We didn't know that from the start'* LiUSAM05, however this might have been good for developing the role, *'[....] looking back, I think it was kind of wise anyway not saying this is exactly what you should do'* LiUSAM04. Accordingly, this apparent lack of direction for the CCs might have offered much flexibility in the given role. Rather than a disadvantage, the flexibility could be viewed as a good opportunity to also solicit the views of individual CCs on how the role could develop into something that could facilitate academic engagement, but this was not the case.

Consequently, some academics seemed disappointed in the fact that their *'expertise could not be utilised'* to optimise the role. For example, one of the CCs complained that, the management appeared more interested in collecting exemplary cases of collaboration rather than actually promoting collaboration

'I consider myself to be good at communicating in written form to various target groups. So I think maybe I got the impression that it could be more about that, about actually writing about what was going on, but it turned out to be not so much of that. We were mainly collecting texts....the reason I had that impression is that since I'm not actually doing these kind of collaborative projects, the reason for selecting me [was] my competence'. Interviewee LiUSAM08

The CCs faced some further challenges in coming up with cases from their departments, especially in those fields where research was more theoretical than applied. When they succeeded in bringing out cases, these were not selected as exemplary cases, which according to them was because they did not involve industry. This reinforced a general view that only those academic scientists who collaborate with industry can be classified as 'engaged' - unfortunately, this was seen as being supported and reflected in the cases selected by the university.

'So that was our main focus in the beginning, and of course I should say the role is of course very different at different departments. Some departments have been collaborating with industry forever, so this is business as usual for them, right? For us it's not so. I mean we have some parts which have been collaborating a lot, but that's a small part. So we don't naturally have contacts with industry so my role was not so much sort of mediating collaborations and so on, but I had more, role of informing and also from both directions right to taking the viewpoints of the staff back to the central meeting and the other way around and doing these impact cases' Interviewee LiUSAM01.

At the end of the interview period, the collaboration staff were even more uncertain what their role would be, given some re-organizations in the university regarding the structure of collaborations. *'And now it is sort of changing again because the structure at the university is changing so now I don't know really what's going on. Because they have changed the whole organization for collaborations and all these things at university'* Interviewee LiUSAM01. However, some CCs obviously had some ideas they were (still are) willing to contribute as interventions towards what their roles could be in the light of the changes.

As a contextual example captured at a particular time, this example especially highlights how universities' management could better involve lower management staff and other individuals within universities in decision-making processes as suggested in Figure 19 below.

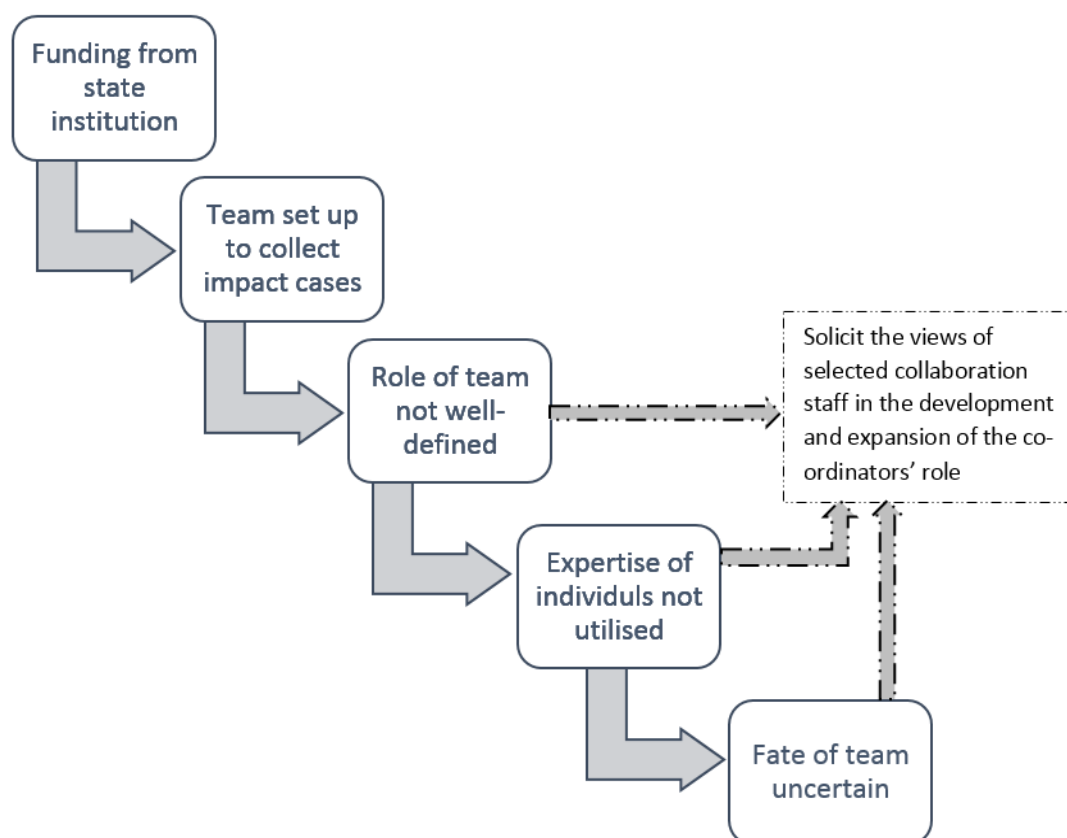


Figure 19: Possible intervention points for staff involvement in universities' decision making process (dotted arrows and text box refer to authors' suggestions)

8.3.2 On overcoming the challenges to regional engagement⁶⁵

The challenges faced by the University of Lincoln, in its quest to engage with its local community can be said to be both internally and externally generated.

A 'cultural gap' exists between the university and its industry collaborators especially bordering on issues of inadequate marketing observed a through lack of information on 'engagement' opportunities on the university's website, and 'relatively' slow response time. Industry partners who are used to a quicker response time than

⁶⁵ Data from this section is included in a RUNIN project book chapter with input from Maria Salomaa and David Charles (available at <https://ris.utwente.nl/ws/portalfiles/portal/22113132>)

experienced from their university partners find this to be a challenge with engagement. This challenge as exemplified below, calls for better understanding between collaborating partners and a sense of urgency from the side of the university when industry is concerned.

‘[...]You get a referral come in, or a question that could have led in a lot more, but we did not respond quick enough, it went to the wrong people, somebody didn’t understand it...I think the understanding that has to take place between industry and academia takes a lot of time and experience to navigate your way through it. If you look at a relationship like Siemens and the school of engineering that’s a very good example where it’s worked well because there is that level of understanding between academia and commercial aspirations’
(Interviewee UoLACA10).

Some internal barriers existed between academic staff focused primarily on teaching and research and staff employed to engage with business. The need to support university aims around teaching excellence and improved research performance in some cases leave limited time available for wider business engagement.

Managing issues of intellectual property posed a challenge where the *‘University academic is interested in publishing a finding, whereas his Industry partners are more interested in patenting it’* (Interviewee UoLACA07). The issue here lies in finding a good balance between the industry’s ‘money-making’ ambitions and the University’s ‘knowledge dissemination ambition’, which may be challenging to always achieve in practice. This is also symptomatic of tensions between local engagement and the research excellence objectives in which publication is a central theme.

For University staff actively engaged in community outreach within the food sector of the county, having enough staff who could engage in training efforts to the locals remained an issue suggestive of the need to invest in more ‘outreach staff’ and to further develop internal mechanisms to link researchers and businesses:

‘..... I am expected to know the entire breadth of qualifications and curriculum because you have to do that, because you can’t go to a company

and say, well I'll get somebody to get back to you...' (Interviewee UoLACA10).

Government interventions and policies, such as the 'apprenticeship levy'⁶⁶ which require effective communication and informing of the local businesses on the changes, and 'Brexit' for instance were found to be significant challenges with regional engagement efforts by the university. This is seen for example in the sense that

'when Brexit was announced, some of our clients lost 20% of their workforce over-night and you know the shock waves that happened [...] those sorts of things impact on us hugely because we have to be proactive in trying to find solutions with them [...] our challenges are externally-driven, political challenges' (Interviewee UoLACA10).

A local infrastructural deficit, relating to the road network to access very rural parts is a challenge with broadening engagement efforts. This, as expressed by an enterprise partner of the University working in the food sector made it challenging to *'share advancements in the food sector in the county'* (Interviewee UoLIND02).

The rural, geographically diverse environment of the county also makes it more difficult to reach businesses outside of Lincoln, and many of the businesses are not aware of their possibilities. *'--getting to those business that are hidden away, which are very busy with production and actually haven't got chance to lift up their head and see what support is out there: how do we reach those and make them aware of what's available and that's our biggest challenge'* (Interviewee UoLACA10).

Though Greater Lincolnshire's economy is relatively stable, its large share of land-based economic structure does not embrace innovation as it is more challenging to

⁶⁶ The UK government is committed to boosting productivity by investing in human capital, for example through the Apprenticeship Levy, introduced in 2017. It is a levy on UK employers to fund new apprenticeships, including at gradual level: the levy will be charged at a rate of 0.5% of an employer's pay bill and each employer will receive an allowance of £15,000 to offset against their levy payment. <https://www.gov.uk/government/publications/apprenticeship-levy/apprenticeship-levy> (accessed 14.08.17)

release resources for investment. The area has many family businesses, which typically are looking for lower risk and long-term investments '*[...] there is a lot of family businesses in Greater Lincolnshire [...] that lends itself to the degree of stability, because those family-based businesses look for long term investments, they have an eye in the future giving the business to their children, so they tend to be a little more risk-averse and there's this link between risk and innovation, it is an interesting one.*' (Interviewee UoLACA10).

A low educational status of people in the county was found to be affecting aspirations of people in the county. This issue was found to be generational and requiring careful management. The following typifies the challenge:

'[...] we have low skills aspirations for those who do stay in the county [...] we have a university academy and if you look at the 11 year olds that are coming into our academy [...] we hear stories where they have never picked up a book before because their families don't have any books at home, very low aspirations [...] you have 3 generations now of families who were land workers, factory workers,...and you now want first generation people who might be dreaming of going to university one-day' (Interviewee UoLACA10).

Interviewees described that there is a large innovation potential in Lincolnshire, but also a lack of ambition hinders economic growth '*[...] the challenge of the Greater Lincolnshire is the ambition [...] and I think we have the key role in driving ambition in Greater Lincolnshire as a whole and there are many (businesses) that are very innovative but don't recognize their potential.*' (Interviewee UoLACA10).

Generally, a problem with graduate retention in the county was re-echoed in interviews. This was found to be the case for various reasons including lack of jobs and the graduate's dream to live in the big city. For example, '*[...] well there are no jobs, some who could actually get jobs just have the big cities like London on their minds*' (Interviewee UoLGRAD01).

All these constraints were observed to be interrelated and somewhat overlapping, especially the graduate retention and cultural gap between university and businesses, which were identified to be both internal and external barriers hindering the

university's regional engagement and contribution to economic development (see Figure 20)

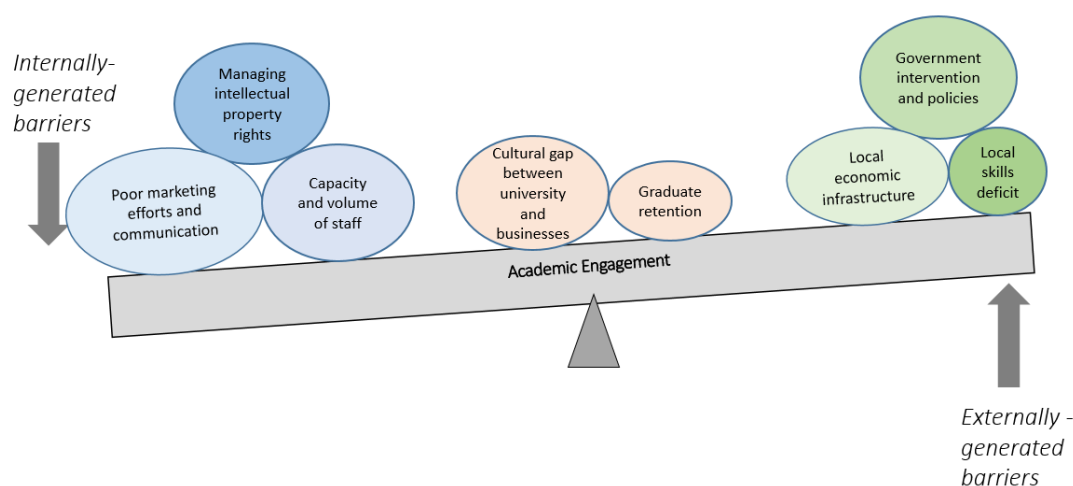


Figure 20: Internally- and externally-generated constraints that off-balance academic engagement

8.3.2.1 Addressing the issue of graduate retention - networks as a mechanism?⁶⁷

The issue of graduate retention as a challenge to regional innovation that shows up in the literature also emerges here from the collected data, as highlighted in the preceding section. As the highest educated workforce, the non-retention of PhD graduates in particular implies that a region loses very skilled human capital. In the following text, I highlight the role networks could play in the possible retention of PhDs in the regions in order to promote regional innovation.

The data collected illustrates that a myriad of factors related to the migration of PhD graduates from their host regions. The search for job opportunities, particularly for industry jobs emerged as an important reason for the non-retention of PhD graduates locally. This search resulted in the graduates leaving the region (or country) where they obtained their doctorates. Also, a distinction was observed in mobility, with the Swedish graduates more likely to stay in the region, while most graduates in the UK moved to obtain employment. Although these findings are in line with the knowledge

⁶⁷ Data from this section is included in a journal article published in *Studies in Higher Education* with input from Eloïse Germain-Alarmatine, Saeed Moghadam Saman and Gerwin Evers. (available at <https://www.tandfonline.com/doi/full/10.1080/03075079.2020.1754783>)

that labour mobility in the UK is higher than in Sweden, the differences could also be explained by the fact that the UK PhD graduates had already moved before - which is understood to increase the likelihood of moving again. The UK graduates themselves mainly ascribed their reason for moving to a lack of employment opportunities in the region of study. Here, a regional career path was not visible, and interviewees were more inclined to fall back on networks (*being industry or academia*) built prior, during or after their PhD. This was highlighted by UoLPHD04,

'To be honest, that time I did not get any opportunity in my field and there was no vacancy actually. But, if I got any opportunity during that time because I was living there for four years we had some kind of social relationship with people and also we know lots of people there. It would have been good for us to stay there...I did my master from P. before, so I already knew the place and that's why I came to [the same place] after my Ph.D.'

An explanation for the absence of relevant local network connections could be that the development of relevant professional network is a long-term process, and hard to develop when starting from scratch as a newcomer to the region. The Sweden sample was characterized by nearly equal proportions of persons who left or stayed in their respective regions. With a very high exposure to industry during the PhD, the tendency was to access these industry contacts for their transition, as in the case of LiUPHD09:

'[My first job in industry] was very tightly connected to my PhD project. The company I work for now, they were the main sponsor of that project. But I was not an industrial PhD, so I was employed completely by the university. [...] basically, they asked me if I wanted to work there [after my PhD].'

To that extent, a regional career path is visible. Additionally, the Swedish informants were found to likely transition into industry after some time of working as a post-doc in academia.

All informants ascribed some relevance of their PhD education to the industry they were working in. This implies that the various disciplines of their research were of significance to the firms they were employed in. However, their jobs did not necessarily always match their qualifications. A section of them were carrying out jobs that were within their research fields for which a PhD degree was a requirement. A

second group, though working in similar fields to the PhD studies, explained that those jobs could equally have been executed by persons with a master's degree in the same field. Notably, a PhD was not always a necessary requirement for a job in industry. Another set were engaged in related research industries where they applied similar theories, methodologies and tools as used during their PhD, however to very different concepts and contexts. One more set attributed the relevance of having a PhD to the skills they acquired and not necessarily the subject they studied. This implied that even in unrelated fields, some generic skills acquired during the PhD proved useful. This was emphasized for example in the case of LiUPHD09:

‘...what I am working on right now is very different from the application I was working on at [the University] but since, I did mathematics, applied mathematics, basically, I'm using those skills that I learned during my Ph.D. When I do the research and present new algorithms and so on. So the application is different, but the background and the basics are the same.’

The industry destination was observed to contrast with doctorands' *a priori* career goal of remaining in academia. Evidently, the career choices of PhD graduates changed during the course of their apprenticeship as PhD students. Generally, this redirection of career trajectory was attributed to factors such as *a lack of career* prospects in academia, *instability/insecurities* involved in working on contract basis, and *family situation*. It was also observed that interviewees moved to industry directly after graduation, with many of them acquiring the position before their graduation. Other PhDs stayed in junior positions in academia before making the move to industry. Some of our interviewees even turned down an academic job offer to pursue one in industry – these interviewees had *lost interest* in an academic career after the first-hand experience during their PhD.

Most of the PhDs in Sweden were familiar with their respective regions before entering their PhD position, while the majority of the interviewees from the UK migrated for study purposes. Evidently, the UK informants were more open in their search for admission into PhD programmes. Considering the motivations to study in the various institutions, two main strains of interviewees are apparent: first, those interested in studying in a particular university and second, those who were more

interested in a field of research rather than the university which offered it, as emphasized by UoLPhD02 – *‘I would be lying to say it was the place.I liked the project, it sounded cool and I was accepted’*. Specifically, for those interviewees who knew from the start that they would opt for an industry career post PhD, the location of the university appeared to be important – if the industries of interest were accessible.

The role of networks in the ‘academia-to-Industry’ transition

In the process of moving to industry, networks seemed to play an important role. The involvement or not of network ties in the transition to industry could be attributed to the disposition of the doctorate holder at the time of job search. With the end of their PhD studies imminent, the student would begin to explore various life paths after obtaining a doctorate. If they wanted a job in academia, they would first explore their options there; if not, they would look elsewhere. It was apparent from our data that the search for a job position was mostly directed by their area of study. If positions were available, *‘interesting’* and provided a *‘good overlap’* to their interests they would take advantage of them. An interplay between the *personal network* of informants and a more *extended network* of their associates was apparent.

Personal networks

The personal network refers to links that were individually known to informants for transitioning into industry without necessarily tapping into the network of another person in their wider network. This includes networks initiated during the PhD as well as network ties that were established during prior work experience. In some instances, relying on personal networks was evident as in the following instance;

‘In that sense I had a collaboration with them but I applied [for the job]. I didn't really apply for a job. I guess, found a person, who I started talking to and then, they ended up offering me a job.’ (LiUPhD07)

This was observed both in the case of collaborative (*research carried out with industry partners*) and non-collaborative doctoral studies. These personal network connections were seen to consist of either industry or academic contacts. Apart from

existing connections (academia or industry), the graduates were also observed to have initiated new connections that led to employment in industry. These links extended beyond the period of PhD education to include links such as colleagues from previous education: as Interviewee UoLPhD05 put it:

‘I had a colleague from London South Bank, where I did my masters, who was the technical manager in that area. When I was in the UK looking for a job opportunity, I contacted my colleagues, and she gave me the opportunity.’

Extended networks

Additionally, I isolate an external network of wider university and industry connections who play unique roles in the graduates’ industry employability. For instance, this was mostly evident when a personal connection of the graduate referred them to another person to increase their job prospects. Some PhD graduates were however reluctant in using the network of fellow academics and preferred to rely on their own network in their job search.

As evident from the data, academic supervisors or principal investigators rarely played a direct or active role in the transition to industry. The participation of PhD supervisors was peripheral and often relegated to the role of a reference person in the recruitment process. Further, none of the informants reported any specific help from their universities in transitioning into an industry job. Belonging to a research group which had some collaborations with industry however provided an exposure to some research-relevant industries.

On the wider university scale, various platforms also provided an opportunity to meet industry employers. In the case of one interviewee, it was an event organised by a student association which was decisive in starting the transition to industry: *‘And so it was very informal. I happened to meet an HR person at a dinner about a year earlier’* (Interviewee LiUPhD07).

Outcome of network-aided transitions

In some of the instances where networks were the mechanism through which the transition to industry has occurred, positions were ‘*created*’ for the doctorate holders. In this way networks did not just facilitate the transition to industry, but also influenced the outcome of the process. Additionally, most of the PhDs maintained their academic network when transitioning to industry. In some cases this was more of a social nature, while in other cases there was also academic content in the form of part-time academic positions and/or co-publication relationships. This academic involvement might for some of the PhDs be motivated by increasing the chances of moving back to academia in a later stage of their career.

Overall, a heterogeneity in both the kind of network ties and their importance for the transition of PhD graduates to industry was observed. Personal networks were more prominent in the university-industry transition than were extended networks. Individuals took advantage of their existing networks or forged new ties in their transition to industry. Depending on the particular interests of the PhD graduate, both explorative and exploitative tendencies were employed to aid their job search. The various channels that emerged from our analysis are summarized in Table 12.

Table 12: Summary of network-aided transitions of doctorate holders from academia into industry.

	Personal networks	Extended networks
New ties	Individual’s search disposition and preferences: <ul style="list-style-type: none">- Exploration- Exploitation	PI’s networks Research group links Wider university links Industry links
Existing ties	Formed prior, during or after PhD education	

Country specificities of network-aided transitions

Based on the data, it is possible to distinguish country-specific dominant patterns, in terms of characteristics and tendencies of university-to-industry career transition, as follows:

In Sweden, having a post-doctoral experience is quite common; and PhDs' academic networks seemed to drive the *academic* career vertically. However, a prolonged stay in academia weakened the ties to the pre-PhD industry networks of PhD candidates. There is overall a relatively high exposure to industry during the PhD, and individuals' post-PhD industry networks are mostly different from their pre-PhD industry networks. Finally, regional career paths are quite noticeable.

In the UK, a post-doctoral experience is seen more as an option than as a preference. Individuals' academic and industrial networks change markedly before, during and after the PhD due to a quite high geographical mobility. When it happens, a high exposure to industry during PhD has a significant impact on transferable skills, and the existence of a firm-centered OILM during PhD education often functions as a network mechanism for post-PhD careers.

Figure 21 schematically summarizes the above-mentioned country-specific trends in a model based on Lam's (2007) OILM framework (see Figure 3 *in literature*).

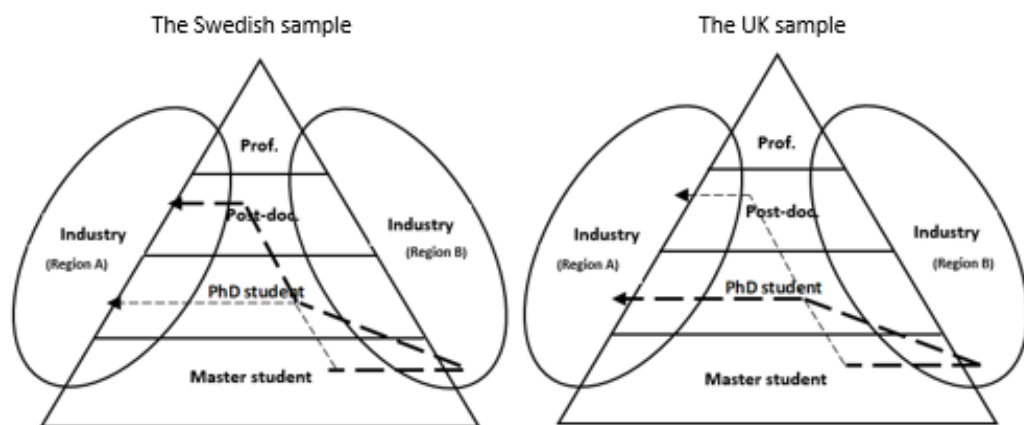


Figure 21: Case-specific dominant patterns of transition of doctorate holders from academia into industry

8.4 DISCUSSIONS

This chapter sheds light on how universities could facilitate academic engagement through the management of knowledge exchange activities. By employing a qualitative approach and drawing on interviews from individuals within and outside the case universities, I show that universities experience some struggles in managing

and facilitating internal knowledge exchange processes. After years of heightened focus and interest in universities' third mission activities, the data shows particularly that universities continue to struggle with the specification of engagement and mechanisms for co-ordinating engagement. Further, a lack of (adequate) institutional support for academics' external engagement activities, and the apparent absence of dialogue between university management and their engaged academic scientists suggests a chasm that needs addressing.

From our data, it is first evident that universities engage in top-down decision making which does not necessarily always reflect the aspirations of individual academic scientists. These top-down decisions are further not well communicated and seemingly not debated upon to achieve the best model. I argue that though making decisions at the top management level is necessary and cannot be eliminated, there is the need for decision making on third mission activities to be as inclusive of the various stakeholders as possible. The structuring of universities into faculties and departments does not always match those of external stakeholder organisations. So while these structures promote smooth running of universities, it imposes a challenge for prospective and active partners who either struggle to contact the right persons or dawdle with too many contacts from the same university. One possibility to overcome this is for university-wide organization of university interaction cutting across faculties, departments, research groups and individual researchers. Additionally, there is a need for establishing different supporting mechanisms regarding engagement in consultation with academics.

As emphasized by Gunasekara (2006), the various dilemmas faced by universities and academics embarking on (regional) engagement are not unknown and indeed common to any change programme. However, weighing the benefits of knowledge exchange to the regional economy (Ferreira et al., 2017), there is great incentive on addressing these dilemmas. From this study, I particularly draw attention to the need for a concerted effort between institutional managers of engagement and individual academics on delivering on their third mission mandate. Emphasis is especially placed on dialogue that would promote the opportunity for individual academics to express the types of assistance they require in a more inclusive, and trust-building decision-making process. Further, it is suggested that an increased focus on transdisciplinary

spaces, accessible to both internal and external stakeholders of the university, is key to bridging the perceived chasm between universities' management and individual academic scientists.

This study indicates that there is interest from both Higher Education Institutions, through their 'academic management', and the individual academics who work in them to engage with industry partners and to share knowledge. There is also an understanding from both the institutional point of view and the individual point of view that these interactions are an important part of the contemporary vision of the role of Higher Education and both recognise these engagements as an important part of the processes – that, either intentionally or unintentionally, help create the environment that supports knowledge exchange.

The research also illustrates the way initiatives at the institutional level can often find themselves competing, or at least not aligning easily, with the micro level activities of individual academics. Perhaps more interestingly, both groups of actors have expressed awareness of this misalignment. Despite this, both co-exist inside the operating environment and through their interactions create multiple possibilities for knowledge exchange. This thesis therefore makes some tentative suggestions about how individual academics and academic institutions (academic management) could improve their practice, and indeed in both universities studied in this chapter, there is evidence of several new initiatives aimed at doing this.

Universities are constantly pushed to reassess their role and relationship with the identified main stakeholders and communities. Understanding and managing the diverse partnerships as well as avoiding undesirable consequences of adopting new collaboration models requires considerable strategic planning (Jongbloed et al., 2008). A key role of universities in facilitating economic growth is defined by their cutting edge research capability in their respective fields, innovation expertise and wide collaboration with businesses (BIS, 2013). They are in a unique position due to their capability to bring together external knowledge and research links with local students, actors and ventures, enabling global knowledge exchange in local processes, and thus increasing the innovation capacity of their host cities compared to relying solely on internal knowledge processes (Charles, 2016).

Retention of skilled labour in the regions

Universities tend to be considered as fairly “fixed” institutes in the regional development literature, with a weak capability to adapt to the changes of the external world. Despite being a hub of highly skilled people, their organisational capacity for strategic planning is seen as rather limited (Gertner et al., 2011). At the same time the growing diversity of partnerships makes universities more integrated with society, also demanding more from management so that the HEIs do not become overburdened by the claims of the stakeholders (Jongbloed et al., 2008). This poses even further challenges especially to rural and peripheral campuses, which are typically expected to respond to the needs of the local economy. These demands may be more diverse and complex than presumed, varying from more traditional sectors such as agriculture, tourism and services to high-technology manufacturing (Charles, 2016).

Whilst Government policies and interventions play a major role in developing business-university collaboration, in the end it comes down to the collaboration and actions between individual universities and businesses to determine whether the partnership is successful (BIS, 2013). It is also worth noting, that a deep employer collaboration may, especially in curriculum design, may steer research orientation. This employer participation is evidenced in the example of the industry digitalisation crusade at the University of Lincoln. The widespread anticipation of the future development of national policies in the post-Brexit era for example, may also change present approaches to innovation support services and university-collaboration patterns, for which more hands-on strategising is expected - especially in the area of communicating with, and educating the local businesses on what to expect, and how to apply themselves to expected changes. Indeed, it appears to be a big challenge to balance research excellence and relevance, and to find a profitable combination of the local and the global (Arbo and Benneworth, 2007). This is especially the case when the challenges in doing so are not all within the university’s reach to solve (e.g. externally-generated challenges created through new government policies and initiatives) and the specific elements of the operational environment coupled with the inability to retain skilled labour in rural and peripheral regions.

From the data, it is evident that networks play a significant role in whether or not skilled persons remain in or leave their host regions. Specifically, different types of

networks come to play in the industry employability of PhD graduates. Firstly, I recognize that the personal network connections of the PhD graduates played an important role, both in the case of collaborative and non-collaborative PhDs. By personal network, I refer to the graduates' own links that directly led to employment in industry. These personal network connections were observed to consist of either industry or academic contacts with whom the graduate had existing connections prior to job search, and extended beyond the period of PhD education (e.g. where previous colleagues from masters programmes played a role in landing an employment).

Apart from their pre-existing connections, the graduates were also observed to initiate new connections that led to employment in industry. Contrary to Mangematin's (2000) observation that PhDs generally do not possess the requisite networks or experience to explore non-academic options, it can be asserted that certain PhD graduates not only possess the requisite networks, but also initiate the needed connections and may actually prefer relying on their personal networks. Secondly, it was possible to isolate an external network of wider university and industry connections who could also play unique roles in industry employability of the graduates. In either case, the network tie could be a new or an existing connection in the graduate's network.

According to the literature (Lam, 2007) three main types of academics exist at the U-I interface. These so-called 'linked academics' bear the identities of professors, post-docs and PhD students. While professors are conceptualised as the focal points of these U-I linkages, post-docs and doctoral students are considered the 'growing' and 'hybrid' categories of linked scientists. Even though professors play a central role in U-I linkages, the evidence collected suggests that their influence in the employability of the PhD graduates in industry is peripheral. Accordingly, it has been reported that professors - or principal investigators (PIs) - often lack the needed networks in industry that could contribute to industry employment of their students. Indeed, they usually lack knowledge of career opportunities that may exist in industry (Golde, 2005). As evidenced from the data collected, their role in many cases was only relegated to the provision of references for their students' job applications.

It has been suggested that the increasing blurring of industry – university boundaries through collaborations (Thune, 2009, Roberts, 2018, Benito and Romera, 2013) offers

a higher probability of job opportunities of PhDs in industry. Particularly, it is projected that university-industry collaborations would serve as a platform for selection, screening and subsequent recruitment of PhD graduates into firms (Lam, 2007). In that case, it would be expected that PhD graduates who were involved in collaborative projects (for their PhD studies) would record a higher ease to industry employment with PI-facilitated employment. This is however not explicitly observed from our evidence. For example, both groups of PhD graduates (from non-collaborative and collaborative) did not experience PI-facilitated employment.

According to Hancock and Walsh (2016), doing a PhD may mean forgoing other training opportunities relevant for non-academic jobs. In line with their assertion, it was observed that in many cases the PhD qualifications are indeed more field-specific than industry jobs would require. Industry opportunities tend to assume a not-too-specific nature and do not necessarily call for very specialized scientists. It is projected that this imposes a mismatch that the extended U-I networks cannot always address and solve. Contrary to Hancock and Walsh's observation, though, it is also observed that the PhD education actually equips PhD graduates with other industry-relevant skills. When they get employed in industry, the edge they present to their employers is not necessarily the merits of a field-specific PhD qualification but a wider set of qualifications and skills, such as those related to management roles. In cases where hiring is based on the field-specific expertise of the graduates, the creation of new roles is observed. It can also be said that PhD degrees are often not a 'necessity' for industry work, but are sometimes useful for work progression once hired, or might lead to the creation of new roles and positions in companies.

The dynamic nature of job type orientation of doctoral candidates needs to be considered too. It has been reported that individuals who pursue a PhD have a taste for science and those who lose interest for research during the PhDs are more likely to pursue industry jobs (Hayter and Parker, 2019 , Sauermann and Roach, 2012) While this change in career preference is evident from our study, it can be perceived that that the destination of PhD graduates (i.e. industry or academia) is also subject to an opportunity 'exploration' and 'exploitation' mode of PhD holders. With the increasingly low likelihood of acquiring academic jobs, non-academic destinations do not simply become a preferred option but a necessary option for the PhD holder. In

such cases the absence of existing networks to exploit - as the candidate's current networks might be mainly of academic nature - leads to exploration of new opportunities by initiating the establishment of networks with industry.

Similarly, it can be concluded that the likelihood of skilled labour to remain in a region is dependent on the availability of the opportunities they seek. In the case of the PhD graduates interviewed in this thesis, an absence of such opportunities caused them to migrate outside their host regions. This point on the presence of career opportunities for graduates' retention somewhat re-echoes the emphasis on regional advantages while exploring the motivations of academics to engage locally in Chapter 6. Overall, the regional advantages of a region, in the form of other skilled persons and relevant industries for instance, provide the appropriate conditions to both attract and retain other skilled persons- in this specific chapter career opportunities can be considered the sought after regional advantage.

Amidst the many challenges faced, the coming years would reveal how the universities will continue to remain relevant combining innovation support of academics' engagement with universities' core functions. Particularly it would be interesting to know how different regions manage to retain more graduates who are essential for knowledge transfer from the university into the local businesses. It will also remain to be seen if universities are able to rise above the various factors that affect their facilitation and co-ordination of engagement to be able to maintain their rather dominant role and cater for changing regional innovation support needs or if other major innovation support providers emerge with an increasingly highly-skilled population.

The findings presented in this chapter provide insight into how top down decision-making could affect processes on the bottom and particularly thwarting the same agenda that was intended to be achieved. This finding is relevant for policy-making which do not consider a wide range of consultation before being implemented. In the first place, even when policies are passed, this study points to the need for continued and effective communication between relevant stakeholders throughout the implementation process. It is also relevant for the notice of university management the need to balance top-down and bottom-up process in decision-making.

The findings related to graduate retention have several implications: Universities need to better support the transition of their graduates into the job market. As seen in this study, though the university-industry interface appears to present a potent opportunity to aid the graduate transition, the PhD students relied on their personal networks, which often led to their migration outside their host regions. As a potential area where the impact of academic networks realised through UiCs could be observed, it behoves on university policy makers, university managers and even principal investigators (PIs) to put the right systems in place to support graduates' personal efforts in the interest of regional innovation.

8.5 SUMMARY

Universities are not always successful in offering the support required for academics to network. And, facilitating and coordinating academics' engagement by universities is often laden with challenges. These challenges require a concerted effort from all relevant stakeholders to address. As evidenced in the case of graduate retention, universities' networks alone are not aid the transition of graduates into the job market. A result of that lack is an inability to address the issue of graduate migration, especially if other provisions are not locally available, and thus buttressing the need for all-hands-on-deck. From the institutional side, it appears that a good balance between top-down and bottom-up approaches to decision-making is essential for enhancing engagement. Additionally, promoting transdisciplinary platforms that enable stakeholder engagement is key for academics' engagement.

CHAPTER 9 - CONCLUSION

In this thesis, I have investigated and presented findings on the microfoundations of academics' networks. Firstly, insights regarding how individual academics initiate their networks have been offered based on the entrepreneurial decision-making variants of causation and effectuation. Additionally, the motivations that drive regional (and extra-regional) collaborations have been explored. Further, by employing a novel methodology for extracting academics' network-tie data, various factors that lead to the evolution of networks, based on individuals' perceptions of importance, have been presented. Lastly, evidence on various modes through which context promotes and/or mitigates academic engagement has been relayed.

9.1 CONTRIBUTIONS TO THEORY

The main facets of this thesis are summed up in the Figure 22. Within the context of University-Industry collaborations, academics' motivation for engagement, as underpinned by networks, was explored from a regional perspective. Collaborations were found to be purposeful and driven by various factors that determine the success of collaborations. Concurrently, the entrepreneurial logic adopted for such an endeavour were explored to reveal how causal or effectual academics behave when building their networks. On the regional side, academics' networks were explored with respect to their relevance to their regional context and in turn, the likely spinning out of new avenues and impact on the region. On the institutional side, the thesis explored universities' support systems for engagement and knowledge exchange activities in general. Additionally, the thesis assessed the extra-regional influences on and by academics' networks.

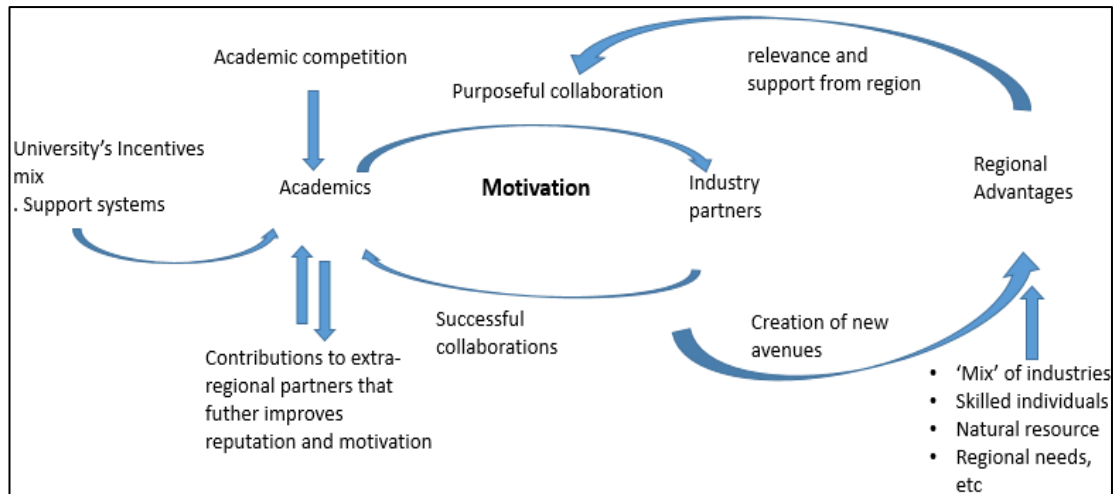


Figure 22: Summary of thesis contributions

Subsequently, in answering the main research question of *how [do] the individual contacts of academic scientists shape the nature and geography of their knowledge exchange networks*, the work contained in this thesis makes several contributions to existing knowledge.

Firstly, the methodology used presents some novelty in the study of network ties, especially pertaining to the types and how they evolve over time. The area of network evolution is not very developed (Powell et al., 2005) and the little work on it focuses on the organizational level, and employs more structural analysis (Perkmann and Walsh, 2007, Mora-Valentin et al., 2004). Rather than the network structure, the thesis looks more closely at the ties themselves based on the ego-network style of network analysis as described by Borgatti et al. (2013). By doing so it was possible to more closely isolate the different types of the individuals' contacts.

In order to answer the question of *how [do] academic scientists build their networks and what motivates local and/or International networking (RQ1)*, I analysed the decision-making process in network building to decipher whether academics were causal or effectual in building their networks. This analysis was grounded on work by Engel et al. (2017). With consistency with the extant literature, the findings presented showed that academic scientists swap between the two decision-making logics (see e.g. Schreier and Senn, 2018, Andersson, 2011). A closer analysis revealed the inherent patterns especially in relation to the type of contacts (industry or academia),

and the geography of the contacts. Having unearthed much heterogeneity in the network types, it was not surprising then that different decision-making logics appeared consistent with a particular type of network tie. Indeed, because academic networks exhibit different characteristics in terms of the nature of ties formed, there appeared a greater need to possess and exhibit the ability to swap between causal and effectual tendencies. This adaptability as evident from this thesis, enabled academic scientists to initiate and maintain their ties with various contacts. With reference to the question of *how the individual network contacts of academic scientists could shape the nature and geography of their knowledge-exchange networks*, it is inferred from the findings that the heterogeneous make-up of individual's network ties influences their network-initiation tendencies.

Further, I explored academics' motivations for network initiation. This thesis places value in the exploration of academics' motivations from a regional perspective and isolating motivations specific for local, and consequently extra-local engagement. The study shows that motivations of academics to engage in, and initiate their network ties are personal. In other words, more weight is placed on the intrinsic factors than extrinsic ones. (see Ramos-Vielba et al., 2016, Thune et al., 2016, D'Este and Patel, 2007) This was evident in the particular case of an unengaged academic, who despite having the same circumstances as his engaged colleague, decided not to build his industry network due to a personal disposition. Indeed, even though this thesis highlights the influence of the regional context on motivations to engage, personal factors remain key. The insight into personal tendencies for initiating relationships is also consistent with the ability of individuals to act as intermediaries across groups for varied reasons. Indeed, the importance of brokers or intermediates resides in the potential of individuals' actions to exact macro-level consequences through the permeability of group boundaries. (Stovel and Shaw, 2012, Burt, 2005, Granovetter, 1973)

Academic scientists form networks across university and industry entities to promote their research agenda whether locally or internationally depending on the returns available to them [academic scientists]. The data presented in this thesis suggests a relationship between geography of (potential) contacts and the motivation to engage. On a continuous assessment basis, the relevance of engagement to the academic is an

important determinant to initiating a particular collaboration, wherever it may lie. If the required advantages were found regionally, academics took advantage of this – otherwise they sought out extra-regional connections. On the other hand, if connections were found in academia, academics were observed to take advantage of this, and would similarly go to industry for other relevant purposes. In the light of *how the individual network contacts of academic scientists could shape the nature and geography of their knowledge-exchange networks*, it is evident from this thesis that location of contacts influences the type of value the academic perceives from a particular collaborator. This influence of spatial placement of collaborators also guides the likelihood to forge and nurture a particular type of network tie or not. The motivations for academics' engagement are therefore very contextual and require careful study to obtain a holistic understanding of them.

To answer the question on *how [do] academic networks evolve over time (RQ2)*, I focused on the changes in the individual academics' perceptions of network tie importance. From the study, it was apparent that academic networks are dynamic and evolve uniquely such that no two ties (even for the same focal person) are the same. This finding is consistent with work by McPherson et al. (2006). Academic scientists perceive important ties to be those that are active, contribute to their research agenda and are close in cognition. It was also observed that evolution of networks were career, initiation-, geography- and regional path- dependent. Further, the evolution of both rural and urban networks of academic scientists were influenced by their context. (Doreian and Stokman, 1997, Burt, 1992, Rowley et al., 2000) Indeed, understanding which factors drive the evolution of networks presents the possibility to nurture conditions that promote the success of these network ties. *Individual network contacts of academic scientists [could thus] shape the nature and geography of their knowledge-exchange networks* depending on how their relationships evolve. That is to say, the success or not of particular ties defines the geography of the academics' network. Further, the quality of relationships also depends on how relevant those relationships are perceived by the actors involved.

Finally, the thesis answers the question of *how institutional level factors and the regional context affect academics' networks (RQ3)*. Academic scientists engage

locally because they perceive the advantages that exist in their regions as relevant for pursuing their research agenda. However, engaging locally is laden with challenges which require a concerted effort from all relevant regional stakeholders to address. On one hand, the universities are perceived by some academic scientists as offering non-resolute support for engagement. Universities are not always successful in offering the support required for academics to network which is evident in top-down approaches and lack of consensus building and communication and differences in organisational outlook compared to industry. I emphasize in this thesis that, whichever approach is adopted by a universities' management (i.e. top-down or bottom-up), a key consideration is to facilitate effective communication and involvement across all relevant stakeholders. On the regional level, various challenges are presented which are arguably more prevalent for rural and peripheral regions. These contextual challenges lend well with what Charles (2016) describes in relation to economies of scale and scope of rural universities embarking on a third mission. By exploring the particular case of PhD graduates' transition into non-academic jobs, I emphasize that academic networks are not sufficient on their own to address the issue of regional graduate retention. Indeed, overcoming the various challenges encountered while collaborating requires a concerted effort from all regional stakeholders. With reference to the question of *how the individual network contacts of academic scientists could shape the nature and geography of their knowledge-exchange networks*, I show the importance of context in promoting and nurturing network ties of academics which are otherwise challenged by various institutional and regional factors.

9.2 LIMITATIONS AND FURTHER RESEARCH

This thesis should be considered in the light of various limitations.

In the first instance as is typical for case study research, I focused on a small sample of respondents in order to explore each of the gaps identified in the literature. This implies that though the findings are relevant for understanding many other cases of similar context, they are not directly generalizable to a larger population. The advantage of the methodology however is that, a large quantity of data resulted from a small number of people through the interviews which enables a deeper understanding of each case. So even though many points of data are not considered, each one presents very deep insights for answering the research questions. Also, whilst the purpose of

case study research is not to generalize, the insights obtained in this thesis may yet be relevant for studying and understanding motivations for academic engagement under different contexts.

For this thesis, the multiple cases employed were focused on answering the main research from different angles. This implies that even though the same research questionnaire was used for the interviews of similar categories of persons, the interviews were semi-structured and focused on a particular issue as deemed relevant to the context at the time. This implies that some of the cases are employed either uniquely (in the case of chapters 5 & 6) or jointly (in the case of chapters 7 & 8) to contribute to a deeper and broader understanding of a particular aspect of the thesis. For instance, though it might have been beneficial to explore the regional perspective of academics' motivations in all the regions included in the thesis, this was a main focus only in the Stavanger case. Arguably, establishing a link between motivations of individual academics to engage and the regional context, is an under-researched gap for which a deeper exploration was necessary. Subsequently, whereas all the interviews could have been focused on answering the question of how academic scientists initiate their networks, only a specific case was employed. Indeed, the other interviews which were focused specifically on evolution and context of networks would therefore make no qualitative contribution to the presented findings if added to the analysis on initiation of networks.

On one hand, the issue, of not employing all the cases of this thesis to answer each of the thesis sub-questions implies that it was not possible to arrive at some level of 'analytical generalizability' which could have been the case should all the 100 interviews from all 5 universities have been focused on answering the same specific question. Arguably however, specializing on a particular, and also related, theme for the cases presents an advantage given that it was possible to focus and dig deeper into a particular issue for each case when necessary. Trading the width of evidence collected for depth of data therefore seems to be a reasonable trade-off. Additionally, this approach helped to answer the research questions from different angles and thus presents a wider scope of contributions to existing knowledge – based on which further research could be conducted.

Interviewing was the main data collection approach utilized in this thesis. This presents the issue of a lack in the ability to verify the collected data since interviews are dependent on individuals' perceptions and are clouded by individuals' experiences and outlook on different situations. Additionally, gathering hindsight data (in the case of the evolution of networks – Chapter 7) presents another dimension, given that interviewees recollect events differently with each narration conditioned by other events that have previously taken place. Triangulating with other interviews and reporting mainly on insights that reached 'data saturation' with respect to the research questions of this work helped to avert the effects of this unreliability in the collected data.

Further, given that academics' engagement cuts across relationships with various stakeholders outside the university environment, this thesis is limited by its focus on UICs. As the data presented highlights, academic scientists also engage with Government Agencies and Service Companies among others –these were not explored. This somewhat narrowed focus implies that this thesis fails to benefit from insights from the different types of network relationships in which academic scientists are engaged. Further research could therefore consider a wider scope of these institutional variants. For example, considering individuals from other institutions who also engage with academic scientists may prove insightful for distinguishing between academics' network initiation from the perspective of these other types of institutional ties. These additional insights could then be compared to the findings for industry ties presented in this thesis. Relatedly, the study has mainly focused on STEM scientists and especially from Engineering. However, engagement is present in other disciplines even if they are not as pronounced or as easily definable as in the STEM disciplines. Replicating this study in various contexts would contribute some interesting insights to understanding the microfoundations of academics' networks.

The nature of this thesis has made it impractical to distinguish between new and existing ties in details because each network tie considered has been analysed as if new. It may have been interesting to also analyse the reasoning logics of academic scientists from the perspective of new and existing ties – to be able to understand the link between these decision making logics with respect to relationship length. Further systematic studies focused on the evolution of networks and the usage of these

decision-making tendencies may also be important for better understanding academics' networks.

Even though this thesis highlights the role intermediaries could play in addressing the challenges of academic engagement, it does not particularly show a detailed meso-level analysis to reveal any intermediaries that could aid knowledge exchange efforts. Particularly since the gap between university management and individual academics seems to be ever widening, studies that focus on intermediaries in the process of knowledge exchange may be useful. For example, it may be that middle management could help bridge the gap observed in facilitating and co-ordinating knowledge exchange activities, but this is not explored in this thesis. Linked to this, it might also be worthwhile for further work to explore the possibility of linking the findings on the tie-level to the wider network structure. Such an effort could be the basis for work focused on exploring similar themes in dense and sparse networks.

9.3 IMPLICATIONS

As far as policymaking is concerned, academics' networks across a wide scope are encouraged to contribute to competitiveness and innovativeness of countries and regions. Even though global competition has opened up the international market and thereby flattened the playing field of the innovation landscape, the connectedness of regional networks to the global arena is also important.

The finding that the success of particular network ties shape the geography of an individual's network presents an opportunity to promote academics' networks. This is important given the emphasis on being glocal where individuals are locally competent and globally relevant. By unearthing the factors that promote successful network relations, it is therefore possible to capitalise on them to design policies that promote interactions on the regional level for instance. Additionally, since this thesis highlights these factors based on broad sub-groupings such as industry, university, international or local ties, it contributes the possibility of promoting network success on a broader level, otherwise only a limited type of relationships are promoted. Indeed, a one-size-fits all approach would not be beneficial for capitalizing on the knowledge of the conditions that lead to successful relationships of academic scientists and their various

connections since these factors vary even for the same individual. So while policies should not be one-size fitting all, they also cannot be made for individuals – this calls for good balance in policy design.

Relatedly, while policies are geared towards regional competitiveness, local networks benefit from extra-regional networks and also need to be encouraged to make local attractiveness of global relevance. Regional policies usually focus on business formation separately from the regional networks that impact them or are impacted by them. However, networks evolve in line with regional comparative advantages, as has been emphasized in this thesis. It is therefore imperative that regional policies that might promote the co-evolution of regional networks and business formation are encouraged. Indeed, the relevance of regional context in promoting the research agenda of academics presents a direct link for delivering the competitive strength of academics' networks for the region's benefit.

From a policy perspective, Governments have encouraged UICs with the view that these interactions are critical for regional development (both dissemination of knowledge and identifying of new knowledge through which knowledge could be converted into commercial form). Where UICs are encouraged as important therefore, academics' adaptation in decision and ability to work with varied stakeholders is important. This suggests that, academics are themselves predisposed in reasoning to continually 'diminish' the perceived boundaries between academia and society (Sataøen, 2018) through being able to work with individuals from either sides. This is important for embedding regional relationships.

In the light of the above insights arising from this thesis, I present several recommendations that should be interesting for government/regional policy makers, university management and industry leaders. These are highlighted in the following:

Government/regional policy makers

1. To encourage a stronger link between global and local networks. This link would better strengthen regional competitiveness rather than solely focusing on the benefits of regional networks alone.

2. To initiate policies that promote a co-evolution of businesses and local networks, given that network relationships are linked to regional advantages.
3. To promote and encourage broad stakeholder involvement in participating in, and addressing the challenges of academic engagement.

Many governments are interested in promoting local competitiveness. While doing this, it is important to strengthen global links as well. Boundary spanning roles of individual academics and other local stakeholders need to be encouraged. Evidently, participation in external research collaborations such as those catered for under the EU's Horizon 2020 programme, which already require for cross-border participation and often industry involvement, support in such an endeavour. The above recommendations however draw closer attention to the need to locally embed such cross-border initiatives by ensuring that they are connected to local interests. Fortunately, even though they do not always play a principal role, regional stakeholders are partners to some of these international collaborations. Their involvement creates the opportunity to foster the link between local and international initiatives and should be paid more attention to. In this way, local competitiveness would not be fostered to the neglect of extra-local benefits. Indeed, as a benefit from cross-border collaborations, interregional networks serve as a means to showcase what regions do for the learning of other partners.

While the contributions of both entities (university and industry) are required for promoting regional competitiveness, it is commonly known that a cultural gap exists between industry and academia. Even though efforts exist in many places, I recommend even more opportunities which allow academics and industrialists to meet. The UK's Knowledge Transfer Partnerships (KTPs) are a good example of how to bridge the gap between industry and academia. In the universities where I collected data, I also came to know about some associations that promote such meetings. An example is the Norwegian Petroleum Society (*Norsk Petroleumsforening*) for people interested in Norway's oil and gas activities. While these groups foster interactions between academia and businesses and indeed other stakeholders, they are usually

focused on particular scientific fields and have strict/specific agendas. Putting in place schemes that support academic collaborations with local businesses across a wider scope is key for a wider involvement and the likely combination of seemingly unrelated knowledge types. On the regional level, because engagement is prevalent in those fields which are related to the core industries, creating such wide-scope platforms for academics and industrialists to meet would help to strengthen and promote academic engagement in those disciplines that are outside the core of regional industries.

Generally, the role individuals play in promoting regional engagement needs to be accorded more importance. In the interest of competitiveness, as many relevant individuals as possible need to be involved in realising the benefits of academic engagement. Particularly, joint participation is required for overcoming the inherent challenges of engagement. Governments and regional policy makers can enforce this broad involvement of stakeholders in the design and implementation of policies.

Industry leaders

1. To allow enough flexibility when collaborating with academic scientists. As emphasized in this thesis, less stringent objectives in projects are more likely to lead to new innovations.
 - i. flexibility is required in the design of collaborative projects
 - ii. flexibility should be allowed in the implementation phase of projects
2. To allow time and exercise patience in collaborating with academic scientists given the incidence of differing organisational cultures.

In essence, academic engagement requires openness, and collaborating partners need to be effectual in their decision-taking. Though it is recognised that some projects require strict adherence to provisions, it was particularly observed in this thesis that collaborations with industry partners were particularly not flexible. Being effectual allows for innovations emerging from serendipitous findings which would otherwise be missed should collaborations

be mainly goal driven. Indeed, the call for flexibility emphasizes the idea of balancing goal-directed and non-goal directed decision-making tendencies. Additionally, industry partners need be mindful of the needs of academic scientists in order to have a collaboration that benefits both parties.

University management

1. To build more transdisciplinary spaces that would promote internal collaboration between universities' stakeholders.
2. To put in place systems that enhance better communication across universities' stakeholders. It is suggested that good communication would mitigate the ills of both top-down and bottom-up approaches to decision-making.
3. To implement better approaches to offering support to academic engagement:
 - i. consider the type of assistance required and not assume a default 'leader' role in projects.
 - ii. consider the existence of different subsets of academics and their correspondingly differing needs for assistance when designing mechanisms to so support engagement.

Essentially, a centralised system demotivates academics' engagement. In this thesis, such centralisation was evident in i) the meeting opportunities available to academics to engage with each other, ii) decision-making processes that did not account for participation of all stakeholders and, iii) support systems available for academic engagement. Even though academics likely engage within their academic fields, it was clear that transdisciplinary spaces would enhance co-operation across relevant stakeholders. Additionally, decision-making should not be characteristic of either top management or lower management but should be a joint and inclusive effort as emphasised in this thesis. Finally, in coordinating collaborations, especially the so-called strategic ones, it might be useful for university leadership to take a 'follower' role to allow the individual academics or even research groups to assume a 'leader' role. This arrangement would help cut-out seemingly unwanted intermediaries in collaborations and also allow individual academics to take the lead in

relationships they have nurtured over a period. Ideally, the specific format taken by each university or collaborating unit should be arrived at in consensus with the relevant stakeholders.

To conclude, researching the microfoundations of academics' networks using their knowledge-related collaborations as the theoretical lens has been an interesting endeavour. After investing much effort into this research, the important role individuals play in delivering regional competitiveness has become more and more obvious to me. The important role of the individuals' network ties (i.e. their contacts) in shaping their knowledge exchange activities has also been evident. Over the last three years I have encountered people who literally contribute their lives daily to ensure that their universities, regions and countries progress and remain competitive in the face of global competition. Whether in senior or junior positions, individuals' agency in ensuring the exchange of knowledge in its various forms could not be over-emphasized. Indeed, whether the needed systems are present or not, individuals continue to act. And as has been stressed many times in this thesis individuals' efforts have usually not been contributed in isolation, but in conjunction with other relevant stakeholders. Subsequently, I fully subscribe to efforts being made across various universities, businesses and indeed countries to promote academics' networks. I believe the insights contributed in this thesis would aid the on-going efforts.

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APPENDICES

Appendix 1: Interview Guide

Opening statement: Introduction of RUNIN project and interviewee's project

ACADEMIC SCIENTISTS⁶⁸

1. Personal account of Career

a. Could you tell a little about your research?

- i. Is this what you have always wanted to do? Personal Interests?
How long have you been in Academia?
- ii. Any typical research project that you can talk about, and you think might be useful for me to understand the way that you organise your research activities?

2. Academic and Non-academic collaborations

a. General

- i. Could you please tell me the research fields that your partners come from?

1. Apart from academic scientists, who are the non-academic partners you collaborate with?

(Non-academic scientists, supra-governmental agencies, business people, non-governmental organizations, journalists, non-academic publishers, learned societies, firms, government agencies? schools/hospitals/other public entities?)

Also personal relations or academic relations? Any social activities together?

⁶⁸ The same guide was utilised for interviews with industry contacts. Questions specific for academics were tweaked or left out since they were seemingly irrelevant for understanding the context of firms' collaboration. For example, instead of asking 'Could you tell about your research?' industry personnel were typically asked, 'Could you tell about yourself and role in this organisation'

- ii. Could you please describe a typical experience of how your research collaboration has evolved over time, from your first meeting and decision to work together?
- iii. Could you please share your experiences of finding collaboration partners earlier on in your career compared to now? Did you actively search for partners? (*Why these people? Same department, interests, proximity?*)
Or, did new partners find you or come to you and ask to work together?
- iv. Are your collaborations typically local, national or international?
- v. Were these experiences (in ii & iii) the same or different for your local and national collaborations? (*Does he work with different people differently?*)
- vi. How important do you see the collaborations
 - 1. local/national/international
 - 2. academic/non-academic
 - 3. Which of them do you perceive as the most important or takes the bigger share of your time?
- vii. Why is that important to you? *How important are these collaborations to you?*

3. Motivation

a. General

- i. Why did you start the particular collaborations or projects you have? Any specific example?
 - 1. What did you expect to achieve from your projects?
Are your reasons Personal? Academic?
 - 2. Relate to Academic or non-academic collaborations
Local/national/international
- i. What do you look for in a partner?
Local/national/international
- ii. For those projects you did not initiate, how did you come to be a part of them? Who introduced you? When and how did you

get acquainted to this person? Already friends? Give an example.

- a. Please mention 10 individuals (pseudonyms if preferred) in your personal network (academic or not). Are there others you consider relevant for your network but who would not fall under these categories? What is the nature of the relationship?
 - b. Who in this network of collaborators are important to your collaboration activities?
 - c. In what areas are they collaborating? Why these people? Proximity? Competence? Friends?
- iii. Why are you even collaborating? Who told you to? Expectation from the university, region, government or where? Are you facing external pressure to collaborate? Managing Academic competition?
 - ii. What drives you to maintain these collaborations? How does maintaining these relations benefit you?
Any specific example/ reason? Which ones do you maintain? Why?

a. *Relate to Academic or non-academic collaborations*

b. *Local/national/international*

- iii. What has driven you to drop a collaboration in the past? *Any specific example?* How does that really happen?

Is this a conscious decision, or something that just happens?

c. Knowledge and other network resource

- i. Could you please tell me what you have learnt from your partners?
 - *Relate to Academic or non-academic collaborations*
Local/national/international
- ii. Exactly how does this learning take place?
- iii. In what ways do you utilise these different kinds of knowledge in your local research and knowledge creation activities?

- iv. Apart from knowledge, what other typical resources do you get from your collaboration partners? Could you provide specific examples where this has happened?
 - *Relate to Academic or non-academic collaborations*
Local/national/international

4. Impact

- i. Could you please share an example of *how* your research collaboration activities have helped in addressing a challenge?
- ii. Are the benefits of your research collaborations typically local/national/international? (Do your local collaborations typically benefit your local community and your international collaboration mostly of international impact? How does it work? *Any example?*)
- iii. Through which means do the learnings from your research get to those who can use them? (*Local or international*) are these means interchangeable? Does it matter the geographical location of the end user?
What does this process entail?
- iv. What are the challenges you face when collaborating? Challenges in managing your personal network? How can these challenges be managed?
- v. How has mobility influenced your collaborations?
- vi. Have you moved around a lot in your career? Which other places have you worked? (Industry or other universities, etc.)
 - a. Have these movements helped you to make new contacts? How? *Locally or internationally did you always make local contacts locally?*
 - b. How does moving around affect your existing network? How do you maintain your personal contacts?

- vii. Institutionalisation: how do you manage sharing your personal contacts as an academic in this institution? *Has the university made new partnerships through you? How was this organised?*
 - a. Vice versa: Have you made new partnerships through the university? *E.g. if a project came through the university?* How was it organised?

COLLABORATION STAFF

- 1. Demographics
- 2. On collaboration
 - i. What does collaboration mean to you?
 - ii. What is your role as a collaboration staff?
 - iii. How is collaboration co-ordinated in this institution?
 - a. Support from the university
 - b. Support for your role
 - c. Support for engaged academic scientists
 - iv. What are the challenges collaboration?
 - a. Facilitation
 - b. Co-ordination

PhD Graduates in Industry

- 3. Demographics
 - i. Age
 - ii. time PhD was completed
 - iii. field of study/research
 - iv. Is present work related to field of study
- 4. Current job
 - i. Describe in a few words your current job
 - ii. Is there any link with your PhD?
 - iii. Are your PhD studies useful for your current job? How?
- 5. Path to industry
 - i. When did you graduate (PhD)?
 - ii. When did you leave academia for industry?

- iii. Have you always wanted to work in industry?
 - a. This kind of industry? Why?
 - b. If changed? Why? (Who and what influenced it?
How did the influence happen?)
- iv. Did you work in industry prior to your PhD?
 - a. Have they returned to the same or similar industry?
 - b. No - What/who could have influenced a change in industry?
 - c. Yes- How has the PhD influenced your work now that you are more educated?

6. Prior connections

- i. How did you find your job (the one of transition)?
- ii. Did your job exist or was it created for you?
- iii. Were you referred to this job?
- iv. Did you know anyone in your job prior to the appointment?
How? Who?
 - a. Did you know this person during your PhD?
- v. Did your PhD supervisor (or any academic) play a role in this transition?

7. Feedback loop

- i. Would you want to go back to Academia? Why?
- ii. Who in academia have you remained in contact with? (Why?)

8. Network

- i. Have you built your network during your PhD studies or before?
- ii. What type of network? (academia, industry)
- iii. Is your network the same as your supervisor's? How?
- iv. Do you still use the network you built during your PhD studies?
- v. Do you think it (the network) could be useful to find a job?
How?

9. Region

- i. Why did you choose [university] for your PhD?
- ii. Why did you leave [stay in] the region after the PhD?
- iii. Would you have liked to stay in [leave] the region?
- iv. Were there job opportunities for you in the region?

- v. If you had been referred to a position in the region, would you have accepted it instead of your current job?

Appendix 2: Consent form for Interviews

Information letter for participants in the RUNIN project

(The Role of Universities in Innovation and Regional Development)

Researcher: Rhoda Ahoba-Sam
Contact details: rahobasam@lincoln.ac.uk / +47 90823034
Institution: University of Lincoln
Supervisor: Professor David Charles
Project Leader: Professor Rune Dahl Fitjar
Website: <http://www.runinproject.eu>
(To find up-to-date information on the evolution and results of the project)

Overall aims of the project: The aim of the RUNIN network programme is to train researchers on how universities contribute to innovation and economic growth in their regions through research seeking to examine how universities fulfil their third mission in relation to regional industry and explore the range of university engagement with regional firms and institutions.

Furthermore, it aims to identify policies and practices that can be adopted by universities, firms and regional stakeholders to improve levels of regional development and innovation. The project seeks to provide an ambitious and innovative doctoral training in the field of innovation studies. It runs for a 4-year period from September 2016 and has received funding from the European Union's Horizon 2020 research and innovation programme.

Local project objectives: The project on 'Networks of individuals in university-industry relationships', examines networks of individuals as a mechanism for knowledge exchange, trying to track how individual contacts shape the geography of knowledge exchange networks.

Specifically, the study will examine the nature and geography of academics' personal networks across different universities, assess the role of individual and institutional level factors in the development of these networks and assess the role of academic mobility in developing of personal networks.

Letter of consent

(If the statements below are agreed upon, please tick the related boxes)

I DO HEREBY GIVE MY CONSENT to being a participant in the RUNIN project, and for the project researchers to use all the data I provide in the interview/focus group.

I hereby also confirm that:

☐ I have read and understood the information about the content and objectives of the above mentioned project, and the researcher has answered any queries to my satisfaction.

☐ I consent to being audio and/or video recorded as part of the project. I understand that the information provided will be used only for research purposes and will not be used in a manner that would allow identification of my individual responses.

☐ I understand that my participation is voluntary and that I am free to withdraw from the project at any time, up to the point of completion, without having to provide any reasons for the withdrawal and without any consequences. If I exercise my right to withdraw and I do not want my data to be used, any data which have been collected from me will be destroyed.

☐ I understand that I can withdraw any personal data (i.e. data which identify me personally) from the study at any time.

☐ I understand that anonymised data (i.e. data which do not identify me personally) cannot be withdrawn once they have been included in the study.

☐ I understand that any information recorded in the study will remain confidential and no information that identifies me will be made publicly available.

This Letter of Consent is being issued in _____ on ____ / ____ 201__

NAME OF RESPONDENT AND SIGNATURE

NAME OF RESEARCHER AND SIGNATURE

Appendix 3: Ethical Approval form

EA2

**Ethical Approval Form:
Human Research
Projects**

Lincoln International Business School

Please word-process this form, handwritten applications will not be accepted



UNIVERSITY OF
LINCOLN
LINCOLN INTERNATIONAL
BUSINESS SCHOOL

This form must be completed for each piece of research activity whether conducted by academic staff, research staff, graduate students or undergraduates.

Please complete all sections. If a section is not applicable, write N/A.

1 Name of Applicant	Rhoda Ahoba-Sam Department: Lincoln International Business School Email: rahobasam@lincoln.ac.uk Phone: 07438826335	
2 Position in the University (indicate)	Research Fellow	Other (details): N/A
3 Role in relation to this research (indicate)	Investigator Other (details): Under the supervision of the Principal Investigator (David Charles)	
4 Brief statement of main Research Question	Research Question: How do individual contacts (<i>of Academics</i>) shape the geography of knowledge exchange networks? The working title of the project is: The Role of Academics' Networks in Regional Development	
5 Brief Description of Project (Please indicate the period you require ethical approval using the start and finish dates)	The research is under the 'RUNIN' project -The Role of Universities in Innovation and Regional Development. My specific research is to examine networks of individuals in University-Industry relationships and their impact/contributions to regional development. As part of the overall study I will carry out research on Social Networks, Knowledge Clusters and Academic mobility of academics as impacting University-Industry relationships. I will employ Case Study as the research approach and utilise Social Network analysis, Interviews and surveys (to a small extent). Approximate Start Date: 20/06/2017 Next Review Date: 01/02/2018 Approximate End Date: 01/05/2020	
6 Name of Principal Investigator or Supervisor (Only if relevant - this applies to a project with multiple researchers)	David Charles Email address DCharles@lincoln.ac.uk Telephone: 01522 83 5012	
7 Names of other researchers or student investigators involved (Use this section for group coverage e.g. a class engaged in teaching/ learning involving primary research)	1. N/A 2. 3. 4.	

8 Statement of the ethical issues involved and how they are to be addressed.

This section should be completed so that a dispassionate party can judge whether consideration of ethical issues has been undertaken reasonably thoroughly.

1. To what extent is participation in your research "voluntary"?

I will go through a 'sampling design process' to agree on the participants and cases that would be interesting for my research. Participants would be contacted, and they have the right to 'opt-out' if they are uninterested. If any 'prospective' participant approaches with an interest in the study, and fits the sampling criteria, they would be considered. Suggested cases from the principal investigator would also be considered as against the agreed criteria for selection.

2. Do you have informed consent? Are the participants capable of giving consent? Are any of the participants under the age of 18? Is there any deception or coercion?

All participants are expected to be above 18 years and able to give their personal consent. No coercion or deception would be involved. Even in the case where all participants are of age, they will be aware that they are providing information for the study.

3. Is there any risk of your participants being harmed psychologically (inc. taking offence or being embarrassed) or physically? What risk of any harm becoming dangerous/ permanent etc? How have the likelihood and the harm been minimised? Will the College face potential embarrassment/ complaint?

The main ethical concerns regarding the subjects (human) of my project border on wrong handling of data/information that may cause embarrassment or humiliation to subjects. For this reason, I would ensure that the following steps are taken to avert any such occurrence:

4. Subjects would be informed about the possibility of recording interviews which would be used solely as data for the given project
5. Where direct 'quotes' would be taken from interviews, subjects would be duly informed for approval before this can be done; their names would not be made public. Codes would be used where necessary to amply conceal the identity of subjects where certain comparisons have to be made, except in cases where subjects express indifference to their identity being known, and where the investigator(s) believe sharing their identity would improve the quality of research
6. Interviews would be convened at a time agreed to be convenient for the subjects. Questions would be asked with *respect*, and usually in a 'semi-structured' interview format.
7. Where surveys are conducted, the anonymity of subjects would be respected as would be done for other data collection efforts.
8. Data/information would be stored securely (*under password*) and only made available to the Principal Investigator on request. (*storage location will be on the University drive*)

9. Can participants withdraw their consent at any stage? Explain

Yes participants reserve their rights to withdraw from involvement in this study. They also have the right to request for a change in prior agreed dates if those dates are no longer convenient for them. Participants will be treated with respect in this area, and a similar respect is expected.

10. Will you need to debrief participants? Explain

Prior to interviews, I will need to give participants a general idea about what the research is about and why I request their audience, but not too much information that would lead them on, in a particular line of thinking.

11. How is the anonymity of the participants maintained? Explain

Where direct 'quotes' would be taken from interviews, subjects would be duly informed for approval before this can be done; their names would not be made public. Codes would be used where necessary to amply conceal the identity of subjects where certain comparisons have to be made, except in cases where subjects express indifference to their identity being known, and where the investigator(s) believe sharing their identity would improve the quality of research

12. How will you maintain confidentiality?

Where direct information would be used, actual names would not be used. Codes would be adopted when reference to specific cases are to be made.

13. How will information/data be stored during, and will it be destroyed after, the project is completed? Do you need a data management plan?

Data/information would be stored securely (*under password*) and only made available to the Principal Investigator on request. (*storage location will be on the University drive*). The raw data would be stored on the University's repository with limited accessibility. Parts of the data that would need to be made public in the future would be taken care of in a data management plan.

14. Have you informed fully/ discussed these ethical issues with your supervisor/ those signing off the EA2?

Yes, the ethical issues have been discussed.

15. What are the personal risks (to you) in the undertaking of this project?

No foreseeable personal risks

There may be long hours involved in data processing/handling into interpretable form. This could be managed with good planning.

Ethical Approval From Other Bodies

9 Does this research require the approval of an external body? e.g. NHS

Yes No If "Yes", please state which body:-
N/A

10 Has ethical approval already been obtained from that body?

Yes No If "No", please state why not:-
N/A

Please append documentary evidence to this form.

Please note that any such approvals must be obtained and documented before the project begins.

Only complete this form once a robust consideration of the ethical issues has been undertaken. The form is designed for approval or referral only.

Approval requires 3 signatures for supervisees or two signatures for self-supervised staff.

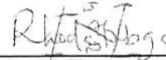
Approval: For completion by the applicant: with supervision

Having reviewed the ethical implications of this research, I certify that there are no issues requiring Ethical consideration from the Business School Research Ethics Committee. I certify that the research will be carried out in compliance with the University's ethical guidelines for research, on humans, with Health and Safety regulations, and with all other relevant University policies and procedures. If there are any changes to the research requiring ethical clearance, I shall gain approval for my updated EA2 before continuing with the research. I have given my supervisor a full picture of the procedure I have followed so far and/or am committed to follow by signing this form.

I certify that I have read the University's ETHICAL PRINCIPLES FOR CONDUCTING RESEARCH WITH HUMANS AND OTHER ANIMALS.

Rhoda Ahoba-Sam

PRINT NAME


Applicant Signature

15/06/2017
Date

Approval: For completion by the applicant's supervisor (member of academic staff) (If self-supervised, sign HERE)

I have considered the request for ethical approval. The risks in the research project are those that one might reasonably expect to encounter, and have been considered appropriately.

DAVID CHARLES
PRINT NAME

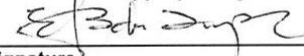

Signature

16 / 6 / 2017
Date

Approval: For completion by a member of academic staff who is not directly related to the conduct of the applicant's project

I have considered the request for ethical approval. The risks in the research project are those that one might reasonably expect to encounter, and have been considered appropriately.

EMMANUEL ADU-AMPONG
PRINT NAME


Signature

16 / 06 / 2017
Date

REFERRAL: For completion by the applicant's supervisor (member of academic staff) IF THE ETHICAL ISSUES ARE TOO COMPLEX TO APPROVE WITHOUT WIDER CONSULTATION

I have considered the request for ethical approval. I am UNABLE to grant request for ethical approval. There are issues involved in the research project that one might reasonably expect to occur that require broader consideration.

PRINT NAME

Signature

Date

Please contact the officer of the Business School Research Ethics Committee

Approval: For completion by the BSREC

The committee has considered the request for ethical approval and is sure that the research team has considered the risks involved in the research project as one might reasonably expect.

PRINT NAME

Signature of Representative
BSREC (or nominee)

Date

Supervisor's Role:

Supervisor should, if requested, provide guidance on how to undertake the research and the concomitant risks;

They should provide guidance on completing the EAF;

Make clear which other members of staff considered the EAF;

Make a clear recommendation (Approval to proceed or Referral to the UREC/BSREC).

A referral requires the supervisor to provide some guidance as to the nature of the complexity inherent in the application and why further consideration is deemed necessary.

Approval is granted on the basis of complete disclosure. Responsibility for the conduct of the research rests with the applicant. The EAF is a means of shielding the applicant and the supervisor from the accusation of improper conduct.

4

Dr D GrayPP



17 07 2017

Appendix 4: Two-way confidentiality agreement from Transcription Company



16\10\2018

Confidentiality agreement between GoTranscript - Parker Corporation LP & the client Rhoda Ahoba-Sam of the University of Lincoln, UK.

1. I hereby undertake to keep all information and files received from the client confidential and agree to non-disclosure of all information and files received from the client during the term of my agreement or after its termination for any reason unless expressly authorised by the client, or required by law to disclose information to any unauthorised person, nor use any of the confidential information related to or received from the client.

2. Such information includes but is not limited to financial information, client personal files and research data. Information is also confidential information if it is clearly marked as such or by its very nature is evidently confidential.

3. I understand that the use and disclosure of all information about identifiable living individuals is governed by the Data Protection Act. I will not use any personal data I acquire during my work for any purpose that is or may be incompatible with the purposes specified in this agreement.

4. I understand that I am required to keep all confidential and personal data securely.

5. I hereby undertake, during the term of my agreement to provide consultancy services to the client, to store all the records and materials related to the client in a safe, secure location as long as they are in my possession.

6. I hereby undertake to ensure that all records provided for the purposes of this agreement, including any back-up records, are deleted as directed, once I have received confirmation that the contract has been satisfactorily completed and all the required information has been provided in accordance with the client's wishes. I also confirm that the client will be able to personally remove the completed transcriptions from our database, and that the records and all the information and data related to them will be completely removed from the translators' computers once the contract is satisfactorily completed.

7. I understand that the client reserves the right to take legal action against any breach of confidence, and will proceed with upmost speed to protect its interests in the event of any such breach.

Signed 

Name Peter Trebek

On behalf of GoTranscript

Address: 39 Duke Street,

Edinburgh, EH6 8HH, United Kingdom

Phone number: +1 (347) 809-6761 **Email:** info@gotranscript.com **Website:**
www.gotranscript.com

Appendix 5: Interview transcript (de-identified)

Example from interview with an academic scientist

My name is Rhoda, and my PhD is under the broad topic of regional development, but I am specifically interested in networks of academics and how they contribute to regional development. So I am going to ask you a few questions about your networks and then I will ask you some general questions about regional development, your perspectives, and just to pick on your thoughts about it

Interviewer: First of all can you tell me about your role here?

Interviewee: Yes, I'm a researcher, mainly, also the director of our Research Institute at [University]. I do research mainly, widely defined within the area of [field].

Interviewee: Around 20 years.

Interviewer: Like this area of research that you are in, does it fit the trend of what you've always been working on or has there been a switch along the way?

Interviewee: Yes, I wrote my thesis is on [another field]. That was a major switch.

Interviewer: All right then. Do you do work with people external to the university, and who are these people that you work with?

Interviewee: Okay, yes. The first is other researchers at the universities and so on. That's mainly [country], but also to a certain extent in Europe, through different networks link to the research I'm doing, but individual scholars, but also some networks. Am also a member [research societies].

Interviewer: Before your next work, what do you consider? What influences your choice of an expert partner?

Interviewee: Your relevance in a general way and that means things that I'm interested in, things that are close to what I'm doing and things that can stimulate my development as a scholar. For instance, one type of collaboration is finding research money, working on quite active in as editors or participant in edited volumes and so on.

Interviewer: Does it matter to you, whether the prospective collaborator is close to you geographically or not, when it comes to selection?

Interviewee: That depends on how I will work together with him or her. Mostly, we work together through the internet then we meet every now and then. It's no problem with distance in a sense, but if I have to have regular contributions I have where I'm into one project together with scholars in [city], another one with scholars in [city], and then third one with scholars in [city]. I've written a couple of research applications together with scholars in [country] and [country] and so on. It depends on what we are going to do together in a sense.

Interviewer: Are you always able to define the focus of the work you're going to do before you actually establish your contact with someone?

Interviewee: No, but as I said generally, it's linked to invitation for an edited volume, invitation for a research application, invitation for seminal, positive feedback on someone having a seminar or on a conference when someone presents. I think that's interesting well and so on. Now planning our research application, and then a regulation is tough it should be, and at least three Nordic countries or two Nordic countries say UK, and then, I start going through my history and so on and checking on the internet. It's generally, I contact people because I like what they are doing, I think either just the possibility are saying that I like that, what they are doing or the possibility of future or actual cooperation.

Interviewer: Within this group of defined population of people you could collaborative, because of the kind of research you do, could you describe to me typically how the process is to establish a contact with anyone just if it can fill an example to start the process?

Interviewee: Generally I feel, since I have so many colleagues from my history, I'm picky. Because I can't say no, because someone approaches me, or generally because, I know I want to have some kind of collaboration. Perhaps not exactly what we will be doing, but more or less. I'm not generally those I get every now and then, these people sending LinkedIn invitations. In case to have big, I'm not one of those. I don't really look actively to enlarge my network if I don't think I don't have any idea of why.

Interviewer: You have been in academia for 20 years so far. Has this attitude of not actively wanting to do this, has it changed over the years? Do you assume this approach now because you are more established or has it always been the case?

Interviewee: I think it's always been in this case and that's led to my- I do critical research, which means that, we generally are not that many, so we generally know about each other. I think it's different if you do more mainstream research. It's a much larger body of scholars and again we generally also have more linkage to power than you do among scholars doing critical research.

Interviewer: Have you ever established collaboration, and active fall outs while is progressed? Has there been in any filled attempts that collaboration work?

Interviewee: Yes, sometimes they, again link to critical perspectives. For instance, there's a lot of European Union applications and so on. Sometimes you're misunderstood, the purpose of the research application and then you discover that this is not anything I can participate in so that would be. Generally, most contacts, in my case, are drop just because of inertia in a sense. You don't have any, don't meet them in a seminar or a conference, you don't write together with them, you don't do an edited volume or you don't see them in seminars and so on. Similarly that, I actively, that's very much linked into big disagreements on research.

Interviewer: Now, I want us do this exercise I spoke about. I want to have an idea of how your network looks like.

Interviewee: Yes, but one important question, would be, because I don't know if it's the same where you from but I work here, but I live in Malmö. I'm a researcher so I don't need to be here more than three days a week which means that a lot of my

research is done at home and so on. That has big implications on the geography of social networks.

Interviewer: That's a good point, but let's see how it looks in the end. I want us to go column by column, and then I explain what I want for each column. I want you to think about your work as an academic, list maximum of ten people, who are important to your work. You don't have to write their actual names but, please maybe their initials, so you know who it is as we move on, so ten people who are important to your work.

Interviewee: Again it's people that- Is this like not lean position you rate or how do I define? Those that I have the most in terms relating to or those that I respect most or those-- What do you want?

Interviewer: Yes, exactly. At this stage I don't want to define for you too much who appears on the list. That's why I said, "Important." At the end I'm going to ask you what you attach to importance you get someone on the list. I don't want you to restrict yourself to within or outside this University, Sweden or international, just thinking broad ends because then we'll discuss each of the people you will send me to understand how the relationship is with them. You're asking me critical questions.

Interviewer: I guess in our list answer where they are geographically. Maybe city and country?

Interviewee: City and country?

Interviewer: Yes.

Interviewee: This is extremely easy to discover. If anyone gets hold of these who-

Interviewer: You didn't mention the person's name. Will it still be easy for someone to know?

Interviewee: If they knew me?

Interviewer: No, they won't know it's you. I won't let them know it's you

Interviewee: No. But yes I think this would be quite easy.

Interviewer: Did you forget the person? We can come back with that. Is a person, academia or industry, or in the governments institute or research institutes or where the person?

Interviewee: Paris University.

Interviewer: Now do you remember now who this is?

Interviewee: I'm trying it.

Interviewer: Okay, we can skip it now. I want you to look at all these 10 people and try to rank them as according to who is more important and so on. On a scale of 1 to 10, 1 being the closest.

Interviewer: We can forget about it for now. Now I'll just make a small change to the table. For this column, let's think about two years ago and try to rank the same people on the scale of one to 10.

Interviewee: Wouldn't change very much. Two years ago perhaps I said six here. Six is fine. That's two. Two years ago.

Interviewer: Just did this for four years ago, the same people?

Interviewee: Counting, when was four years ago.

Interviewer: Thank you. Here's another first question which you asked me before is, how do you define importance generally across this table? What did you attach to the word Importance symbols generate this list?

Interviewee: I took a little bit from different aspects. The very close staff people that I work with, think or do interesting research and are close in some ways in my life. But there's also some that I'm working with now but I don't think it's equally interesting work. But they are close actively in my daily life or weekly life and so on. I took a couple of outside of Sweden just to reflect on. But there's a big difference between the relationships that you have when you are quite far away. That's more or less.

Interviewer: Just to pick on that point you made, what you perceive to be the big difference between networking with someone who is far away and someone who is closer?

Interviewee: Yes. The everyday task of research is quite different if you're not that present in each other's life. I meet most of the other people regularly, at least a month. The others I meet perhaps once a year and so on. Still, I'm one of those conservatives that mean real life interaction cannot be substituted for or e-mail exchanges and so on.

Interviewer: Okay. Good point. What generally are some of the advantages that you obtain from these international collaborators which couldn't have been provided by the local or national closer collaborators.

Interviewee: I would argue that they again now I did this very quickly but it's generally because I've written articles that either have been inspired by their theoretical perspectives and studies or that have followed some ideas that I've had and so on. It's about theoretical closeness.

Interviewer: Are you saying then that the international academics because all these people are academics you go for them because they are theoretically closer to what you're doing than the people you would otherwise find within the local? Just on two scales of regional or let me make it even national collaborators and international collaborators, why would you choose international over just having them on the same competence level, would you still be able to choose between them? Would it matter that one is international one is not or?

Interviewee: Yes, but based on effort. It's easier to contact and maintain a contact if you're closer. Basically, a lot of this research I'm doing is influenced by tradition and so on. Most of us pick a lot of or base part of our research on theories developed in

US or UK and so on. Secondly, if you have it in the room next door why would you look for it in UK?

Interviewer: The next question I have on a general level is first noticing again that everyone on this list is an academic and I'll just ask maybe directly, why are all these people, 10 of them important? Why are they all academics? Do you collaborate with industry people at all? Do you collaborate with people in the government institutes?

Interviewee: Not in industry..... I haven't written down any departments here or university, it's individual whereas when I collaborate outside of the universities is generally with an organization or a group or something like that. The point is that the individual isn't that important in that collaboration.

Interviewer: I understand that. Now, I want us to take each role at a time and describe the kind of relationship you have. If you please, I'll like to know first of all how the relationship was established and how it evolved over time just briefly. I'll like us to refer to them as number one, two three and so on.

Interviewee: But if it becomes impossible because this is my partner in the last 33 years or 32.

Interviewer: Number one?

Interviewee: Number one, we meet when we were writing our dissertations and we've been working together since then.

Interviewee: Is he in this department with you, number one?

Interviewee: No, she's not here.

Interviewer: Okay fine. Where is she now?

Interviewee: She is in [city]. She lives in [city]. This was a mixture based on where they are academically or where they live. She lives in [city] and she's at University [in another city].

Interviewer: All right, also it's a mixture...I'll just add that in this report, that's fine. Let's take number two.

Interviewee: A close colleague that I met here and that I was like a shadow supervisor for and we've been working in research together since then.

Interviewer: Do you have any publications with him?

Interviewee: Yes, a number.

Interviewer: Let's take number three then.

Interviewee: That's another family member, in the same research area.

Interviewer: in the first two these are people you've meet while you did your research and all that? Were you the one to establish the collaboration you have with them or did they establish and based on what did they collaborate with you?

Interviewee: In the first case, yes, I think I was more important but we didn't really start out with the academic collaboration, we started out with student politics and from there on we went into academic collaboration on the first. On the second, as I said, I became some kind of shadow supervisor to him so I don't know. I think he took more contact initially with me but in both cases, it wasn't like a one-way street more of some kind of Ping-Pong.

Interviewer: Should we take number four then?

Interviewee: Number four. That's really through research applications and a number of such and we've been together for a couple of projects. She took contact really not with me but with another then I joined the team in a sense.

Interviewer: What happened here because this person becomes number four closer to you? We'll it's not too significant just a step on but did anything special happen four years ago?

Interviewee: No, more interaction. It's a short period so that's why there's a very little but basically the change is based on interaction intensity.

Interviewer: Is this project you're working on, is this still ongoing?

Interviewee: Yes.

Interviewer: Number five.

Interviewee: Number five. A very close colleague, he's retired now so that could be one off since he's not as present but otherwise, we've written together, we had a project together being directors and co-directors together, deputy directors and so on.

Interviewer: He's retired but are you still in touch with him for academic process?

Interviewee: Yes, that's why.

Interviewer: Number six.

Interviewee: Number six. That's one that is fairly new. It's a long history. We wrote some text some years ago that mentioned a book, some articles by him and then suddenly we met and then I wrote an article in a special issue that he was editing. We started talking and so on. I've always liked him but we've never had a very close relationship and now it's been slightly more upgraded.

Interviewer: What did you say is the reason for the more upgraded relationship with him?

Interviewee: I would say it was this special issue since he was the editor we started communicating a little bit more.

Interviewer: All right then, seven.

Interviewee: Seven. That's also a [country] scholar that in a sense has been active in research program rather than projects that I have been active in. We met in a number of conferences and we've been chatting and chatting, been in dissertation committees and so on. While for a way much more intensity with her than with him and also

flagging a little bit but with time you establish some kind of communication which means that it's easier to just send an email when you think about the project application and questions.

Interviewer: Do you have any specific research ongoing with him?

Interviewee: No.

Interviewer: Okay, alright next one, number eight?

Interviewee: Number eight it's a colleague from here. A good scholar, we have a project together, he has a project that I'm associated to. A very good colleague on taking a large part of institutional responsibility which I think is very important. Almost all here on all the Swedes have institutional responsibilities. That goes to my perspective of critical research it's not only individual scholarship, but also making the environment. We've been working closer and closer together so that's why.

Interviewer: Okay, number 10?

Interviewee: Number 10, that's also a retired scholar, she was not as close as him, but very close. Again, this is problematic for you to keep anonymize because within [field] if I say that it's the partner of him and I'm the partner of that, then, there wouldn't be anyone else in [country] that could fit the model so I would say all within [field] would know about it. Would know who he is yes

Interviewer: Okay. Then I have to extract this when I analyse. Okay, so I have a few more questions and then yes I don't want to take too much of your time. How do you think that your work in general, your research how does it impact the society that you work in?

Interviewee: In my case, my interest is to have a dialogue with [stakeholders]. I think I'm not perfect, probably not very good, but I think I'm doing a part of that.

Interviewer: How do you convey the knowledge to these groups?

Interviewee: A lot of talks, I'm talking quite often, try to write. We're very colonized by the [country] international academia so we write more and more in English, but I try to write on every project a couple of texts in [language]. You can have a dialogue with people that do not prefer to read English or can't read English so that's...

Interviewer: I missed asking you that the 20 years that you've spent as academia has it always been in this university?

Interviewee: No, I come from [another] University, had a short stop or part-time stop at another department in that University. In-between I have been here more or less since a couple of years after my dissertation and then I had a couple of years in the University of [Country] and then I came back.

Interviewer: With respect to this move that you just described in your network how did you say that mobility, in general, has affected your networks just thinking about people you were collaborating with while you were at [city] and then with respect to now because I don't see anyone from [city] in this list if I'm right. How would you

describe what has been the effect of your absence, physical presence at [city] for you to stay in touch with the network that you established there?

Interviewee: The essence there is, is that besides my partner number one here there is extremely a lot of research on [field] in a critical way from the university. As I said, initially with my dissertation on that was [field]. There was a big group and so on but they're quite spread out. I don't lack or see that I miss any colleagues from [city] in a sense that they don't do what I want to do and so on. I have some like personal friends and so on, but not in academia.

Interviewer: Okay. Also, the movements that you're involved in, I know that's related to the research you're doing but is there a requirement from this university for you to be externally engaged with anyone in the society?

Interviewee: I beg what?

Interviewer: Is there a requirement from the university, I mean as a researcher you would sit in your office and type away and do your research but you're out there, you're talking to people is it a requirement from the university?

Interviewee: I wouldn't call it a requirement, it's supposed to be a requirement but it's not a requirement but its part of what we're supposed to do. I wouldn't consider that being exactly the idea around that is probably not exactly what I'm doing because I'm targeting often it's linked to industries, government and so on. I prefer working with others. It's called cooperation with the society outside of the university. Earlier it was called the third task.

Interviewer: Third mission, yes. I also wanted to ask you this -The relationships you have with these [stakeholders] because you explained that it's for the organizations and not the individuals. Are these connections institutionalized as in the university or it's yours personally?

Interviewee: Generally not some, not institutionalized but they're invited to seminars by our department.

Interviewer: The department or individuals in the department?

Interviewee: No, there is no contract, in a sense but we pay for their travel and so linked to projects or programs.

Interviewer: What I'm driving at here is that with if you have a link with an organization A for instance, will the organization still come here to give conferences if you were to leave the university or would they not have anyone to come here through that is what I'm driving at?

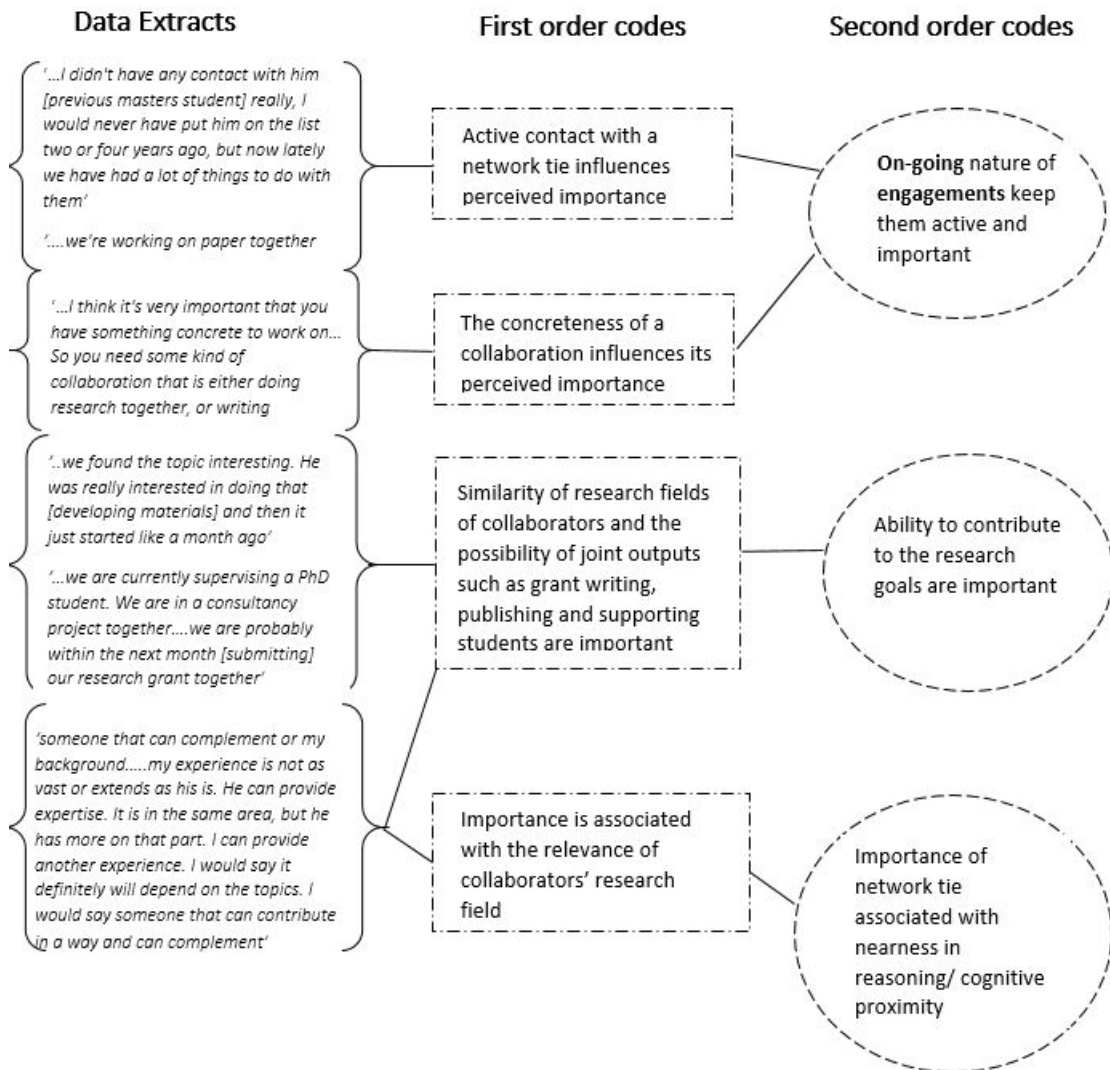
Interviewee: Then, I would say it's in between. Many times its research groups here with three-four persons so if all three, four persons leave then they wouldn't come but if I leave then they could come.

Interviewer: That would be all. I have asked all my questions now. Thank you very much.

Capture of sample analysis in Excel on network evolution (based on network table)

255

Example from analysis on perceptions of tie importance



Appendix 7: List of manuscripts/papers included in thesis

1. Ahoba-Sam, R. & Charles, D. 2019. Building of Academics' Networks—An analysis based on Causation and Effectuation theory. *Review of Regional Research* 39, 143–161. <https://doi.org/10.1007/s10037-019-00134-2>
2. Ahoba-Sam, R. 2019. Why do academics engage locally? Insights from the University of Stavanger. *Regional Studies, Regional Science*, 6:1, 250-264, DOI: 10.1080/21681376.2019.1583600
3. Ahoba-Sam, R., Caputo A., Charles D. & Herron R. 2020. Bridging the chasm? Exploring the Effect of the University Context on Knowledge Exchange. *RUNIN Project working paper series*. Paper 01/2020. DOI: 10.3990/4.2535-5686.2020.01
4. Ahoba-Sam, R., Salomaa M. & Charles D. 2018. On overcoming the barriers to regional engagement: Reflections from the University of Lincoln. *RUNIN Project working paper series*. Paper 04/2018. DOI: 10.3990/4.2535-5686.2018.04
5. Germain-Alamartine, E., Ahoba-Sam, R., Moghadam-Saman S. & Evers G. 2020. Doctoral graduates' transition to industry: networks as a mechanism? Cases from Norway, Sweden and the UK. *Studies in Higher Education*. DOI: 10.1080/03075079.2020.1754783

Appendix 8: Statement of Contribution to joint manuscripts included in the thesis

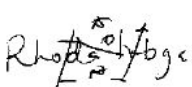
Contribution Statement

Journal Article: Building of Academics' Networks – An analysis based on Causation and Effectuation theory

Authors: Rhoda Ahoba-Sam (RAS) and David Charles (DC)

Conception and design of work	RAS
Data Collection	RAS
Data Analysis and Interpretation	RAS
Drafting the article	RAS
Critical revision of the article	RAS, DC
Final approval of the version to be published	RAS, DC

Authors' signatures and initials

1. RAS - 

2. DC - 

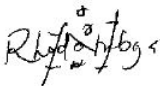

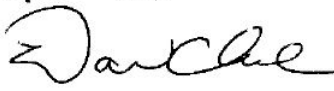

Contribution Statement

Journal Article: Bridging the chasm? Exploring the effect of the University Context on Knowledge Exchange

Authors: Rhoda Ahoba-Sam (RAS), Andrea Caputo (AC), David Charles (DC) and Rebecca Herron (RH)

Conception and design of work	RAS
Data Collection	RAS
Data Analysis and Interpretation	RAS
Drafting the article	RAS
Critical revision of the article	RAS, AC, DC, RH
Final approval of the version to be published	RAS, AC, DC, RH

Authors' signatures and initial

1. RAS - 
2. AC - 
3. DC - 
4. RH - 

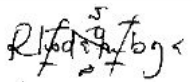


Contribution Statement

Book Chapter: On overcoming the challenges to regional engagement: reflections from the University of Lincoln

Authors: Rhoda Ahoba-Sam (RAS), Maria Salomaa (MS) and David Charles (DC)

Conception and design of work	MS, DC
Data Collection	MS, RAS
Data Analysis and Interpretation	RAS, MS
Drafting the article	MS
Critical revision of the article	RAS, DC
Final approval of the version to be published	RAS, MS, DC

Authors' signatures and initials

1. RAS - 
2. MS - 
3. DC - 


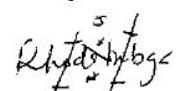

Contribution Statement

Journal Article: Doctorate Holders' Transition to Industry: Networks as a Mechanism? Cases from Norway, Sweden and the UK

Authors: Eloïse Germain-Alamartine (EG), Rhoda Ahoba-Sam (RAS), Saeed Moghadam-Saman (SM) and Gerwin Evers (GE)

Conception and design of work	EG, RAS
Data Collection	EG, RAS, SM
Data Analysis and Interpretation	EG, RAS, SM
Drafting the article	EG, RAS, SM, GE
Critical revision of the article	EG, RAS, SM, GE
Final approval of the version to be published	EG, RAS, SM, GE

Authors' signatures and initials

1. EG 
2. RAS 
3. SM 
4. GE 