Promoting academic engagement in regions:

How individual and contextual factors shape engagement activities

by

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Dedication

To the memory of my dearest uncle Samuel Oduro, whose self-sacrifice, steadfast support, and inspiration have brought me this far. Although he is not here to see the fruits of the seed he sowed, I will forever remember his selfless love. Paa Sammy, this is for you!

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Abstract

The need to harness knowledge to improve the innovativeness and economic development of regions has brought the regional role of universities to the fore of academic and policy discourses. Being producers and disseminators of knowledge, policymakers and societal actors expect universities to contribute to the knowledge needs of the regions in which they are located. These include exchanging knowledge with regional partners, provision of requisite human capital for local industries as well as offering place leadership. Even though universities are located in regions, they nonetheless engage with diverse stakeholders in several activities at multiple territories. Hence, universities balance a variety of roles to provide benefits to all their stakeholders. While trying to meet the needs of their multiple stakeholders, most universities — perhaps in response to policy pressures — have developed strategies and policies aimed at deepening engagement in their regions.

Although universities, as institutions, are expected to lead regional engagement, academics remain the agents that engage with external actors in practice. Academics need to perform other work roles in addition to engaging with regional actors. These competing demands make the effective fulfilling of the regional engagement role challenging. Amidst these tensions, there is a need to understand whether and how academics engage with regional actors and the factors that influence such engagement. However, most prior studies on the topic have focused on the university and have largely ignored the individual academic. This limits understanding of the behavior of academics toward regional engagement and affects the design of effective policies. Accordingly, the overall goal of this thesis is to provide new insights on the role of individual and contextual factors in academics' regional engagement.

This thesis is a synthesis of four papers that together contribute to answering the overall research question. It uses both quantitative and

qualitative research methods to investigate regional engagement from the perspective of academics and firms in different empirical contexts. These variety of methods enrich the analyses and provide deeper insights into the phenomenon. The findings generally demonstrate that both individual and firm-related factors remain important drivers of regional engagement, while university-related factors matter less.

Specifically, individual motivations are important for the external engagement of academics. However, different motivations become more salient at specific career stages. Career motivation is more important at the early career stage, while pecuniary motivation matters most at the late career stage. Prosocial motivation remains more important at the midcareer stage. Also, the embeddedness of academics in both formal and informal social networks facilitates knowledge transfer and regional engagement. Moreover, academics' attachment to place tends to increase their engagement activities with regional actors. However, there are some variations in the effect of place attachment and informal social networks on regional engagement between native and non-native academics. Place attachment is important for both groups, while informal social networks matter only for native academics. Furthermore, the findings show that regional firms' knowledge strategies increase the likelihood of firms to collaborate with university partners. Lastly, the perception of organizational fairness has a limited or no effect on the external engagement of academics.

The findings from the thesis contribute primarily to the academic engagement and the university-industry collaboration literatures with new insights on the factors driving academic engagement. The study extends place attachment and organizational justice theories to explain the underlying mechanisms of the external engagement behavior of academics. Besides the theoretical contribution, the findings also provide insights to guide practitioners and policymakers in designing policies to promote regional engagement. In particular, university managers should pay attention to career development policies. Because academics'

external engagement is chiefly influenced by career motivations, rewards and incentives for external engagement should be geared towards helping academics progress in their careers. Also, policies seeking to promote university-industry collaboration should target firms more than universities. Policymakers need to provide incentives that motivate firms to develop cooperative partnerships with universities.

Table of Contents

Table of Figures

List of Tables

Papers included in this thesis

Paper I: What motivates academics for external engagement? Exploring the effects of motivational drivers and organizational fairness

Paper II: Engaging for love of place? The role of place attachment in academics' regional engagement efforts.

Paper III: Atta-Owusu, K. (2019). Oasis in the desert? Bridging academics' collaboration activities as a conduit for global knowledge flows to peripheral regions. *Regional Studies, Regional Science*, *6*(1), 265-280.

Paper IV: What drives university-industry collaboration: Research excellence or firm collaboration strategy?

1 Introduction

1.1 Background

The socio-economic development of regions[1] has assumed growing policy interest in recent decades. Within the prevailing knowledge-based or learning economy, the priority of policymakers has been to leverage knowledge to improve the competitiveness and economic growth of both developed and developing regions (Howells, 2005; OECD, 2018). This is evident in the expansion of the knowledge-intensive sectors through cluster development and the emphasis on knowledge application in all sectors. Moreover, the importance of interaction between higher education institutions[2] (hereafter universities) and actors in both public and private sectors is emphasized to enhance the innovativeness of regional industry (Lester & Sotarauta, 2007; OECD, 2020). The recognition of knowledge as a key factor for economic development has also increased the regional role of universities in policy and academic discourses (Charles, 2006; Harrison & Turok, 2017; Uyarra, 2010).

The importance of universities to the success of regions stems primarily from the wealth of resource endowments under their control, as well as their contribution to knowledge creation and diffusion (Charles, 2006). These attributes have led to heightened expectation and policy pressure on universities to contribute to the knowledge needs of the regions in which they are located (Gunasekara, 2006b). In particular, universities

[1] There are various definitions of the concept of a region. The term is usually conceived as economic or cultural territories, units of economic planning, or regional governance (Fitjar, 2010, p. 2-3). In this thesis, a region is generally defined as the sub-national level of an administrative or political unit within a country equivalent to NUTS (Nomenclature of territorial units for statistics) 3 level classification. However, region is defined at the level of the labor market (NUTS 4 level) in Paper IV.

[2] In this thesis, higher education institutions (HEIs) refer to universities and colleges that conduct research and provide education leading to the award of bachelors, masters, and doctorate degrees. However, for consistency in the use of language, the term "universities" is used to mean HEIs throughout the thesis.

are expected to transfer relevant knowledge to regional partners, as well as to commercialize research results locally through, for example, the setting up of spin-off companies or the licensing of inventions to local firms (Huggins, Jones, & Upton, 2008). In addition, universities are required to respond to the human capital needs of regions by attracting bright talent, educating students and training people in the workforce with knowledge and skills tailored to the requirements of firms (Abel & Dietz, 2011; Charles, 2006). Besides these roles, universities are expected to play a place-based leadership role through networking and institutional capacity building. By offering their knowledge or expertise to regional organizations, faculty and staff contribute to the development and effective functioning of these organizations, which indirectly leads to the socio-economic development of regions (Chatterton & Goddard, 2000; Goddard & Vallance, 2011b).

Undoubtedly, universities are key assets for the development of regions. But they also remain relevant to the wider global community (Altbach, 2011). Whereas universities 'reside' in regions, their activities transcend multiple territories. Hence, they have responsibilities to diverse stakeholders rather than specific regions (Brennan & Cochrane, 2019; Chatterton & Goddard, 2000). With the chunk of the budget of universities financed by national governments, universities are obliged to contribute to the development of an excellent higher education system through quality teaching and research (Aagaard & Schneider, 2016; Liefner, 2003). Furthermore, research has become more globally oriented. As a result, universities' activities have an international dimension with many academics embedded in international research networks to advance the frontier of science and help address global challenges (Adams, 2013; Jacob & Meek, 2013; Kwiek, 2018). Universities are thus responsive to various stakeholders and must balance a variety of activities to provide benefits for all partners.

Notwithstanding these tensions and the fact that universities engage across multiple scales, public policy continues to focus on promoting

their active participation in regional engagement. Most European governments have enacted legislation and instituted various funding mechanisms, like the Structural Funds, to incentivize and persuade universities to play a central role in the knowledge-led growth of their regions (Kitagawa & Lightowler, 2013; Laredo, 2007). Concurrently, almost all universities have included regional engagement activities, in some form or the other, as part of their internal policies and strategic plans (Pinheiro, Langa, & Pausits, 2015a). Also, universities have established structures like technology transfer offices (TTOs), community liaison offices, and business incubators to signal their willingness to engage and facilitate engagement with regional actors (Pinheiro, Benneworth, & Jones, 2012). Amid these tensions and competing demands on universities, it remains important to understand how they carry out their regional role as well as the factors shaping this engagement.

1.2 Motivation and research question

In the literature, universities are often assumed as the key agents that initiate and participate in regional engagement activities (Evers, 2020; Gunasekara, 2006c). Accordingly, studies focusing on the university as the unit of analysis have sought to advance understanding of, for example, the impact of regional engagement on teaching and research (e.g. Sanchez-Barrioluengo, 2014; Wang, Hu, Li, & Pan, 2016). Others have examined the various approaches and strategic choices universities take in fulfilling their regional engagement mission, the socio-economic impact on localities or regions, and the potential benefits (or costs) to universities (e.g. Degl'Innocenti, Matousek, & Tzeremes, 2019; de la Torre, Rossi, & Sagarra, 2019; Rosli & Rossi, 2016).

Much research focus has been at the level of the university, while less attention has been devoted to the individual academic. Individual academics are the principal actors that engage with external actors (Benneworth, Zeeman, Pinheiro, & Karlsen, 2017; Gunasekara, 2006c).

Indeed, "regional collaborations tend to […] depend on the enthusiasm of individual researchers rather than a collective institution-wide effort." (Kempton, 2019, p. 2255). Moreover, evidence in the literature suggests that engagement with external actors is initiated mostly through the activities of academics rather than by university agencies (Hughes, Lawson, Kitson, Salter, Bullock, & Hughes, 2016). Notwithstanding the pivotal role of academics in regional engagement, "studies on university or other forms of engagement with external constituencies tend to focus on the structural and institutional features at the expense of the individual behaviour across the academic heartland" (Pinheiro, Langa, & Pausits, 2015b, p. 243). It is, therefore, imperative that research gives attention to individual academics to advance understanding about their regional engagement behavior. Lack of insights in this regard can affect the effective design of policies to promote engagement with regional actors. Thus, this thesis departs from prior macro-level studies and focuses primarily on academic scientists.

Whilst regional engagement depends primarily on academics, various demands on them pose a challenge to the effective fulfilment of this role. For instance, balancing several work roles such as teaching, supervision, and research in addition to regional engagement remains daunting. To understand how academics engage with external actors amid these constraints, researchers have examined several individual and contextual factors thought to mediate this role (for recent reviews, see Hmieleski & Powell, 2018; Perkmann, Salandra, Tartari, McKelvey, & Hughes, 2021). Numerous studies have explored a variety of individual level factors impacting public engagement. However, these studies have largely been on demographic characteristics with little focus on the attitudes and behaviors of academics (Perkmann et al., 2021). This has prompted calls to investigate other individual-level factors (or micro processes) that may be "critical drivers of individual […] engagement decisions" (Balven, Fenters, Siegel, & Waldman, 2018, p. 22). Therefore, an examination of academics' perceptions and attitudes is

necessary to achieve a deeper understanding of their engagement with regional actors (Korff, van der Sijde, Groenewegen, & Davey, 2014).

Besides individual characteristics, the organizational context within which academics are embedded also influences their behavior. Although academics have autonomy and control over their work, they are also subjected to the internal policies, culture, and other factors existing in their organizations (Tartari, Perkmann, & Salter, 2014). Academics' evaluation or perception of the favorability or otherwise of these conditions influences their external engagement. This notwithstanding, prior research has given little attention to examining how conditions in the organizational or university context shape the external engagement of academics (Balven et al., 2018; Perkmann et al., 2021). Just like the organizational context, the external or geographical environment also plays an important role. Academics' immediate environment remains the university. Nonetheless, they maintain close links with the wider surroundings. Indeed, external engagement primarily involves interactions with partners located in the region in which the university is situated (Pinheiro, 2012). Hence, it is possible that conditions prevailing in the local or regional context influence the engagement of academics (Davey, Rossano, & Van der Sijde, 2016; Radinger-Peer, 2019).

Even though academics remain the key agents, they do not engage in isolation but do so together with external actors. Since regional engagement activities depend on the cooperation between academics and external actors, examining the factors that determine engagement from academics' perspective alone cannot fully explain the phenomenon (Hjertvikrem, 2019). To get a broad understanding, it is necessary to also examine the drivers of regional engagement from the perspective of external actors. The thesis focuses on firms because of the importance public policy attaches to collaboration between universities and industry (Looy, Debackere, & Andries, 2003; Thune & Gulbrandsen, 2011; Uyarra, 2010). It is worth stating that the choice of firms is by no means intended to downplay the importance of other collaboration actors.

Accordingly, the objective of this thesis is to address these gaps by examining the impact of individual and contextual factors on regional engagement. To achieve this objective, the overall research question addressed by the thesis is formulated as follows:

To what extent do individual, organizational, and regional factors influence academic engagement activities?

To answer the overall research question, four sub-questions are further developed in the following section. Each of these questions addresses an aspect of the research problem in a separate paper, which together form the core of this thesis.

1.3 Development of research sub-questions

Academics' engagement with external actors is driven primarily by individual volitions and, in part, by organizational factors (Perkmann et al., 2021). Given that involvement in these activities is largely pursued on a discretionary basis, research has sought to unravel the motivations behind academics' engagement decisions. Scholars argue that a complex set of extrinsic and intrinsic motivations drive academics' external engagement (Lam, 2011a; Iorio, Labory, & Rentocchini, 2017; Orazbayeva & Plewa, 2020). In particular, the desire to acquire resources to conduct research for career advancement, prestige and the possibility to earn additional income or financial gain remain key extrinsic motivations (van de Burgwal, Hendrikse, & Claassen, 2019b). In addition, academics are influenced by intrinsic motivations like satisfaction derived from engaging in challenging and creative activities with external actors, as well as the desire to make a difference or contribute to the advancement of society (Iorio et al., 2017; Lam, 2015). While existing studies have deepened understanding of the motives underlying academics' engagement, some questions remain unexplored. For instance, it is unclear whether the motivations have differing effects on the engagement of academics at different career stages. Individuals'

motivations do not remain the same throughout their careers (Duarte & Lopes, 2018). They are likely to change as they move from one career stage to another, which in turn can have different effects on engagement activities.

In addition to individual motivations, organizational conditions represent other drivers of academics' engagement. While some studies have examined the effect of factors like the quality of the university, incentives, entrepreneurial culture, and organizational support on academic engagement (Perkmann et al., 2021), no studies have looked at the role of organizational fairness in external engagement (Balven et al., 2018). Presently, we do not know whether academics' perceptions of the fairness climate in their institutions shape their external engagement. These gaps are addressed in the thesis to shed new light on the relative impact of individual motivations and organizational fairness climate on academic engagement. The following sub-question is thus formulated:

RQ1: How do different motivational drivers and organizational fairness perceptions affect external engagement of academics?

Scholars often argue that territorially embedded interactions between academics and local actors engender knowledge transfer to local firms and industries (Asheim & Isaksen, 2002). Based on this premise, policymakers have made concerted efforts to promote collaboration among these actors to boost innovation and regional economic development. The literature highlights several factors or conditions that facilitate or inhibit regional engagement. Some prior studies have investigated the macroeconomic conditions as well as the nature of innovation systems and governance structures (Kroll, Dornbusch, & Schnabl, 2016; Zhang, MacKenzie, Jones-Evans, & Huggins, 2016). Others have looked at the regional absorptive capacity and geographical proximity effects (Azagro-Caro, Archontakis, Gutiérrez-Gracia, & Fernández-de-Lucio, 2006; Laursen, Reichstein, & Salter, 2011). However, research rarely examines the impact of individuals' attitudes

or dispositions and social embeddedness in a region. Indeed, there is a vast body of evidence showing that individuals' emotional attachment to a place influences diverse place-related behavior (see studies reviewed in Lewicka, 2011). This suggests that academics who are attached to their regions might be more inclined to engage. However, the effect of academics' place attachment on regional engagement is yet to be empirically tested.

Furthermore, some research points to the significant role of professional and social networks of academics in determining their engagement decisions (Fernandez-Perez, Alonso-Galicia, Rodriquez-Ariza, & del Mar Fuentes-Fuentes, 2015). Academics' embeddedness in social networks can provide several resources and opportunities for collaboration with external actors (Thune, 2007). Yet, not all academics are equally placed to benefit from social networks in their locality. For example, non-natives with short residency tend to have few and different social ties, which constrains their regional engagement (Lawson, Salter, Hughes, & Kitson, 2019). The importance of social networks notwithstanding, there has been less interest in examining its influence on academics' regional engagement. Besides, its relative impact on the engagement activities of native and non-native academics have not been explored. Accordingly, the thesis aims to fill these gaps by exploring the effects of place attachment and social embeddedness on the regional engagement of academics. The following sub-question is addressed:

RQ2: How do academics' embeddedness in a region affects their engagement with regional actors?

While the interactions within the regional context can stimulate localized learning and knowledge spillovers, these are inadequate to foster long-term competitiveness of firms (Isaksen, 2009). For a region to remain innovative, it is necessary to source global knowledge to complement what is locally available (Bathelt, Malmberg, & Maskell, 2004). Regional actors, especially firms and research organizations are expected

to contribute to this endeavor through their engagement in extra-regional production and innovation networks (Isaksen, Martin, & Trippl, 2018).

The extent to which global knowledge can flow to a region depends on its existing conditions (Martin, Wiig, Grillitsch, & Herstad, 2018). Regions differ in their endowment of innovation, social and economic assets which enable or inhibit actors' knowledge exchange with external partners (Simmie, 2005). Compared to metropolitan regions, regions in peripheral areas[3] are characterized by the presence of few leading firms, nonexistent or weakly developed industrial base, and few research and supporting organizations (Trippl, Grillitsch, & Isaksen, 2018). The lack of a critical mass of actors to connect peripheral regions to international networks limits the flow of external knowledge to these places. However, it has been suggested that academics can fill this gap by drawing global knowledge to these regions through their collaboration activities or networks (Trippl, 2013). Accordingly, this thesis explores how academics' collaboration networks help connect peripheral regions to external knowledge sources and the mechanisms that draw in global knowledge. This leads to the following sub-question:

RQ3: How do the collaboration activities of academics facilitate the transfer of extra-local knowledge to peripheral regions?

Firms remain key engagement partners, and it is important to also look at which factors attract them to collaborate with universities (Maietta, 2015). Especially, there is a need to know whether a firm's engagement decisions are determined by characteristics of the universities or mainly by the firm's own strategic choices. University characteristics, notably research excellence, represents a primary factor driving firms' decision to collaborate (or not) with university partners (Laursen et al., 2011).

[3] A general definition of a peripheral region is difficult to find in the literature. Researchers and policymakers follow different approaches to arrive at a workable definition. In this thesis, peripheral regions refer to "regions at the edge of a communication system, where they are away from the core or controlling center of the economy" (Goodall, 1987, p. 350).

Some scholars hold an explicit or implicit position that excellent academic research is beneficial to industrial innovation (Jonkers & Sachwald, 2018; Mansfield, 1995). Thus, given the novelty of knowledge from such research, firms might be attracted to universities that conduct advanced research or boast of excellent researchers to take advantage of their knowledge and technologies (Bellucci & Pennacchio, 2016). However, others argue that the pursuit of research excellence by universities can make collaboration unattractive to certain firms because the advanced knowledge universities produce does not satisfy their needs, or they lack the absorptive capacity to utilize it (Azagro-Caro et al., 2006).

In parallel, some studies establish that firms' strategic decisions or choices, rather than university characteristics, drive their engagement. In particular, firms may collaborate with a university with the view of building its research competence in order to benefit in the future (Fitjar & Gjelsvik, 2018). Moreover, firms' knowledge networks with partners other than universities provide opportunities for university engagement (Laursen & Salter, 2004). Existing studies emphasize the essential role of university research excellence and firm knowledge networking strategies. However, the effect of these factors is often examined separately (Bellucci & Pennacchio, 2016 is an exception). Hence, we lack an integrated view of the relative impact of both university and firm-related factors. The thesis thus examines how university research excellence and firm networking strategy impact firms' propensity to collaborate with universities within and outside their region. Accordingly, the following research question is formulated:

RQ4: How do local university research excellence and firm networking strategy affect firms' collaborative activities with university partners?

A summary of the appended papers is presented in the following section. Table 1 shows the link between the questions and individual papers and their contribution to answering the overall research question.

1.4 Summary of papers

Paper I explores the relative impact of individual and organizational factors on the external engagement of academics. The paper builds on individual motivations and organizational justice literatures to provide new insights on the role of differing motivational drivers and perceptions of organizational fairness in the engagement behavior of academics. Using cross-sectional survey data for the empirical analysis, the findings show that academics' career motivation exerts a stronger effect than pecuniary and prosocial motivations on external engagement. Meanwhile, distributive and procedural fairness have little or no impact on engagement. An interesting pattern emerges in the effects of different motivations when analyzed for groups of academics based on their career stage. Career motivations remain relevant at every stage, but the effect is stronger at early and late career stages. Pecuniary motivations become more important at the late career stage, while prosocial motivations are important at the midcareer stage.

Paper II examines the influence of individual attitudes and social ties on the engagement of academics with regional actors. Drawing on place attachment and social networks literatures, the paper explains how academics' embeddedness in the region affects external engagement and how this differs between native and non-native academics. Employing the same data as in Paper I, the findings suggest that place attachment and informal social networks are important drivers of regional engagement of academics. Moreover, marked differences exist in the effects of these variables between native and non-native academics. Place attachment remains essential in the engagement activities of both groups, while informal social networks matter only for natives.

Paper III explores the role academics play in transferring knowledge from external sources to peripheral regions through their collaboration activities. Building on a single case study of the University of Twente, the findings suggest that academics' networking activities can enable the

region to tap into global knowledge flows. Through their 'bridging' activities between scientific and non-scientific networks, academics initiate and develop research partnerships with non-academic actors. These collaborations contribute to knowledge flows through permanent and temporary mobility of researchers or students and collaboration projects with local stakeholders.

Paper IV investigates the relative impact of the research excellence of local universities and firms' networking strategies on firms' collaboration with university partners across different geographical scales. The paper explores this at the firm level relying on data from various sources, including the Community Innovation Survey (CIS) of Norway and bibliometric data of Norwegian universities from Scopus. The findings of the empirical analysis demonstrate that research excellence of local universities (measured by publications and citations in relevant disciplines) does not matter for firms' decision to engage with university partners at the local level. Conversely, firms' own cooperation strategies with other partners (i.e. suppliers, consultants, research institutes etc.) are closely associated with the development of university-industry collaboration at the same scale.

1.5 Outline of thesis

This thesis consists of a cover essay and four appended papers. The cover essay synthesizes the theories, methodologies, empirical findings, and implications of the research conducted. The appended papers are four independent articles each addressing a specific aspect of the overall research question. The cover essay is organized as follows. Chapter 2 discusses the key theories the individual papers build on and presents a conceptual model of the factors that influence academic engagement. Chapter 3 outlines the methodology of the thesis, including the research contexts, research design and data collection. Chapter 4 presents an overview of the descriptive findings of the survey conducted. Chapter 5 provides summaries of the papers comprising this thesis. Finally, chapter

6 concludes with a discussion of the overall findings, limitations, and policy implications.

To what extent do individual, organizational, and regional factors influence academic engagement activities?			
Appended papers	**Factors addressed**	**Literature/ theoretical perspectives**	**Data (Methods)**
Paper I	● Motivational drivers ● Organizational fairness	● Individual motivation ● Organizational justice ● Academic engagement	● RUNIN-ECIU Academics' Survey (Quantitative)
Paper II	● Place attachment ● Informal social networks	● Place attachment ● Social embeddedness ● Academic engagement	● RUNIN-ECIU Academics' Survey (Quantitative)
Paper III	● Academics' collaboration networks & knowledge transfer	● Geography of innovation ● Regional innovation systems	● Interviews (Qualitative)
Paper IV	● University research excellence ● Firm networking strategy	● University-industry collaboration ● Open innovation	● Register data ● Bibliometric data (Quantitative)

Table 1 Overview of the papers and their contribution to addressing the overall research question

2 Theoretical framing

2.1 Conceptualizing academic engagement

Academics engage in diverse interactions with external actors in different contexts. Given the breadth of these interactions, there is no all-encompassing or universal definition of what constitutes academic engagement. Depending on the aspect of external engagement being studied, different researchers use various definitions of the concept, depending on their purposes. Researchers from the academic entrepreneurship tradition narrowly conceive academic engagement in terms of technology transfer and commercialization cooperation between academics and industry (Bozeman, 2000; Grimaldi, Kenney, Siegel, & Wright, 2011). The university-industry collaboration literature moves beyond this narrow conception to include both commercialization and non-commercialization-oriented interactions with industry partners (D'Este & Patel, 2007). However, with the broadening scope of activities and actors involved, efforts have been made to define the concept more broadly. Perkmann et al. (2021, p. 1) define academic engagement as "knowledge-related interactions by academic researchers with non-academic organizations." Focusing on the entrepreneurial aspect of engagement, Abreu and Grinevich (2013, p. 408) also define the concept as "any activity that occurs beyond the traditional academic roles of teaching and/or research, is innovative, carries an element of risk, and leads to financial rewards for the individual academic or his/her institution."

Taken together, these definitions reveal several things that characterize academic engagement. First, it is performed by academics outside the context of teaching and research roles, using resources like knowledge, research results and personnel from these roles. Second, the engagement involves a range of non-academic actors, which usually are individuals or organizations in the private, public and third sectors. Third, the

partners involved derive some form of economic and social benefits from these interactions.

While these definitions capture broader aspects of academic engagement, the spatial contexts in which engagement occurs remain unaddressed. Academic engagement involves actors at regional, national, and international scales. Although it cannot be restricted to a specific setting, the geographical scale at which interactions occur is also important. However, except for a few studies that consider the geographical dimension of academic engagement (e.g. Lawson, et al., 2019), most of the research has remained aspatial.

2.2 Dimensionality of academic engagement

In the literature, academic engagement is conceived as having multiple dimensions with different groups of activities (Fini, Rasmussen, Siegel & Wiklund, 2018). Various classifications of these dimensions exist (see e.g. Abreu, Grinevich, Hughes, & Kitson, 2009 for one such classification). However, this thesis distinguishes three main dimensions based on existing studies. These are knowledge and technology transfer, further education, and societal engagement (Berghaeuser & Hoelscher, 2020). Table 2 presents a delineation of the academic engagement concept.

Whereas academic engagement has traditionally focused on knowledge and technology transfer, there is a broadening of focus to encompass further education activities and societal engagement (Perkmann et al., 2021). One aspect that is gaining attention is the professional development of employees. With the growing need for lifelong learning, academics are being called upon to partner with external organizations in providing continuing education to address this need (Berghaeuser & Hoelscher, 2020; Chatterton & Goddard, 2000). This involves teaching modules whereby the academic transfers new developments and techniques to participants in external organizations for them to keep up

with professional knowledge (Alexander & Childe, 2013). This continuous professional development training can be in the form of short-term certificate courses, open seminars and lectures (Berghaeuser & Hoelscher, 2020). In addition, academic engagement has a social dimension. It entails academics' interactions with different actors including government agencies, civil society and citizens to provide knowledge and find solutions to societal challenges (Benneworth, 2013). It involves activities ranging from citizen science to social entrepreneurship (Berghaeuser & Hoelscher, 2020). Although societal engagement is an important dimension of academic engagement, this thesis focuses on knowledge and technology transfer, and further education.

Academics' engagement with external actors mostly happens through *knowledge and technology transfer* (Bozeman, 2000). Through research and teaching activities, academics produce scientific and technological knowledge, which when applied by users in new contexts can generate innovation or help solve problems. For external organizations to benefit from knowledge and technology, these need to be transferred from places of production to points of application. This requires some form of interaction between academics and knowledge users (Grimpe & Hussinger, 2013). Technologies produced by academics can be transferred to others at arms-length because of their codified nature. However, the technology cannot be transferred separately from the knowledge upon which its composition is based (Bozeman, 2000). The inherent tacit knowledge needs to be understood, thus making interaction a necessary condition for a meaningful application of knowledge (Karnani, 2013).

Dimensions of academic engagement	Key external actors	Examples of engagement activities	Degree of formality
Knowledge and technology transfer	▪ Industry	▪ Patenting ▪ Licensing ▪ Start-ups	Formal
	▪ Industry ▪ Public organizations ▪ Civil society	▪ Consultancy ▪ Contract research ▪ collaborative research ▪ Joint supervision ▪ Joint conference ▪ Student placement ▪ Membership of advisory boards ▪ Networking ▪ Informal advice	
Further education	▪ Industry ▪ Public organizations ▪ Civil society	▪ Employee training courses ▪ Open seminars or lectures	Informal
Societal engagement	▪ Public organizations ▪ Civil society ▪ Citizens	▪ Integration of public into research process ▪ Popular science communication ▪ Open data sharing ▪ Lectures for the community ▪ School projects ▪ Public exhibitions ▪ Community based sports ▪ Social entrepreneurship projects	

Table 2 Conceptualization of academic engagement

Note: Table adapted and modified from Berghaeuser and Hoelscher (2020) with additional information from Abreu et al. (2009) and Miller et al. (2018b). The shaded section represents the academic engagement dimensions of interest in this thesis.

Different forms of knowledge and technology objects are exchanged in academics' engagement with external actors. Among these, *technology commercialization or science-directed commercialization* is one

category that has received attention in the literature but represents only a small fraction of engagement activities (Cohen, Nelson, & Walsh, 2002; Grimaldi et al., 2011; Gulbrandsen & Slipersaeter, 2007). It involves formal collaboration between academics and (mostly) industrial partners to develop new knowledge or technology with the potential for commercialization (Meyer-Krahmer & Schmoch, 1998). In this form of engagement, the academic scientist is actively and directly involved in the entire process that results in tangible products (Gulbrandsen & Slipersaeter, 2007). This can happen through the setting up of joint laboratories or academics obtaining funding from the companies with the option of exploiting any inventions or discoveries that result from the research work (Shane, 2004). Depending on the nature of the invention or technology, the partners can decide on several pathways or channels to commercialize them. This includes filing for a patent to protect the technology, granting of licenses to other companies to use the intellectual property for further innovation, or establishing a company to develop the technology into commercial products or services (Abreu & Grinevich, 2013; Jensen & Thursby, 2001).

Another category entails *knowledge transfer*, which involves the exchange of scientific knowledge for subsequent application in external organizations. Unlike technology commercialization, the transfer object is intangible, mostly in the form of know-how that is stored in people's heads and is thus unprotected by legal instruments (Gopalakrishnan & Santoro, 2004; Landry, Amara, & Ouimet, 2007). The knowledge transfer occurs through different cooperation mechanisms. These include academics' application of their expertise to solve specific problems which external actors lack the competence to address. Examples are consultancy and contract research (Perkmann & Walsh, 2008). Another mechanism is cooperative knowledge creation in which academics and external actors work jointly to produce new knowledge to solve an existing problem or contribute to new knowledge. This often occurs through activities like collaborative research, joint supervision of

students, and joint publications (Alexander & Childe, 2013; Cohen et al., 2002). Moreover, mobility of personnel from universities and external organizations contributes to knowledge exchange between partners (Bienkowska & Klofsten, 2012). Examples include internships, student placements, adjunct professorships, and membership of advisory boards (Abreu et al., 2009; Galan, 2018).

In addition to the previous distinctions, another aspect often discussed in the literature pertains to the degree of formality (i.e. formal or informal nature) of the academic engagement channels or activities (Miller, Alexander, Cunningham, & Albats, 2018b). Formal engagement activities are transactional in nature, usually governed by contractual agreements or intellectual property regulations and resulting in financial benefits (Jensen & Thursby, 2001; Shane, 2004). These formal agreements tend mainly to be between the university and external organizations. Patents, licensing, consultancy, and contract research fall in this group. Informal engagement activities develop from personal relationships outside the formal university system, often governed by social or relational mechanisms like trust, and can result in financial or non-financial benefits (Cohen et al, 2002; Perkmann & Walsh, 2008). Examples of activities within this bracket include networking, employee training, ad-hoc advice, student placements, collaborative research, and secondments. While the distinction provides some conceptual clarity, the difference between the two types is not clear-cut. Some overlaps among these activities make placing them in one or another group quite problematic. For instance, joint supervision of doctoral students by an academic and their industrial partners can be both a formal and an informal activity depending on how formality is defined (cf. Grimpe & Hussinger, 2013). Therefore, activities cannot be split into strictly dichotomous categories but exist on a continuum with varying degrees of formality (Miller et al., 2018b).

In sum, academic engagement consists of many dimensions that can broadly be classified into three forms: knowledge and technology

transfer (KTT), further education, and societal engagement. Among these, KTT remains the most researched, but the other forms are also gaining prominence in the literature. Academics' collaboration with non-academic actors occurs through several pathways or channels which can be formal or informal depending on the governance mechanism. However, this distinction is not absolute as there are overlaps between these channels.

2.3 Factors influencing academic engagement

Academics' involvement in external engagement, as well as external actors' decision to participate, are shaped by a range of factors or conditions. These factors originate from differing sources, including individual characteristics, and organizational and territorial contexts (Hmieleski & Powell, 2018; Perkmann et al., 2021; Radinger-Peer, 2019). The following sub-sections discuss some of these factors, starting with those related to the academic scientist.

2.3.1 Individual motivations

In the literature, motivation theories are often used to explain academics' engagement behavior. Motivation is a psychological attribute that refers to "an internal state of a person that impels them towards action" (Ryan, 2014, p. 356). In other words, the enactment of a behavior is driven by cognitive and emotional forces contained in a person. While numerous motivation theories exist, self-determination theory (SDT) has been the perspective most often employed in explaining the factors that motivate academics to engage with external actors. Most theories of motivation conceive motivation as a unitary concept varying primarily in amount. The theories focusing on overall amount of motivation assume that the more motivation individuals have for certain behaviors or actions, the greater the achievement or successful performance (Deci & Ryan, 2008a). SDT, by contrast, suggests that different types of motivation

exist, and the type or quality of a person's motivation is more essential in predicting important outcomes of their actions (Deci & Ryan, 2008a).

A key feature of SDT is its delineation of motivation into two main types: autonomous motivation and controlled motivation (Deci & Ryan, 2000). People are *autonomously motivated* when they act with a sense of volition or experience self-endorsement of their actions (Gange & Deci, 2005). Put differently, individuals have autonomy over their behaviors when they engage in an activity volitionally because they find it interesting or pleasurable to do. A typical example of autonomous motivation is intrinsic motivation. In contrast, individuals are *controlled motivated* when their behavior is driven by an experience of pressure to feel, think or behave in a specific way (Deci & Ryan, 2008b). Extrinsic motivation is a classic example of controlled motivation. While there are differences between autonomous and controlled motivation in terms of their regulatory processes and their attendant experiences, both rely on the intentions of individuals. Hence, both motivational states are opposite to *amotivation*, which involves no intention or desire to act or enact a particular behavior.

Based on this differentiation, SDT postulates that a person's motivation for enacting a behavior exist on a continuum of self-determination. This ranges from amotivation, which is completely lacking in self-determination or autonomy, to intrinsic motivation, which is entirely self-determined or autonomous (Gange & Deci, 2005; Lam, 2015). Between the two extremes of the continuum lie differing forms of extrinsic motivation depending on the degree of self-determination. The variation in extrinsic motivation originates from an important assumption that extrinsic motivation can vary in the degree to which it is autonomous or controlled. In SDT, extrinsic motivation can be transformed into intrinsic motivation because of the behavioral regulation that underlies it (Lam, 2015). Individuals' behaviors are *externally regulated* when their actions are directed by the intention of obtaining desired outcomes (e.g. monetary reward) or avoiding

unwanted consequences (e.g. punishment). However, when individuals have internalized values and attitudes associated with external regulation, their behavior is no longer dependent on instrumental outcomes or consequences. Hence, their actions become *internally regulated* or autonomous (Gange & Deci, 2005).

According to Deci and Ryan (2000), internalization is a natural process whereby people try to transform mores or norms sanctioned by society into personally approved values and self-regulation. Depending on the degree of self-regulation, three distinct forms of internalization processes emerge: introjection, identification, and integration (Gange & Deci, 2005). *Introjected regulation* occurs when an external regulation has been partially internalized by a person but has not been accepted as their own. In such instances, their behavior is not consistent with their values, and it appears as if the regulation is controlling the person. *Identified regulation* occurs when individuals identify with the value of their behavior and feel greater freedom or autonomy because the behavior is more compatible with their personal goals and identities. Finally, *integrated regulation* occurs when externally regulated people feel completely autonomous because they have identified and assimilated socially regulated mores into their self-concept, and thus see their actions as completely compatible with their values, interests and identity (Gange & Deci, 2005; Lam, 2015).

Following from the elaboration of the different types of motivation, the theory also proposes that there are three main groups of outcomes linked with these motivation types. These outcomes are material, social and affective (Lam, 2015). Material outcomes (e.g. pay rise or praise) are typically associated with extrinsic motivation while affective outcomes (e.g. satisfaction or enjoyment from engaging in challenging tasks) are primarily related to intrinsic motivation. Social outcomes (e.g. feeling of sense of worth) are related to the different types of extrinsic motivation.

Building on this theory, scholars contend that academics may be motivated by a complex mix of intrinsic and extrinsic motivations in their engagement with external actors (Orazbayeva & Plewa, 2020). In an influential work, Lam (2011a) showed that academics are driven by diverse motivations, metaphorically referred to as 'gold', 'ribbon' and 'puzzle'. The gold refers to the motivation that arises from the desire for financial rewards while the ribbon represents the motivation arising from the desire to obtain some reputational or career benefits. Both gold and ribbon are forms of extrinsic motivation. By contrast, the puzzle refers to an academic's intrinsic motivation to derive satisfaction from solving complex problems or advancing scientific knowledge. Extending this line of research, Iorio et al. (2017) recently demonstrated that academics' engagement is also driven by their prosocial motivation which is characterised by their desire to help other people or seek the betterment of society (Grant, 2008).

Both intrinsic and extrinsic motivations are at play in academic engagement. But existing studies suggest that academics are mostly driven by intrinsic motivations, with 'puzzle' and prosocial motivations being more important than career and pecuniary motivations (Orazbayeva & Plewa, 2020; van de Burgwal et al., 2019b). Moreover, existing studies barely investigate motivations for engagement for different groups of academics. The only study that has examined this finds that professors and non-professors do not differ in their 'puzzle', career, or pecuniary motivations. But they do differ when it comes to prosocial motivation (van de Burgwal et al., 2019b).

Paper I examines two ways in which these motivations can matter. First, it looks at whether these motivations are important or less important for academics. With this approach, the paper finds that prosocial motivation is most important, and that there are only minor differences across career stage. Next, it explores how important academics find the motivations are associated with variations in actual levels of engagement. The findings show that career motivation is important at the early and late

career stages while prosocial motivation matters only for midcareer stage academics. Pecuniary motivation is most relevant for late career stage academics. Taken together, the findings indicate that most academics are motivated by prosocial motivation, and hence variation in it does not influence variation in actual engagement. However, the degree to which academics are driven to engage by career motivation vary, with large implications for their actual engagement behavior.

2.3.2 Place attachment

The literature highlights the significant role people's attachment to places play in their actions or behaviors toward such places (Lewicka, 2011; Low & Altman, 1992). The concept of place attachment has been used to explain individual behaviors in different research contexts, ranging from migration to pro-environmental behaviors (Scannell & Gifford, 2010a). The application of the concept to many topics has resulted in the accumulation of many definitions. Even though a generally agreed upon definition does not exist, researchers often conceive place attachment as "a multifaceted concept that characterizes the bonding between individuals and their important places" (Scannell, & Gifford, 2010a, p. 1). Although multifaceted, place attachment is an integrating concept that incorporates several inseparable features or properties of people-place bonding (Low & Altman, 1992). Building on this notion, Scannell & Gifford (2010a) argue that the concept consists of three interrelated aspects, namely person, process, and place, and accordingly propose a three-dimensional framework of place attachment.

The *person* dimension represents the actor or the one attached. In general, place attachment happens at the individual and the group levels. At the individual level, attachment or connection to a place develops from meanings people make from important experiences like milestones and experiences of personal growth (Scannell & Gifford, 2010a). For instance, a person may have a deep connection to the place they met their spouse or where they found their first job. Conversely, attachment at the

group level involves the meaning shared among members through historical experiences, values, culture, or religious practices (Low & Altman, 1992). Although place attachment can occur through individual or collective meaning making, the focus of this thesis is on the individual level of attachment.

The *process* dimension outlines the psychological processes underlying the way individuals' attachment to place are formed. Scannell and Gifford (2010a) suggest place attachment is characterized by three components: affect, cognition, and behavior. Affect or emotions remain central features of place attachment. Even though bonding with place is typically described as a positive emotional experience (Giuliani, 2003), negative affect like hatred can also represent people's relationships with a place (Manzo, 2005; Low & Altman, 1992). The cognitive aspect of place attachment involves the construction of place meaning as a mental model that fosters bonding to a place. Individuals develop meanings, knowledge, beliefs, and memories from their experiences in a place. This place-related knowledge and beliefs are organized as sets of schemas that one can connect to. These schemas are, in turn, stored in memory or become incorporated into one's self-concept which is readily recalled in behavioral decisions related to a place (Bugden & Stedman, 2019). Finally, the behavioral aspect represents the expression of attachment through actions. These actions can manifest in various forms such as proximity-maintaining behaviors (i.e. closeness to specific places), reconstruction of place and place-protective behaviors.

The *place* dimension describes the nature of the object of attachment. According to Lewicka (2011), place is a meaningful location with social and physical dimensions. A place can be socially constructed or conceived as an imagined community (Andersen, 1991). They are imaginary in the sense that they exist in the minds of people who share mutual bonds, identity, or fraternity although they may not know each other (Andersen, 1991; Fitjar, 2010, p. 4). Thus, some people may be attached to a place because of generational rootedness, close ties, or

feelings of a sense of belonging together with others from the same place (Lewicka, 2011). Places can also have physical or tangible features like natural landscapes, recreational amenities, and built environments (Hidalgo & Hernandez, 2001; Manzo, 2005). Other people may feel attached to the physical aspect of a place because of its aesthetic or functional qualities (Özkan & Yilmaz, 2019). The social and physical aspects of a place are not easily disentangled from each other. However, scholars argue for their distinction because of their unique roles in place attachment processes (Scannell & Gifford, 2010b; Lewicka, 2011). The dimensions of place attachment are not distinguished in this thesis because the focus is not on the processes of attachment development. Further, the object or place to which people are attached can vary in size and scale from a room, neighborhood, city, region, country, or continent (Lewicka, 2011). However, the scale of interest of this thesis is the region.

Place researchers link place attachment to beneficial social outcomes such as individuals' participation in place-related activities. This linkage originates from the assumption that individuals with positive emotional and cognitive bonds to a place are strongly motivated to engage in actions to preserve or improve it. This reasoning stems from attitude theory that has "shown that consistent and extensive attitudes (e.g. sense of place) are more likely to consistently influence subsequent judgements and behaviors related to the same attitude object." (Bugden & Stedman, 2019, p. 112). In other words, individuals that have favorable attitude or affinity toward a place will be inclined to work for its betterment. Studies provide empirical evidence to support the place attachment-behavior link. For instance, recent studies show that residents' attachment to a city has a positive effect on their aspiration to participate in civic engagement (Shaykh-Baygloo, 2020; Wu, Li, Liu, Huang, & Liu, 2019a). Correspondingly, some research in environmental psychology also demonstrate significant relationships between place attachment, pro-environmental behaviors (Scannell &

Gifford, 2010b) and place protective actions (Devine-Wright & Howes, 2010).

The empirical evidence, albeit in diverse contexts, suggests place attachment might represent a suitable mechanism for explaining academics' behavior with respect to external engagement. As articulated earlier, academics' interactions involve actors at varied geographical scales. However, there is increased expectations to engage within their locales even if there are few opportunities, rewards, or benefits for this. Amidst these low incentives or motivations for engaging locally, academics' attachment to place can account for why they engage with regional actors. Moreover, recent academic engagement research demonstrates place of birth effects in the engagement behavior of academics. Native born academics have greater levels of regional engagement than non-native academics (Lawson et al., 2019). Place attachment might also explain the differences between these groups of academics. The findings from Paper II demonstrate that academics who are strongly attached to a region tend to engage more with local actors. Moreover, place attachment matters for the engagement of both native and non-native academics, albeit with a moderately stronger effect for the former group.

2.3.3 Social embeddedness and networks

Academic engagement is a social process, which is influenced among other things by individuals' embeddedness in social relations or networks within a regional context. Embeddedness refers to social relationships between individuals and/or collectives like organizations grounded in societal structures (Hess, 2004). The importance of social relationships lies in the array of resources these networks provide for individuals to use in collaborations (Nahapiet & Ghoshal, 1998). These resources, collectively termed social capital, are mutually owned and tightly bound to members of a network and cannot be easily appropriated by only one member. Hence, any member can leverage it for productive

purposes (Coleman, 1990; Nahapiet & Ghoshal, 1998). Given the valuable resources inherent in social relationships, academics' embeddedness in these networks can perform a critical role in their engagement activities.

The role that social embeddedness plays in individuals' economic behavior was first highlighted in the pioneering work of Granovetter (1985). In this work, he stresses that social embeddedness consists of two related aspects of tangible social relations and structures (or networks) which perform unique roles in the routine work and achievements of different economic actors (Moran, 2005). One is relational embeddedness, which represents the quality of personal relations of individuals. The other is structural embeddedness, which denotes the configuration of a person's network of relations. Building on this conceptualization, Nahapiet and Ghoshal (1998, p. 244) define structural embeddedness as "the impersonal configuration of linkages between people or units." It focuses on aspects like the presence or absence of ties between actors and morphological features like density and connectivity (Moran, 2005). Conversely, relational embeddedness refers to "the kind of personal relationships people have developed with each other through a history of interactions" (Nahapiet & Ghoshal, 1998, p. 244). It includes characteristics like norms, trust, and mutual obligations. Each of these dimensions provides unique social capital or resources that facilitate or constrain the flow of information among network members (Thune, 2007).

Social networks can also be differentiated based on the actors that form the membership and the context in which social relationships are forged (Broekel & Binder, 2007). Informal networks develop from less structured and more casual social interaction or connections among family, colleagues, and friends with shared interests in a work or non-work setting. Membership of this network is basically voluntary and interpersonal relationships are governed by relational mechanisms like trust and reciprocity (Birley, 1985; Ibarra, 1995; Fernandez-Perez et al.,

2015). In contrast, formal networks represent explicit or sanctioned cooperation between members of the same or different organizations with the intent of achieving a work-related goal. Membership of this network is involuntary, and interactions among members are expected to be in line with what has been officially prescribed (Allen, James, & Gamlen, 2007). Interactions are thus governed by transactional mechanisms like contracts, reports, and incentives. Both informal and formal networks exhibit distinctive characteristics, but their unique resources are useful for academic engagement. Informal networks contain structural and relational capital, while formal networks provide cognitive resources that facilitate interaction between academics and non-academic partners (Birley, 1985; Thune, 2007).

Existing studies emphasize the importance of social networks for external engagement (e.g. Aschhoff & Grimpe, 2014; Ponomariov & Boardman, 2008). Yet research has not specifically examined the influence of access to informal networks on the regional engagement of academics. Moreover, accessibility to informal networks provides resources and opportunities for engagement with local actors. However, not every academic is equally able to participate in local networks. In particular, academics who do not hail from a region may have limited access to informal networks compared to native academics, thus hampering their local engagement (Lawson et al., 2019). But the possible differences in the effect of informal social networks on the regional engagement of these groups of academics have not been empirically investigated. In addressing these gaps, Paper II finds that informal social networks positively impact academics' engagement with regional actors, corroborating previous findings. Furthermore, native academics' access to informal networks tends to increase their regional engagement, whereas that of non-natives has no effect on their local engagement.

In addition, the social networks of academics span geographical boundaries (Bathelt & Cohendet, 2014; Christopherson, Kitson & Michie, 2008). The formal and informal networks of academics within a

regional context enable the transfer of knowledge and other resources between organizations. Academics' embeddedness and social interactions with local actors can contribute to local knowledge spillovers (Schiller & Diez, 2010). In particular, involvement in scientific collaborations with other scientists and research organizations can contribute to generation of knowledge locally that firms can exploit in their innovative activities (Trippl, 2013). Moreover, informal interactions between academics and employees in local organizations can lead to the forging of informal collaborations, which can serve as a precursor to formal relationships between universities and local organizations (Ponomariov & Boardman, 2008; Fitjar & Gjelsvik, 2018).

Apart from local networks, academics are also part of social networks that exist outside their regions. By virtue of their research activities, academics are involved in cooperation or networking with fellow researchers at national and international levels (Altbach, 2011; Wakefield & Dismore, 2015). Interactions in such scientific communities provide resources and opportunities that can be harnessed for local interactions. Not only that, but some academics are involved in innovation networks comprising non-academic partners at the international scale (Britto, Camargo, Kruss, & Albuquerque, 2013). Such external networking enables academics to channel requisite knowledge, information, and opportunities to regions. Thus, whereas local networking of academics is important in terms of proximity effects, their extra-regional networks are even more valuable because of the resources they provide regions to enhance their competitiveness (Christopherson et al., 2008).

The importance of extra-regional knowledge for innovation and growth of regions cannot be underestimated. Regions require knowledge from external sources to supplement knowledge present locally (Bathelt et al., 2004). However, some regions (particularly peripheral ones) may be unable to attract external knowledge because of their disadvantaged conditions (Trippl et al., 2018). In such situations, academics'

networking activities can fill this void. But, the potential of academics' networking to contribute to the channeling of knowledge to a region has barely been explored in the literature. Paper III finds that academics' collaboration activities in scientific and non-scientific networks at different scales contribute to drawing external knowledge to peripheral regions. International knowledge flows to localities through collaborative projects involving local actors and the mobility of researchers and students.

2.3.4 Organizational justice climate

Organizational justice represents a broad concept that refers to employees' cognitive evaluation of fairness in their organization's decisions, procedures, and policies (Colquitt, 2001). Put differently, it is individuals' subjective judgement of events or decisions within an organization. Even though the evaluation process is internal to the individual, the object of evaluation is events or policies in organizations, hence the thesis treats it as an organization-level factor (Balven et al., 2018).

Traditionally, researchers identify three types of justice (Colquitt, Greenberg, & Zapata-Phelan, 2005; Greenberg, 1990). Distributive justice denotes the perceived fairness of the allocation of resources or outcomes in relation to the effort or contributions of an individual (Li, Cropanzano, & Molina, 2015). In evaluating the fairness of their outcomes, individuals often compare the ratio of their input (e.g. skills) and output (e.g. salary) with the equivalent ratio of a reference other (e.g. co-workers). If the ratios are the same, they feel equitably rewarded and satisfied. Conversely, if the ratios are unequal, individuals feel dissatisfied from the perceived inequitable treatment (Greenberg, 1990).

Procedural justice involves the degree to which decisions in organizations are made following a fair procedure. In a decision-making context, individuals evaluate a decision as fair or otherwise depending

on the amount of control they have over the process or outcome. If individuals are given process control or allowed to provide input in the process, they tend to view a decision as fairer than when denied process control, even if the outcomes are unfavorable (Thibaut & Walker, 1975). Finally, interactional justice pertains to the degree to which employees perceive they are treated with respect and dignity as well as provided with accurate and timely information or explanations by their superiors (Bies, 2015). This form of justice has been divided into interpersonal and informational justice in subsequent research (Li et al., 2015).

Although these aspects of organizational justice are interdependent, they are conceptually different in relation to the level of justice evaluation (Balven et al., 2018). Distributive and procedural justice perceptions are associated with processes and outcomes at the organizational level, while interactional justice is linked closely with microprocesses at the relational level (Balven et al., 2018). Given that understanding the effects of organizational factors on academic engagement is one of the empirical interests of this thesis, only distributive and procedural justice are examined. Interactional fairness pertains mainly to internal relationships and is less relevant in this thesis.

Organizational justice perception remains a precondition for the effective running of organizations because it regulates employees' behavior and other workplace outcomes (Cho & Sai, 2013; Laundon, McDonald, & Cathcart, 2019b, p. 295). As in other organizational settings, academics' perception of justice within their institutions can impact their external engagement behaviors. Put differently, evaluation of universities' policies in general and those pertaining specifically to external engagement can to some extent promote (or impede) academic engagement (van de Burgwal et al., 2019a). Academic engagement is weakly formalized in universities' policies. In most cases, research performance represents the most essential criterion in recruitment, promotion, and compensation decisions (Jongbloed, Enders, & Salerno, 2008; Mamiseishvili, Miller, & Lee, 2016). Moreover, universities often

have inadequate or no records on the engagement activities of academics. Under these conditions, academics active in external engagement may feel their contributions are not adequately appreciated or rewarded (Hayden, Weib, Pechriggl, & Wutti, 2018). This, in turn, can lead to negative judgement of the fairness of organizational processes and outcomes, and weakened motivation for engagement with external actors.

Notwithstanding the impact of organizational justice on individuals' behavior, research has not investigated its effect on the actual engagement behavior of academics. That is, it is unclear whether the justice perception of the processes and outcomes of university policies can explain academic engagement. Contrary to expectation, Paper I observes no association between organizational justice and academics' external engagement. This indicates that the perception of the justice climate in universities plays a less significant role in the engagement behavior of academics.

2.3.5 University research excellence

The primary missions of universities have historically been teaching and research (Scott, 2006). Universities have and continue to provide students with the knowledge and skills required in the workplace. Also, their goal has been to produce and disseminate relevant knowledge through good research or scholarship. Besides these roles, universities are faced with demands to contribute to economic and social development through knowledge transfer interactions (Pinheiro et al., 2015b; Sánchez-Barrioluengo, 2014). Not only do they need to engage with external actors, but their knowledge and other resources are expected to be relevant to the needs of these actors. To balance these competing expectations and reduce the risk of mission overload, the strategy of most universities has been to prioritize or focus on research excellence as this can produce a virtuous cycle connecting the various missions (Wigren-Kristoferson, Gabrielsson, & Kitagawa, 2011).

Universities are not merely to fulfill their missions. They are expected to do so in an excellent manner. This expectation is reflected in the requirements of various funding instruments available to universities (Hallonsten & Silander, 2012). More specifically, research excellence has become central in the research funding environment. The assessment and allocation of funding are based on some elements of excellence, such as publications or citations received (Hicks & Katz, 2011). Accordingly, the pursuit of research excellence can increase the attractiveness of universities for research collaborations and their chances of receiving funding to further reinforce their research capabilities (Langfeldt et al., 2015). Moreover, universities around the world are in competition for scarce resources like funding and students (Marginson, 2004). One way in which universities respond to this competition is by building their reputation through conducting excellent research in niche scientific fields (Bradmore & Smyrnios, 2009). The enhanced reputation increases the visibility and attraction of high-quality faculty and good students who in turn strengthen the teaching and research roles of universities (Fumasoli & Huisman, 2013).

Furthermore, some scholars argue that research excellence focus feeds into the external engagement role of universities. Innovation in firms depends on the availability of new knowledge. So, firms require a constant supply of quality external knowledge to augment the knowledge internally generated in their innovation processes. Considering this need, firms will be attracted to collaborate with universities conducting frontier research to acquire new knowledge for innovation. In other words, the research excellence of a university can stimulate collaboration with firms, thereby fulfilling part of their public engagement role (Barra, Maietta, & Zotti, 2019; Bellucci & Pennacchio, 2016; Johnston & Huggins, 2017). However, this has been contested by other scholars. These scholars contend that research excellence can be detrimental to collaboration because of its potential to produce knowledge which does not meet the needs of firms. That is, universities' research excellence can

generate cutting-edge knowledge and technologies. But these will not automatically translate into collaboration if firms find them not useful or they lack the absorptive capacity to apply such advanced knowledge in their operations (Azagra-Caro et al., 2006; Kempton, 2019).

The issue goes beyond the argument of whether university research excellence is beneficial or inimical to industry collaboration. At the heart of the matter is whether excellent research is relevant for the local industrial sector. There are differences among the economic sectors in terms of the use of scientific knowledge in their innovation processes (Meyer-Krahmer & Schmoch, 1998). According to Schartinger, Rammer, Fischer and Fröhlich (2002), firms that operate in science-intensive industries rely more on new scientific knowledge in their R&D activities than those that operate in less science-intensive sectors. Hence, they may be attracted to collaborate with universities conducting frontier research. However, even in science-intensive industries, firms may not collaborate with excellent universities if there is a mismatch between their knowledge needs and what the universities produce (Handscombe & Patterson, 2000). For example, firms in the mechatronics industry may not collaborate with a local university that conducts world-class biotechnology research. Thus, university research excellence in fields of science considered industrially relevant can be a good driver for collaboration (Bellucci & Pennacchio, 2016).

This then moves the discussion from the perspective of the university to the firm. Undoubtedly, firms require novel knowledge from other sources to feed their internal innovation. However, universities are not the sole sources that can provide this knowledge. So, it is important to understand what goes on in firms' strategic choices of a collaboration partner. While the excellence of the university might play a role, few studies have examined the importance of this factor in local firms' collaboration decisions. The findings of Paper IV suggest that local universities' research excellence does not matter much and may even

have an adverse effect on local firms' collaboration with university partners.

2.3.6 Firm knowledge search strategies

Academic engagement also depends on the willingness of partners to engage with them. In addition to academic and university level factors, the literature also stresses the salience of firm level factors in driving collaboration. In particular, the knowledge search strategies of firms have been emphasized as key in informing their decisions or choices in collaborating with academics (Fontana, Geuna, & Matt, 2006; Guerrero, 2020; Laursen & Salter, 2006). Firms can derive competitive advantage from developing innovative products using internal R&D capabilities. However, there is growing evidence that internal knowledge alone is not sufficient for firms to stay at the innovation frontier (Moraes Silva, Lucas, & Vonortas, 2020). Scholars contend that innovation is not a linear, static process occurring within the boundaries of a firm. Rather, it remains a dynamic and interactive process that entails exchange of knowledge among varied actors such as lead users, suppliers, and research institutions (Asheim & Isaksen, 2002; Godin, 2006; von Hippel, 1988).

Building on the notion of innovation as a distributed and open process, Chesbrough (2003) proposed an open innovation paradigm. This perspective conceives R&D as an open process relying on knowledge and expertise from diverse external sources. Central to this model is the argument that knowledge is widely distributed among external actors. Hence, firms can be innovative by integrating these knowledge sources into their innovation process and competitive strategy (Chesbrough, 2003; Laursen & Salter, 2006). This openness logic has rendered the boundary between the firm and its environment permeable, thus allowing the commercialization of ideas through diverse pathways. These diverse pathways result in loosely coupled networks of different actors and

innovators exploiting embedded knowledge to their advantage (Laursen & Salter, 2006).

Openness to the external environment can allow firms to tap ideas to enhance their innovation process. But the open search strategies they employ also affect their collaboration with academic partners on innovation activities (Guerrero, 2020; Laursen & Salter, 2004). Firms that use varied knowledge sources like suppliers, customers, users, or competitors in their innovative activities are 'open' in their search strategy. These open search strategies make them more likely to collaborate with universities than those that employ a 'closed' strategy (Laursen & Salter, 2004; Segarra-Blasco & Arauzo-Carod, 2008). This is because prior R&D collaboration with external partners enhances the capacity of firms to absorb complex knowledge from academic partners (Agarwal, 2001; Hewitt-Dundas, Gkypali, & Roper, 2019).

Even though a firm's open search strategies can promote collaboration with academic partners, becoming deeply reliant on other partners can adversely affect university collaboration. Building linkages with external partners requires resources and attention. Hence, firms that spread their resources thinly in developing deep relationships with a higher number of external actors might encounter difficulties in maintaining beneficial exchanges with external actors, including universities (Laursen & Salter, 2006). In addition, past unrewarding experiences of firms may prevent them from collaborating with universities. Firms engage in external cooperation with the aim of acquiring some benefits. However, given the uncertainties inherent in these relationships, they cannot determine upfront which collaborations will be rewarding. Hence, past unproductive relationships resulting from conflicts over IP or secrecy over publishing may deter firms from collaborating with universities (Bruneel, D'este, & Salter, 2010; Fontana et al., 2006; Laursen & Salter, 2006).

There is no question about the role of firms' knowledge search strategies in university-industry collaboration. However, what is less known is the degree of importance firms place on their knowledge networking with other partners relative to the characteristics of universities in their collaboration decisions. Paper IV finds that firms' tendency to network with partners like suppliers, customers, and consultants increases their likelihood to engage with university partners. In fact, networking with these external partners is also linked with collaboration with universities at the same geographical scale. This indicates that firm characteristics remain very important drivers of collaboration with university partners.

2.4 Summary

As presented in the overall research question, the thesis is interested in understanding how various factors arising from an individual, the university, and the regional environment determine academic engagement. As part of their formal roles, academics are expected to engage in knowledge exchange collaborations with non-academic actors. Doing so can contribute to innovation in organizations and the long-term economic growth of the localities in which their institutions are located. Knowledge-related collaboration, which is broadly termed academic engagement, happens through many channels and with various actors, including firms/industries, government agencies, civil society, and citizens. However, collaboration between academics and firms has received most policy and research attention. The literature review identifies different factors or conditions that promote or constrain the performance of this role. These can be grouped broadly under individual, organizational, and regional factors. Figure 1 presents a schematic model of these factors.

Among the individual-level factors, individual motivations represent an important driver of academic engagement. Specifically, academics' need for career advancement, financial gain, and the betterment of society are the key motivational drivers. Using SDT as a theoretical lens, Paper I

explores the impact of motivational drivers on academic engagement and the relative importance of different motivations at varied career stages of academics. Paper II examines the role of academics' place attachment in academic engagement within the region and whether it exerts differing effects between native and non-native academics. In addition, academics' embeddedness in social networks partly shapes their engagement behavior. Academics' formal and informal social ties within and outside a region are rich in social capital. This provides the resources and opportunities for academics to establish collaboration partnerships and contribute to the transfer of knowledge to their regions. Accordingly, Papers II and III examine how the social networks of academics impact their engagement with local actors.

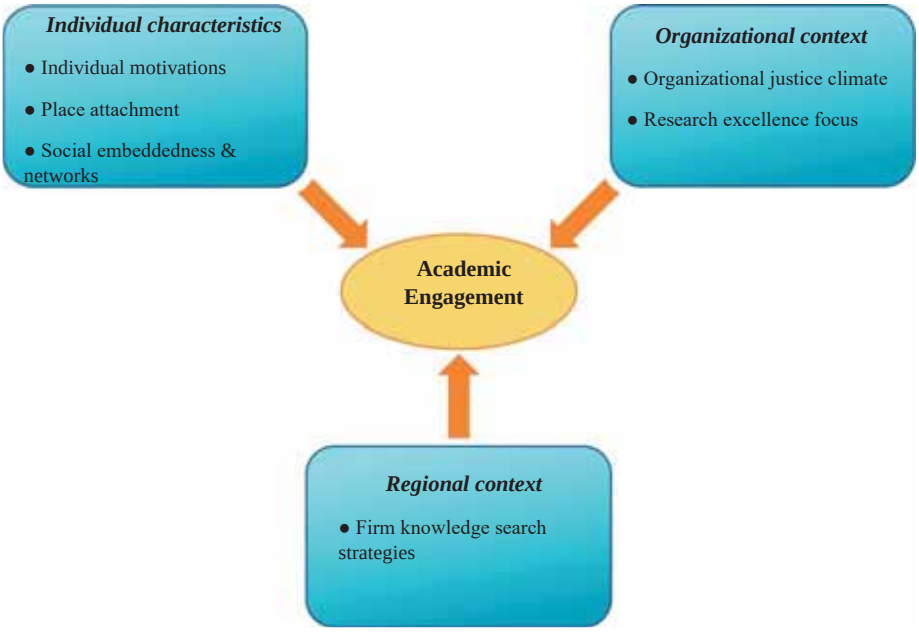

Figure 1 Conceptual model of factors influencing academic engagement

Conditions or factors within universities can also partly account for academics' engagement behavior. Notably, justice climate or academics'

perception of fairness in the distribution of resources and decision processes can prevent them from or encourage them to engage with external actors. Building on an organizational justice perspective, Paper I explores the influence of organizational justice on academic engagement. Another organizational level factor is research excellence focus of universities. Universities' excellence in research can generate new knowledge that can foster innovation. But not all knowledge generated from academic research is relevant to external actors. Hence, the research excellence focus of universities can be an important factor in external actors' decision to collaborate with academics. Paper IV investigates the influence of this specific factor in firms' collaboration decisions.

Lastly, conditions or factors prevailing within the local/regional context can also explain academic engagement. For instance, regional firms' knowledge search strategies determine their collaboration decisions and hence academics' collaboration opportunities. Accordingly, Paper IV investigates the relative importance of firms' knowledge search strategies in their decisions to collaborate with academic partners. Table 3 summarizes the factors that each paper addresses.

	Paper I	**Paper II**	**Paper III**	**Paper IV**
Individual motivations	●			
Place attachment		●		
Social embeddedness & networks		●	●	
Organizational justice climate	●			
Research excellence				●
Firm knowledge search strategies				●

Table 3 Factors influencing academic engagement and papers addressing them

Note. A black dot denotes the factor addressed in a paper.

3 Research design and methods

3.1 Research contexts

As alluded to earlier, academic engagement happens across multiple geographical scales. Accordingly, the research has been conducted in three separate settings. This section presents a brief description of these contexts to guide the interpretation of the findings. Papers I and II draw on data from the ECIU network, a university association in Europe, whilst Paper IV is based on the national context of Norway. Lastly, Paper III builds on the Twente region in the Netherlands.

The ECIU is an international network of universities founded in 1997. It aims to develop an innovative culture in member institutions and play a leading role in transmitting knowledge for innovation in industry and society. The consortium began with 10 universities that share a common profile in Europe but presently (2021) includes 13 members with one international associate member (Nieth & Benneworth, 2020). Data for Papers I and II were collected from seven universities of the 13 members of the consortium. The universities are in countries distributed quite widely across Europe. Aalborg University (AAU) and University of Stavanger (UiS) are located in the north, whereas Autonomous University of Barcelona (UAB) and University of Trento (UNITN) are in the south. Kaunas University of Technology (KTU) is in the east while University of Twente (UT) and Dublin City University (DCU) are located in the northwest. UAB, with a student population of over 27,000 and almost 5,000 employees, is the biggest, whereas KTU is the smallest. Table 4 presents an overview of some characteristics of the universities.

The ECIU network provides a good context for the thesis because of the integration of external engagement into the mission of these universities. The mission of this consortium is to be world class universities through excellent research and education in addition to contributing to innovation and the development of their regions. With such a seemingly wide

mission, this consortium offers a favorable setting to investigate the extent to which universities perform their missions in practice. Moreover, it allows the examination of academics' attitudes and behavior toward external engagement, not least at the regional level, given their institutions' stated intentions to contribute to regional development.

Institution	Founding year	Student enrolment	Academic staff (FTE)	Support staff (FTE)	Publications (Per Academic)
Aalborg Univ.	1974	20,211	2,155	1,343	6,356 (2.9)
Autonomous University of Barcelona	1968	27,158	2,666	2,275	4,568 (1.7)
Dublin City University	1980	16,187	624	976	1,167 (1.9)
Kaunas University of Technology	1922	9,034	771	1,176	735 (0.9)
University of Stavanger	2005	11,235	961	522	1,008 (1.1)
University of Trento	1962	16,379	643	734	2,352 (3.7)
University of Twente	1961	11,136	1,636	1,128	2,307 (1.4)

Table 4 Characteristics of the ECIU affiliate universities that participated in the study

Source. Compiled from the universities' websites, annual reports, and strategy documents. The table is based on 2018 data.

Paper III focuses on the University of Twente located in the Twente region. The region is part of the administrative province of Overijssel located in the eastern Netherlands and shares a border with Germany. The region has over 629,000 inhabitants, approximately 3.6% of the Dutch population. It consists of 14 municipalities with over half of the population living in key cities of Enschede, Hengelo and Almelo and the rest in rural hinterlands (Kopelyan & Nieth, 2018). Historically, the

region has had a weak industrial base, but it has been known for its prosperous textile industry in the middle of the 19th century. However, the region experienced economic decline between 1955 and 1980 following a rapid de-industrialization resulting in massive unemployment in the textiles industry (Benneworth & Hospers, 2007). Following the collapse of the textile and allied industries, a technical college (now University of Twente) was established to help revitalize the regional economy. The entrepreneurial approach adopted by the university contributed to the setting up of a science park and the establishment of many high-technology companies. This led to the emergence of a knowledge-based economy in the 1980s and 1990s (Kopelyan & Nieth, 2018).

Currently, the region has a more diversified economy consisting of manufacturing, business services, trade, healthcare, and tourism sectors. However, the industrial structure is characterized by predominantly small and medium-sized enterprises (SMEs) with few branch plants of national and multinational companies. In fact, SMEs employ over 78 percent of the labor force in the region (Kopelyan & Nieth, 2018). The lack of leading businesses coupled with its distance from the geographic center of the Netherlands hampers the region's ability to connect to international networks and attract external resources. This partly accounts for Twente's lag in productivity compared to the national average, notwithstanding the changes in the economic structure over the last two decades (Bazen & Bijleveld, 2012).

Paper IV focuses on the context of Norway. Norway is a small and open economy nation with a population of over 5.3 million. It has experienced a remarkable economic transformation making it one of the wealthiest countries in Europe (OECD, 2017). In 2019, its Gross Domestic Product (GDP) per capita of €69,890 was twice that of the European Union average (Eurostat, 2019). The economy has witnessed a gradual diversification from agriculture, mining and shipbuilding to oil and gas, manufacturing, aquaculture, and service sectors. Service activities

dominate the Norwegian economy with a 39% share of GDP, followed by petroleum activities and maritime (14.4%). Manufacturing and mining accounted for over 16% (Statistics Norway, 2020).

Cooperation in R&D and innovation is relatively common among Norwegian companies. In 2016, over 37% of all firms that produced some form of innovation collaborated with external partners. This figure was above that of Sweden and the EU average, but slightly below that of Denmark and Finland (NIFU, 2019). Correspondingly, business R&D expenditure has increased steadily since 2011, recording a growth of 10 percent in 2017 (Statistics Norway, 2018). For example, the business sector's share of the total R&D expenditure of Norway was about 43% in 2017, amounting to NOK 39.5 billion. This represents an increase of 9% on the 2016 figure. Of this amount, the R&D services acquired from other companies and institutions amounted to NOK 7.4 billion. Almost one-fifth was spent on research services from higher education institutions and public research institutes, representing a decline of 9% from 2016 (NIFU, 2019; Statistics Norway, 2018). There has been a gradual decrease in the purchase of R&D services from universities in the past decade, despite efforts at stimulating collaboration and continuous improvement in university research quality (NIFU, 2019).

Norwegian universities[4] have made significant contributions to the growth in the country's research performance in the last couple of years (OECD, 2017). In 2018, universities accounted for 72% of the approximately 27,000 scientific publications Norway recorded. Four universities — University of Oslo, University of Bergen, Norwegian University of Science and Technology, and University of Tromso — accounted for 48% of all publications, while the rest of the HEIs contributed 24 percent (NIFU, 2019). Another feature of the higher education system is the rise in international research collaboration as

[4] The number of public HEIs in Norway currently stands at 21, including 10 universities, five specialized university colleges and six university colleges. In addition, there are many private institutions, of which 15 receive public support (MER, n.d.).

reflected in the number of multilateral projects (e.g. in the EU's Horizon 2020 program) and international co-authorship patterns. For instance, over half of all publications registered in the Cristin[5] database included at least one international co-author. This represents a 10% increase on the 2011 figure (NIFU, 2019). Collectively, these statistics show that Norwegian universities have become more internationally oriented in their research efforts. Perhaps, this focus might partly be driving the decline in R&D collaboration with firms.

3.2 Research design

The thesis uses a mixed-method research design relying on inductive and deductive approaches in the research process. The use of both approaches is informed by the different research objectives outlined in the individual papers. The primary objective pursued in Papers I and II is to explain the influence of varied factors on academics' engagement with external actors. Paper IV also has a similar goal of explaining the drivers of firms' collaboration with academic partners. In these papers, a deductive approach is adopted whereby a set of hypotheses, based on existing literature, are put forward. These are subsequently tested with quantitative data and appropriate analytical techniques (Saunders, Lewis, & Thornhill, 2016). In Paper III, the aim is to understand the mechanisms underlying academics' collaboration networks and knowledge transfer in peripheral regions. To be able to explain the complexities inherent in these activities and provide more nuanced insights requires following an abductive approach, which combines induction and deduction in theory development. The process starts from a general conceptual framework as a source of inspiration, and subsequently requires obtaining detailed data on the experiences of academics. Analysis of the qualitative data

[5] Cristin (Current Research Information System in Norway) is a Norwegian scientific database that documents all publications of researchers in the higher education sector in Norway.

allows for identification and explanation of themes and patterns observed (Saunders et al., 2016).

In following this approach, both quantitative and qualitative data are collected and analyzed in the different papers (Saunders et al., 2016). Papers I and II follow a cross-sectional survey strategy. The data were collected from academics through questionnaires and analyzed with statistical techniques. Paper IV also relies on a survey strategy, building on register data (CIS) and bibliometric data. The data were analyzed with statistical techniques. Paper III employs a single case study strategy relying on qualitative data collected through semi-structured interviews with academics. The interviews are analyzed using thematic analysis, where common patterns of meaning in the data are identified, grouped, and interpreted. Table 5 presents a summary of the research design and methods used in the individual papers. The following section describes the different types of data used in the thesis.

Paper	**Research strategy**	**Data sources**	**Data analysis**	**Unit of analysis**
I	Survey	Online questionnaire completed by academics in 7 universities in Europe	Poisson regression analysis	Academics
II	Survey	Same data as in Paper I	Poisson regression analysis	Academics
III	Single case study	Semi-structured interviews	Thematic analysis	Academics
IV	Survey	- Register data/CIS - Linked Employer-Employee Data (LEED) - Bibliometric data	Logit regression analysis	Firms

Table 5 Summary of the aspects of research design of the individual papers

3.3 Data collection

As discussed in the previous section, the thesis relies on quantitative and qualitative data collected from different sources. Understanding the drivers of academic engagement requires testing the associations between several variables using large datasets. Collecting data from academics using questionnaires allows for statistical inferences and helps to explain the processes behind academics' behavior. However, not every aspect of academics' engagement behavior can be easily operationalized and analyzed with questionnaires and statistical techniques. Thus, when complemented with in-depth interviews, a nuanced and rich insight on the mechanisms underlying the behavior can be unearthed. Moreover, relying on large micro-level datasets on firms allows for statistical analyses of firms' attitudes and choices regarding engagement with academic partners. The variety of these approaches provides the benefit of being able to collectively capitalize on the strengths of each approach and offer a broader set of evidence helping to derive meaningful conclusions.

3.3.1 The RUNIN-ECIU Academics' Survey

Part of the data collection involved gathering of primary quantitative data about the attitudes and perceptions of academics toward external engagement. The target population for this data collection was academic scientists of universities in the ECIU network. The reasons informing the selection of these universities were theoretical and practical. To gain clear insights about external engagement requires searching for institutions that articulate this as an integral part of their mission and demonstrate a record of accomplishment in collaborating with external partners. The universities in this network are suitable candidates because of the close links they maintain with industry and societal actors in and outside their regions. Furthermore, gaining access to these institutions

posed less challenge as most of them were part of the RUNIN Project[6]. To ensure the success of the survey, the ECIU leadership was invited to support the data collection exercise. To this end, the Secretary General sent invitation letters to all affiliate members of which seven agreed to participate. The universities were contacted for the email addresses of academic staff, but due to data protection issues, only one obliged to this request. As a result, the sample could not be selected beforehand.

The questionnaire was designed following the guidelines provided in the literature (e.g. Dillman, Smyth, & Christian, 2014). I prepared the initial questionnaire in English, building on existing surveys with inputs from the in-depth interviews (see sub-section 3.3.2). I then asked two professors to review the draft questionnaire and suggest further improvements. After a few rounds of revision, the final version was translated into 11 European languages by a professional translation firm. After this, I forwarded the translated versions to experts on the subject, who are also native speakers, for further review. The aim was to check for equivalence of meaning between the English and other versions as well as to identify potentially problematic items for evaluation and retranslation (Harkness, 2003). Lastly, I conducted a pilot study where the questionnaire was sent to 10 academics to check whether the questions were properly constructed and understood. The feedback gathered from the pilot was factored into the final changes to the questionnaire. Appendix 1 contains the questionnaire used for the data collection.

Following this, the questionnaire was distributed using a web-based survey developed by a private company called *Opinion AS*. Before the

[6] The RUNIN Project (the Role of Universities in Regional Development and Innovation) was a Marie Skłodowska-Curie Actions network that offered innovative training to 14 early stage researchers at seven universities. The project was funded by the European Union's Framework Programme for Research and Innovation (Horizon 2020) under the Grant Agreement No. 722295. It ends in February, 2021.

distribution, a press release was issued to all the universities describing the purpose of the survey and asking for faculty members' participation. Then, a formal invitation letter together with a personalized link was sent directly to the academics whose emails were available. To reach those whose emails we did not have, a standard invitation with an open link was forwarded to contact persons at the respective universities for onward circulation. The press release as well as the invitation letters were written in a local language and English to reach a broader section of academics. In addition, participants could return the questionnaire in any of 12 languages of their choice. Following these approaches, 7,330 academics were contacted either directly or indirectly through their universities. The population of interest comprised all faculty with teaching and/or research positions from the rank of post-doctoral fellow to full professor. This defined population therefore excludes PhD students, research assistants, technicians, and administrative personnel.

The data collection occurred between September and November 2019. Two reminders, sent two weeks apart, were forwarded to participants after the initial invitation. At some universities, a third reminder was issued due to low response rate. At the close of the survey period, 635 questionnaires were returned, representing a response rate of 8.70%. The response rate varies across the universities (see chapter 4 for details). Low response is a common problem in web-based surveys (Dillman et al., 2014), and was also to be expected given the challenges encountered in getting universities to participate. I conducted formal tests to check whether the response rate had any effect on the quality of the data. A non-response bias test was performed by comparing early respondents to late respondents on key variables like gender, position, professional experience, discipline, academic engagement, individual motivations, and place attachment, among others. Except for pecuniary motivation in which the T-test was significant, the differences for all the other variables were small and insignificant. This suggests that non-response bias was

less likely to present a major problem in the sample (Hair, Black, & Babin, 2010). Table 11 in the appendix shows the results of the tests.

In addition, I took steps to minimize the effect of common method bias in the data. Since a single respondent completed the questionnaire, there is a risk of artificial covariance occurring between the explanatory and outcome variables. This can lead to spurious results and potentially misleading conclusions (Podsakoff, MacKenzie, & Podsakoff, 2012). Mindful of this, I implemented various procedural strategies in the questionnaire development and administration stages to minimize self-reporting bias. For instance, I separated questions intended to measure dependent variables from those measuring independent variables. Moreover, the dependent variables were measured on a nominal scale while the predictors were assessed with Likert scale.

Furthermore, I ensured that the anonymity of respondents was safeguarded by not collecting any personal data like emails or unique personal identifiers that could be linked with background information to identify a respondent. To preserve the confidentiality of respondents, the data were stored securely on the UiS server, and I alone had access to it for analysis. Prior to data analysis, I also checked the possibility of common method bias in the data by conducting a Harman's single-factor analysis. All items of the measures of interest were entered into a factor analysis. The principal component analysis (PCA) resulted in 12 components with eigenvalues greater than 1.0 that accounted for 70% of the total variance. The first unrotated factor solution accounted for 13% of the covariance among the measures. This provides no evidence of common method bias affecting the validity of the research findings (Podsakoff et al., 2012). Highlights of the key descriptive results from the survey are presented in chapter 4.

3.3.2 Semi-structured interviews

Given Paper III's objective of understanding how academics' collaboration activities can help in drawing external knowledge to peripheral regions, I employed semi-structured interviews for data gathering. To gain rich information, I adopted a purposive sampling method to select academics with the experience of engaging in collaborative activities with academic and non-academic partners (Patton, 2002). I commenced the processes of identifying participants with a search on the University of Twente's website. The website contains a database that records the publications, networks, and projects of faculty members. I searched the database and identified some potential participants. Subsequently, I searched the home pages or personal websites of these academics to get detailed information about their collaboration activities and networks. The selection process yielded a shortlist of 25 academics from various disciplines. At the following stage, I extended a formal invitation to the academics requesting them to participate in the study. An email with a brief overview of the RUNIN Project and a description of the purpose of the study was forwarded to the selected academics. Of this number, 11 finally accepted to take part in the study. A detailed description of the characteristics of the sample is provided in Paper III.

I conducted face-to-face interviews with all the participants at their offices to reduce potential discomfort that an unfamiliar setting might cause. I prepared an interview guide to keep the interview on track. This included questions on the evolution of collaborative activities, the motivations, modes of collaboration, and local knowledge transfer activities. Before an interview began, I had repeated the purpose of the study, and sought the participant's consent to record the interview. Thereafter, I gave them a consent form to read and sign if they agreed with the terms of the study. The duration of the interviews was between 30 and 90 minutes. After each interview, I asked the informant whether they had any questions or further comments. In addition to the

recordings, I took notes and sought further explanations of statements that were unclear.

At the end of the interviews, I transcribed and analyzed the recorded data thematically following the approach of Braun and Clarke (2006). I read the transcripts to identify recurrent themes from the narratives. I initially coded these themes and the codes that were related were later grouped under broad themes. Through an iterative process, I constantly compared the coded data to the entire data to check for patterns of commonalities. I finally interpreted the themes that emerged in relation to the conceptual framework and presented them as findings.

3.3.3 Other data sources

In addition to the survey and interviews, I used data from public registers and publication databases in the thesis. These include the Community Innovation Survey (CIS), Linked Employer-Employee Data (LEED) and Scopus bibliometric data. The CIS of Norway is carried out as part of the European-wide survey and monitors innovation investments, processes, and outputs of Norwegian businesses. It provides information on the types of innovation firms develop, the different partners with whom they collaborate, and the geographical location of these partners, among others. It was first conducted in 1992 and has since been carried out biennially. The population of interest represents firms operating in manufacturing or service industries, as well as petroleum and aquaculture. The sampling is conducted on a tiered basis, such that the survey is a census for all businesses with 50 or more employees. For all firms with less than 50 employees, a random sample, stratified by industry and size class, is drawn.

The Norwegian CIS has two characteristics worth noting. First, participation is mandatory for sampled firms, with fines for non-respondents. This almost rules out non-response bias. Second, the routing structure ensures all firms report collaboration activities, even

those with no innovation output. This notwithstanding, the self-reporting of innovation activities might lead to the possibility of measurement bias. Firms that consider the questionnaire as encroaching on their time might under-report activities to answer fewer questions. Conversely, others might inflate their activities perhaps to project a good image of their companies (Podsakoff et al., 2012; Solheim, 2017). Another downside is the dichotomous nature of most questions regarding collaboration. In the CIS, firms are required to indicate whether they collaborated with external partners or not during the reference period. Such questions only show the breadth of collaboration but fails to capture the depth or intensity of these interactions (Evers, 2020).

The Norwegian LEED is a complete dataset containing information on employee demographics, job characteristics, as well as firm characteristics. This dataset is compiled and managed by Statistics Norway, and accessible for research purposes. An essential aspect of this dataset is the unique identifier assigned to each person, establishment, and business. This feature allows the tracking of employees, even if they shift jobs or are unemployed (Jensen, 2010). The LEED dataset was linked to the CIS data for the following purposes. First, it is used to identify the location of a firm based on the municipality where most of its employees work. In addition, it provides information on the number of employees and the level of their educational attainment. This allows for controlling for the size of a firm and level of human capital in the empirical estimation in Paper IV.

The publication data was compiled from the Scopus database. Scopus is an abstract and indexing database developed by Elsevier in 2004. It contains 75 million documents sourced from over 24,000 active titles and 5,000 publishers. The database covers contents from journals, conference proceedings, book series and trade publications in all scientific fields. Moreover, it offers enhanced sorting and searching features enabling researchers to access over one billion citations going back to the 1970s. An additional feature of Scopus is the system of

unique identifiers (profiles) that allow users to track research outputs of individual authors and organizations. Using the profiles of authors or institutions, one can compute the number of publications and citations for all subject areas within a certain period (Aldieri, Kotsemir, & Vinci, 2018). Aggregate publications and citations data provide a reasonable idea about the degree of research intensity and quality of a university (or universities) in a region. These data were used to develop measures of research excellence in disciplines relevant to regional industries. The procedure for creating these measures is described in detail in Paper IV.

4 Key findings from the RUNIN-ECIU Academics' Survey

4.1 Background information on survey respondents

As indicated previously, the survey was administered in seven ECIU member universities. The individual universities recorded varied response rates. As shown in Table 6, UiS and UT are the institutions with the highest response rate, of 18%. In comparison, DCU and KTU record the lowest response rate of less than 5%.

University	Population	Number of respondents	Response rate (%)
Aalborg University	1,387	137	9.90
Autonomous University of Barcelona	2,666	151	5.70
Dublin City University	625	28	4.50
Kaunas University of Technology	680	32	4.71
University of Stavanger	699	126	18.00
University of Trento	643	50	7.80
University of Twente	630	111	17.60
Total	7,330	635	8.66

Table 6 Distribution of survey response rate by university

Table 7 reports the distribution of the sample. Fifty-six percent of the total respondents are men, whereas 44% are women. The distribution by scientific fields shows that the social sciences have the highest share of the sample (38%) followed by engineering and natural sciences (28%). Humanities and arts are the least represented with a 16% share of the sample. In terms of academic rank, about 10% are research fellows, 21% are assistant professors, 43% and 26% are associate and full professors, respectively. Lastly, 21% of the sample are under the age of 40, while 48% are over 50 years.

	Biological Sciences & Health	Engineering & Natural Sciences	Humanities & Arts	Social Sciences	Total
No. respondents	113	175	102	235	625
Share of respondents (%)	18.1	28.0	16.3	37.6	100
Share men (%)	46.9	74.3	45.1	51.1	55.8
Share women (%)	53.1	25.7	54.9	48.9	44.2

Table 7 Distribution of the sample by discipline and gender. *Note.* Analysis based on final sample after data cleaning

4.2 Academics' engagement with external actors

The results of the survey indicate that external engagement is widespread among the academics in the sample. As shown in Table 8, 78% of the total number of respondents participated in at least one engagement activity in the past three years. The rest of the respondents (22%) did not engage with external partners during the corresponding period.

Indicator	Number of engaged respondents (%)
Gender	
Men	267 (76.5)
Women	219 (79.4)
Total number of engaged respondents (%)	486 (77.8)
Discipline	
Biological Sciences & Health	80 (70.8)
Engineering & Natural Sciences	142 (81.1)
Humanities & Arts	73 (71.6)
Social Sciences	191 (81.3)
Academic rank	
Research fellow	42 (65.6)
Assistant professor	102 (79.1)
Associate professor	214 (79.9)
Professor	128 (78.1)

Table 8 Distribution of engaged academics by gender, discipline, and rank

Variations emerge when analysed across different indicators. There is little difference regarding the engagement activities of male and female academics, with 79% of women compared to 77% of men having some form of interaction with external partners. Across disciplines, 81% of academics in social sciences and engineering and natural sciences engage, compared to 71% in biological sciences and humanities. With respect to academic rank, associate professors engage the most, followed closely by assistant professors and full professors. Research fellows were the least engaged.

Table 9 shows the distribution of the sectors of respondents' external engagement by discipline and gender. According to the survey results, academics' engagement with external actors cuts across diverse organizations. Of the total number who engage with external actors, 70% from all scientific fields collaborate with business organisations. However, academics in science, technology, engineering, and mathematics (STEM) disciplines have the highest engagement with businesses, while those in social science and humanities (SSH) disciplines engage less with businesses. The results show that almost 90% of academics in engineering and other applied sciences and close to three-quarters of biological and health sciences academics engage with business organizations. In comparison, 64% of social sciences academics and less than half of those in humanities interact with businesses.

	Business organizations	**Public organizations**	**Third-sector organizations**
All scientific fields (%)	342 (70.4)	391 (80.5)	163 (33.5)
Biological Sciences & Health (%)	57 (71.3)	62 (77.5)	29 (36.3)
Engineering & Natural Sciences (%)	127 (89.4)	100 (70.4)	34 (23.9)
Humanities & Arts (%)	35 (47.9)	63 (86.3)	23 (31.5)
Social Sciences (%)	123 (64.4)	166 (86.9)	77 (40.3)
Men (%)	214 (80.2)	214 (80.2)	87 (32.6)
Women (%)	128 (58.5)	177 (80.8)	76 (34.7)

Table 9 Distribution of sectors of engagement by discipline and gender (n = 486)

With respect to public sector engagement, the results show that 81% of academics engage with public organizations. This is eleven percentage points more than those who collaborate with business organizations. While engagement with public organizations tends to be generally high among academics in various disciplines, SSH academics report the highest level of interaction. About 86% of academics in social sciences and humanities interact with public partners, compared to an average of 74% of those in engineering and biological sciences. Compared to the private and public sectors, the third sector represents the sector with the least engagement. Thirty-four percent of academics interact with organizations in this sector. As with public sector engagement, social scientists engage the most (40%) with the third sector, followed by academics in biological and health sciences (36%). Academics in engineering and natural sciences have the least collaboration. Only 24% collaborate with organizations in the third sector. This is over 60 percentage points lower than the interaction these scientists have with business organizations.

There are marked gender differences with respect to the sectors of engagement. Men engage much more with businesses, while there are hardly any gender differences when it comes to engagement with public or third-sector organizations. Eighty percent of men cooperation with business organizations, compared to 59% of women. However, women have a marginally higher engagement with public organizations than men. Correspondingly, 35% of female academics collaborate with partners in the third sector, compared to 33% of male academics. These differences, however, are not statistically significant. Altogether, academics engage with partners in various sectors, and interesting patterns emerge when the engagement is examined from disciplinary and gender angles.

In relation to the sectors of engagement, previous studies suggest that academics who have worked in other sectors or established their own business are more likely to engage with external partners (Gulbrandsen,

& Thune, 2017). In the survey, respondents were asked to indicate the sector(s) they have worked in prior to entering academia. The results, as presented in Figure 2, show that a sizeable share of academics have work experience in at least one organization outside academia. Thirty percent of respondents have prior experience in business and public organizations. By contrast, a small share of respondents (9%) had prior work experience in third sector organizations. When it comes to entrepreneurial experience, 13% of academics have prior experience of starting or managing their own business. Lastly, nearly one-fifth of academics have formerly worked in a research organization other than a university. These results indicate diversity in the professional experience of academics.

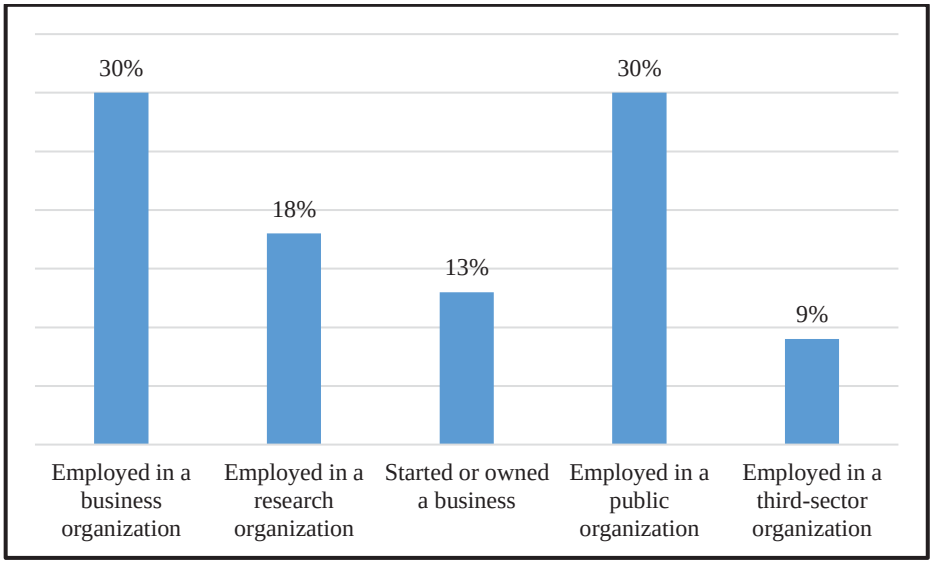

Figure 2 Distribution of prior work experience of academics (n = 486)

Finding a suitable partner(s) is a necessary condition for developing relationships between academics and external actors. In building external linkages, academics rely on different mechanisms — some formal and others informal. In the survey, respondents were asked to state the actors that normally initiate their engagement partnerships (respondents had an

option of selecting multiple initiators). As shown in Figure 3, over three-quarters of academic engagement are initiated by external partners. By contrast, university personnel (e.g. TTOs) and public agencies are the least cited initiators (33%). It is worth stressing the proactive role of academics, as 69% are themselves the initiators of their engagement ties. Furthermore, mutual interactions between academics and external actors in formal and informal settings also play a notable role in the development of engagement relationships. More than half of academics' cooperation with external actors are initiated through these mechanisms. These results suggest that bottom-up, informal mechanisms might be more effective than top-down, formal mechanisms like TTOs in promoting collaborative partnerships.

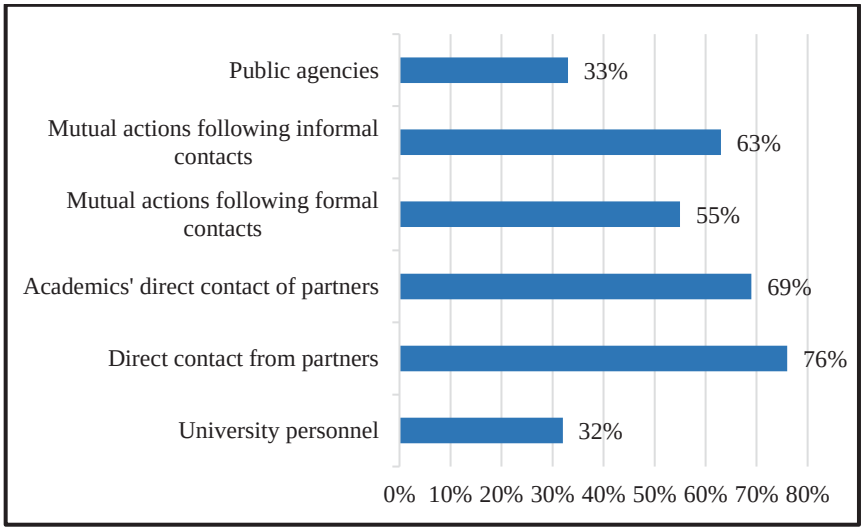

Figure 3 Ways of initiation of external engagement (n = 486)

4.3 Channels of engagement between academics and external actors

Academics interact with external partners through different modes of informal and formal activities. The survey identifies patterns of engagement by examining the activities academics engage in and the

geographical scale of these engagements. As shown in Figure 4, providing informal advice, and conducting joint research are the most widely used activities of engagement. Approximately 80% of academics record engaging through these activities. Following these, the next most frequent activities are student projects and internships, and contract research — 47% and 41% of academics interact through these activities, respectively. Other activities used less frequently include consultancy (36%), training of employees of external organizations (35%) and sitting on advisory boards (32%). Research commercialization represents the least commonly used channel of engagement, with only 8% of respondents using this in the past three years.

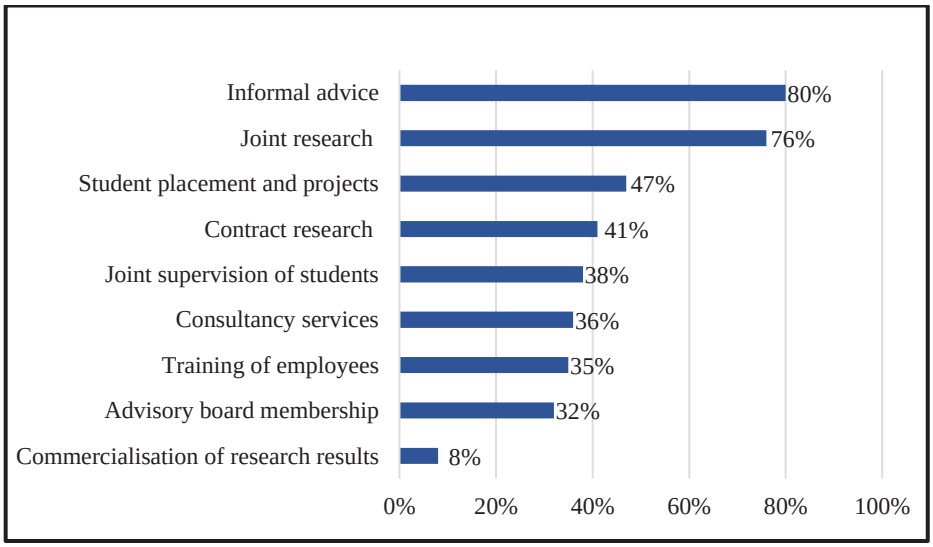

Figure 4 Use of different channels of engagement (n = 486)

There is also variation in the mode of engagement across scientific disciplines. As shown in Figure 5, most of the engagement activities of academics in social science disciplines were through the provision of services like training of employees and membership of advisory boards. For example, almost half of social science academics served as members of advisory boards of external organizations. This is twice that of

academics in engineering disciplines. Over 40% of social scientists organized training for external organizations' employees and provided consulting services. This is ten percentage points higher than the share of academics in engineering who performed these services. This trend is similar in other activities like giving informal advice, joint research projects and contract research. However, academics in engineering were more likely than their counterparts in the social sciences to engage in student-related cooperation. Forty-one percent and 38% of engineering academics collaborated through joint supervision of students, and student projects and internship programs, respectively. By contrast, 31% and 33% of social sciences academics performed these respective engagement activities. Unsurprisingly, larger shares of respondents in engineering (62%) and biological sciences (30%) engaged through commercialization activities than those in humanities (5%) and social sciences (3%).

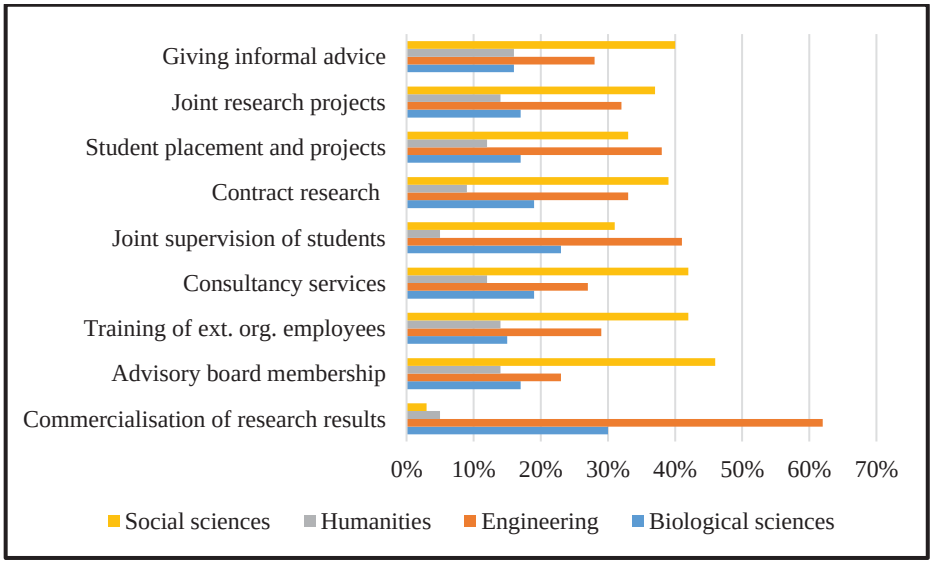

Figure 5 Use of different channels of engagement by discipline (n = 486)

The results highlight some important variations regarding the geographical dimension of the use of different channels for engagement.

Considering that academics' engagement takes place at varied spatial scales, the survey asked respondents to indicate whether they had engaged through any of the nine activities with regional, national and/or international partners. Figure 6 presents the proportion of academics that engage in the various activities at each geographical scale. The results show that respondents engage in more activities within a country than outside a country. Except for informal advice and joint research activities that had over 30% of respondents interacting with international actors, a relatively small share interacted internationally through the remaining activities. Regarding intra-national engagement, academics tend to have higher interaction at the national level than at the regional level. Close to 60% of academics offer informal advice to national partners, compared to 50% who interact with regional actors through this channel.

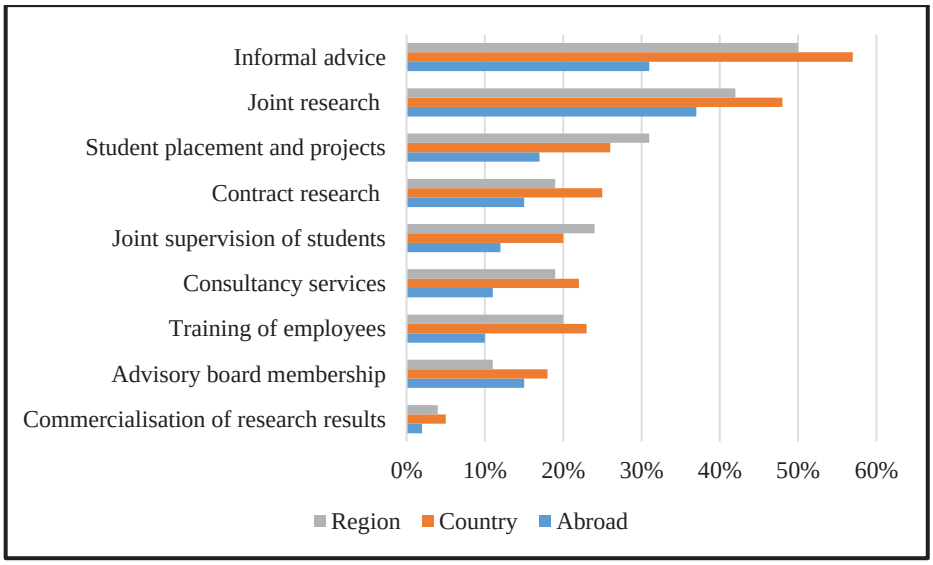

Figure 6 Use of different channels of engagement by geographical scale (n = 486)

A similar picture pertains to other activities like joint research, contract research and serving on advisory boards. However, student-related engagement is more localised in regions than at the national level. For instance, 31% of academics cooperated with regional organizations

through student projects and internships, compared to 26% that engaged nationally. The localization of these activities may be due to proximity advantages in partner search and possibly lower transaction costs involved in securing placements for students in organizations located within the region (Fitjar & Gjelsvik, 2018).

Overall, the results highlight the diverse activities academics use in their engagement with external partners. Also, differences between scientific disciplines and at varied geographical scales in the use of specific channels are emphasized. Specifically, social sciences academics mostly engage through service provision, whereas engineering academics collaborate through student-related activities. Furthermore, engagement in all activities is more frequent at the national scale. But a stronger regional interaction is reported in student-related activities.

4.4 Motivations and benefits from academics' engagement

Numerous reasons have been offered to explain why academics engage with external actors. To understand the motivations of academics, the survey asked respondents to rank the importance of a variety of motivations for their engagement with non-academic partners on a scale from one to five (where 1 is unimportant and 5 is very important). Consistent with prior studies, most of the 486 respondents indicate that the development of research activities and societal benefits of research were the most important motivations for their engagement with external actors (see Figure 7). The research related motivations that were considered by most academics as important or very important include gaining new ideas for research (81%) and securing funding for research (72%). In addition, building and maintaining professional networks was rated as important or very important by 80% of academics. Aside from the personal motivations, almost 90% of respondents ranked the societal impact of research as the most important motivation for their

engagement. In contrast, securing personal monetary benefits was ranked as the least important motivation for engagement (17%).

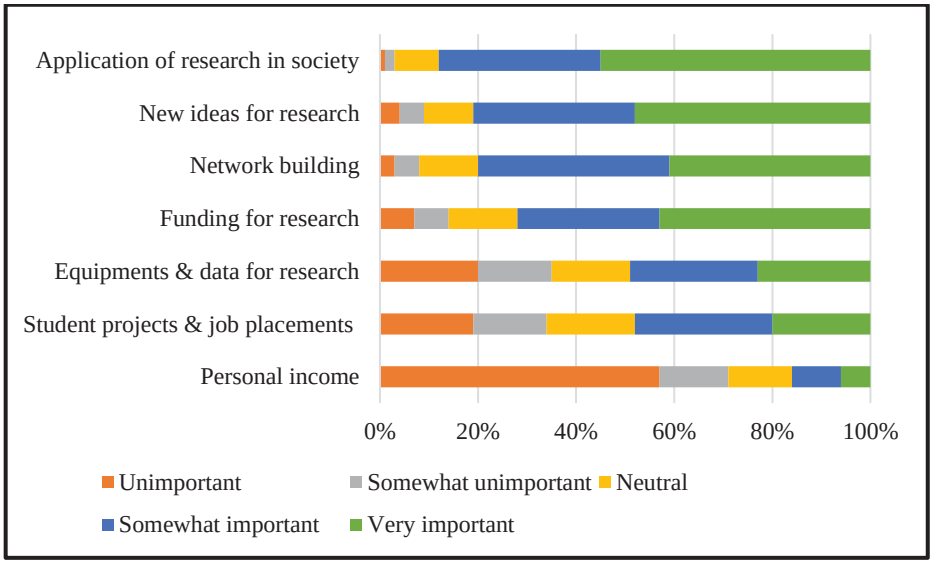

Figure 7 Importance of different motivations for academics' external engagement (n = 486)

Figure 8 shows that motivations remain generally consistent across academic ranks, although with some important differences. Acquiring resources like new ideas, equipment, and data for research, as well as gaining personal income, are more important motivations for research fellows compared to associate and full professors. These patterns are unsurprising considering the uncertainty and insecurity inherent at this early career stage. Research fellows require these resources to conduct research and publish to secure tenure. Conversely, professional networking, securing funding for research and securing jobs and projects for students are more important to full and associate professors than research fellows and assistant professors. These motivations are also reasonable because academics in these senior positions usually head a research group and they need more funding to manage their group and hire quality researchers.

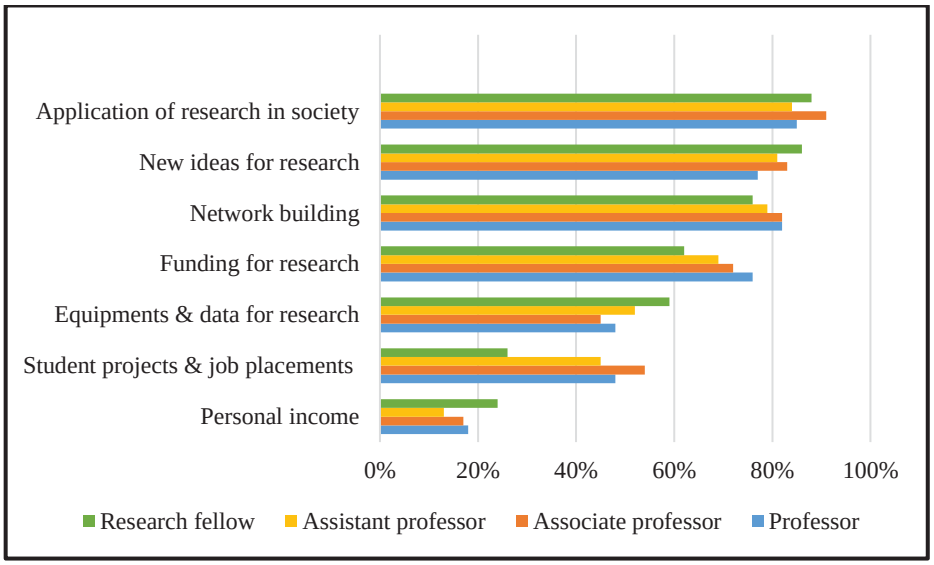

Figure 8 Share of academics who consider different motivations as important and very important for external engagement, by rank (n = 486)

Besides examining the motivations underpinning academics' external engagement, the survey also sought to establish whether academics use the resources and external experience in their teaching and research roles. Respondents were asked to indicate their level of agreement with some statements on the benefits of their external engagement for the performance of other academic roles. As shown in Figure 9, a significant proportion of engaged academics report a high benefit of these activities on their research. Approximately 90% agree or strongly agree that external engagement contributed to their securing new contacts and new ideas. A slightly lower share (78%) indicates that it has enhanced their reputation in the scientific field. In comparison to research, the reported benefits on teaching are relatively lower. Specifically, 55% of academics agree or strongly agree that external engagement resulted in changes to course programs and the delivery of course content. The least cited benefit is for students' entrepreneurial skills (30%).

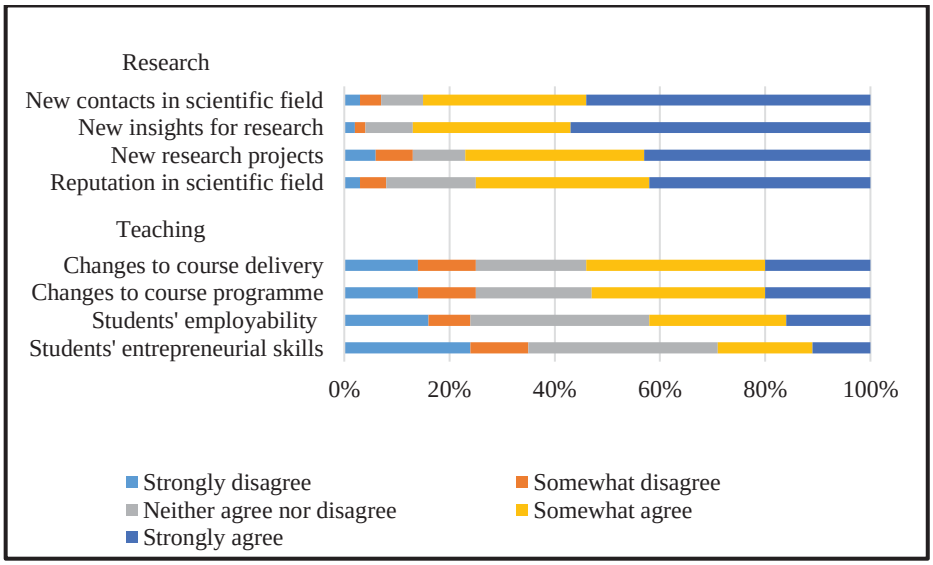

Figure 9 Academics' level of agreement on the benefits of external engagement for research and teaching (n = 486)

4.5 Summary of findings

The survey provided evidence that academics engage with actors in various external organizations. Academics from all disciplines engage with external partners, although those in the social sciences and engineering and natural sciences reported higher levels of engagement. Contrary to prior studies, the survey did not find any marked gender gap in the engagement efforts of academics except for engagement with businesses. Regarding the channels of engagement, the survey shows that academics engage through a broad range of activities. Variations, however, exist in the use of these activities across disciplines and spatial scales.

The development of the collaborative relationships occurs through diverse mechanisms. These include the use of intermediaries, academics' direct contact of partners, external partners' direct contact of academics and mutual actions. The survey finds that most of academics' external

engagement are initiated through the latter three mechanisms. This supports the findings of Paper III that shows that academics develop their external ties through active search, passive search, and fortuitous encounters. Moreover, the role of social networks in the development of cooperative ties is highlighted in Paper II. The results from the regression analysis reveal a significant association between informal social networks and regional engagement. It is not surprising that most engagement starts from bottom-up informal mechanisms as existing social ties serve as a bridge to formal engagement.

Lastly, the survey also demonstrates that academics engage with external partners for several reasons. These include acquiring resources for research, contributing to the betterment of society, and securing personal income. The two former reasons are the most important motivations, while the latter remains the least important. In addition, these instrumental and altruistic motivations remain reasonably stable across career stages of academics. However, variations exist between these motivations at different career stages as highlighted in the regression analysis in Paper I. Career motivation is more important at the early stage, whereas pecuniary motivation is important at the late stage. Prosocial motivation, however, is more salient at the midcareer stage.

5 Summary of research papers

This chapter presents brief summaries of the papers included in the thesis. As discussed in chapter 3, all the papers are empirical, relying on data from different sources to address specific research questions. Each of the papers is written separately in a journal article format. They, nonetheless, are interconnected and together contribute to understanding the influence of various individual, organizational, and regional factors on academic engagement. Paper I investigates how academics' motivational drivers and the perception of fairness in the policies of their institutions affect their external engagement. Paper II examines how academics' embeddedness in a region is associated with their engagement with local actors. Paper III provides an in-depth examination of how academics' collaborative activities in diverse networks across spatial scales contribute to knowledge transfer to peripheral regions. And lastly, Paper IV provides insights on how local firms' knowledge search strategies and the research excellence of regional universities determine their collaboration with university partners. Table 10 gives an overview of the research papers, including the authors, research questions, findings, and publication status.

5.1 Paper I: What motivates academics for external engagement? Exploring the effects of motivational drivers and organizational fairness

Drawing on individual motivation and organizational justice theories, the paper first argues that various motivations — career, pecuniary, or prosocial — are important for academics' engagement behavior. It further contends that different motivational drivers will be more salient at different career stages of academics. This is because career needs and expectations are likely to change as academics transition from one stage

to another. As such, their motivations may vary depending on these and other conditions. Furthermore, the paper theorizes that academics will be encouraged to collaborate with external partners if they feel that they are receiving fair compensation or recognition for their efforts. And if they perceive that the processes for enacting and implementing such compensations in their institutions are fair.

The findings indicate that academics consider prosocial motivation to be most important for engagement and only minor differences exist across career stage. However, there are marked differences regarding the association between the importance of motivation and actual engagement. Notably, career motivations are strongly associated with external engagement at early and late career stages, while pecuniary motivation is strongly related to engagement at only the late stage. Prosocial motivation is positively correlated with external engagement at only the midcareer stage. Contrary to expectations, neither distributive nor procedural fairness are associated with external engagement. This evidence suggests that organizational fairness perceptions matter less or not at all for academic engagement. The paper adds to the literature by providing nuanced insight into the effects of different motivations on academic engagement at different stages of the career cycle. It also extends justice perspectives to the academic engagement literature and shows that justice perceptions play a less essential role in the engagement behavior of academics.

Title	Author(s)	Research question	Key findings	Status
I. What motivates academics for external engagement? Exploring the effects of motivational drivers and organizational fairness	Atta-Owusu, Kwadwo and Fitjar, Rune Dahl	How do motivational drivers and organizational fairness perceptions influence engagement activities of academics?	Individual motivational drivers tend to exert significant impact on the external engagement of academics, while organizational fairness perceptions matter less. Different motivations become important at specific career stages of academics.	Submitted to Science and Public Policy
II. Engaging for love of place? The role of place attachment in academics' regional engagement efforts.	Atta-Owusu, Kwadwo and Fitjar, Rune Dahl	How does academics' embeddedness in a region affects their engagement with regional actors?	Academics' attachment to place, and informal social networks are relevant for their engagement in regions. However, the effects differ markedly between native and non-native academics.	Submitted to Regional Studies

Table 10 Summary of research papers

Title	Author(s)	Research question	Key findings	Status
III. Oasis in the desert? Bridging academics' collaboration activities as a conduit for global knowledge flows to peripheral regions.	Atta-Owusu, Kwadwo	How do the collaboration activities of academics facilitate the transfer of extra-local knowledge to peripheral regions?	Academics embeddedness and activities in different networks serve as potential conduit for transmitting distant knowledge to peripheral regions. The mobility of researchers and research projects are the main mechanisms that facilitate such knowledge transfer.	Published in Regional Studies, Regional Science (Volume 6, Issue 1)
IV. What drives university-industry collaboration: Research excellence or firm collaboration strategy?	Atta-Owusu, Kwadwo, Fitjar, Rune Dahl and Rodríguez-Pose, Andrés	How do university research excellence and firm networking strategy affect collaborative activities with university partners?	Local firms' external knowledge search strategies tend to be more salient in collaboration with universities. In contrast, local university research output tends to impede collaboration with firms.	Submitted to Technological Forecasting and Social Change

Table 10 Summary of research papers

5.2 Paper II: Engaging for love of place? The role of place attachment in academics' regional engagement efforts

The paper builds on place attachment and social network literatures to examine how academics' place attachment and their informal social networks influence their engagement with local partners. It additionally compares the importance of these factors between native and non-native academics to examine whether local embeddedness works through different mechanisms for those who migrate to a region than for those who were born there. The paper suggests that academics with strong attachment to a place will more likely engage with local partners with the view to improving the region. Furthermore, it argues that informal networks fulfil a crucial role in the local engagement of academics, as embeddedness in these networks provides social capital and opens opportunities for collaboration. However, non-natives may maintain less extensive informal networks because of various obstacles in the host region limiting their opportunities for local collaboration.

The empirical findings show the importance of place attachment and informal social networks in academics' regional engagement. Moreover, the impact of place attachment remains consistent across the two groups, albeit with a weaker effect for non-native academics. However, the informal social networks of native academics show a highly significant association with regional engagement, whilst the relationship remains insignificant for non-natives. The paper contributes to the academic engagement and place attachment literatures by shedding light on the importance of academics' sense of local rootedness and social embeddedness for the processes of regional engagement.

5.3 Paper III: Oasis in the desert? Bridging academics' collaboration activities as a conduit for global knowledge flows to peripheral regions

Building on the case of the University of Twente, the paper explores how academics' embeddedness in different scientific and non-scientific communities across geographical scales can connect peripheral regions to global networks and facilitate knowledge flows. The findings indicate that academics' embeddedness and activities in different networks serve as potential channels for transmitting distant knowledge to peripheral regions. Academic collaboration often precedes cooperation with non-academic partners. Academics' scientific competences and cooperation with other scientists in niche research areas increase their visibility in scientific communities. This enhanced visibility and reputation opens opportunities to also collaborate with non-academic partners.

Additionally, temporary, or permanent mobility of researchers or students, as well as collaborative projects, represent the key mechanisms of knowledge flows. The projects bring in human capital and contribute to network building between researchers and firms in and outside the Twente region. The paper contributes to the literature by highlighting the important role 'bridging' academics can play in enabling peripheral regions to tap into international networks. It also underscores the key mechanisms that facilitate knowledge transfers in such networks. This paper provides insights into the potential of academics' professional networks and collaboration in contributing to knowledge transfer to peripheral regions.

5.4 Paper IV: What drives university-industry collaboration: Research excellence or firm collaboration strategy?

The paper examines the factors that drive firms to cooperate with university partners from the perspective of the firm. It specifically investigates the extent to which research excellence of regional universities and the knowledge search strategies of local firms influence their choices of whether to collaborate with universities. Some studies emphasize the importance of university excellence or quality in firms' decision to collaborate with universities. Others also stress the importance of firms' cooperation with external partners other than universities. However, these studies have explored these aspects separately. Therefore, there is little evidence on the relative importance of both factors in firms' decisions regarding university collaboration.

Accounting for both factors in an integrated analysis, the findings reveal that university research excellence (as measured by the number of publications and citations) have a low or adverse impact on university-industry collaboration. University research excellence tends to reduce firms' collaboration with universities in general, as well as collaboration with regional and national universities specifically. On the contrary, firms' cooperation with non-academic partners exerts a significant impact on university-industry collaboration. Firms that collaborate with other external partners are more likely to also collaborate with universities in general. Moreover, firms that collaborate with external partners at a specific geographical scale tend to also collaborate with universities at the same scale. This paper contributes to the literature by demonstrating that firms' external knowledge search strategies, as reflected in their networking with other partners, are important in their decision to collaborate with universities.

6 Conclusions and implications

The aim of this thesis was to provide further understanding of the factors that shape academic engagement. To this end, the following overall question was framed to guide the research: To what extent do individual, organizational, and regional factors influence academic engagement activities? The contributions of the individual papers, as summarized in the previous chapter, collectively help in answering this question. In this chapter, the key findings and contributions are discussed. Considering that the individual papers investigate factors in different contexts, the discussion will follow the themes outlined in the schematic model (see Figure 1 on page 40). The findings pertaining to individual characteristics are discussed first, followed by organizational and regional factors.

6.1 Findings

The existing literature points to the significant role of individual characteristics and attitudes in academic engagement (e.g. Perkmann et al., 2021). Extending this discussion, the thesis specifically examined how academics' motivation, their attitudes toward place, and social embeddedness influence engagement with external actors. Accordingly, the empirical focus of Papers I and II was to examine the influence of individual motivation and place attachment on academic engagement. In line with existing studies, Paper I finds that individual motivation generally exerts a significant impact on the engagement activities of academics (Lam, 2011a; van de Burgwal et al., 2019b). More specifically, the findings suggest that different motivations — career, prosocial and pecuniary — are associated with academic engagement. However, the contribution of the findings to existing literature lies in the effects of these motivational drivers at different career stages.

Career motivation has a strong effect on the engagement of early and late career stage academics. The external engagement of the former group may be a strategic decision aimed at acquiring resources for research to achieve their career goals (Lam, 2011a). It is intriguing that career motives continue to remain salient at late career stages. One could expect that having attained tenure and the security that comes with it, career advancement would be the least important motivation for engagement of full professors. A plausible reason for the persistence of this motivation is the desire for prestige or reputation in a scientific field or society (Stephan, 1996). Having secured their position, academics' primary motivation shifts to the pursuit of activities that deliver meaningful contributions and raise their social reputation or prestige in scientific fields. Thus, their career motivation for engagement is somewhat different from those at the early stage.

In addition, pecuniary motivation is particularly important for late career stage academics. A probable reason might be that at the early stages, academics sacrifice short-term financial rewards to secure their career. Having achieved this goal, they may use external engagement as a legitimate means to earn personal income to supplement their salaries (Lam, 2011a). All the motivational drivers are salient at midcareer stage, but prosocial motivation has the strongest impact. This could be explained by a broadening of motivational goals arising from career stability. Academics at the midcareer stage might experience some stability in their career, due to attainment of tenure. With their careers stabilized, other motivations come to the fore. Although career needs might still be present, socially oriented goals of midcareer academics become more important. This is perhaps from the realization that they are sacrificing altruistic values at the expense of instrumental goals.

Besides individual motivations, findings from Paper II suggest that a strong sense of attachment to a local context increases the likelihood of academics' regional engagement. Positive sentiments or emotions from pleasant experiences in a region increases the feeling of attachment that

in turn stimulates academics' engagement with local partners. By this same mechanism, negative emotions from unpleasant experiences in a region can weaken academics' attachment, thereby inhibiting their regional engagement. In general, place attachment tends to impact academic engagement. However, the findings indicate that the effects differ among native and non-native academics with place attachment having a stronger impact on the regional engagement of natives than non-natives (Song & Soopramanien, 2019). Paper II makes a novel contribution to the literature by testing and extending place attachment theory to explain academics' engagement with regional actors.

Focusing on social embeddedness and networks, Papers II and III underscore the relevance of formal and informal networks for the regional engagement of academics and the subsequent transfer of knowledge. The findings from Paper III point to the potential of academics' collaborative activities in diverse networks to engender knowledge transfer to peripheral regions. Academics' interaction in both scientific and non-scientific communities at differing geographical scales provide them opportunities to acquire unique resources as well as forge collaborative partnerships. These collaborative projects contribute to knowledge flow to the local context through mobility of researchers and students and involvement of local partners in such projects (Trippl, 2013). Since scientists maintain their networks even when they move, these researchers and students connect their current partners with their existing international networks, thus promoting the transfer of international knowledge (Agrawal, Cockburn, & McHale, 2006). Furthermore, temporary mobility of academics, students and industry actors outside the region also helps draw in knowledge as the mobile individuals acquire new competences and learn about best practices from international interactions (Coey, 2018). Finally, academics' involvement of local partners in international collaboration projects helps these partners tap into external networks and benefit from the specialized knowledge that such projects generate.

Aside from the formal networks, Paper II also shows that academics' embeddedness in informal social networks matters for regional engagement. Recall that the descriptive findings of the RUNIN-ECIU Academics' survey and previous studies (e.g. Hughes et al., 2016) show that one of the most common avenues for initiating collaboration was mutual actions following informal contacts. Interacting with friends and acquaintances in informal settings provide academics with network resources like social capital and opportunities that can be harnessed to develop collaborative partnerships. Whereas informal social networks are important for academic engagement, the degree of importance differs between groups of academics. Informal social networks tend to benefit native academics' engagement, while they have no impact on that of non-natives (Song & Soopramanien, 2019). Altogether, the findings contribute to the existing literature by providing new evidence highlighting the important role of individual-related factors in academic engagement.

Turning to the organizational context, Papers I and IV examine the impact of factors within the university context on academic engagement. Paper I investigates the effect of organizational fairness and finds it matters less in the engagement of academics. More notably, the findings show that neither distributive nor procedural fairness exerts any effect on academic engagement. This evidence suggests that academics' evaluation of the fairness climate in their institutions seems not to influence their decision to engage with external actors. This finding is somewhat surprising given that the effect of organizational fairness on diverse employee and organizational outcomes has been identified in numerous empirical studies in the business sector (e.g. Li et al., 2015; Laundon et al., 2019b, p. 295).

A possible reason for this finding could be the differences in values, norms and culture that characterize universities and businesses. Even though rewards are tied to performance in universities, the link may not be as strong as the pay-performance policies existing in private

organizations. Hence, academics may be less sensitive to perceived organizational fairness infractions compared to employees in business entities. The paper contributes to the academic engagement and organizational justice literatures by testing the importance of organizational fairness in explaining the engagement behavior of academics.

In a similar vein, the findings from Paper IV show that the research output at the local university is negatively associated with firms' collaboration at the local level. The reason might be that universities' preoccupation with attainment of research excellence prevents them from reaching out to local firms. In their quest for prestige, local universities may feel reluctant to invest in local collaboration if such partnerships might not contribute or even distract them from the achievement of their goals. Such reluctance to collaborate might, in turn, drive local firms to search for other collaboration partners who can contribute meaningfully to their innovation processes. Not only does local university research output affect local collaboration, but it also decreases local firms' collaboration with universities in other parts of Norway. This could partly be due to the inability of local universities to connect these firms to other national universities in their network because of the limited or non-existent local interactions. However, local university research output is not significantly related with local firms' collaboration with international universities. Collectively, the evidence suggests that local university research excellence might not be particularly important in local firms' decisions to collaborate with universities.

Conversely, the findings indicate that regional firm characteristics, notably firms' knowledge search strategies, remain important for their collaboration with universities. More specifically, firms that collaborate with external partners like suppliers, customers and consultants are more likely to collaborate with universities. In addition, firms' collaboration with external partners at a specific geographical scale tends to affect

mainly their collaboration with universities at that same scale. In general, the findings suggest that the decision of firms to collaborate with local universities appears to be driven more by the strategic decision of the firm to develop its innovation process in localized networks than by what the local university itself has to offer (Laursen & Salter, 2006; Segarra-Blasco & Arauzo-Carod, 2008). In essence, firms' strategic knowledge collaborations with other partners at different geographical scales serve as bridges connecting them to universities. The paper contributes to the literature by providing evidence on the possible adverse impact of universities' research excellence focus on firms' collaboration with universities.

To summarize, the findings overall provide support for the claim that "academic engagement appears […] to be more driven by autonomous individual motivations and characteristics and less influenced by embedded university characteristics." (Perkmann, et al., 2021, p. 2). Individual characteristics, such as individual motivations, place attachment, and social embeddedness and networks, appear to matter more than organizational factors in the engagement of academics with external actors. In addition, regional firms' knowledge search strategies prove to be essential for collaboration with academic partners.

6.2 Limitations and further research

This thesis, like any other research, has several limitations, and interpretations of the findings should be conducted with these in mind. Nevertheless, the limitations also provide possible opportunities for further research. First, the single case study design provided rich and detailed finding about how academics' interactions can contribute to knowledge flows in the Twente region. Nonetheless, the focus on academics in one context renders the findings not universally valid and caution is required in applying the findings to other contexts. Further research using a multiple case study design could explore the questions in other peripheral regions to increase the generalizability of the findings.

Furthermore, the empirical strategy was to focus on academics' engagement activities in peripheral regions. However, these activities are not limited to only peripheral regions. Hence, further research employing comparative case studies could explore the extent to which the role of academics' engagement in knowledge flows are common or different across peripheral and metropolitan regions.

Second, the empirical analyses in two of the papers rely on data collected from academics across seven ECIU member universities in Europe. Even though the characteristics of these universities may be similar to other universities in Europe, the focus on this consortium limits the generalizability of the findings. To increase the generalizability of the findings across Europe, future studies using a large-scale survey design might consider replicating the studies in other universities. Moreover, the sample was selected from only one university in each country which limits comparison of academics' engagement activities within and across countries. Future studies might explore intranational and international comparative studies to shed light on external engagement of academics in different regional and country contexts, respectively. Furthermore, academic engagement is conceptualized as a multidimensional construct, but this thesis focused on the knowledge transfer and education dimensions. Testing whether the factors identified in this thesis could explain the societal aspect of academic engagement might be a fruitful direction for future research to explore.

Third, part of the findings of this thesis is derived from the empirical context of Norway. As previously discussed, Norway's research capabilities, innovation and industry-university interactions are like some other small and open economies but differ from other countries. This limits the generalizability of the findings to other contexts. Therefore, care should be exercised when applying the results in different contexts. To increase the generalizability of the findings, further research might be conducted in other countries. In addition, quantitative analysis in Paper IV provides a general view of the

association between research excellence, external knowledge search strategies and firms' choices of collaboration with academic partners. However, it cannot elaborate how and why these factors exert their differing effects. Therefore, future research might consider case studies of both industry and university actors to disentangle the mechanisms that underlie the findings.

6.3 Policy and practice implications

The limitations notwithstanding, this thesis contributes to further understanding of the factors that impact the engagement of academics with external actors. Apart from the implications of the findings for theory and research, some relevant policy and practice implications emerge from the findings. First, policymakers interested in improving the innovativeness and competitiveness of peripheral or lagging regions might consider using academics at universities in these places as network connectors. To benefit from external knowledge flows, policymakers must evaluate the knowledge needs of local firms and connect them with academics possessing the relevant expertise and external networks. In addition, interventions like targeted funding of specific collaborative projects involving local firms, academics and their international partners should be considered to promote firms' connections to international networks and the mobility of talent to these regions.

Second, given that firm-related conditions strongly influence firms' decisions to collaborate with universities, policies to promote university-industry collaboration should mostly target firms. Pressurizing universities to simultaneously pursue research excellence and increase their interactions with regional firms might not work. Rather, policymakers should channel their energies on firms and incentivize them to develop collaborative ties with universities.

Third, there is a need for policymakers to think about strategies that stimulate academics' identification with and embeddedness in localities.

Policy interventions that promote inclusiveness and diversity and help academics develop social bonds could be effective in promoting the engagement of academics in regions. Notably, non-native academics who have stayed for a short period in a region might have no or few social ties. Therefore, initiatives assisting them in establishing their social networks would be most important in providing opportunities for engagement.

Fourth and related to the previous point, university managers need to ensure that the research excellence of academics in international communities also trickles down to regions to stimulate development. One fruitful means academics' research can impact local communities is through their embeddedness in the region. Although building social ties remains a private responsibility, university managers can facilitate academics' social interaction by organizing social and cultural events. Equally, they can encourage faculty to join voluntary or industry associations by, for example, sponsoring membership or subscription fees.

Fifth, university managers need to pay attention to personnel and career development policies by clearly articulating the importance of external engagement in recruitment and career progression decisions. Since academics are motivated more by career goals, ways should be found to give rewards that enhance the advancement of academics' careers. For instance, rewarding academics that engage with external actors with more research time and extra funding represents a promising motivation policy. However, such a policy will require the implementation of effective engagement performance reporting systems across all management levels and reliable metrics to adequately measure and reward deserving academics.

6.4 Concluding remarks

Academics' engagement with external actors continues to attract academic and policy attention. In addition to their primary roles, academics collaborate with external actors in several knowledge exchange activities. Academics' activities cut across diverse sectoral and geographical domains. But there have been growing calls from societal actors and policymakers for academics to increase their interactions in their regions. Doing so, they assert, can help in the transfer of novel knowledge to local actors to stimulate innovation and economic development. The goal of this thesis has been to examine whether and how individual and contextual factors influence the engagement activities of academics. Using both quantitative and qualitative methodological approaches, the thesis sheds new light on how multiple factors collectively stimulate or constrain academic engagement.

The evidence from the analyses reveals that individual-level factors represent the most important drivers of academic engagement, followed by firm-related factors. Factors within the university context exert the least impact. More specifically, individual motivations and place attachment exert a significant impact on academic engagement. In addition, academics' embeddedness in professional or informal social networks tends to promote regional engagement and knowledge transfer. Moreover, firms' knowledge search strategies or networking with partners other than universities matter most in their decisions to collaborate with universities. On the contrary, university research excellence appears to matter the least for firms' collaboration decisions. Furthermore, the fairness of university policies has no effect on the engagement behavior of academics. Altogether, the thesis contributes to and extends the discussion on academic engagement by providing new evidence on the relative importance of various drivers of engagement. In addition, the findings contribute to policy and practice by providing nuanced insights to guide the design of policies to promote regional engagement.

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Appendices

Appendix 1 – RUNIN-ECIU Academics' External Engagement Survey

A. General research and engagement activities

A1. When undertaking research, which of the following statements most closely describes your work?

Basic/theoretical research	
User-inspired basic research/theoretical research motivated by considerations of use	
Applied/practically oriented research	
None of the above applies to my research	

A2. In your research activities, have you engaged with any of the following **external partners** in recent years? *Tick **all** that apply*.

*In this questionnaire, 'recent' refers to the **latest phase of your career** in which you have had a reasonably consistent and stable way of working. Often in terms of working on similar projects with similar partners, and within a disciplinary community. This would typically be a period of **around 3 years**. However, you are free to choose a different period if it makes sense in terms of your own personal ways of working and research skills.*

	Yes	No
External academic partners (i.e. partners within other universities and research organizations)		
External non-academic partners (i.e. partners outside universities and research organizations)		

A3. Which of the following activities have you engaged in with **external academic partners** in recent years? Please indicate whether you have taken part in the activity and state the geographical location of the partners involved. *Tick **all** that apply.*

	Engaged in activity?		Location of partner	
	Yes	No	Country	Other countries
Answering calls for proposals or writing research grants				
Joint supervision of Masters/PhD students				
Conducting scientific research				
Writing academic materials (e.g. articles, books, reports)				
Sitting on scientific committees of scholarly societies				
Joint presentations at academic conferences or meetings				
Setting up spin-off companies				

A4. Which of the following activities have you engaged in with **external non-academic partners** in recent years? Please indicate whether you have taken part in the activity and state the geographical location of the partners involved. *Tick **all** that apply*

In this question, 'region' refers to your administrative region (county).

	Engaged in activity?		Location of partner		
	Yes	No	Region	Rest of country	Other countries
Giving informal advice/invited lectures					

	Engaged in activity?		Location of partner		
	Yes	No	Region	Rest of country	Other countries
Joint supervision of Masters/PhD students					
Arranging student projects/placements with external organizations					
Sitting on scientific advisory boards of external organizations					
Organising training courses for employees of external companies					
Participating in joint research					
Conducting contract research					
Providing consultancy services					
Applying for patents/providing licenses of inventions/creating spin-offs					

A5. How frequently have you been involved in the following activities with **non-academic partners** in recent years? *Please select the appropriate response*.

	Never	Infrequently	Occasionally	Frequently	Very frequently
Giving informal advice/invited lectures					
Joint supervision of Masters/PhD students					
Arranging student projects/placements with external organizations					
Sitting on scientific advisory boards of external organizations					

	Never	Infrequently	Occasionally	Frequently	Very frequently
Organising training courses for employees of external companies					
Participating in joint research					
Conducting contract research					
Providing consultancy services					
Applying for patents/providing licenses of inventions/creating spin-offs					

A6. Has your engagement with **external non-academic partners** mainly been initiated by the following?

	Yes	No
The university technology transfer office/department/research group/colleagues		
Direct contact from external partners		
Your own actions in approaching external partners directly		
Mutual actions following up a contact at a formal conference/meeting		
Mutual actions following up informal contacts		
A government/public agency		

A7. How important were the following reasons for your decision to cooperate with **external non-academic partners**? *Please indicate the level of importance*

	Not at all important	Somewhat unimportant	Neutral	Somewhat important	Very important
Gain new insights in the area of my research					
Secure access to specialist equipment, materials or data					
Create student project and job placement opportunities					
Build and maintain professional networks					
Secure funding for research					
Promote the practical application of my research in society					
Secure personal income					

A8. Have you had any substantial professional experience in the following before joining academia? *Please indicate **all** that apply*

Employed in a business organization	
Employed in a research organization (external to the university sector)	
Started or owned a business	
Employed in a public sector organisation	
Employed in a voluntary or charitable organisation	
None of the above	

A. Perceptions about knowledge exchange and engagement

The questions in this section relate to your beliefs about the activities you perform in your work and interactions with external non-academic partners.

B1. To what extent are you satisfied with the amount of time available to you to undertake the following tasks? *Please select "not applicable" if you do not undertake any of the tasks.*

*In this question, **Outreach activities** refer to all activities that are undertaken outside the university with external partners such as training of staff, dissemination of research, consulting, and contract research.*

	Very dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Very satisfied	Not applicable
Conducting research						
Teaching and related activities						
Performing outreach activities						
Performing administrative activities						

*The following statements refer to how important each activity is for your **self-image**. Please read the statements that match the activity or activities you undertake and answer appropriately.*

B2. To what extent do you agree with the following statements about your **academic and outreach related** activities?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know
My teaching activities are important part of my self-image						
My teaching activities are important reflection of who I am						
My research activities are important part of my self-image						
My research activities are important reflection of who I am						

My outreach activities are important part of my self-image						
My outreach activities are important reflection of who I am						

B3. The following statements represent the impact of your interaction with external non-academic partners in recent years on the **research** you do. To what extent do you agree or disagree with them?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know
It has led to new research projects						
It has strengthened my reputation in the field						
It has given me new insights for my work						
It has led to new contacts in the field						

B4. The following statements represent the impact of your interaction with external non-academic partners in recent years on the **teaching** you do. To what extent do you agree or disagree with them?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know
It has led me to make changes to the course programme						
It has led to changes in the way I present the material						
It has led to an increase in the employability of my students						

It has led to an increase in entrepreneurial skills among my students						

B5. Please indicate your level of agreement with the following statements about the **performance of both academic and outreach activities**.

*Under this question, **Academic activities** refer to **all teaching** and **research related activities** such as lecturing, curriculum development, student supervision, and conducting research.*

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know
My work would be easier if I performed only academic activities and no outreach activities						
I am able to perform outreach activities better because of my academic identity						
Engaging in outreach activities interferes with performing academic activities well.						
I am glad that I perform both academic and outreach activities						
I feel that the academic way of doing things is opposed to how outreach activities are done						
I feel capable of performing outreach activities because of my scholarly achievements						

B6. To what extent do you agree or disagree with the following statements?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Not applicable

I have to miss family activities due to the amount of time I must spend on work responsibilities						
I have to miss work activities due to the amount of time I must spend on family responsibilities						

A. Engagement and support from organization

The following questions refer to support you receive from your university and the level of fairness exhibited by your managers in relation to your external engagement.

C1. Please indicate the degree of your agreement or disagreement with the following statements about your university's support for external engagement.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know
My university is very effective in supporting collaboration with external partners						
My university is an obstacle in the collaboration with external partners						
My university rewards me for working with external partners						
My university actively encourages me to work with external partners						

C2. The following items refer to your **pay or promotions** and the **procedures** used to arrive at these outcomes by your university management.
To what extent:

	To a small extent	To some extent	To a moderate extent	To a large extent	To a very large extent	Don't know
Do your pay or promotions reflect the effort you put into your work?						
Do your pay or promotions reflect what you have contributed to the university?						
Is your pay or promotions justified, given your performance?						
Have the procedures to determine your pay or promotions been applied consistently by your university?						
Have the procedures to determine your pay or promotions been based on accurate information?						
Have you been able to appeal the pay and promotions determined by those procedures?						

A. Perceptions about the region and social interactions

Research suggests social proximity enables trust-based interactions between people in communities. In this section, we are interested in your thoughts about social interactions, and feelings of belonging to the region in which your university is located. Please read each question carefully and select the option that best describes your opinion.

D1. To what extent do you agree or disagree with the following statements?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know
I miss this region when I am not here						
I have little influence on the affairs of this region						
I am rooted in this region						
I want to be involved in what is going on in this region						
I would like to move away from this region						

D2. Please indicate the amount of time you spent on social interactions with the following groups in any typical month.

	Not at all	Once a month	2 to 3 times a month	Once a week	Several times a week
Your friends					
Colleagues from work or your profession					
People at sports clubs, voluntary or service organizations					

D3. Please indicate your level of agreement with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Don't know
In general, I think most people can be trusted						
One cannot be too careful in dealing with other people						

I have great trust for people I meet for the first time						

D4. Please select the most applicable statement relating to your affiliation with the region and country in which your current workplace is located.

I am a native of the region	
I am not a native of the region but hail from other part of the country.	
I am not a native of the country.	

D5. If non-native, how would you rate your ability in speaking the local language?

Do not speak the language	
Fair	
Good	
Excellent	

D6. How many years have you resided in the region?

…….

A. Personal Characteristics

E1. Please indicate your age group.

Under 30	
30-39	
40-49	
50 and over	

E2. Please indicate your gender.

Female	
Male	
Other	

E3. What is your family status?

Married/Partner	
Single	
Other	

E4. Is your partner, a native of the region in which your university is located?

Yes	
No	

E5. What is your position within the institution of current employment?

Post-Doctoral Research Fellow	
Assistant Professor/Lecturer	
Associate Professor/Reader/Senior Lecturer	
Professor	

E6. How many years have you spent in a full-time position at the institution of **current** employment?

……

E7. How many years have you spent working at a higher education/research institution **within** your **home country**?

…….

E8. How many years have you spent working at a higher education/research institution **outside** your **home country**?

……..

E9. Please indicate the year and country you obtained your Doctoral degree (if applicable)

Year	**Country**	**Earned in country of current employment?**			
		Yes		No	

E10. Please indicate your main subject area.

Agriculture & Veterinary Sciences	
Biological/Life Sciences	
Engineering, manufacturing & Construction	
Humanities & Arts	
Medical & Health-Related Sciences	
Physical Sciences, Mathematics, Computer Sciences	
Social & Behavioural Sciences	

Appendix 2 – Non-response bias test results

Variable	*T*-test for equality of means						
	T	*df*	Sig.	Mean difference	SE difference	95% CI of the difference	
						Lower	Upper
Gender	-1.32	623	0.19	-0.06	0.04	-0.14	0.02
Age	-0.87	623	0.38	-0.06	0.07	-0.19	0.07
Professional experience	0.23	623	0.82	0.01	0.04	-0.07	0.09
Research orientation	1.21	623	0.22	0.09	0.07	-0.05	0.23
Academic rank	0.21	623	0.84	0.02	0.08	-0.14	0.17
Discipline	1.02	623	0.31	0.10	0.09	-0.09	0.29
Institution	1.32	623	0.19	0.28	0.22	-0.14	0.71
Affiliation with region	0.56	623	0.57	0.02	0.04	-0.06	0.11
Academic engagement	-1.57	623	0.12	-0.31	0.20	-0.70	0.08

Variable	*T*-test for equality of means						
	T	*df*	Sig.	Mean difference	SE difference	95% CI of the difference	
						Lower	Upper
Regional academic engagement	-1.31	623	0.20	-0.21	0.16	-0.53	0.11
Pecuniary motivation	2.12	484	0.03	0.27	0.13	0.02	0.51
Career motivation	0.42	484	0.67	0.03	0.08	-0.12	0.19
Prosocial motivation	0.61	484	0.54	0.05	0.08	-0.11	0.21
Distributive fairness	1.04	623	0.30	0.09	0.91	-0.08	0.27
Procedural fairness	0.54	623	0.60	0.04	0.08	-0.11	0.20
Place attachment	-0.59	593	0.56	-0.05	0.08	-0.20	0.11
Informal social network	-1.10	623	0.27	-0.08	0.08	-0.24	0.07
Length of residence	-0.58	564	0.56	-0.05	0.09	-0.22	0.12

Table 11 Results of non-response analysis of early and late responses.

Note. The analysis is based on equal variance assumption. The test was also run with unequal variance assumption, with similar results.

Appended papers

Paper I

What motivates academics for external engagement? Exploring the effects of motivational drivers and organizational fairness

Kwadwo Atta-Owusu and Rune Dahl Fitjar

Abstract

Academic engagement may be driven by different motivations, including to advance one's career as a researcher (career motivation), to contribute to society (prosocial motivation) or to acquire monetary benefits (pecuniary motivation). However, we know relatively little about how these motivations vary across academics, and how this in combination with their perception of fairness in their institution's policies influence engagement with external actors. This paper examines the effects of different motivational drivers and fairness perceptions on the external engagement of academics. Prosocial motivations tend to be most important, followed by career motivations, while few academics consider pecuniary motivations to be important. The perceived importance of all three motivations is positively associated with actual engagement behavior. Career motivations are more important at the early and late career stages, whilst the pecuniary motivation becomes more important later in the academic career. Perceptions of organizational fairness show no relationship with external engagement.

Keywords: individual motivation, organizational fairness, career stages, academic engagement

1. Introduction

Universities are increasingly expected to contribute to solving societal challenges in collaboration with industry, governments and civil society (Sanchez-Barrioluengo, 2014). Accordingly, most institutions have integrated the societal engagement mission into their activities. However, academics are under pressure to perform in multiple areas, including as researchers and educators, and they enjoy considerable freedom in how they spend their time. Hence, achieving societal impact depends on the commitment and active participation of academics. Given the critical role of academics in external engagement, researchers and policy makers alike seek to understand the factors that might influence academics' external engagement (Perkmann, Salandra, Tartari, McKelvey, & Hughes, 2021).

A large volume of research has explored the role of individual and organizational factors in the external engagement of academics (see e.g. de Wit-de Vries, Dolfsma, van der Windt, & Gerkema, 2019; Perkmann et al., 2013), including the role of individual motivation (Iorio, Labory, & Rentocchini, 2017; van de Burgwal, Hendrikse, & Claassen, 2019b). Academics' external engagement can be driven by reputational, financial or even hedonic benefits (van de Burgwal et al., 2019b), as well as by intrinsic motivations such as a desire to contribute to society (Iorio et al., 2017; Orazbayeva & Plewa, 2020). Even though this line of research has deepened our understanding about the working of individual motivations in external engagement, important questions remain unaddressed. One such question is whether motivational drivers of academics differ across career stages. Since academics pursue external engagement for several reasons, their motivations may change over the course of an academic career. Understanding how motivations change over time is important in the design of effective strategies to mobilize all categories of faculty to engage with external actors.

The growing emphasis on societal engagement also requires universities to change their organizational policies (Lach & Schankerman, 2008; van de Burgwal, Dias, & Claassen, 2019a). Universities have traditionally relied on research and teaching performance as well as ability to attract research funding as key criteria in promotion and remuneration decisions. Conversely, academics that perform well in external engagement often feel that their contributions are overlooked and that these policies are therefore unfair or do not reflect their efforts. To address this, schemes such as royalty sharing, bonuses and sabbaticals aimed at incentivizing faculty to engage with external actors now form part of career development and remuneration policies at many universities (van de Burgwal et al., 2019a). Yet, little is known

about how academics' perception of the fairness of organizational processes and outcomes influence actual engagement behavior. Organizational fairness[1] is important for individual behavioral outcomes in businesses (Laundon, McDonald, & Cathcart, 2019b, p. 295) and public organizations (Cho & Sai, 2013). Fairness is also related to motivation, insofar as academics who perceive their organization to be unjust may lose motivation for their work. However, scant attention has been devoted to investigating its effect on external engagement, although there have been calls for research in this direction (van de Burgwal et al., 2019a).

This paper addresses these gaps to shed new light on how individual motives and fairness perceptions are associated with academics' external interactions. We draw on theories of motivation and organizational justice to examine the relationship between different motivational drivers, fairness of incentives and rewards, and the external engagement of academics. Additionally, we go a step further and analyze how these relationships differ between academics at different career stages.

We do this using survey data collected from 625 academics in seven European Consortium of Innovative Universities (ECIU) member institutions located in seven different countries. We find that academics tend to rate prosocial motivations as most important, followed by career motivations. Few academics consider pecuniary motivations to be important. Furthermore, we find a positive and significant relationship between the perceived importance of all three types of motivation and actual external engagement. The strongest relationships are also in this case for career and prosocial motivations. However, these relationships vary markedly at the early, middle and later career stages. Notably, career motivations are most important for early career researchers, while pecuniary motivations become more important later in the academic career. Conversely, we observe no significant association between distributive and procedural fairness, and external engagement. This suggests that how academics perceive organizational fairness has little impact on their external engagement activities.

The remainder of the paper is structured as follows. The following section reviews the literature and develops the hypotheses for subsequent testing. The third section describes the data, the variables and the methods utilized in the analysis. The empirical results are reported in the penultimate section. The final section draws conclusions and points to some policy implications.

[1] Organizational fairness refers to employees' perception of fairness in the processes, interactions, and outcomes in a workplace (Greenberg, 1990).

2. Theoretical framework and hypotheses development

2.1 Determinants of external engagement of academics

Research spanning varied fields analyze external engagement between academic scientists and non-academic actors. The bulk of the literature hitherto focused on scientists' collaboration with firms. But recent studies have broadened the scope to incorporate engagement with other social partners like governmental agencies and civil society (Llopis, Sanchez-Barrioluengo, Olmos-Penuela, & Castro-Martinez, 2018). This stream of research has primarily aimed at unravelling the mechanisms and processes that determine the engagement behaviour of academics. These factors arise from diverse contexts, including individual, organizational and institutional (Perkmann et al., 2021).

Individual level antecedents have been widely explored in the literature. The sustained attention stems chiefly from the crucial role individual academics play in engagement with external actors. Among the individual factors, demographic attributes have obtained special scrutiny. Several studies demonstrate the relationship between external engagement and gender (Abreu & Grinevich, 2017); age (Tartari & Breschi, 2012); place of birth or nationality (Lawson, Salter, Hughes, & Kitson, 2019); and mobility (Edler, Fier, & Grimpe, 2011).

Whereas external interactions are primarily determined by individual volitions and characteristics, organizational-level factors also exert some influence. These organizational conditions may enable or constrain the engagement of academics in external interactions. Some of the key factors identified in previous studies include university or department quality (Ponomariov & Boardman, 2008); university strategic orientation (Giuri, Munari, Scandura, & Toschi, 2019); and university promotion and incentive policies (van de Burgwal et al., 2019a). Existing studies have highlighted the effects of incentives, but the evidence has been ambiguous. While some research suggests incentives are relevant in motivating academics to participate in commercialization (Caldera & Debande, 2010; Lach & Schankerman, 2008), others indicate incentives do not matter or may even have deleterious effects (Göktepe-Hulten & Mahagaonkar, 2010; Markman, Gianiodis, Phan, & Balkin, 2004). These inconsistent findings perhaps arise from a narrow focus on monetary incentives and on one type of engagement activities, specifically commercialization. However, this is gradually changing as recent works have included broader incentive mechanisms in a range of external engagement activities (van de Burgwal et al., 2019a). Furthermore, studies hint at the possible influence of academics' perceptions of fairness of university policies in the performance of external

engagement activities (e.g. Arqué-Castells, Cartaxo, García-Quevedo, & Godinho, 2016; van de Burgwal et al., 2019a). Nevertheless, no studies have explicitly accounted for the perceived organizational fairness of existing policies in empirical analyses. The absence of such empirical evidence limits university managers in making an informed evaluation of the effectiveness of these policies in stimulating desired behavioral change.

2.2 The effects of motivational drivers on external engagement

Motivation has long been identified as a fundamental driver of diverse human behaviours. As a result, scholars have sought to comprehend the nature of individual motivation as well as the mechanisms explaining the link between forms of motivation and behaviour (Ryan, 2014). Particularly, the self-determination perspective in social psychology conceptualizes motivation as a function of external control and an individual's internal need for autonomy and self-regulation (Deci & Ryan, 2000; Gagné & Deci, 2005). Individual motivation exists on a continuum of self-determination, ranging from amotivation through to extrinsic and intrinsic motivation. Amotivation denotes expressing no intent of participation in an activity due to disinterest. Extrinsic motivation means participating in an activity for external rewards, while intrinsic motivation refers to participation in an activity out of innate desire and willingness (Deci & Ryan, 2000).

Drawing on the extrinsic and intrinsic dimensions of motivation, researchers have distinguished different motivational drivers of academics in external engagement. Academics may see engagement as a way to further their careers as researchers (van de Burgwal et al., 2019b), e.g. by gaining access to data, funding or useful contacts. They may also acquire monetary benefits to supplement their personal income (Orazbayeva & Plewa, 2020). Besides these extrinsic motivations, academics may also have intrinsic motivations to pursue external engagement, as they derive satisfaction and joy from engaging in challenging activities and offering creative solutions to external actors (Lam, 2011a). For instance, many academics want their research to make a difference in society (Iorio et al., 2017).

Despite efforts to raise the recognition of education and engagement activities, research excellence remains the most important factor in universities' recruitment and promotion decisions. Hence, academics need to consider the impact of engagement activities on their research in order to develop their careers. Academics may be driven to engage with external partners because it provides access to data, ideas and networks needed to conduct better research and thus build their careers (D'Este & Perkmann, 2011). In addition, engagement

provides visibility which can be important in the job market and for access to external funding (Lam, 2015; Orazbayeva, Davey, Plewa, & Galán-Muros, 2019). For example, collaborations with industrial actors may lead to publications and to prestige in the epistemic community (Bikard, Vakili, & Teodoridis, 2019; Gulbrandsen & Smeby, 2005). In much the same way, those who perform research for government agencies may acquire recognition as subject matter experts. Hence, academics motivated by career interest are more likely to engage in external engagement to increase their reputation and career advancement prospect. This leads us to hypothesize that:

H1a: The stronger the career motivation of academics, the more they will participate in external engagement.

While career motives have clear financial implications in the long run, academics may also be motivated by the desire to acquire pecuniary benefits more directly (van de Burgwal et al., 2019b). Researchers enjoy relatively stable employment; however, remunerations are not as attractive as in industry. As such, some may be willing to pursue external engagement as a legitimate means to obtain extra income to augment their salaries (Lam, 2015; Orazbayeva et al., 2019). For instance, a large literature has examined how the revoking of professors' privilege and the introduction of Bayh-Dole type legislation has influenced academic innovation (e.g. Ejermo & Toivanen, 2018; Grimaldi, Kenney, Siegel, & Wright, 2011; Hvide & Jones, 2018), often from the perspective that the relative loss of individual financial rewards reduces the incentives for academics to innovate. Accordingly, we propose that:

H1b: The stronger the pecuniary motivation of academics, the more they will participate in external engagement.

The need for research to make meaningful contribution to the wider society or improve the quality of human life also plays a role in academics' external engagement. Academics are driven by values and ethos that seek to advance science and its application to solving societal challenges (Lam, 2011a). One of the means of achieving this goal remains collaborating with external stakeholders. By engaging with different actors, academics develop the capacity to apply their knowledge in novel contexts to solve problems (D'Este, Ramos-Vielba, Woolley, & Amara, 2018). The influence of prosocial motivations on external engagement has recently been established in the literature. For example, in a study of a sample of Italian academics, Iorio et al. (2017) found that prosocial motivations positively affect both the variety and intensity of knowledge transfer activities. Among Dutch life scientists, prosocial motivations were found

to be associated with their performance in engaging with academic, civil-society, governmental and economic stakeholders (van de Burgwal et al., 2019b). Accordingly, we hypothesize that:

H1c: The stronger the prosocial motivation of academics, the more they will participate in external engagement.

2.3 The effects of organizational fairness on external engagement

Academic engagement remains only weakly institutionalized in universities. Performance in research remains the most important influence on recruitment, promotion, and remuneration decisions. Other types of rewards, such as sabbaticals, are in most cases also related to research activities. Furthermore, universities often have poor or no data on most types of engagement activities. Hence, academics who perform well in engagement activities may feel that their contributions go under the radar and is not adequately recognized or rewarded by the university. In short, they may feel that the organizational processes or outcomes are unfair. Over time, this may result in amotivation for these types of activities.

Fairness or justice is considered a prerequisite for an effective functioning of organizations. This is because fairness perceptions determine individual behaviours and different consequences in the workplace (Greenberg, 1990; Laundon et al., 2019b, p. 295). Individuals' relations with their organizations are governed by mutual responsibilities. As such, individuals invest effort in the furtherance of organizational goals if they are equitably rewarded. However, they tend to withdraw from the pursuit of the organization's goals if they perceive their reward not to be commensurate with their inputs. Therefore, issues related to organizational fairness is at the heart of most employee and organizational outcomes (McFarlin & Sweeney, 1992).

In the literature, organizational fairness is conceptualized as a multidimensional concept consisting of three dimensions– distributive, procedural and interactional fairness[2]. These dimensions are interdependent, but they differ conceptually with respect to the level of justice evaluation. Perceptions of distributive and procedural fairness are associated with processes and outcomes at the organizational level, whereas interactional fairness perceptions are linked closely with micro processes at the relational level (Balven, Fenters, Siegel, & Waldman, 2018). Given that the empirical focus of this paper is to understand the influence of organizational

[2] Distributive fairness refers to an individual's evaluation of how commensurate their inputs are with rewards or recognition. Procedural fairness denotes the fairness of the procedures or rules guiding the distribution of rewards or recognition. Lastly, interactional fairness represents an individual's perception of the quality of interpersonal treatment and the provision of accurate and timely information by superiors (Colquitt & Rodell, 2015).

factors on external engagement, we consider only distributive and procedural fairness. Interactional fairness pertains mainly to internal relationships and is less relevant in this context.

2.3.1 Distributive fairness and external engagement

The issue of fairness of compensation and promotion policies have significant implications for academics' external engagement. The compensation and promotion policies of most universities are most closely connected to research performance, while the integration of external engagement in such policies varies widely (van de Burgwal et al., 2019a). Given that the perceived equity in distribution of outcomes relative to one's effort leads to behavioral modification, academics' perception of the degree of equity in compensation and promotion decisions is likely to influence their external engagement (Greenberg, 2005). For example, researchers that feel that external engagement is accorded relatively similar importance to research or teaching may be more inclined to engage with external actors. By contrast, those that perceive that external engagement is insufficiently appreciated in reward and career progression might avoid performing this role (Laundon, Cathcart, & McDonald, 2019a; Törnblom & Kazemi, 2015).

Moreover, academics may receive some form of reward for external engagement. This ranges from royalty sharing from inventions to prizes and awards in recognition of service to society (van de Burgwal et al., 2019a). While these rewards may not provide full compensation for the efforts expended, they nonetheless signal the value that universities place on external engagement (Gallus & Frey, 2017). All else equal, an academic will continue to interact with external actors to the extent that they feel their reward is relatively commensurate with the effort and resources expended vis-à-vis other academics (Greenberg, 2005). Conversely, an academic who participates in external engagement may alter their behaviour if they feel that less deserving colleagues have been rewarded instead of them.

In summary, we expect academics' perceptions of distributive fairness to influence their external engagement. They would participate more in these external activities if compensations and rewards are judged as fair and may avoid engaging if judged to be unjustly distributed. Based on the above arguments, we propose that:

H2a: The higher the perceived distributive fairness of academics, the more they will participate in external engagement.

2.3.2 Procedural fairness and external engagement

Much as individuals prefer fair remuneration and promotion outcomes, they are also concerned about procedures for determining these outcomes. Procedures for distribution of rewards are important to people because of their association with fair outcomes (Bobocel & Gosse, 2015; Konovsky, 2000). Emphasizing the saliency of procedures, earlier theorists posit that individuals perceive outcomes as fair when they are allowed some degree of control over the reward allocation process (Thibaut & Walker, 1975). Given that people are the best evaluators of their own inputs and contributions, granting them some control in a decision process enhances their view about the fairness of the procedure and subsequent outcomes (Bobocel & Gosse, 2015). In an organizational context, the form of control can be employees providing inputs in the formulation of procedures and rules, as well as offering them the opportunity to voice concerns in the event of perceived injustice (Avery & Quiñones, 2002).

Based on this reasoning, academics may be motivated to participate in external engagement if they feel that fair procedures govern the determination of promotion and remuneration. Academics' perception of fairness may be reinforced if they can provide information to the formulation of policies or given the chance to air their grievances in the event of unjust treatment. Conversely, they may choose not to engage in these activities if they perceive that fair procedures are not followed in allocation decisions, or their inputs are not respected (Bobocel & Gosse, 2015).

Numerous evidence in organizational studies suggest procedural fairness predicts employee work attitudes like organizational commitment and job satisfaction (McFarlin & Sweeney, 1992) and behaviours such as counterproductive work behaviours and organizational citizenship behaviours (Holtz & Harold, 2013; Moorman, Blakely, & Niehoff, 1998), among others. Whereas studies focusing on the academic context are scarce, the few that exist show an association between procedural justice and academics' work attitudes and behaviours. For example, in a longitudinal study of untenured management professors in the US, Ambrose and Cropanzano (2003) found that procedural fairness perceptions related strongly to job satisfaction, organizational commitment and turnover intentions prior to and immediately after the tenure decision. Based on the preceding discussion, we postulate that:

H2b: The higher the perceived procedural fairness of academics, the more they will participate in external engagement.

2.4 Motivational drivers of external engagement at different career stages

As discussed above, the external engagement decisions of academics may be driven by various motives. However, the saliency of motivational drivers might vary at different career stages. Academics exhibit different attitudes and behaviours at varied career stages (Subramaniam, 2003). These differences arise because of the changes in value orientations, needs and interests that occur at distinct junctures of their careers (Jung, 2014). Accordingly, engagement with external actors may be triggered by motives consistent with the attributes salient at a particular stage. As different values and needs become more pronounced at specific points, we expect diverse or mixed motivations to influence external engagement.

Following the faculty career stages model (Baldwin, 1990), this paper distinguishes three stages in academics' career. These include an 'early career' stage, which denotes the period between career entry and achievement of tenure; a 'midcareer' stage, which is the period between achievement of tenure and full professorship, and a 'late career' stage, which refers to the period between attainment of full professorship and retirement. The early stage is typically marked by uncertainty, intense socialization and stress as an academic strives to get established and work towards tenure (Baldwin, 1990; Jung, 2014). Since career progression remains a primary concern, academics need to focus on their research and set challenging professional goals (Baldwin, 1990; Low & Bordia, 2011). Given this career advancement need, academics at this stage might engage with external partners mainly with the view of achieving this ambition. They will be more interested in obtaining resources, ideas and connections that might enhance their professional development. Conversely, seeking personal income in the short term might be less important at this stage (Janger & Nowotny, 2016). Taken together, career motivation will be a more salient driver of external engagement at the early career phase. Hence, we hypothesize that:

H3a: Career motivations are relatively more important for academics at an early career stage than for those at later career stages.

At the midcareer stage, academics often become more independent and begin enjoying more professional influence in their disciplines because of increased productivity (Baldwin, 1990; Low & Bordia, 2011). In addition, the anxiety and uncertainty regarding job security tend to decline as many secure tenure. Career concerns remain important at this stage as faculty directs efforts toward new goals like achieving full professorship status (Baldwin, 1990; Jung, 2014). However, personal values and interests that were less important during the early career years

begin to reemerge (Baldwin, 1990). The relative stability may lead to reassessment of personal values which in turn can provoke efforts to achieve some balance between instrumental and altruistic values. In addition to existing career needs, the desire to contribute to the betterment of society and secure some personal income may become more salient. This leads to the following hypothesis:

H3b: Prosocial motivations are relatively more important for academics at the mid-career stage than for those at earlier or later career stages.

Academics in the late career stage often have secured jobs and may be at the peak of their careers. Having accomplished significant professional goals, they establish new goals and try to channel their knowledge and experience to service within and outside their institutions (Mamiseishvili, Miller, & Lee, 2016). Moreover, career advancement needs become less important whereas financial security and leaving a legacy become more critical (Baldwin, 1990; Zacher, Rosing, & Frese, 2011). The need to give back to society may increase in the last years of one's career (Mamiseishvili et al., 2016). At this stage, academics may also care more about remunerations and external monetary rewards as they plan towards their retirements (Janger & Nowotny, 2016; Zhou & Volkwein, 2004). Accordingly, we hypothesize that:

H3c: Pecuniary motivations are relatively more important for academics at a late career stage than for those at earlier career stages.

3. Data and Methodology

3.1 Data

The empirical analysis draws on data from the RUNIN-ECIU Academics' Survey. The survey was conducted by the Centre for Innovation Research (CIR) in autumn 2019 as part of the European Union funded Role of Universities in Innovation and Regional Development (RUNIN) Project[3]. The study's participants were academics working at universities affiliated with the ECIU Network. The choice of this network as the study context is based on both theoretical and practical reasons. The theoretical rationale arises from the integration of external engagement into the mission of the ECIU member universities. Established in 1997 with 10

[3] The aim of this data collection exercise was to examine the attitudes and perceptions of academics towards their knowledge exchange interactions with external actors. The survey comprises of two main parts. The first part asks about the variety of channels through which respondents interact with external actors, the frequency, the geographical scale as well as the importance of various motivations for external interaction. The second part asks about perceptions of organizational fairness, attitudes towards the geographic area where the university is located, individual and demographic characteristics.

universities, ECIU presently consists of 13 members with one affiliate partner. It sees itself as an association of mid-sized, research intensive and entrepreneurial universities committed to fostering innovation and the leveraging of research to solve industrial and societal challenges. This ideal is reflected in the close linkages between the universities and industry and other societal partners (Nieth & Benneworth, 2020). Although these institutions are located in different countries and country-specific conditions may affect their external interactions differently, their common profiles and shared beliefs make them comparable institutions.

The practical reason is mainly due to accessibility to academics for data collection. In the context of the EU's General Data Protection Regulation, university managers are often unwilling to provide proprietary information (e.g. email addresses of employees) to external researchers. Thus, we had to rely on our networks in the ECIU to secure access to academics to participate in the study.

In all, seven universities took part in the survey (see Table 1). The targeted population was academics in all scientific fields, from the rank of research fellow to full professor, involved in research and/or teaching in all disciplines at these universities. We contracted a survey company to undertake the data collection. The initial version of the questionnaire was prepared in English and subsequently translated into eleven European languages. These were then reviewed by experts in the field who are native speakers to ensure equivalence across the questionnaires (Hui & Triandis, 1985). Before the survey was administered, a press release was issued on the intranet of the respective universities to inform respondents about the upcoming survey. After this, the survey was distributed via e-mail from local university contact persons, using university mailing lists to 7,330 academics. At the end of the data collection period, 635 completed responses were collected, representing a response rate of 8.7%. The data was then cleaned to remove responses from ineligible respondents (e.g. PhD candidates), leaving a final sample of 625. Table 1 presents the distribution of the population, sample size and response rate of the individual universities.

Considering the possible effects of the relatively low response rate on the representativeness of the sample, we conducted non-response bias tests to compare the respondents with the non-respondents with regards to external engagement, motivations, organizational fairness, gender, age, rank, professional experience and scientific discipline. Since auxiliary data on non-respondents are unavailable, we followed existing conventions in the literature and used late respondents as a proxy for non-respondents in the analyses (Armstrong & Overton, 1977). As appropriate, we conducted chi-square and t-tests to verify if differences existed between

academics that returned the questionnaire without any prompting and those that required one or more reminders. The results largely show small and insignificant differences between early and late respondents on the variables of interest and provide no evidence for non-response bias in the study.

------ Table 1 about here ------

3.2 Measures

Dependent variable

The dependent variable, external engagement, is built by following the approach of previous studies (e.g. Iorio et al., 2017). We construct this measure from responses to a question that asks whether respondents engaged in any of nine activities with external actors in the past three years. The activities include giving informal advice, joint supervision of students, membership of advisory boards of organizations, joint research, and commercialization of research outputs, among others (see Table A1 in appendix for the full list of activities). To create a summary measure of academic engagement, we counted the number of engagement activities, such that a respondent who did not engage in any activity scores zero and one who engaged in all activities scores nine. This measure has a Cronbach's alpha of 0.76, indicating a high reliability.

Independent variables

The independent variables employed in the analysis measure academics' motivational drivers and their perceptions of fairness in their organizations. Using a 5-point scale (1 = unimportant; 5 = very important), respondents were asked to rate the importance of seven reasons for their engagement with external partners. On this basis, we identify three dimensions of motivational drivers: career, pecuniary and prosocial motivations. The measure for career motivation is created by mean scoring the responses to four items: 'Gain new insights in the area of my research', 'Build and maintain professional networks', 'Secure access to specialist equipment, materials or data' and 'Secure funding for research'. This measure has a Cronbach's alpha of 0.60, suggesting a low reliability[4]. Prosocial and Pecuniary motivations are measured with

[4] We nonetheless use it in the analysis because a low alpha does not suggest a measure is not useful. As Schmitt (1996, p.352) suggested, such a measure can still be useful when it has "other desirable properties like meaningful

single items. These are 'Promote the practical application of my research in society' and 'Secure personal income', respectively. One item, 'Create student project and job placement opportunities', is removed from the analysis because it does not conceptually relate to any of the motivations.

We adapt six items from the Organizational Justice Measure (Colquitt, 2001) to construct the distributive fairness and procedural fairness measures. In the questionnaire, respondents were asked to rate the extent to which their pay and promotions and the procedures used by university management to determine those outcomes has been fair. The items include 'Does your pay or promotions reflect the effort you put into your work?', and 'Have the procedures to determine your pay or promotions been based on accurate information?'. The full list of items is presented in Table A1 in the appendix. Respondents rate the items using a 5-point scale (1 = "to a small extent"; 5 = "to a very large extent"). A 'Don't know' option was included in the responses. We replaced each observation with this option with an item mean. Afterwards, three items are mean scored to create a summated measure for distributive and procedural fairness, with Cronbach's alphas of 0.87 and 0.75 respectively.

We distinguish between three career stages based on the academic rank of the respondents. The respondents were asked to indicate their position, ranging from post-doctoral fellow to full professor. Post-doctoral fellow and assistant professor/lecturer ranks are combined into an early career stage, while associate professor/senior lecturer and professor ranks constitute midcareer and late career stages, respectively.

Control variables

We control for various individual and contextual characteristics that the extant literature has shown to influence academics' external engagement. To account for individual demographics, we first include controls for gender (a dummy variable coded 1 for female and 0 for male), age (a categorical variable coded into three groups: below 40 years, 40 to 49 and 50 and above) and professional experience (a dummy taking the value 1 if the respondent has worked in other sectors prior to joining academia and 0 otherwise). In addition, we control for scientific discipline, classified as biological sciences & health, engineering & natural sciences, humanities & arts, and social sciences. Finally, seven university dummies are added to account for differences across the universities in external engagement.

content coverage of some domain." Qualitative evaluation of the items underlying the measure indicates that they adequately cover career motivations.

3.3 Empirical Model Specification

The dependent variable, the number of types of external engagement activities in the past three years, is a count. Hence, we estimate a series of Poisson regression models using a quasi-maximum likelihood approach to examine the relationships between external engagement, motivational drivers, and fairness perceptions. The Poisson specification[5] has been shown to be robust to misspecification arising from over-dispersion and incidence of excessive number of zeros, provided the conditional mean is correctly specified (Bertanha & Moser, 2016; Cameron & Trivedi, 2010, p. 574). The main regression model tests external engagement for the entire sample, while the additional analyses focus on sub-samples of academics at different career stages. The econometric model is of the following specification:

$$Log(External\ engagement_i) = \alpha + \beta_1 Pecuniary_i + \beta_2 Career_i + \beta_3 Prosocial_i + \beta_4 Distributive\ fairness_i + \beta_5 Procedural\ fairness_i + \beta_6 \boldsymbol{Controls}_i + \varepsilon_i \quad (1)$$

where $External\ engagement_i$ denotes the dependent variable, whereas *Pecuniary*, *Career*, *Pro-social*, *Distributive fairness*, and *Procedural fairness* represent the explanatory variables defined above. ***Controls*** is a vector of academic and disciplinary specific control variables and ε_i is the error term.

4. Results

We now turn to the empirical results, which we divide into two parts: First, we examine how prevalent different types of engagement activities are among academics, and how important the various motivational drivers are for them. Second, we turn to the regression analysis, examining whether academics for whom different motivational drivers are more important, also tend to engage more.

4.1 What motivates academics for engagement?

Starting with the engagement activities, Figure 1 displays the distribution of the nine types of activities during the past three years (2016-2019). Providing informal advice and joint research were the most widely used mechanisms for engagement. Approximately 80% of respondents reported engaging in these activities. Student projects and contract research follows, with over

[5] As a robustness check, we also estimated the model with a Negative binomial and an Ordinary Least Squares (OLS) regression method. Overall, the results were not qualitatively different from the main analyses. The results are available upon request.

40 percent academics involved in these activities. Consultancy services, training activities and advisory board memberships also involve more than 30 percent of academics. At the other end of the scale, less than 10 percent of academics engaged in commercialization of research activities. Overall, these findings are in line with existing research which demonstrates that academics interact more with external actors through informal and less formal channels than through formal ones like patenting or spinouts (Abreu & Grinevich, 2013; D'Este & Patel, 2007; Thune, Reymert, Gulbrandsen, & Aamodt, 2016). This provides further support for the idea that the most frequently used indicators of academic engagement only capture the tip of the iceberg of engagement activities.

------- Figure 1 about here ------

Figure 2 shows the importance of different types of motivations for engagement. The largest share of academics considers societal impact of research as the most important motivation for external engagement. More than half of academics consider this a very important motivation for their engagement, and almost 90 percent consider it somewhat or very important. Hence, pro-social motivations emerge as the leading reason for academics to engage in external activities. However, it is followed closely by various types of career motivations, including acquiring new ideas, building professional networks and obtaining funding for research. More than 80 percent of respondents rated the first two of these as important or very important, while 70 percent did the same for research funding. Conversely, only 17 percent rated acquiring personal income as important or very important, while more than half found it unimportant. The findings thus suggest prosocial motivations mostly drive academics' engagement with external actors, followed by their career motivation. Financial gain is the least important driver.

------- Figure 2 about here ------

The importance of motivations for engagement is fairly stable across career stages. The only dimension for which there are statistically significant differences across career stages, is building of professional networks, which is more important for midcareer academics. The average score for midcareer academics is 4.3, compared to 4.0 for early-career and late-career

academics ($F(2, 483) = 3.65$, $p < 0.05$). At the ten percent significance level, there are also significant differences across career stages in the motivation for securing student projects and job placements, which is less important for early-career academics. The average score for this variable is 2.9 for early-career academics, compared to 3.3 for midcareer and 3.2 for late-career academics ($F(2, 483) = 2.54$, $p < 0.1$). For the other types of motivation, there are only marginal and non-significant differences across career stages.

-------- Figure 3 about here ------

4.2 Do more motivated academics engage more?

While the analysis above shows how important academics consider different motivations for external engagement to be, the question remains whether academics who are more strongly motivated by career, pecuniary, or pro-social motivations in fact also engage more in external activities. To address this, we now turn to the regression analysis.

Table 2 and Table 3 present descriptive statistics and the correlations between all variables used in the analyses, respectively. The correlations among the motivation variables are low, indicating that each measures a distinct aspect of motivation. The correlation between the organizational fairness variables is somewhat higher (0.56), but still not large enough to cause multicollinearity concerns. The VIF tests show a mean value of 1.35 for the main analysis while those for the career stage analyses are 1.60, 1.36 and 1.61 for early career, midcareer and late career, respectively, and no variable has a VIF score above 5.

------ Table 2 about here ------

------ Table 3 about here ------

Table 4 reports the results of the Poisson estimation testing the association between motivational drivers, fairness perceptions and the external engagement of academics. We adopt a three-step approach in the estimations. First, we specify a baseline model for the entire sample (Model 1) containing only the control variables with external engagement as the dependent variable. Next, the explanatory variables are introduced in the main model (Model 2). Finally, we estimate three separate models (Models 1-3, Table 5) for the career stage sub-groups.

------ Table 4 about here -----

Beginning with the controls (Model 1), being female has a negative and significant effect on external engagement. Similarly, being younger than 40 years old is negatively and significantly correlated with external engagement. These findings are consistent with previous studies indicating a gender and youth gap in external engagement (Iorio et al., 2017; Lawson et al., 2019). The results also show a positive and significant relationship between professional experience and external engagement. This in line with prior studies showing non-academic work experience effects in external engagement activities (Gulbrandsen & Thune, 2017). Finally, we find higher levels of engagement in biological sciences and engineering disciplines than in social sciences. Contrarily, working in humanities is negatively associated with external engagement compared to the social sciences.

In Model 2, we include the explanatory variables. All the control variables have the same effects as in the baseline model. In line with expectations, we find that career motivations increase the likelihood of academics to engage externally. The results show a significant positive association between career motivations and external engagement, thus supporting Hypothesis 1a. Academics driven by financial motivations are also more likely to interact with external partners. Specifically, pecuniary motivations have a positive and significant relationship with external engagement, confirming Hypothesis 1b. Finally, prosocial motivations also have a positive and significant relationship with external engagement, supporting Hypothesis 1c. This suggests academics' aspiration to contribute to society has an impact on their collaboration with external partners. Taking the effect sizes into account, career motivations are most closely related to external engagement, followed by pro-social motivations, while pecuniary motivations are the least important. However, only the difference between career and pecuniary motivations is statistically significant at the 90 percent level. In line with prior studies, the findings confirm the importance of motivational drivers (Iorio et al., 2017; van de Burgwal et al., 2019b).

Contrary to expectations, academics' fairness perceptions of their institutions have little or no effect on external engagement. Specifically, distributive and procedural fairness have no significant relationship with external interactions in Model 2, or in any of the career stage models (Table 5). Therefore, Hypotheses 2a and 2b are not supported. This evidence does not support the assumption that academics' perception of unfair compensation and promotion policies can have adverse effects on their external engagement.

4.3 Does the importance of motivational drivers vary across career stages?

Table 5 presents the analyses testing whether the effects of motivations of academics differ across career stages. Consistent with expectations, we find that career motivations are most strongly related with external engagement for early career academics. A standard deviation (SD) increase in career motivation is associated with a 19% increase in external engagement for early-career academics, compared to 7% for mid-career ones. However, career motivations are also important at late career stages, increasing almost to the level of early-career academics. Taken together, these results provide partial support for Hypothesis 3a.

------ Table 5 about here -----

Pro-social motivations have a significant effect on engagement only for mid-career academics. At this career stage, it has the strongest effect size of all motivational drivers. Indeed, a one SD increase in prosocial motivations results in an increase of 10% in the expected number of external engagement activities for mid-career academics. Based on these results, Hypothesis 3b is supported.

Pecuniary motivations tend to become more important for external engagement in later career stages. It is not significantly related to engagement at the early-career stage, and only weakly significant at the mid-career stage. At the late career stage, a one SD increase in motivation for financial gain yields an 11% increase in expected number of external engagements, which is significant at the 1 percent level. The overall results, therefore, support Hypothesis 3c.

5. Conclusions

Academics represent important agents driving the external engagement mission of universities. Besides teaching and research, faculty also engage in knowledge exchange activities with external partners. However, this role is often seen as insufficiently appreciated and not beneficial for progress in an academic career (Hayden et al., 2018). This raises the question of what motivates academics to participate in these activities. Various motivations, such as career, pecuniary and prosocial motivations, have been identified as potential drivers of external engagement. This paper builds on the academic engagement literature by highlighting the influence of individual motivations and organizational fairness on external engagement, also taking into account the variation in the effects of motivations across career stages.

The study establishes the critical role of career motivations in external engagement. Prior studies suggest acquiring career-related benefits is less important when academics collaborate with external partners (e.g. Orazbayeva & Plewa, 2020; van de Burgwal et al., 2019b). However, career considerations tend to be strong driver of external engagement for researchers in this sample. Career advancement and gaining recognition in the scientific community, undoubtedly, remains the ambition of most academics. While publications may still be the main means for the attainment of these goals, engagement in external activities can provide resources to further one's scholarly endeavors (Lam, 2015). Academics who view engagement as a beneficial activity for enhancing their careers, therefore tend to engage more with external actors.

The study also highlights the importance of prosocial motivations. Indeed, the vast majority of academics consider pro-social motivations to be important for their engagement. Furthermore, academics with strong society-oriented motives also tend to engage more with external partners. Finally, pecuniary motivations also have a significant effect on external engagement. While few academics consider these to be important for them, those who are motivated by pecuniary incentives do indeed tend to engage more. Nonetheless, it is more weakly related to engagement than career motivations.

Although career, prosocial and pecuniary motivations remain relevant for external engagement, their importance varies across different career stages. Career motivations remain important for researchers at every career phase. We had anticipated this to be the case for early and midcareer academics because of their need for job security. But what is striking is the relevance of career motivation for engagement also at the late career stage. This could be explained by a shift in focus from a need for security to gaining recognition. Having secured their positions, academics at late career stages may pursue activities that raise their social reputation or prestige in scientific fields. Prosocial motivation, by contrast, are only significantly related to engagement at the midcareer stage. At this stage, academics enjoy some semblance of stability so the norms and values of science they internalized from socialization in the early stage become important. Even though career needs may be present, socially oriented goals become more pressing, perhaps through the realization that altruistic values are being sacrificed. Contrarily, pecuniary motivations assume importance only at the later phase of one's career. These findings indicate that multiple motivations are internalized by academics. However, there are variations in the importance of motivations for external engagement across career stages.

Finally, the findings also indicate that perceptions of organizational fairness tend to play a lesser or no role in academics' engagement with external actors. Neither the fairness of the outcomes nor of the procedures for determining the outcomes matter for engagement behaviour. Hence, academics may be less sensitive to fairness issues in contrast to employees who operate in the business sector, where organizational fairness has been shown to matter for a range of outcomes.

The study has implications for policies to promote external engagement. Since academics are strongly motivated by career considerations in their external engagement, it is imperative that university managers devote attention to the design of career development policies. Providing recognition for engagement performance in recruitment and promotion decisions could be a key factor in promoting greater engagement. Furthermore, it is important to highlight that engagement need not come at the expense of research. On the contrary, it can provide access to funding, resources and data which are important for developing a research agenda. Providing a foundation for research and engagement activities to mutually support each other may be important to avoid the perception that engagement represents a burden that comes at the expense of research time. Finally, considering the variations in motivations of academics at different career stages, they may be unamenable to the same compensation or promotion policies. Hence, targeting them with the same policies may be inefficient. Providing policies specifically aimed at different groups could be an effective means to enhance engagement efforts.

There are some limitations to the study that future research needs to address. Data was collected from a few universities, all with a specific ambition to excel in the engagement mission. Even though the characteristics of these universities may be different from other universities, some of the findings may hold more broadly. Moreover, the cross-sectional nature of the research design limits the possibility of making causal claims. Hence, the findings should be interpreted in the light of these limitations. Relatedly, the career stages were determined at a single point in time but not over time. Therefore, we cannot draw any conclusions about changes in motivational drivers as academics transitions from one stage to another. A study that tracks academics' career trajectories longitudinally would be helpful in untangling this causal link.

These limitations notwithstanding, this study provides new evidence supporting the primacy of individual motivations in external engagement of academics. It also unravels how motivational drivers differ for academics with different career profiles. This suggests that faculty at a particular career stage would respond to incentives differently. Therefore, university managers

need to take this into account when designing policies to mobilize academics for external engagement.

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Table 1: Survey response rate by university

University	Population*	Number of respondents	Response rate (%)
Aalborg University	1387	137	9.90
Autonomous University of Barcelona	2666	151	5.70
Dublin City University	625	28	4.50
Kaunas University of Technology	680	32	4.71
University of Stavanger	699	126	18.00
University of Trento	643	50	7.80
University of Twente	630	111	17.60
Total	7330	635	8.66

Note: *Population represents post-doctoral fellows to full professors in research and/or teaching positions

Table 2. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
External engagement	625	3.05	2.34	0	9
Main predictors					
Career	486	3.65	.83	1	5
Prosocial	486	4.37	.84	1	5
Pecuniary	486	1.97	1.31	1	5
Distributive fairness	598	2.67	1.07	1	5
Procedural fairness	534	2.78	.93	1	5
Controls					
Female	625	.44	.5	0	1
Age < 40	625	.21	.41	0	1
Age 40-49	625	.31	.46	0	1
Age ≥ 50	625	.48	.5	0	1
Professional experience	625	.6	.49	0	1
Biological Science & Health	625	.18	.39	0	1
Engineering & Natural Sciences	625	.28	.45	0	1
Humanities & Arts	625	.16	.37	0	1
Social Sciences	625	.38	.48	0	1

Table 3. Correlation matrix of variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) External engagement	1.00														
(2) Career	0.28*	1.00													
(3) Prosocial	0.19*	0.27*	1.00												
(4) Pecuniary	0.12*	0.05	0.06	1.00											
(5) Distributive fairness	0.00	0.06	0.06	-0.07	1.00										
(6) Procedural fairness	-0.04	0.00	0.02	-0.11*	0.56*	1.00									
(7) Female	-0.06	0.02	0.14*	-0.04	-0.01	-0.03	1.00								
(8) Age below 40	-0.18*	-0.01	-0.05	0.05	0.04	0.09*	0.04	1.00							
(9) Age 40 to 49	0.08*	0.01	0.04	-0.07	-0.06	0.03	0.06	-0.35*	1.00						
(10) Age above 50	0.07	0.00	0.00	0.03	0.02	-0.10*	-0.09*	-0.50*	-0.64*	1.00					
(11) Professional experience	0.15*	0.01	0.02	0.09*	-0.10*	-0.12*	0.05	-0.13*	0.04	0.07	1.00				
(12) Biological Science & Health	0.00	0.00	0.01	-0.16*	-0.06	-0.06	0.08*	-0.08*	-0.02	0.09*	0.03	1.00			
(13) Engineering & Natural Sciences	0.11*	0.07	-0.10*	0.00	0.05	0.09*	-0.23*	0.13*	-0.01	-0.09*	-0.12*	-0.29*	1.00		
(14) Humanities & Arts	-0.14*	-0.06	0.11*	0.02	0.01	-0.02	0.10*	-0.06	0.05	0.00	0.02	-0.21*	-0.28*	1.00	
(15) Social Sciences	0.01	-0.01	0.00	0.11*	-0.01	-0.03	0.07	-0.01	-0.01	0.01	0.08	-0.36*	-0.48*	-0.34*	1.00

*Note: * p<0.05*

Table 4. Poisson regression analyses of academics' external engagement

	Base model	Full model
	(1)	(2)
	External engagement	
Career		0.139***
		(0.026)
Prosocial		0.100***
		(0.027)
Pecuniary		0.054***
		(0.018)
Distributive fairness		0.011
		(0.022)
Procedural fairness		-0.026
		(0.026)
Female	-0.080*	-0.104**
	(0.044)	(0.044)
Age (Reference: Age ≥ 50)		
Age < 40	-0.245***	-0.253***
	(0.067)	(0.062)
Age 40-49	-0.008	0.008
	(0.046)	(0.043)
Professional experience	0.127***	0.099**
	(0.046)	(0.044)
Discipline (Reference: Social Sciences)		
Biol. Sciences & Health	0.136**	0.174***
	(0.065)	(0.061)
Engineering & Nat. Sci	0.104**	0.094*
	(0.052)	(0.049)
Humanities & Arts	-0.126*	-0.140**
	(0.066)	(0.065)
Constant	1.344***	0.355**
	(0.068)	(0.164)
University dummies	Yes	Yes
Wald Chi^2	64.51[14]***	138.9[19]***
Pseudo R^2	0.0270	0.0539
Observations	486	486

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 5: Poisson regression analyses of academics' external engagement by career stage

	(1) Early career	(2) Midcareer	(3) Late career
Career	0.215***	0.093**	0.182***
	(0.051)	(0.040)	(0.038)
Prosocial	0.067	0.118***	0.052
	(0.054)	(0.038)	(0.048)
Pecuniary	0.046	0.050*	0.083***
	(0.029)	(0.028)	(0.027)
Distributive fairness	-0.023	-0.004	-0.027
	(0.046)	(0.036)	(0.038)
Procedural fairness	0.066	-0.052	-0.015
	(0.048)	(0.042)	(0.042)
Female	-0.136	-0.082	0.092
	(0.092)	(0.062)	(0.072)
Age (Reference: Age ≥ 50)			
Age < 40	-0.060	-0.079	-0.132
	(0.117)	(0.125)	(0.171)
Age 40-49	0.112	0.035	-0.031
	(0.105)	(0.061)	(0.083)
Professional experience	0.088	0.063	0.110
	(0.092)	(0.069)	(0.074)
Discipline (Reference: Social Sciences			
Biol. Sciences & Health	0.298***	0.115	0.088
	(0.111)	(0.092)	(0.098)
Engineering & Nat. Sci	0.035	0.010	0.122*
	(0.105)	(0.074)	(0.069)
Humanities & Arts	0.029	-0.240***	-0.053
	(0.122)	(0.092)	(0.133)
Constant	-0.151	0.569**	0.515*
	(0.344)	(0.246)	(0.291)
Observations	144	214	128
University dummies	Yes	Yes	Yes
Wald Chi^2	76.93[19]***	59.33[19]***	134.6[19]***
Pseudo R^2	0.0694	0.0440	0.0912

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

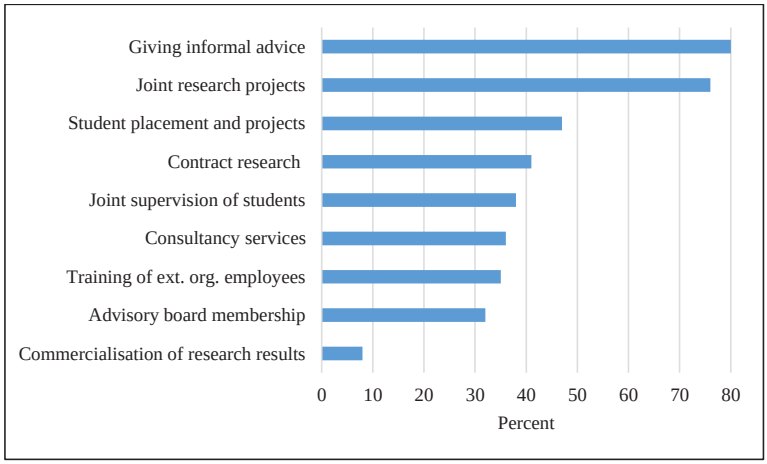

Fig. 1. Proportion of academics using different channels for engagement with external actors.

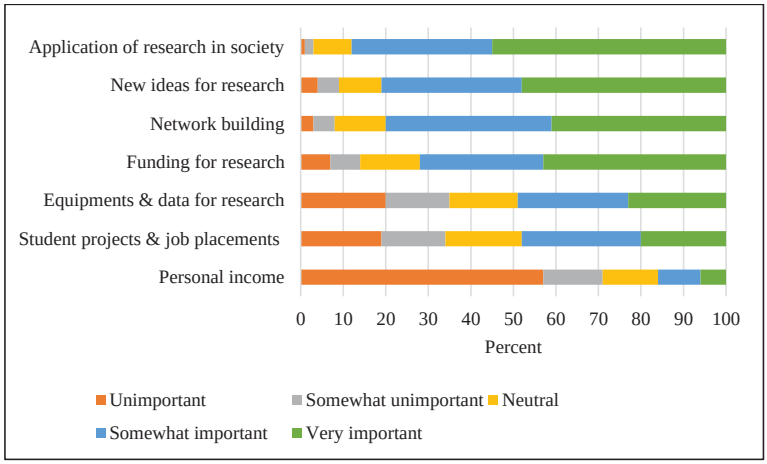

Fig. 2. Importance of different motivations for academics' external engagement

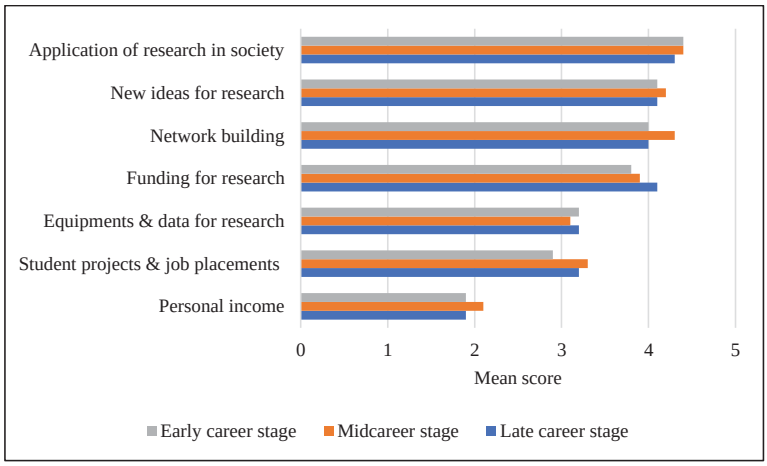

Fig. 3. Importance of different motivations for academics' external engagement by career stage (mean score)

Appendix

Table A1. Summary statistics of individual items of key variables

Variable name	Item	N	Mean	SD	Min	Max
External engagement	Giving informal advice/invited lectures	625	0.62	0.49	0	1
	Joint supervision of Masters/PhD students	625	0.30	0.46	0	1
	Arranging student projects/placements with external organizations	625	0.36	0.48	0	1
	Sitting on scientific advisory boards of external organizations	625	0.25	0.43	0	1
	Organizing training courses for employees of external companies	625	0.27	0.44	0	1
	Participating in joint research	625	0.59	0.49	0	1
	Conducting contract research	625	0.32	0.47	0	1
	Providing consultancy services	625	0.28	0.45	0	1
	Securing patents/providing licenses of inventions/creating spin-offs	625	0.06	0.25	0	1
Career motivation	Gain new insights in the area of my research	486	4.17	1.04	1	5
	Build and maintain professional networks	486	4.12	0.98	1	5
	Secure access to specialist equipment, materials or data	486	3.16	1.45	1	5
	Secure funding for research	486	3.94	1.22	1	5
Prosocial motivation	Promote the practical application of my research in society	486	4.37	0.84	1	5
Pecuniary motivation	Secure personal income	486	1.96	1.31	1	5
Distributive fairness	Do your pay or promotions reflect the effort you put into your work?	625	2.53	1.16	1	5
	Do your pay or promotions reflect what you have contributed to the university?	625	2.53	1.15	1	5
	Is your pay or promotions justified, given your performance?	625	2.94	1.30	1	5
Procedural fairness	Have the procedures to determine your pay or promotions been applied consistently by your university?	625	2.85	1.17	1	5
	Have the procedures to determine your pay or promotions been based on accurate information?	625	3.10	1.16	1	5
	Have you been able to appeal the pay and promotions determined by those procedures?	625	2.42	1.07	1	5

Paper II

Engaging for love of place? The role of place attachment in academics' regional engagement efforts

Kwadwo Atta-Owusu and Rune Dahl Fitjar

Abstract

The third mission of universities is often conceived as a regional one, encompassing contributions to regional development and engagement with regional actors. Yet, universities are increasingly global institutions with internationally mobile faculty. This raises the question of how the embeddedness of academics in their regions shape engagement at the regional scale. Using survey data of 625 faculty members at seven universities, we investigate the role of place attachment and informal social networks in shaping academics' regional engagement efforts. The findings indicate that academics with a strong sense of local attachment and extensive social networks engage more with local partners.

Keywords: Place attachment, informal social networks, academic engagement, native and non-native academics, regional engagement

1. Introduction

With knowledge considered an increasingly vital source of competitive advantage for regions, universities are seen as important drivers of development (Goddard & Vallance, 2011; Trippl & Maier, 2011). The contribution of universities is dependent on academics interacting with regional stakeholders and exchanging knowledge with public and private actors in the region (Looy, Debackere, & Andries, 2003). While universities' external engagement occurs at multiple geographical scales (Ponds, Oort, & Frenken, 2009), it is frequently oriented towards the local community. Collaboration with stakeholders such as firms often takes place at the local scale (Fitjar & Gjelsvik, 2018; Trippl, 2013). Indeed, the so-called third mission of universities is often understood as a regional one (Pinheiro, Normann, & Johnsen, 2016; Sánchez-Barrioluengo & Benneworth, 2019). Given the potential opportunities and benefits of these interactions for regional competitiveness, significant policy efforts have been geared toward promoting academics' engagement in their regions (Charles, 2003; Chatterton & Goddard, 2000).

While universities have always been important for the cities and regions in which they are located, they are also inherently global institutions which are part of international scientific communities and which aim to develop knowledge new to the world. Research is increasingly conducted through international collaboration (Henriksen, 2016; Wagner & Leydesdorff, 2005), and universities attract larger numbers of international faculty and students (Adnett, 2010; Altbach & Yudkevich, 2017). This raises the question of to what extent universities are able to balance increasing internationalization and increasing expectations for regional engagement. In order to assess whether these developments are in conflict, we need to know how important the local rootedness of faculty is for the processes of regional engagement.

However, prior research has paid little or no attention to how academics' attitudes and dispositions, and their social relations in the region, shape regional engagement. Which are the factors driving academics to engage with regional partners despite the inherent tension between the performance of this role and other core duties? While research has focused on how the regional and university contexts shape regional engagement (Bagchi-Sen & Smith, 2012; Looy et al., 2003; Qiantao, Niall, Dylan, & Robert, 2016; Sánchez-Barrioluengo & Consoli, 2016), the embeddedness of the individual academic in the region is also bound to matter. For instance, individuals' place attachment – which denotes the emotional ties people form with specific places – is known to affect a wide range of place-related behaviors (Lewicka, 2011; Low &

Altman, 1992; Stedman, 2002). It stands to reason that academics' engagement may also be shaped by their affective dispositions. However, previous research has not studied how the emotional bonds academics form with the regions in which they live and work, stimulate or dampen their local engagement efforts. Examining this relationship empirically could provide valuable input to regional engagement policies.

Similarly, academics' professional and social networks tend to shape their engagement decisions. For example, academics may engage more if they interact with colleagues who are engaged (Aschhoff & Grimpe, 2014; Tartari, Perkmann, & Salter, 2014). Similarly, maintaining informal network links with industry partners makes it easier for academics to engage in industrial collaborations (Østergaard, 2009; Ponomariov & Boardman, 2008). Thus, embeddedness in social networks can unlock collaboration opportunities. However, not all academics are equally well placed to benefit from social ties in their locale. For instance, foreign-born academics tend to have less extensive regional networks, which hampers their ability to engage in local collaboration (Lawson, Salter, Hughes, & Kitson, 2019; Libaers, 2014). Hence, social networks can facilitate as well as hinder academic engagement. However, little attention has been paid to the role of social networks for local engagement, or to how their relationship to engagement behavior differ between native and non-native academics.

Building on place attachment and social network literatures, this paper bridges these gaps by exploring whether academics' place attachment and their informal social networks are related to engagement with local actors. Furthermore, we compare the importance of these factors between non-native and native academics in order to examine whether embeddedness works through different processes for those who migrate to a region than for those who were born there.

The paper addresses these questions by means of data from a cross-sectional survey of 625 academics from seven universities affiliated with the European Consortium of Innovative Universities (ECIU). The findings demonstrate the relevance of place attachment and informal social networks in the regional engagement efforts of academics. Furthermore, the effect of place attachment is consistent across the two groups, albeit with a weaker effect for non-native academics. However, the informal social networks of native academics are strongly related to regional engagement, whereas they are insignificant for non-natives.

The paper proceeds with a review of the literature and formulation of hypotheses. The third section presents the data and method, while section four reports the empirical analysis and results. The final section draws conclusions and highlight some implications for policy.

2. Local rootedness and academic engagement

2.1 Rationale for local engagement of academics

Universities are increasingly broadening their external interaction to be relevant and responsive to the needs of societal stakeholders. As a result, academic engagement, which used to be an informal activity performed by few academics, is now recognised by most universities as an integral role (Pinheiro, Benneworth, & Jones, 2012). Academic engagement is understood as academic scientists' knowledge exchange collaboration with non-academic partners or organizations (Perkmann et al., 2013). Whereas much attention has been on interaction with industry, academics equally engage with governmental agencies and third sector organizations (Hughes et al., 2016; Olmos-Peñuela, Castro-Martínez, & D'Este, 2014). Collaboration with external actors occurs through a variety of channels, including formal knowledge exchange activities such as patenting, consultancy and contract research, and informal activities such as advisory roles, training of personnel and student supervision (Cohen, Nelson, & Walsh, 2002; D'Este & Patel, 2007; Grimpe & Hussinger, 2013; Perkmann et al., 2013).

Many studies have examined the geographical contexts in which academics' collaboration takes place (Fromhold-Eisebith & Werker, 2013). Engagement activities happen at varied geographical (i.e. local, national, international) scales (Lawson et al., 2019; Ponds et al., 2009). However, as with other types of collaboration, academic engagement tends to happen more frequently between co-located actors (Fitjar & Gjelsvik, 2018; Ponds, Van Oort, & Frenken, 2007; Trippl, 2013). Local collaboration brings well-known benefits from geographic proximity. Coordination of cooperation relationships requires considerable time and effort, which grow when the parties are far apart from each other. As such, academics may prefer collaborating with geographically close actors to minimize coordination costs (Cummings & Kiesler, 2007). Local collaboration can also reduce opportunistic behavior. Academic engagement often involves the exchange of proprietary knowledge, and partners need to be trustworthy. Given the difficulty in assessing the trustworthiness of unknown distant actors, academics may be more inclined to interact with local partners whose credibility can be evaluated through existing networks (Ponds et al., 2007).

Academics may also collaborate locally simply because they want to make a difference in their region. Besides achieving scientific impact, many academics are committed to ensuring the economic and social impacts of their work. Considering the importance of knowledge exploitation to economic development, they may be inclined to collaborate with partners who will use their research and with whom they can interact closely in its implementation (Sánchez-Barrioluengo & Benneworth, 2019). Collaborative activities such as joint research, student placements and employee training equip beneficiaries with skills and knowledge assets that enable successful collaboration also in the future (Bishop, D'Este, & Neely, 2011; Salter & Martin, 2001).

Finally, access to resources such as equipment, facilities, grants, and networking opportunities are also rationales for local engagement. Decreasing internal funding for research has compelled academics to act strategically in securing additional resources (Slaughter & Leslie, 2001). Whereas they can search for these resources from varied geographical sources, the characteristics of the local context play a role in the search decision. Funding by regional actors or for regional development purposes may attract academics to regional collaborations. Academic philanthropy often also takes place at the local scale (Glückler & Ries, 2012).

2.2 Link between place attachment and regional engagement

There is evidence that people attached to a particular place are more willing to engage in activities aimed at benefiting that place (Halpenny, 2010; Scannell & Gifford, 2010b). Individuals develop affinities through different experiences from their relationships with a place (Bugden & Stedman, 2019). In situations where action is required to protect or improve a place, people draw on place representations stored in memory or by constructing a sense of place on the spot, from contextual cues, to guide behavioral response (Bugden & Stedman, 2019). Such representations may involve both physical and symbolic (e.g. cultural, institutional) aspects that make up the identity of a place (Paasi 2001). Place attachment is related both to the place itself and to the imagined community which it represents and with which an individual may identify to a greater or lesser extent (Fitjar 2010).

Extending this perspective, we expect academics with stronger place attachment to be more inclined to collaborate with regional actors. First, a strong regional consciousness or sense of belonging to the region can make academics more motivated to contribute to the development of the region. For example, an academic with a high sense of attachment may be more willing to share knowledge or expertise with local firms or agencies even if they receive no material or

financial benefits in return. From studies of firms, we know that the desire to contribute to the region can be an important motivation for university-industry collaboration even when there is no immediate benefit for the firm (Fitjar & Gjelsvik, 2018). Such motivations may also be at work for academics with strong place attachment. Place attachment may also be conducive to trust in other members of the imagined community. Since mistrust or the suspicion that partners would behave opportunistically can impede knowledge exchange interactions (Bruneel, D'este, & Salter, 2010), these attitudes can ease suspicions about other peoples' motives, thereby increasing their willingness to forge collaborative relationships with regional actors (Mesch & Manor, 1998). We therefore expect academics with stronger place attachment to be more motivated to perform engagement activities at the regional scale. Accordingly, we hypothesize that:

H1. Strong place attachment will increase the level of regional engagement of academics.

2.3 Link between informal social networks and regional engagement

On top of the desire to interact, engagement also depends on opportunities to do so. In order to collaborate with external actors, networks and contacts with potential partners are necessary. Besides formal social networks developed, for example, in joint projects, academics can also develop relationships through casual interactions and socializing with family, friends, colleagues or members of recreational or voluntary organizations (Granovetter, 1985). Such interactions predominantly take place at the local scale. These amorphous and loose relationships forged in a societal context may also be important in that they are endowed with relevant relational resources that foster external engagement (Broekel & Binder, 2007). In short, they represent the social capital which enable local engagement to happen.

Informal social networks influence academics' engagement efforts through various mechanisms, providing academics with network resources (Nahapiet & Ghoshal, 1998). By engaging in frequent casual interactions and leisure activities, academics learn to trust other people and gain the trust of others (Coleman, 1990). More so, obligation norms are cultivated whereby individuals feel obliged to reciprocate favors they receive (Thune, 2007). In addition, informal networks provide opportunities for collaboration (Uzzi, 1997). Academics can acquire vital information for external cooperation through interactions with friends or acquaintances, hence reducing their search costs (Broekel & Binder, 2007). Moreover, since actors in informal networks often come from diverse professional backgrounds, they have the potential to link actors across sectors (Ponomariov & Boardman, 2008). Finally, interactions between friends or

working for voluntary organizations could bring awareness of the problems and needs of a region, leading to place-based research and collaborations with other researchers and local stakeholders to address these challenges (Bodorkós & Pataki, 2009).

In summary, informal social networks of academics provide diverse organizational contacts and connections to potential partners. These network resources facilitate their engagement with regional actors. Thus, we propose that:

H2a: Informal social networks will increase the level of regional engagement of academics.

While informal social networks may be related to engagement behaviors of academics, this effect may be more pronounced for native academics than non-natives because of the possible differences in the composition of their networks. Native academics will have experience from participating in various types of social arenas in the local environment through their life. This may facilitate their interaction with diverse groups of people. This crosscutting interaction allows them to develop expansive networks, accumulate rich socio-cultural capital and access novel knowledge (Behtoui, 2007; Burt, 2005). Drawing on this wealth of resources enables natives to identify collaboration partners and effectively utilize local opportunities. For non-native academics, on the other hand, a larger share of their social contacts will likely have developed through work, as they lack family or childhood friends in the region. This could lead non-natives to interact more with, for example, colleagues from work or with a similar background (Harvey, 2008; McPherson, Smith-Lovin, & Cook, 2001). Hence, although they may have similar levels of social interaction, the networks of non-natives might to a lesser extent involve contacts from other sectors which open engagement opportunities. Thus,

H2b. The relationship between informal social networks and regional engagement efforts will be stronger for native academics than non-native academics.

3. Method

3.1 Data

This study employs data from the RUNIN-ECIU Academics' Survey conducted in autumn 2019 to investigate the attitudes and experiences of academics regarding engagement with non-academic actors. The survey forms part of a large-scale research project whose objective is to examine the roles that universities perform in regional innovation and development. Since the

study is designed to capture the sentiments of academics working within European universities, the study population is drawn from institutions affiliated with the ECIU, a university association. ECIU was established in 1997 as a network of research intensive and entrepreneurial universities committed to promoting innovation and entrepreneurship and solving industrial and societal challenges in their regions. This vision is reflected in the close relations between these universities and industrial and societal actors. Presently, the consortium has 13 members and one affiliated partner. All are generalist universities with crosscutting disciplines, although with strengths in science, technology, engineering, and mathematics (STEM).

The survey was undertaken in seven ECIU member universities, and the target population was all academics, from research fellows to full professors, in teaching and/or research positions in all scientific disciplines. We contracted a private survey company to conduct the data collection. Before the survey was administered, a press release was issued on the intranet of the respective universities to sensitize respondents about the impending exercise. After this, the survey was distributed via e-mail from local university contact persons, using university mailing lists. Employing these methods, the questionnaire was distributed to 7,330 academics. In total, we collected 635 usable responses, yielding an overall response rate of 8.7%. After removing responses that were completed by ineligible respondents (e.g. PhD candidates), a final sample of 625 remained for analysis.

We conducted non-response bias tests to assess whether the relatively low response rate affects the reliability of the sample. Given the unavailability of auxiliary data on non-respondents, we compared early and late respondents in terms of regional engagement, place attachment, informal social networks, length of residence and the control variables (Armstrong & Overton, 1977). The results did not show any significant differences between early and late respondents on any of these dimensions when controlling for academics' background characteristics. Thus, there is no evidence of response bias in the study.

3.2 Variables

3.2.1 Dependent variable

In the survey, respondents were asked to indicate whether they had engaged in any of nine types of interaction with external actors over the past three years. Additionally, they were asked to

indicate whether the interactions in which they engaged took place within the region, within the country or internationally (see Table 3 for the distribution). We employ the responses from the interaction activities within the region in the main analysis. Furthermore, we test for the specificity of these results by also estimating the model for engagement at the national and international scales.

The dependent variable, regional engagement, follows the approach of earlier studies (e.g. Lawson et al., 2019). It is constructed by counting the number of types of interaction activities in which an academic engages at the regional scale. We consider the following types of activities: giving informal advice/invited lectures, joint supervision of Masters/PhD students, arranging student project/placements, sitting on advisory boards of external organizations, participating in joint research, conducting contract research, providing consultancy services, and commercializing research (see Table 3 for full list of items and Appendix Table A1 for summary statistics). We count how many types of engagement activities the respondent participates in with regional partners, such that a respondent who does not engage in any activity scores zero and one that engages in all activities scores nine. This measure has a Cronbach's alpha of 0.74, indicating a high reliability of the measure.

3.2.2 Explanatory variables

The place attachment measure assesses a respondent's attachment to the region in which the university is located. It is measured with five items adapted from the Place Attachment Scale (Lewicka, 2008): "I miss this region when I am not here"; "I have little influence on the affairs of this region"; "I am rooted in this region"; "I want to be involved in what is going on in this region"; and "I would like to move away from this region" (see Appendix Table A1 for summary statistics). Respondents rate each item on a 5-point scale ranging from "strongly disagree" to "strongly agree". We reverse-code the negatively worded items and replace don't knows or missing responses with the mean score of each item. Finally, we sum the mean scores to generate a measure for place attachment (Cronbach's alpha = 0.72).

The informal social networks measure captures the breadth as well as the density of the networks of respondents. This measure is constructed from three questions that asked respondents to indicate the amount of time they spend in a month interacting socially with friends, with colleagues from their work or profession, and with people at leisure clubs or voluntary organizations, respectively. For each item, the responses were scored on a five-point

scale from “not at all” to “several times a week”. The measure was generated by mean scoring the three items. It has a Cronbach’s alpha of 0.65.[1]

3.2.3 Control variables

We control for several factors that may influence regional engagement. First, we include gender (a dummy variable coded 1 for female and 0 for male), age (a categorical variable coded into three groups: below 40 years, 40 to 49, and 50 and above), birthplace, and length of residence to control for demographic characteristics of respondents. The birthplace variable distinguishes between natives of the region, natives of another region in the same country, and foreign born. Because of data constraints, we combine those born in another region of the same country and foreign-born groups into one category – non-native academics – for the sub-sample analyses. We compare this group to academics born in the region of interest (i.e. native academics). Length of residence measures the number of years a respondent has lived in the region where the university is located. The responses for the entire sample range from 0 to 69 (Mean = 27.13; SD = 19.44). Second, we control for professional experience outside academia (a dummy taking the value 1 if a respondent has worked in other sectors before joining academia and 0 otherwise). Third, we include the research orientation of respondents, based on a self-reported classification distinguishing between basic research, user-inspired research, applied research, and other. Finally, we include seven dummies to account for variations in external engagement across the universities (and, by extension, the regions in which they are located). Appendix Table A.2 reports the descriptive statistics for the variables, while Table A.3 presents the pair-wise correlations between all the variables in the regression model. The correlation coefficients between the explanatory and control variables are largely low. The VIF test shows values ranging between 1.10 and 2.45 with a mean value of 1.65, indicating that multi-collinearity is not a potential problem in the analysis.

[1] By conventional standards this suggests a low reliability. Nevertheless, we used it in the analysis because a low alpha does not render a variable useless. Schmitt (1996, p.352) opines that a measure can still be useful when it has “other desirable properties like meaningful content coverage of some domain.” Qualitative evaluation of the items underlying the measure indicates that they adequately cover informal social networks.

3.3 Estimation and model specification

As the dependent variable is a count, we estimate the model with Poisson regression using pseudo-maximum likelihood approach[2]. The model specification takes the following form:

$$Pr(Regional\ engagement_i) = \alpha + \beta_1\ Place\ attachment_i + \beta_2\ Informal\ social\ networks_i + \beta_3\ \boldsymbol{Controls}_i + \varepsilon_i \quad (1)$$

Regional engagement refers to the dependent variable delineated above. *Place attachment*, and *Informal social networks* represent the explanatory variables of interest. *Controls* is a vector of socio-demographic, research focus, and university specific control variables, and ε_i is the error term.

4. Empirical findings

4.1 Descriptive results

Table 1 reports the distribution of the engagement of academics in different activities across varied geographical scales during the period between 2016 and 2019, while Table 2 compares native and non-native academics on key variables. As shown in Column 1 of Table 1, giving informal advice (80%), and participating in joint research projects (76%) are the most widely used activities for engagement. Student-related engagement is also important, as 47% and 38% of academics collaborated with external actors through student internships and projects, and joint supervision of students, respectively. Similar levels of engagement are also found for contract research (41%) and consultancy services (36%). Commercialization activity (8%) is the least used channel.

---- Table 1 about here ----

[2] We have also estimated the model using Negative Binomial regression in a separate model. Furthermore, we have estimated the model with an Ordinary Least Squares (OLS) regression using the Academic Engagement Index as a dependent variable. The variable was built following the approach of (Bozeman & Gaughan, 2007) in which variables are weighted by the inverse of their shares (i.e. less common types of engagement carry higher weight). Overall, the results obtained in both cases were consistent with those of the main model. The results are available from the authors upon request.

When disaggregated by scale, levels of engagement tend to be higher at the national than at the regional and international scales. For instance, 57% of academics report giving informal advice to external actors at the national scale. This figure is seven percentage points higher than at the regional scale. Also, more academics engage in contract-based interactions at the national scale compared to the regional scale. However, student-related engagement mostly occurs at the regional scale. At the regional scale, 31% and 24% of academics interact through student internships and projects, and joint supervision of students, respectively. By contrast, interactions through these activities at the national scale are about five percentage points lower.

With respect to differences between native and non-native academics (Table 2), the former engage in relatively more activities than the latter at the regional scale. On average, natives to the region engage in 1.9 types of activities in the region, compared to 1.5 types for non-natives, and this difference is statistically significant ($t(623) = -2.54$, $p < 0.05$). At the national and international scales, there are no significant differences between natives and non-natives in the level of engagement: Natives engage in an average of 1.8 types of activities at the national scale and 1.1 types of activities at the international scale, while non-natives engage in an average of 2.0 and 1.2 types of activities at these respective scales. Regarding place attachment, the scores of both groups are above the mid-point score of 2.5. Specifically, natives also report higher place attachment (3.7) than non-natives (3.0). This difference is also significant ($t(623) = -10.1$, $p < 0.001$). Finally, both groups report engaging in social interactions with friends, work colleagues, and members of recreation organizations an average of two to three times per month. Comparing the two groups reveals no significant difference between them at the 95% level ($t(623) = -1.70$, $p = 0.08$).

---- Table 2 about here ----

4.2 Regression results

Table 3 reports the regression results both for the full sample and separately for natives and non-natives to the region. We adopt three steps in the estimation of the regression model. First, we estimate a baseline model (Model 1) with only the control variables for the whole sample. Next, the main model (Model 2) introduces the key explanatory variables. Finally, we run

separate regressions for non-native (Model 3) and native academics (Model 4) to compare the drivers of regional engagement across the two groups.

Starting with the controls (Model 1), there are no significant differences in the regional engagement of natives of the region, those from other parts of the country, and foreign born This result is inconsistent with Lawson et al. (2019). However, a significant difference emerges between natives of the region and those from other parts of the country when we introduce the main independent variables in Model 2. This suggests that the model explains the engagement behavior of natives better than that of non-natives from the same country. We find a positive and strong relationship between length of residence and regional engagement. This suggests that academics with longer residencies in a region tend to engage more regionally. However, the strength of the relationship weakens in Model 2, as the influence of length of residence partly works indirectly through the development of stronger place attachment and informal social networks. Women academics are less likely to engage with regional actors compared to their male counterparts, in line with previous literature on engagement in general (Lawson et al., 2019). Furthermore, academics between 40 and 49 years of age tend to be more regionally engaged than those aged 50 and above. Professional experience outside academia is positive and strongly significant, indicating that academics with experience from other sectors tend to engage more, again in line with previous literature (Gulbrandsen & Thune, 2017). Finally, those doing user-inspired and applied research are more regionally engaged than academics who do basic research.

In Model 2, we introduce the main independent variables. Place attachment is positive and highly correlated with regional engagement, confirming H1. As predicted, a strong sense of attachment to the region is associated with more regional engagement activities. An increase of one standard deviation (SD) in place attachment of an academic is associated with a 24% rise in engagement activities. Informal social networks are also positively associated with regional engagement, supporting H2a. Academics who have frequent social interactions tend to engage more in knowledge transfer interactions with local actors. A one SD increase in informal social networks is associated with a 15% increase in the expected number of engagement activities. Overall, the results show the importance of individuals' attachment to place and embeddedness in social networks for academics' regional engagement behaviors.

---- Table 3 about here ----

However, the effects of these factors differ significantly between native and non-native academics (Models 3 and 4). We find a significant positive relationship between place attachment and regional engagement for both native and non-native academics. Non-natives' place attachment is more weakly associated with engagement compared to their native colleagues. A one SD increase in place attachment increases the expected number of engagement activities of natives by 31%, compared to 15% for non-natives. However, the difference in the coefficients are is not statistically significant (Chi^2 (1) = 2.33, p = 0.13).

For informal social networks, we find no significant association for non-natives, but a significant positive correlation for natives. The difference in the coefficients between the two groups is statistically significant (Chi^2 (1) = 5.60, $p < 0.05$). Thus, H2b is supported. Informal social networks tend to be more relevant for natives' local engagement, with a one SD increase being associated with a 28% rise in the expected number of types of engagement activities. Regarding controls, there are some differences between the sub-groups. Notably, we find a positive and strong correlation between length of residence and the regional engagement of non-natives, but an insignificant association for natives. This finding is in line with Lawson et al. (2019) who show that foreign-born academics tend to engage more locally the longer they stay in the UK. The analysis here shows that this also holds at the regional scale.

To check the specificity of these findings to regional engagement, rather than engagement in general, we also examine how the model performs in predicting national and international engagement (Appendix Table A.4). The idea behind this is to assess whether there are any underlying confounding variables that affect both engagement in general and the independent variables in the study. According to the theory outlined above, the effects of place attachment and informal social networks should be specific to regional engagement and will not influence engagement at other scales. Indeed, this is precisely what we find. Place attachment and informal social networks have no significant effect on national and international engagement. Hence, we conclude that the model works in predicting regional engagement specifically.

5. Conclusions

The goal of this paper is to contribute to a better understanding of how the embeddedness of faculty in their regions shapes local engagement. Specifically, we examine whether place

attachment and informal social networks influence local engagement, and if so, whether there are any differences between native and non-native academics in the effects of these factors. The findings generally reveal that regional embeddedness matters significantly in academics' engagement with local partners. Academics who feel strongly attached to the region tend to collaborate more with local actors. The study also shows that academics who maintain diverse social ties engage more regionally. However, informal social networks matter only for native academics' interactions and has no effect on non-natives' engagement. Altogether, the findings provide evidence for the important, yet neglected, role of place attachment and social networks for the regional engagement of academics. In addition to contributing to the extant literature, it also has implications for policymakers and university managers.

First, a lesson for regional policymakers is that reaping the benefits of research at the regional university may be dependent on the ability of the region to embed the university and its academics in wider regional structures. Unlocking the regional development potential of a university is not just a function of investing in research and technology transfer. The university and its academics must also be embedded into the region in a socio-cultural sense. Hence, regional innovation policy that relies on the contribution of universities needs to adopt a dual approach of investing both in research and in embedding the university in the region. Research universities with an international profile may become cathedrals in the desert unless their academics develop an attachment to the region and informal social networks. The challenge for regional policy makers is to think about strategies or initiatives to stimulate academics' identification and attachment to the region and the development of their social networks.

Second, universities need to manage the tension between internationalization and research excellence on the one hand, and the need to create impact and participate in the regional community on the other. While there is certainly potential for regional development to benefit from universities bringing in excellent academics and taking central positions in global knowledge networks, these rewards do not happen automatically. Rather, the university needs to help their academics to embed in the region. Although social interaction is a private responsibility, universities can perform a facilitating role through e.g. social and cultural events, voluntary associations, festivals, etc.

Third, universities face the challenge of attracting and retaining academics for a long time in the context of increasing international academic mobility. To keep talented academics (especially non-natives), university managers need to pay particular attention to reward systems

and career development. Career development policies that ensure research autonomy, attractive research-teaching balance and tenure prospects – particularly for early stage academics – could incentivize them to stay relatively longer (Janger & Nowotny, 2016).

These findings notwithstanding, the study has limitations that must be duly acknowledged. Firstly, we rely on self-reported data from academics both for engagement and for embeddedness variables. Both dimensions are difficult to observe using other methods, but there are obvious measurement issues with this approach. Secondly, the costs of implementing the survey and the need to find universities willing to participate resulted in a sample limited to a relatively small number of universities with a particular profile. Hence, we do not know to what extent these results can be generalized to other universities. Finally, we only have data from a cross-section at one point in time and have no way of assessing the evolution of engagement and embeddedness across time for individual academics. These limitations notwithstanding, we believe that this study – being the first on this topic – provides useful insights into an important set of drivers of academic engagement.

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Table 1. Share of academics who participate in different engagement activities overall and at each geographical scale, percent (n = 486)

	Engagement			
Activities	Overall	Regional	National	International
Informal advice	80	50	57	31
Joint research	76	42	48	37
Student placements and projects	47	31	26	17
Contract research	41	19	25	15
Joint supervision of students	38	24	20	12
Consultancy services	36	19	22	11
Training of employees of external organizations	35	20	23	10
Membership of advisory boards	32	11	18	15
Commercialization of research results	8	4	5	2

Table 2. Difference between native academics and non-native academics on key variables

Key variables	Non-native		Native			
	N	Mean	N	Mean	*t* value	*p* value
Regional Engagement	361	1.54	264	1.93	-2.54	0.011
		(0.10)		(0.12)		
National engagement	361	2.00	264	1.75	1.53	0.130
		(0.11)		(0.12)		
International engagement	361	1.23	264	1.09	0.97	0.335
		(0.10)		(0.10)		
Place attachment	341	3.03	254	3.72	-10.09	0.000
		(0.05)		(0.05)		
Informal social networks	361	3.02	264	3.15	-1.70	0.088
		(0.05)		(0.06)		

Note: Standard errors in parentheses

Table 3. Poisson regression analyses of academics' regional engagement efforts

	Baseline Model	Full Model	Regional engagement by place of birth	
	(1)	(2)	(3)	(4)
	Regional engagement		Non-native academics	Native academics
Place attachment		0.255***	0.172**	0.368***
		(0.061)	(0.083)	(0.098)
Informal social networks		0.148***	0.019	0.257***
		(0.052)	(0.077)	(0.065)
Controls				
Birthplace (Reference: Native of region)				
Native of another region in same country	0.187	0.286**		
	(0.126)	(0.120)		
Foreign born	-0.022	0.068		
	(0.193)	(0.190)		
Residence length (log)	0.228***	0.172*	0.344***	-0.208
	(0.086)	(0.090)	(0.083)	(0.210)
Female	-0.155*	-0.150*	-0.294**	-0.077
	(0.089)	(0.086)	(0.126)	(0.116)
Age (Reference: Age ≥ 50)				
Age < 40	-0.029	-0.101	0.123	-0.411*
	(0.141)	(0.139)	(0.206)	(0.212)
Age 40-49	0.276***	0.158	0.350**	-0.085
	(0.101)	(0.101)	(0.138)	(0.136)
Professional experience	0.360***	0.346***	0.346**	0.294**
	(0.101)	(0.099)	(0.138)	(0.136)
Research orientation (Reference: Basic research)				
User-inspired basic research	0.684***	0.733***	0.704***	0.812***
	(0.182)	(0.183)	(0.249)	(0.284)
Applied research	0.817***	0.847***	0.849***	0.833***
	(0.170)	(0.172)	(0.230)	(0.267)
Other	0.674**	0.692**	-0.069	1.131***
	(0.283)	(0.286)	(0.534)	(0.345)
Constant	-1.108***	-2.277***	-1.947***	-1.446
	(0.394)	(0.399)	(0.424)	(0.894)
University dummies	Yes	Yes	Yes	Yes
Log likelihood	-1070.326	-994.796	-512.711	-458.310
Wald Chi^2	88.31[16]***	152.4[18]***	99.28[16]***	96.39[16]***
Pseudo R^2	0.0751	0.111	0.122	0.140
Observations	566	544	292	252

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix

Table A.1: Summary statistics of individual items of key variables

Variable name	Items	N	Mean	SD	Min	Max
Regional engagement effort	Giving informal advice/invited lectures	625	0.39	0.49	0	1
	Joint supervision of Masters/PhD students	625	0.19	0.39	0	1
	Arranging student projects/placements with external organizations	625	0.24	0.43	0	1
	Sitting on scientific advisory boards of external organizations	625	0.08	0.28	0	1
	Organizing training courses for employees of external companies	625	0.15	0.36	0	1
	Participating in joint research	625	0.33	0.47	0	1
	Conducting contract research	625	0.15	0.36	0	1
	Providing consultancy services	625	0.14	0.35	0	1
	Securing patents/providing licenses of inventions/creating spin-offs	625	0.03	0.18	0	1
Place attachment	I miss this region when I am not here	586	3.02	1.30	1	5
	I have little influence on the affairs of this region (reversed)	592	2.41	1.22	1	5
	I am rooted in this region	607	3.35	1.48	1	5
	I want to be involved in what is going on in this region	606	3.83	1.07	1	5
	I would like to move away from this region (reversed)	577	4.04	1.16	1	5
Informal social networks	Time spent on social interactions with friends	625	3.30	1.07	1	5
	Time spent on social interactions with colleagues from work or profession	625	3.23	1.43	1	5
	Time spent on social interactions with people at sports clubs, voluntary or service organizations	625	2.70	1.45	1	5

Table A.2: Descriptive statistics for the full sample

	N	Mean	Std. Dev.	Min	Max
Reg. engagement	625	1.704	1.93	0	9
Place attachment	595	3.323	.885	1	5
Informal social networks	625	3.075	.911	1	5
Native of region	625	.422	.494	0	1
Native of another region in same country	625	.427	.495	0	1
Foreign born	625	.15	.358	0	1
Residence length (log)	566	3.080	.975	0	4.2
Female	625	.442	.497	0	1
Age below 40	625	.213	.41	0	1
Age 40 to 49	625	.307	.462	0	1
Age 50 & above	625	.48	.5	0	1
Basic research	625	.194	.395	0	1
User-inspired basic research	625	.286	.452	0	1
Applied research	625	.475	.5	0	1
Other	625	.045	.207	0	1
Professional experience	625	.598	.491	0	1

Table A.3: Correlation matrix of regression variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) Reg. engagement	1.00															
(2) Place attachment	0.26*	1.00														
(3) Informal social network	0.15*	0.18*	1.00													
(4) Native of region	0.10*	0.38*	0.05	1.00												
(5) Native of other region in same country	-0.04	-0.26*	0.00	-0.74*	1.00											
(6) Foreign born	-0.09*	-0.17*	-0.07	-0.36*	-0.36*	1.00										
(7) Residence length (log)	0.17*	0.40*	0.06	0.57*	-0.23*	-0.48*	1.00									
(8) Female	-0.02	0.01	-0.08*	-0.01	0.01	0.00	0.01	1.00								
(9) Age below 40	-0.11*	-0.11*	-0.05	-0.03	-0.13*	0.23*	-0.39*	0.04	1.00							
(10) Age 40 to 49	0.06	0.06	0.07	-0.02	0.04	-0.03	-0.06	0.06	-0.35*	1.00						
(11) Age 50 & above	0.03	0.04	-0.03	0.05	0.07	-0.16*	0.38*	-0.09*	-0.50*	-0.64*	1.00					
(12) Basic research	-0.22*	-0.03	-0.05	0.00	0.04	-0.06	-0.06	-0.09*	-0.01	0.05	-0.04	1.00				
(13) User-inspired basic research	0.02	-0.03	-0.01	-0.04	0.03	0.02	-0.01	-0.01	-0.02	0.02	0.00	-0.31*	1.00			
(14) Applied research	0.16*	0.04	0.02	0.02	-0.03	0.00	0.05	0.06	0.02	-0.06	0.04	-0.47*	-0.60*	1.00		
(15) Other	0.00	0.03	0.06	0.03	-0.08	0.06	0.02	0.04	0.00	0.02	-0.02	-0.11*	-0.14*	-0.21*	1.00	
(16) Professional experience	0.15*	0.01	0.03	0.03	-0.06	0.05	0.04	0.05	-0.13*	0.04	0.07	-0.17*	0.07	0.06	0.02	1.00

*Note: * $p<0.05$*

Table A.4: Poisson regression analyses of academic engagement at other geographical scales- Robustness checks

	Baseline Model	Full Model	Baseline Model	Full Model
	(1)	(2)	(3)	(4)
	National engagement		International engagement	
Place attachment		0.051		0.070
		(0.059)		(0.085)
Informal social networks		0.056		0.070
		(0.053)		(0.079)
Controls				
Birthplace (Reference: Native of region)				
Native of another region	0.328***	0.376***	-0.003	0.067
in same country	(0.108)	(0.112)	(0.164)	(0.171)
Foreign born	-0.115	-0.053	0.525***	0.592***
	(0.155)	(0.158)	(0.201)	(0.207)
Residence length (log)	0.145**	0.141**	0.112	0.085
	(0.066)	(0.069)	(0.097)	(0.099)
Female	-0.177**	-0.170*	-0.163	-0.180
	(0.088)	(0.090)	(0.132)	(0.137)
Age (Reference: Age ≥ 50)				
Age < 40	-0.277**	-0.294**	-0.504**	-0.507**
	(0.131)	(0.132)	(0.209)	(0.213)
Age 40-49	0.159*	0.154*	-0.045	-0.096
	(0.092)	(0.093)	(0.134)	(0.138)
Professional experience	0.190**	0.184**	0.106	0.093
	(0.090)	(0.092)	(0.134)	(0.138)
Research orientation (Reference: Basic research)				
User-inspired basic research	0.698***	0.786***	0.492*	0.504*
	(0.194)	(0.199)	(0.267)	(0.275)
Applied research	0.826***	0.888***	0.661***	0.695***
	(0.185)	(0.190)	(0.246)	(0.255)
Other	0.730***	0.782***	0.547	0.505
	(0.264)	(0.275)	(0.353)	(0.374)
Constant	-0.421	-0.908**	-0.772*	-1.217**
	(0.311)	(0.368)	(0.427)	(0.531)
University dummies	Yes	Yes	Yes	Yes
Log likelihood	-1071.272	-1019.182	-926.427	-889.872
Wald Chi^2	114.5[16]***	113.7[18]***	84.28[16]***	82.36[18]***
Pseudo R^2	0.0978	0.104	0.0821	0.0875
Observations	566	544	566	544

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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Oasis in the desert? Bridging academics' collaboration activities as a conduit for global knowledge flows to peripheral regions

Kwadwo Atta-Owusu

ABSTRACT

Peripheral regions, like others, require a sustained flow of global knowledge to stimulate innovation and economic growth. Unfortunately, the dearth of innovative firms in these regions hampers foreign knowledge attraction. Nevertheless, academics are recognized as potential agents to perform such a role considering their embeddedness in diverse collaboration ties. As feasible as this may seem, prior research has not thoroughly examined this proposition. This paper, therefore, investigates how the collaboration activities of bridging academics facilitate the flow of knowledge to peripheral regions. Employing a case study of academics in a peripheral region in the Netherlands, it also identifies the mechanisms enhancing knowledge flows. The findings indicate academics tend to have more collaborations with partners in academia and industry than other sectors. Additionally, they use various pathways to establish cooperation relations. Lastly, the mobility of researchers and collaborative projects constitute the widely used channels for knowledge transfer. The implications of these findings for universities and policy-makers include the need to devote particular attention to cooperation ties of faculty; and the assessment of the knowledge needs of organizations in a region and connecting them with academics with the right expertise.

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KEYWORDS

knowledge flows; collaboration; global–local linkages; peripheral regions; bridging academics; the Netherlands

INTRODUCTION

In the last couple of decades, knowledge transfer has become topical academic and policy issue owing to its perceived contribution to economic development of regions. In fact, many scholars believe the generation and exploitation of knowledge remains a key driver of regional competitiveness (e.g., Howells, 2005). Whilst knowledge is the 'fuel' driving economic growth, local knowledge alone is not sufficient. For a region to stay at the frontiers of innovation, locally present knowledge needs to be supplemented with those from external sources. Accessing the external knowledge pools, however, requires regional actors to establish connections with extra-regional networks. Consequently, the policy prescription has been to 'encourage domestic firms and research organizations to participate in global knowledge flows in order to underpin national and regional competitiveness' (Organisation for Economic Co-operation and Development (OECD), 2004, p. 11).

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Yet, being part of global knowledge circuits alone does not guarantee automatic access to novel knowledge. Rather, it is the proactive and cooperative behaviour of domestic actors that engenders the channelling of outside knowledge to regions. For instance, the literature documents the role of local firms in knowledge transmission (e.g., Gertler & Levitte, 2005). The competitive and cooperative activities of small and large companies in global arenas have been shown to contribute to renewed investments and the flow of new knowledge to regions (e.g., Aslesen, Hydle, & Wallevik, 2017; Martin, Aslesen, Grillitsch, & Herstad, 2018). Similarly, the activities of universities have been highlighted as conduits for attracting distant knowledge to regions (e.g., Benneworth & Hospers, 2007; Benneworth, Coenen, Moodysson, & Asheim, 2009). Their role becomes essential, particularly, in peripheral regions where there are few or no leading firms to connect the region to distant knowledge sources.

Whilst existing studies have shed some light on the role of these actors in global knowledge flows,[1] they nonetheless suffer from two main shortcomings. First, the empirical focus has largely been on firms in metropolitan regions. Considering the importance that policy-makers attach to the development of peripheral regions, it is surprising that few studies have focused on knowledge flows to peripheral regions (Fitjar & Rodríguez-Pose, 2011; Grillitsch & Nilsson, 2015; and Pinto, Fernandez-Esquinas, & Uyarra, 2015, are some exceptions). Second, the practices of universities as institutional actors have received much attention, whereas the micro-level practices of academic scientists have frequently been overlooked (Miller, Alexander, Cunningham, & Albats, 2018). This is somehow intriguing given the meaningful roles they perform in the knowledge transfer processes. The unique position academics occupy in international knowledge communities, and their closeness to local actors, facilitates knowledge exchange and the brokering of linkages between distant actors (Trippl, 2013). Therefore, investigating the knowledge-exchange practices of individual academics could enhance the understanding of the dynamics of knowledge flows to peripheral regions as well as inform sound policy formulation.

To understand the knowledge flow dynamics, the paper focuses on academics who simultaneously collaborate with their peers and non-academic partners across varied geographical scales. The bridging role of such academics in diverse networks offers the opportunity to acquire new knowledge from external sources and facilitate their transfer to regional partners. Hence, the primary goal of this paper is to examine the potential role that collaboration activities of such academics play in drawing outside knowledge to peripheral regions. Based on in-depth interviews with a sample of bridging academics at the University of Twente (the Netherlands), the study explores how their cooperative linkages with various actors within and outside the region contribute to knowledge transmission. The research questions addressed are as follows:

- How do the collaboration activities of bridging academics facilitate the transfer of extra-local knowledge to peripheral regions?
- What are the promising mechanisms that can promote extra-regional knowledge transfer?

The paper is structured as follows. The next section presents the conceptualization of the knowledge flows arising from the collaboration activities of bridging academics. The third section discusses the methodological approach adopted in this study. The fourth section presents the findings from the analysis. The paper concludes with a discussion and policy implications.

CONCEPTUAL BACKGROUND

The knowledge link model

Trippl (2013) explicates how the mobility of academic scientists from one region to another contributes to knowledge transfer and the socioeconomic growth of these regions. The model makes a distinction between inter- and intraregional knowledge transfers. The interregional knowledge

flows occur when a researcher moves from region A to region B. This initial movement triggers a series of knowledge spillover effects between the regions. This can assume diverse forms. For instance, members of the researcher's former team or promising students may follow them to their new destination. In addition, maintaining existing ties with partners in the previous location can facilitate a backward transfer of knowledge from the current region. This can also result in the exchange of expertise between these two localities. Furthermore, the development of formal and informal collaboration ties (e.g., joint research, contract research, joint publication and staff exchange) with firms can offer opportunities for sustained knowledge flows across the regions.

Intraregional knowledge flows, conversely, result when academics engage in knowledge transfer activities with various actors within their current location. The maintenance of collaboration ties with partners in educational and research organizations can promote the diffusion of advanced knowledge in the academic sector of the new region. In addition, the building of linkages with industry actors and the commercialization of scientific knowledge or inventions represents a key means of knowledge transfer within the region (Trippl, 2013).

The knowledge link model represents a promising framework for elucidating the dynamics of extra- and intra-regional knowledge flows. However, its narrow focus on the mobility of 'star scientists' makes it insufficient to explain the phenomenon adequately. Indisputably, the mobility of highly qualified persons constitutes a vital mechanism for knowledge transfer. Nevertheless, it remains one of numerous channels of knowledge transfer. Besides mobility, publications, the social network of researchers and research collaboration are other important conduits of knowledge flow (Adams, Black, Clemmons, & Stephan, 2005). Furthermore, the model assumes knowledge flows between two regions: the sending and the receiving regions. While this dichotomous conceptualization is understandable on grounds of parsimony, in reality, knowledge is globally dispersed (Dicken, 2007, p. 82; Powell & Grodal, 2005). Finally, academic scientists do not solely build cooperative linkages with regional actors. They are equally part of 'linkages [that] may be tied to different social networks, different regions and nations, or different cultural contexts' (Bathelt & Cohendet, 2014, p. 2). Therefore, the model is extended to encompass all the aspects raised in the foregoing argument.

Towards an extended knowledge link model

The collaboration activities and networks of academics extend across regional, national and international boundaries. Therefore, focusing on knowledge exchange at one scale while ignoring the other scales does not reveal the entire picture (Fromhold-Eisebith & Werker, 2013). Adopting a multi-scalar perspective can help expound fully the dynamics of knowledge flows. The extended model conceptualizes knowledge flows at multiple geographical levels. However, for ease of presentation, only the regional and global levels are captured in Figure 1. Global knowledge refers to knowledge pools that may be located in regions, countries or a combination of such territories outside the region of bridging academics (Bathelt & Cohendet, 2014). Conversely, regional knowledge denotes knowledge stocks within the locality or region of bridging academics.

Another extension relates to the embeddedness of academic scientists within multiple collaboration ties. In this model, the collaboration activities of academics are conceived as 'bridges' linking different sectors and geographical scales. Through collaboration with international partners and engagement with local actors, such academics ensure a sustained supply of novel knowledge to peripheral regions. In addition, they can also connect regional actors to global networks of knowledge (Bramwell & Wolfe, 2008).

The geography of collaboration activities of bridging academics

The need for scientists to contribute to the advancement of knowledge, and help solve grand societal challenges, has necessitated the forging of research cooperation within and across scientific communities (Katz & Martin, 1997; Sonnenwald, 2007). Academic scientists acquire novel

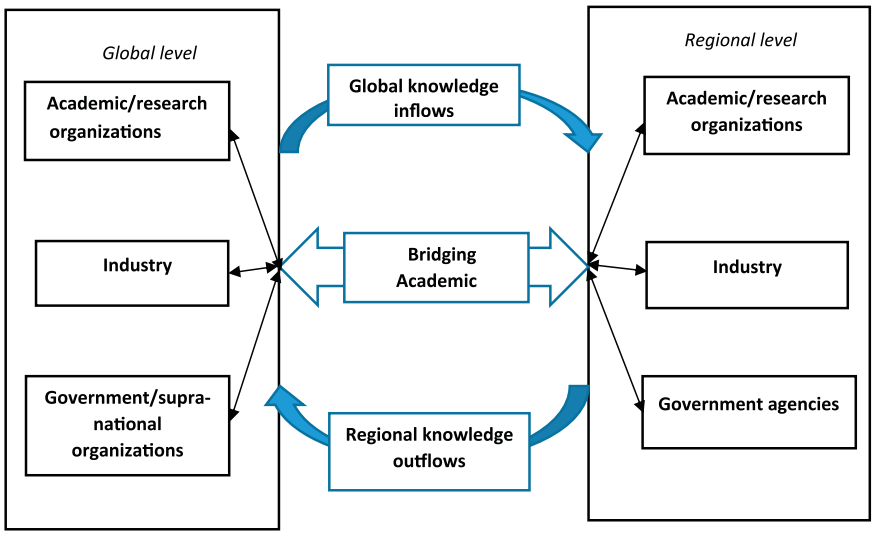

Figure 1. Extended knowledge link model based on Trippl (2013).

knowledge and unique competences through their interaction with reputable researchers outside their regions. This advanced knowledge is subsequently circulated in the region through cooperative linkages with researchers or research institutions (Trippl, 2013).

Another key mode of bridging academics' international collaboration represents their interaction with foreign companies. Bridging academics by virtue of their expertise are involved in research cooperation with both transnational companies (TNCs) and international small and medium-sized enterprises (SMEs; Ponds, 2009). Some researchers have attributed the growth of this phenomenon to academics' need to diversify their external funding sources (e.g., Kauppinen, 2012). However, funding is not the sole resource that academics acquire from these engagements. They also obtain access to new knowledge, equipment and data, and develop new networks that they use in their subsequent research (Jeong, Choi, & Kim, 2014). Similarly, these academics also engage in regional knowledge transfer activities with firms. They forge collaborative ties through various mechanisms such as the placement of students in firms, research and development (R&D) collaborations, and the commercialization of scientific knowledge (Perkmann et al., 2013; Trippl, 2013).

Bridging academics also build and maintain cooperative relationships with external government agencies or supranational organizations. These bodies rely on the scientific research and expert advice in the performance of their functions (Prince, 2012). Put differently, they play the role of advisors or researchers to international policy-makers. An example is the Intergovernmental Panel on Climate Change (IPCC) that provides scientific information for governments to formulate policies on climate change. In much the same way, academic scientists also transfer novel knowledge to regional public agencies through collaboration partnerships. The transmission of such experiences and learning from their international engagements can foster public and social innovation (Abreu & Grinevich, 2013).

The mechanisms and processes of knowledge flows

Novel knowledge from bridging academics' international cooperative activities and networks does not naturally trickle down to regions. However, it is transmitted through diverse channels and the

active interaction with regional actors and organizations. Academics use both formal and informal mechanisms and practices in the knowledge-transmission process (Martin et al., 2018). The choice of a particular mechanism depends largely on the nature of the knowledge being disseminated and the cooperative relationships of the academics.

One of the mechanisms is the mobility of scientists. The mobility of exceptionally skilled individuals constitutes a primary channel of knowledge flows (Faggian, Rajbhandari, & Dotzel, 2017; Trippl, 2013). The movement of these individuals presents an opportunity for new knowledge to spill over into regions, thereby preventing lock-in. Bridging scientists can help attract foreign human capital into peripheral regions through their international networks. By leveraging their connections, such academics can persuade promising researchers to assume positions in the region. Moreover, the temporary mobility of the bridging scientists can also promote the transfer of knowledge to their localities (Jöns, 2015). Embarking on sabbaticals or short research visits overseas equip these scientists with new experiences, knowledge and interpersonal skills. The experiences can result in lasting outcomes such as knowledge production, innovation and social capital. Furthermore, their socialization in different countries provides them with the skills to identify potential transferable or applicable knowledge to their regions (Coey, 2018).

Relatedly, events that bring together academic scientists and professionals of a particular scientific community or technology field also promote knowledge flows (Bathelt & Glückler, 2011, p. 181). Temporary gatherings in the form of international conferences, workshops and seminars facilitate learning and the exchange of tacit knowledge (Maskell, Bathelt, & Malmberg, 2006). Such transient co-location constitutes an opening for face-to-face interaction that helps researchers form personal ties (Orazbayev, 2017). In addition, participation in these events allows bridging scientists to be abreast with advances in knowledge or technology in their field and identify suitable partners for future collaboration.

Another mechanism that facilitates the transfer of foreign knowledge to regions is R&D collaborative projects. Such projects bring together scientists with unique expertise. Therefore, bridging academics' involvement in transnational collaboration may enhance their competences in new areas. In addition, they can also become familiarized with best practices that can be transferred to their region's research organizations (Jeong et al., 2014). Likewise, bridging academics may recommend the inclusion of local research organization or firms in research consortia to undertake international projects (e.g., European Union Framework projects). The regional actors' exposure to international best practices in science can sharpen their research capabilities and help them establish strategic external networks. Harnessing these assets in future research collaborations can ensure sustained knowledge flows into the region (Belderbos, Van Roy, Leten, & Thijs, 2014).

The discussion thus far has focused on extra-knowledge inflows to peripheral regions. However, being a dynamic process, there is the need to account for the backward diffusion of knowledge from regions. While bridging academics' collaborations outside the region contribute in attracting knowledge into the region, their interaction and activities also stimulates knowledge transfer outside. Several mechanisms engender knowledge outflows. The mobility of skilled researchers is one notable avenue. Outstanding students trained by bridging academics may move from the region to assume positions in international research organizations or firms (Saxenian, 2005). Another mode represents the formal collaboration involving bridging academics and external partners. A joint R&D project or a contract research for an international company constitute a conduit of extra-regional knowledge transfer. Furthermore, the commercialization of technological or scientific inventions of scientists also promotes the flow of knowledge. This transfer occurs when scientists sell intellectual property to foreign companies or team up with international partners to establish a spin-off company outside the region.

In sum, the combination of the inward and outward flows triggers transregional circulation of knowledge. This subsequently provides the impetus for innovation and economic development of regions (Trippl, 2013).

METHODOLOGY

The focus of this paper is to explore how the collaboration activities of academics across diverse spatial scales facilitate knowledge transfer in peripheral regions. Because of this empirical focus, a single case study approach is adopted (Eisenhardt, 1989). This approach offers the opportunity to present a nuanced or holistic view of the phenomenon being investigated. An in-depth study of the University of Twente was conducted with faculty members as the unit of analysis. The university was selected as the empirical context because of the following reasons. First, because of its role in the economic development of a peripheral region. The university was created, among other things, to help address the economic and technological decline of the Twente region. Although poorly endowed from the onset, it rose to the challenge to attain 'local economic relevance and international excellence' (Lazzeretti & Tavoletti, 2005, p. 475). Second, its ability to attract high-quality faculty, researchers and students. The attractiveness of the university lies in the scientific excellence it has gained in fields such as nanotechnology, materials science and biomedical technology. This has resulted in numerous research projects involving local and global partners. Such a vibrant research environment provides the ideal context in which to examine the topic under investigation. Lastly, the regional engagement focus of the university. Through several initiatives, it has encouraged the interaction and exchange of knowledge between the university community and regional agents.

Description of the University of Twente case

The University of Twente is a Dutch university located in the city of Enschede, in the eastern province of Overijssel. It was established initially as a polytechnic in 1961 to augment the training of the anticipated demand for technicians and engineers in the engineering fields. It attained university status in 1986 (de Boer & Drukker, 2011). With a technical focus, the university began with four departments: chemical, mechanical, electrical engineering and general science. Enrolment commenced in 1964 following the appointment of professors and the erection of essential infrastructure. Enrolment grew gradually from 250 initially to fewer than 4000 by 1978 (Lazzeretti & Tavoletti, 2005). However, the decline of the textile and machinery industry in the Twente region and financial challenges threatened the collapse of the young university. In fact, student enrolment dropped as low as 200 in 1979, which sparked rumours that the polytechnic would be closed in the beginning of 1980 (Benneworth & Hospers, 2007; Lazzeretti & Tavoletti, 2005).

The fortunes of the embattled technical college turned around following the appointment Harry Van den Kroonberg, a mechanical engineer, as the new Rector Magnificus in 1979. With the support of the new board of governors, the charismatic rector proposed and implemented a radical and distinct entrepreneurial vision for the university (de Boer & Drukker, 2011). He instituted varied institutional reforms and innovative schemes such as the technology transfer office, a business incubator and student entrepreneurship (the TOP programme). This entrepreneurial orientation fostered the engagement of the university with regional actors and the setting up of spin-off companies (Benneworth & Hospers, 2007). While pursuing this regional relevance strategy, it also intensified its teaching and research activities to achieve national and international excellence. Albeit the initial setbacks, the University of Twente has come to be acclaimed as one of the most respected enterprising research universities in the Netherlands. Indeed, it has been consistently adjudged the most entrepreneurial university in the Netherlands

in the past five years.[2] It also won the best technical university award in 2018 in the annual *Keuzegids Universiteiten* study guide.[3]

From the initial four departments, the university presently comprises five faculties with several departments as well as research institutes and centres. One of such institutes is the world-renowned MESA+ Institute for Nanotechnology, which offers cutting-edge research in nanotechnology. The university offers 20 bachelor's and 37 master's programmes in fields ranging from engineering to business administration to more than 10,000 students. It has a staff strength of over 3000, of which faculty constitute 56%. Its vibrant start-up culture has resulted in the establishment of approximately 1000 companies since 1984.[4]

Data collection and analysis

The selection of participants and the fieldwork for data collection commenced in the autumn of 2017. Given that the aim of the study was to gain a comprehensive understanding of a complex phenomenon, a purposive sampling approach was deemed to be more suitable (Eisenhardt & Graebner, 2007). Consequently, the following selection criteria were developed to identify potential participants for the study. First, the academic was an active researcher who has published with international partners or maintains a minimum of five international collaborators in their research network. In addition, she or he has participated in an international or national research (either as the principal investigator or as a partner) in the last three years. Furthermore, he or she was a member of a board of either a national or an international company, a government agency or a non-profit organization.[5] After searching the publication records as well as information on research projects and extra-academic activities, 25 academics were selected. Formal invitations were sent via email to all the identified academics to request for their participation in the study. Of this number, 11 ultimately accepted the invitation and indicated their consent to be interviewed. Table A1 in Appendix A describes the characteristics of these participants.

Data for the study were gathered primarily through interviews. A semi-structured interviewing technique was used to provide flexibility in asking sequence of follow-up questions to encourage comprehensive responses from participants. The intention was to document the detailed perspectives and experiences of academics' collaboration and knowledge exchange practices. Specifically, participants were asked to narrate how their research collaborations evolve and the motives for establishing those relationships. Furthermore, questions related to the key processes of knowledge exchange with collaboration partners and the mechanisms for transfer of knowledge were also probed. The interviews lasted between 30 and 90 min and were audio recorded to obtain accurate account of the dialogues. The data were later transcribed and analyzed thematically (Braun & Clarke, 2006). The transcripts were read to identify interesting recurrent themes from the narratives. These were initially coded, and the codes that were related were later grouped under broad themes. Through an iterative process, the coded data were constantly compared with the entire data to check for patterns of commonalities (Eisenhardt, 1989). The themes that emerged were then examined in relation to the conceptual framework and presented as findings. Selected extracts from the data were added to the selected themes to provide practical illustration to the analysis.

EMPIRICAL FINDINGS

The dynamics of collaboration activities of bridging academics

The collaboration activities of bridging academics follow some sequence of evolution. Academic collaboration, it emerged, typically serves as the precursor to non-academic collaborations. Bridging academics' unique scientific competences, their work in niche research areas, and cooperation with others enhance their visibility in scientific communities. This subsequently put them on the radar of potential partners in industry and government. Their reputation provides them opportunity to also work with other partners at the national and international

level. These relationships, however, do not replace the existing academic partnerships. On the contrary, the non-academic collaboration tends to complement and reinforce the scientific collaboration as it provides new resources for subsequent scientific research. This point is captured by the following quotations:

> [I]t started with research project together with different researchers in America and Asia in my field before it moved to working with companies and government agencies. (PA3)

> I came here [University of Twente] as professor in XXXX … set up a research team and built a certain reputation. We have quite some good inventions that have been very well received which are used in a lot of products. So we became very famous in our field and companies started to approach me and asked if they could sponsor a research in our group. (PA6)

It is instructive to note that other actors do not always initiate collaboration relations. Just as interested partners approach bridging academics to establish research ties, they in turn contact potential partners when the need arises. In effect, relationships can be developed at the instance of any partner, as intimated by this respondent:

> There is no one way of working in that sense. For instance, we just entered into a collaboration with a company looking for a research group that was able to produce some materials for them. … Sometimes I also search for companies that can use our technology. So it goes in two directions. (PA4)

Interestingly, collaborations resulting from unplanned meetings represent a recurrent theme through the narratives of the respondents. Some recount how research cooperation begins through the chance meeting of partners at formal events such as conferences. In essence, the collaborative relationships of bridging academics, sometimes, commence as a result of fortuitous circumstances, as the following quotations illustrate:

> It can be very different. Most at times someone you meet through accident or someone who hears of you through the media or other means and they say 'Oh we're putting in a project proposal or we're going to start a project and we think you could add something interesting.' (PA9)

> At times it [collaboration] just happen by accident. I met people or people saw me give a presentation and collaboration started. For example, I was giving a presentation on a research project and after I finished, the Minister of Education of XXXX [an Eastern European country] asked me to help them develop a research programme. (PA3)

However, there were differing degrees of interaction. While collaboration with academics was widespread, there were variations in interactions with other partners. These differences arise primarily from the research orientation and the motivation of individual academics. Academics working in the science and technology fields expressed their preference for working with firms. For example, one informant explained that firms remained his essential partners because the nature of his research is more relevant to industry than other sectors. Therefore, if the idea is to consider an application for a piece of research, bridging academics naturally seek cooperation with industrial partners. Conversely, if the intent is to build a research consortium or search for funding or other resources, collaboration with other actors is sought:

> We're in science and technology and dealing mainly with external stakeholders that are in the field of science and technology. So in that sense, government is not our direct connecting point. … But companies are very much our natural partners. (PA5)

> I work with a couple of people who work at companies and often very content oriented, it's always the case. And the position that I have right now is more of I seek strategic partnerships. I talk with lots of people in companies and local government to set up strategic alliances. (PA2)

The research orientation regardless, the stage of the research equally determines the relevant partner such academics work with. If the research is at the experimentation phase, the researcher tends to interact more with government agencies (e.g., hospitals) and non-governmental foundations. However, as it moves to the development or commercialization phase, cooperation with companies become critical, as the following quotations exemplify:

> We work with some clinicians [hospitals] and do have some collaborations with companies as well. But then I guess in that case their input is more on the engineering side so something or technology that has been developed here in the lab and they pick that and build some sort of demonstrator or proof of concept. (PA10)

> Well, because we do research on medical applications, it's important to have connections with hospitals. Because if we develop technology but has no connection with the hospital, it means you're just doing something that's never going to be used. Therefore, it's important to have collaboration with doctors. Companies are also important because we're doing research but we don't really have the power to make products on the market. Since at some point you want your work to go to the next stage, you need to collaborate with companies. (PA8)

Another key observation concerns the geographical dimension of collaboration activities. The research linkages of bridging academics are assumed to transcend multiple geographical scales. Nevertheless, there were differences in the level of interactions. Academics did not maintain the same relationships with partners at various scales. While some respondents emphasized their cooperation with all the actors at several locations, others stated they maintain ties with some selected actors at specific geographical locations:

> Yeah, I will say I collaborate with academic partners and the Association of XXXX [a health NGO] in Europe. Most at times, I work with small to medium enterprises because you want an intervention to land in the market. … Sometimes also with large corporations or large government institutions. (PA9)

> We're working together with big companies but also with small and medium enterprises both regionally as well as the national landscape but less abroad. (PA5)

Knowledge flows through mobility and collaborative projects

The actions and behaviours of academics in their collaboration practices contribute directly or indirectly to knowledge flows. Various practices that foster knowledge flows were identified in the narratives of these academics. These mechanisms are broadly classified into two, namely, mobility and collaborative projects. Consistent with the above discussion on mobility, the analysis revealed informants used two types of mobility in their collaborations: permanent mobility and temporary mobility. Through permanent mobility the academics leverage their connections in extra-regional networks to recruit talented students to work in research projects locally. The movement of the students not only promotes the flow of person-embodied knowledge but also helps to formalize informal cooperation, as in the following comment:

> I always seek collaborators who have more knowledge than I do on specific sub-topics. So, I have a long-standing relationship with a group at XXXX [an Eastern European university] and we wanted to make

> this formal between our universities. The arrangement was that they will bring in potential students and then depending on the interest of the students and our mutual interest we define the [research] topic. This is how I expand my collaboration network. (PA2)

It is worthwhile noting that mobility is not typically in one direction. Some bridging academics encourage some of their students to move out to assume positions internationally. While there, the students acquire novel competence and develop new networks. If such students maintain their relationships with the region, they can serve as new conduit of knowledge flows:

> I'm always advising people who do their PhD here and want to stay. I tell them it's very nice but they should first go away, meet new people, get exposed to different environments, different culture, and different way of working, and create their own networks. We will always be interested in bringing them back if they are successful. (PA4)

In addition to the permanent mobility, scientists, their students and regional partners also move out of the region (albeit temporarily) to acquire knowledge. Some interviewees spoke of instances when they have sent students to learn some techniques or new methods from their collaboration partners. This often happens when the local research group has to work on a project but are deficient in certain aspects. This interviewee opined:

> Another thing you can do is if you have a collaborator who has certain knowledge you don't have, you can also send some of your students to learn from the lab of your collaborator. (PA9)

Relatedly, the interviewees spoke about how attendance at international conferences and seminars created opportunities to acquire and exchange knowledge with other partners. Some academics narrated how they got new research cooperation after they had presented their research at such international fora. Another also talked about how he organized visits abroad for some local partners to interact with selected international firms in his network. The rationale was to enable these firms acquaint themselves with international best practices, and to establish linkages with international companies. The following quotations capture these observations:

> sometimes at international conferences and through international networks, when you're there … it gives you the opportunity to give some informal advice or mentorship. On the other hand, you also get the chance to seek advice from someone who is more experienced than you are on some problems. (PA8)

> You really can show them [companies] that they are not unique and that they have to think outside the box. Sometimes I take people from [local] companies and bring them to Germany or Switzerland or Italy to show them why these companies are different and that they too can do it differently. (PA1)

Knowledge also flows from the collaborative projects of academics in the region and beyond. In the international collaborations, the researchers work on varied projects involving different collaborators. In the course of working in interdisciplinary projects, the scientists become familiar with creative methods, technology or innovative approaches to conducting research. Some of the respondents recounted experiences on the collaborative projects with local companies intended to transfer knowledge and help resolve societal problems. An interviewee stated:

> Well as I said, my research is far out but with a local company as one of the collaborators we've developed a robot that is used in diagnosing XXXX [a medical condition]. This robot is now in pre-clinical trials and if it works out that will be something that will help patients. (PA10)

Aside collaborating with regional partners to undertake local projects, academics also team up with them to carry out international projects. One academic recollects his cooperation with a local organization as follows:

> … A good example is a project we just started in XXXX [European country]. 'Alpha' is a testing organization and we've been working together on computer-based testing and have developed a lot of knowledge on how to organize such a large scale assessment. An [European country] organization has to do this huge project so they contacted one of my former PhD students … and she contacted us … we agreed that for the next three years we are going to help them run such a programme and also train them. (PA6)

To sum up, the evolution of collaboration activities of bridging academics follows unique path. It starts with academic partners and develops to include non-academic partners. Moreover, the development of relationship with partners is informed by the nature of research, motivation of the academic, and the stage of the research. Furthermore, they do not maintain cooperation with all at every geographical scale. However, bridging academics maintain ties with relevant actors at distinct locations. Lastly, the practices of these scientists facilitate the flow of knowledge across regions. Notable mechanisms that enable this to happen are mobility and collaborative projects. The following section discusses these findings.

DISCUSSION AND CONCLUSIONS

The regional innovation literature suggests the nature of the innovation system prevailing in a region determines the level of global and local knowledge exchange (Martin et al., 2018). Peripheral regions have been described as suffering from organizational thinness. Hence, they have few or no innovative firms with the international networks to absorb global knowledge (Trippl, Grillitsch, & Isaksen, 2017). In the absence of such firms, academics who maintain links with diverse partners across multiple scales can potentially perform that role. The collaboration activities of these bridging academics remain the promising pipeline through which novel knowledge can flow to peripheral regions. To assess this proposition, the paper drew on the knowledge-link model proposed by Trippl (2013). However, the conceptual model was inadequate to explain how collaboration activities of bridging academics enable the flow of global knowledge to peripheral regions. Consequently, some extensions were proposed. The extended model conceptualized the collaboration ties of bridging academics with diverse actors across multiple geographical scales promote the circulation of knowledge. This subsequently engenders innovation and economic renewal of peripheral regions. The paper empirically analyses this conceptualization using a sample of academics at the University of Twente.

The empirical findings suggest academics maintain relationships with specific actors they find to be relevant for their research and not with all the actors identified in the model. Contrary to the models' assumption, bridging academics appeared not to maintain equal links with academics, industry and government partners at all levels. Most of the participants tended to have more ties with academic and industry partners than with government actors. This does not suggest, however, that the former ties are more important that the latter. As alluded to in the previous section, the research orientation of academics determines – to some extent – the choice of collaboration partners. The disposition of the academics in the study to collaborate more with actors in academia and industry could be attributed to their science and engineering backgrounds. Another study with a representative sampling of academics is required to ascertain if similar or conflicting finding would emerge.

Regarding the geographical dimension of the cooperation ties, there was evidence to suggest differences in the degree of interactions at various scales. Most of the participants engaged intensely with actors in the international arena. This is completely understandable given that the bulk

of knowledge networks exist at the global level. While some researchers enjoy the luxury of engaging with all the actors at various levels, others maintained strategic relations at certain locations. The plausible explanation for these variations may comprise the following. First, the nature of the research. Research remains an invaluable tool for knowledge dissemination but not all knowledge is relevant for every actor. The needs of actors at other scales may not be the same. Therefore, academics may want to collaborate with partners who express a need and would benefit from their research. For example, a researcher working on applied photonics would prefer to interact with companies at the global scale than with regional governmental agencies. Because their research might be more commercially valuable than having policy relevance.

Second, strategic considerations. Establishing and maintaining collaboration relations entail considerable costs. Therefore, it would be uneconomical to maintain cooperation with diverse partners across numerous geographical locations if such ties are unfavourable. Acting rationally, bridging academics establish partnerships with specific partners at locations that offer highest utility in terms of novel knowledge and resources for research.

While the framework is silent on how bridging academics develop their partnerships, the findings reveal distinct pathways through which they establish relations with various partners. These are through active search, passive search and fortuitous encounters. Active search entails the deliberate scouting of prospective partners by academics. Passive search, on the contrary, involves contacting of bridging academics by others partners who want to establish collaboration ties.

Lastly, fortuitous encounters are chance meetings between academics and potential partners that result in subsequent collaboration (Björneborn, 2017). Academics employ various combinations of these channels to build their collaboration networks. However, some may be more significant depending on the career stage, the reputation, and the type of research of the academic. For instance, an academic in the early stage of their career may utilize an active search mode to develop research partnerships. However, they could also obtain solicitations from potential partners if they conduct high quality research. Taken jointly, variations exist among these pathways but there is equally an interplay between them.

In the conceptualization, knowledge is assumed to flow across peripheral regions through various practices of bridging academics such as mobility, collaborative projects and research commercialization. Consistent with this, the paper provides some evidence to suggest that academics' engagement in some of these practices indirectly enhances knowledge transfer to the region. The collaboration activities with international partners promote the permanent mobility of talented researchers into the region. Arguably, the destination of these scientists remains the university and research institutes. Nonetheless, some end up in local firms as industrial doctoral students. These students serve as a conduits of global knowledge flows by maintaining ties with research institutions and scientists in their home country (Bramwell & Wolfe, 2008). Moreover, the temporary mobility practices of bridging academics, their students and regional partners facilitate the transfer of knowledge to the region. Lastly, collaboration projects proved to be a fruitful conduit for regional knowledge transfer. Most of the academics involve their regional partners in some national and international projects. By doing so, they help connect regional firms to global innovation networks (Coe & Bunnell, 2003). These key mechanisms were also instrumental in the backward flow of knowledge from the region. However, there was scant proof to show that the academics used research commercialization for knowledge transfer in their collaborations.

The findings from this study have some implications for universities and policy-makers in peripheral regions. First, university authorities need devoting particular attention to the informal network relationships of their faculty members. As demonstrated in this paper, such linkages abound with opportunities and resources that can be harnessed for the benefit of both the university and the region. While academics enact these relationships at the personal level, department or faculty heads could examine some of the partnerships that hold promise and formalize them at the institutional level. This could promote the mobility of talented researchers to the region.

Next, the universities should also improve the capacity of academics to apply for European-level projects. Involvement of scientists in collaborative projects such as the European Commission's Innovative Training Networks (ITNs) help extend their networks and attract early-stage researchers into regions. Because these projects are competitive, their application is also demanding. As such, universities can establish a unit or hire consultants to assist academics with grant writing. Additionally, they can offer periodic training workshops to help improve the capacity of researchers in project applications.

Lastly, knowledge from global sources is essential for innovativeness of peripheral regions. Nevertheless, not every knowledge may be relevant for the regional actors and organizations. More so, regional actors may not possess the capacity to convert every knowledge into beneficial outputs. Therefore, regional policy-makers need to profile regional organizations to assess their knowledge needs and connect them to regional academics who possess relevant expertise. When certain scientific expertise does not exist at the regional university, local academics can link firms to their external partners with such knowledge. This could prevent under-utilization of knowledge and redundant knowledge flowing into the region.

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NOTES

[1] In this paper global, international, extra-regional and trans-regional knowledge are used interchangeably to refer to knowledge flows from outside a region.

[2] See https://www.utwente.nl/en/news/!/2017/12/312872/the-ut-has-the-highest-impact-in-the-netherlands-and-has-once-again-been-named-the-most-entrepreneurial-university/.

[3] See https://www.utwente.nl/en/news/!/2017/11/601/giant-leap-in-keuzegids-universiteiten/.

[4] See https://www.utwente.nl/en/facts-and-figures/#a-living-smart-campus-where-change-begins/.

[5] A participant had to meet at least two of these criteria to qualify for selection.

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APPENDIX A

Table A1. Characteristics of the respondents ($n = 11$).

Interview code	Faculty	Academic rank	Nationality	Years at university	Years working abroad
PA1	Engineering Technology	Professor	Dutch	40	1
PA2	Electrical Engineering, Mathematics & Computer Science	Professor	Dutch	4	0
PA3	Science & Technology	Professor	Dutch	18	1
PA4	Science & Technology	Professor	Dutch	30	n.a.[a]
PA5	Science & Technology	Professor	Dutch	17	5
PA6	Geo-Information Science & Earth Observation	Professor	Dutch	n.a.	n.a.
PA7	Electrical Engineering, Mathematics & Computer Science	Professor	Dutch	19	0
PA8	Electrical Engineering, Mathematics & Computer Science	Associate professor	French	12	< 1
PA9	Electrical Engineering, Mathematics & Computer Science	Professor	Dutch	6	6
PA10	Engineering Technology	Professor	Canadian	7	7
PA11	Engineering Technology	Professor	Dutch	21	1

Note: [a]n.a., Not available.

Paper IV

What drives university-industry collaboration: Research excellence or firm collaboration strategy?

Kwadwo Atta-Owusu, Rune Dahl Fitjar, and Andrés Rodríguez-Pose

Abstract

Research and innovation policy aims to boost research output and university-industry collaboration (UIC) at least in part to allow firms access to leading scientific knowledge. As part of their mission, universities are expected to contribute to innovation in their regions. However, the relationship between research output and UIC is unclear: research-intensive universities can produce frontier research, which is attractive to firms, but may also suffer from a gap between the research produced and the needs of local firms, as well as mission overload. This may hinder local firms' ability to cooperate with universities altogether or force them to look beyond the region for other suitable universities to interact with. This paper investigates the relationship between the research output of local universities and firms' participation in UICs across different geographical scales. It uses Community Innovation Survey (CIS) data for Norwegian firms and Scopus data on Norwegian universities' research output across various disciplines. The results demonstrate that local university research intensity and quality are negatively associated with firm participation in UICs at the local level. Firm characteristics, in particular the firm's general strategy towards cooperation and its geography, turn out to be much more important than university characteristics in explaining UICs. Notably, firms' cooperation with other external partners at the same scale is a strong predictor of UICs.

Keywords: Research, universities, firms, university-industry collaboration, Norway.

1. Introduction

The impact of universities on the performance of firms in their vicinity is a major topic in the geography of innovation literature. The presence of research-intensive universities has traditionally been associated with the production of geographically bounded knowledge spillovers, which enhance the innovation capacity of firms located in close proximity to the universities generating frontier research (e.g. Jaffe, 1989). Universities are, consequently, considered fundamental players in models of regional innovation, from triple-helix through learning regions to regional innovation systems. University-industry collaboration (UIC) is regarded as an important channel for the production and diffusion of knowledge from universities to firms, and most commonly takes place in close geographical proximity (Acs, Audretsch, & Feldman, 1994; Piergiovanni & Santarelli, 2001; Zucker, Darby, Furner, Liu, & Ma, 2007). The more advanced the research conducted at local universities, the greater the knowledge production which neighbouring firms can potentially benefit from. Accordingly, research and innovation policies have frequently aimed simultaneously to promote university research excellence and to stimulate UIC with a view to enhance the impact of universities on local firm-level innovativeness. A salient question in this regard is which factors influence firms' decisions to collaborate with universities or not, and how this decision is affected by characteristics of the regional university and of the firm itself.

While the decision to collaborate may be driven by the structure of universities, of the type of research being conducted there, as well as by the characteristics of the firms, most previous research has examined the impact of university or firm characteristics separately, with only a few exceptions (e.g. Garcia, Araujo, Mascarini, Gomes Santos, & Costa, 2015; Maietta, 2015). Hence, an integrated perspective on the drivers of university-industry collaboration is largely missing. In this paper, we focus in particular on the impact of two potentially important factors influencing firms' decisions to collaborate with universities: university research intensity and firm network scope. Furthermore, while geography has a strong influence on university-industry interaction (Fitjar & Gjelsvik, 2018; Laursen, Reichstein, & Salter, 2011), firms may also collaborate with universities at longer distances (Ponds, Van Oort, & Frenken, 2007). This decision can also be driven partly by local university characteristics, which increase or reduce the need to look beyond the region for suitable partners. Little previous research has examined how the underlying drivers may influence collaboration at various scales differently.

But how is university research output related to UIC? On the one hand, more cutting-edge research would lead to potentially more valuable the knowledge spillovers and, consequently, to greater potential advantages for collaborating firms. Firms will therefore be more willing to collaborate with universities with an advanced research output in fields that are relevant to them (D'Este & Iammarino, 2010; Johnston & Huggins, 2017; Laursen et al., 2011). Following this logic, policy-makers increasingly emphasize the need for research excellence as a means to promote innovation. Scarce public R&D resources are thus progressively channeled towards a smaller number of highly research-intensive 'world-class' institutions. However, the pursuit of research excellence by universities can also be detrimental to collaboration with firms (Maietta, Barra, & Zotti, 2017). Universities require their research to have scientific as well as societal impact. A dominant focus on frontier research may lead to a widening of the gap between the knowledge produced by universities and that which can be absorbed by firms in the local environment. Moreover, under conditions of mission overload (Jongbloed, Enders, & Salerno, 2008), research universities may focus more on their research mission to the detriment of interacting with local industry.

While this is an increasingly crucial topic with important implications for innovation policy, the number of studies that have sought to analyse whether the ever increasing pursuit of research excellence by universities is having an impact on university-industry collaboration is scarce (e.g. Minguillo & Thelwall, 2014). In parallel, few studies have looked at the impact of firm innovation strategies on their cooperation with universities at different scales. The move to open innovation implies an increase in the use of external partners in firm innovation processes more generally. This also influences the use of universities as collaboration partners. Besides the general level of external networking, innovation strategies also encompass the geographical scope of firm's innovation networks – be they mainly regional, national or international. However, previous research on university-industry collaboration has not considered how firm networking may have varying effects on collaboration with universities at different spatial scales.

This paper examines how firm and regional university characteristics collectively affect firms' propensity to collaborate with universities, within as well as beyond the region. The paper draws on a dataset compiled from several data sources. Using Norway as the empirical context, we gather information on firm characteristics from three waves of the Community Innovation Survey (CIS) for Norway, supplemented with Norwegian Linked Employer-Employee Data

(LEED). This yields a representative sample of over 18,000 firms. In addition, we collect data on the research output of Norwegian universities from the Scopus database.

The results of the analysis, generally, show that local universities' research output and quality relates negatively to the propensity of firms collaborating with universities. This indicates that research intensity or an excellence-oriented mission of universities may have less of an impact on the immediate transfer of knowledge to society than the emphasis of policies would suggest. Pursuing research excellence, rather than maximising the benefits for the local socio-economic systems in the short term, can come at the cost of university-industry collaboration. Conversely, firms' tendency to collaborate with other external partners, such as suppliers, customers, or consultants, is a major driver of UIC. Indeed, firms that collaborate broadly with external partners exhibit a high propensity also to cooperate with universities. Remarkably, this effect is limited mainly to collaborations at the same geographical scale. Finally, distance to the closest university has a curvilinear relationship with collaboration, suggesting that proximity to a university matters only up to a point, after which being more or less close to a university has little influence on the propensity to collaborate. The other firm side controls exhibit positive associations with collaboration across diverse spatial scales. This finding confirms the notion that firm attributes play a substantial role in determining collaboration decisions.

The remainder of the paper is organized as follows. The next section discusses the factors that determine collaboration between universities and firms. The third section describes the data, variables and methods employed in the analysis. The results of the analysis are presented in the penultimate section. The concluding section draws conclusions and highlights some policy implications.

2. Regional university characteristics and firm collaboration strategies as drivers of university-industry collaboration

Universities continue to attract attention in innovation and science policy research as sources of valuable knowledge for innovation in local firms (Bishop, D'Este, & Neely, 2011). As knowledge producers, universities generate new knowledge through research and impart existing and newly-generated knowledge to students. Firms benefit from this scientific knowledge when they hire graduates or engage the services of academic researchers (Leten, Landoni, & Van Looy, 2014). In addition, forging knowledge exchange linkages with a local

university is considered to improve creativity, problem solving, and R&D capabilities at the level of the firm (Perkmann et al., 2011). Furthermore, universities contribute to the regional knowledge pool by transmitting knowledge and attracting talent from their networks outside the region (Atta-Owusu, 2019; Bramwell & Wolfe, 2008). These and other roles universities perform make them potentially significant actors in regional innovation.

However, not all universities perform these functions equally. Universities are not homogenous entities but differ on various dimensions. Some may be prolific at producing and transferring cutting-edge scientific research, while others are more capable at educating qualified graduates for the job market (Kempton, 2019; Sanchez-Barrioluengo, 2014). Because of the advantages of geographical proximity, firms are more likely to collaborate with local universities. Hence, the different profiles of universities may have an important impact on both the performance of firms and on the local economy. Being close to a university that specialises in education will have a different impact on firm innovation and performance than being close to a top research university. Moreover, different universities adopt different *modus operandi* in terms of external engagement activities and, as a consequence, reward the outreach activities of their academics in different ways. While many consider only publication output when evaluating academics for recruitment or promotion, others also have requirements for societal impact or other incentives for such activities.

These contrasts between universities may shape the decisions of local firms to collaborate with the university, and – in case of a negative decision – of whether to look for other universities beyond the region or to drop UICs altogether. Local university characteristics matter for the extent to which firms cooperate with universities within as well as outside their region. The university-related factors examined in the literature include geographical proximity, strategic orientation, faculty size, and research quality or intensity, among others (e.g. D'Este & Perkmann, 2011; Perkmann et al., 2013).

There is some consensus in the literature that geographical proximity fosters interaction and knowledge exchange collaboration between firms and universities. Most research has underlined that knowledge spillovers remain geographically bounded (e.g. Moreno, Paci, & Usai, 2005; Rodríguez-Pose & Crescenzi, 2008; Sonn & Storper, 2008). As such, firms that locate near universities may find it easier to access (especially tacit) knowledge through frequent face-to-face interaction with university researchers and scientists (Adams, 2002; Audretsch & Feldman, 1996; De Fuentes & Dutrenit, 2016; Jaffe, 1989). Additionally, firms require a broader pool of universities from which to select potential partners for collaboration.

However, they are usually constrained by limited resources and information. Therefore, many firms restrain their search to proximate institutions, on which they are likely to have more information or existing relations. This allows firms to minimise transaction costs and risk of opportunistic behaviour from unknown universities (Fitjar & Gjelsvik, 2018). Such satisficing choices reduce the cost of accessing and absorbing knowledge, resulting in a predominance of local university-industry collaboration (Audretsch, Lehmann, & Warning, 2005).

Although regional universities remain the primary cooperation candidates, firms, nonetheless, can also – and frequently do – interact with other universities outside their region. Various reasons can account for this, but local university characteristics can serve as a potential "push" factor. Its research specialisation is one such factor. Relatedly, the lack of synergy between the knowledge needs of local industry and the research focus and expertise of a university can equally be a determining factor. Not all universities will have experts in the area in which a particular firm requires support or have sufficient competence. If the local university has little competence in disciplines relevant for the firm, it may look to universities outside the region for relevant expertise (Gunasekara, 2006). Equally, a university that focuses strongly on attaining and maintaining academic excellence but places weak emphasis on or avoids building linkages with industry may compel local firms to collaborate with more entrepreneurially orientated universities beyond their region (Gunasekara, 2006; Huggins & Johnston, 2009). Certain firms may also seek cutting-edge knowledge that is only being generated in a small number of universities and research centres.

2.1 Research intensity and university-industry collaboration

A university's research quality is widely considered to be a vital driver in university-industry partnerships (D'Este & Patel, 2007; Giunta, Pericoli, & Pierucci, 2016). Firms are attracted to leading research universities out of the conviction that they can harness their novel knowledge to improve internal innovativeness (Mansfield, 1995). Additionally, research-intensive universities often possess other resources, such as excellent facilities, equipment and extensive networks, making them attractive to industrial partners (Santoro & Chakrabarti, 2002). Firms may be more willing to overcome geographical distance to develop relationships with universities conducting cutting-edge research outside their region. Indeed, several studies empirically demonstrate that access to high-quality knowledge overrides proximity effects in firms' cooperation with universities (e.g. Laursen et al., 2011).

To be sure, research intensity can also cause rifts between firms and universities. Many contributions point to the inherent conflicts in university-industry collaborations, due to the different goals, incentives and time horizons of universities and firms (e.g. Bruneel, D'este, & Salter, 2010; Hewitt-Dundas, Gkypali, & Roper, 2019). While university researchers want to publish the results from collaborative projects, firms may want to keep them secret while preparing a patent. Furthermore, university researchers tend to aim for more breakthrough research, spending time to search for the perfect solution, while firms may be looking for something that is good enough and works here and now.

Nonetheless, many studies find evidence of a positive relationship between research excellence and industry support. For instance, building on US data, Mansfield and Lee (1996) find that universities with distinguished faculty attract higher funding from firms than universities with less accomplished academics. Hewitt-Dundas (2012) also finds that research-intensive universities tends to perform more knowledge transfer activities in the UK. Perkmann, King, and Pavelin (2011) show academic quality to be more related with industry engagement in the technology-oriented and basic sciences disciplines. And Bellucci and Pennacchio (2016) observe that academic research quality relates positively to knowledge interaction between universities and industries. Adopting a cross-border perspective, Suzuki (2017) shows that the research quality of partner universities contributed positively to firms realizing benefits from the joint research partnerships.

On the balance of evidence, this leads to the hypothesis that:

H_1. University research intensity is positively associated with firms' collaboration with universities.

2.2 The geography of firm collaboration networks and university collaboration

Innovation remains a dynamic process that entails exchange of diverse types of knowledge among various actors. Besides knowledge exchange with universities, firms can exchange knowledge with their users or customers, with other firms, such as suppliers, competitors or consultants, and with other types of organisations, including research institutes (von Hippel, 1988). Firms adopt different strategies for how they navigate this landscape, in terms of their use of internal or external knowledge sources, the types of external partners they connect with, and the geographical scope of their innovation networks (Drejer & Vinding, 2007; Fontana, Geuna, & Matt, 2006). These broader firm innovation strategies are bound also to affect how firms interact with universities. University-firm interaction is shaped both by the extent to

which the firm sources knowledge externally in general, and by the scale at which it develops its innovation networks (Bercovitz & Feldman, 2007; Drejer & Østergaard, 2017). In short, firms with extensive regional networks are more likely to also connect with universities in the region, while firms that maintain global innovation networks will, to a greater extent, also consider universities across the world as potential partners.

Not only that, the connectedness of firms to other partners is equally vital for university interactions (de Faria, Lima, & Santos, 2010). Collaborating with other partners that perform related research is considered to enhance the capacity of firms to absorb complex knowledge from universities (Agrawal, 2001). Firms that maintain R&D collaborations with suppliers or customers increase the chance of establishing new partnerships with other actors in the value chain (Belderbos, Gilsing, Lokshin, Carree, & Fernández Sastre, 2018). Firms that cooperate with external partners are also more likely to establish and reap benefits from research collaboration with universities (Dezi, Santoro, Monge, & Zhao, 2018; Segarra-Blasco & Arauzo-Carod, 2008). Hence, we expect a firm's embeddedness and interaction within external networks to influence its willingness and ability to collaborate with universities. Furthermore, this relationship is likely to be relatively specific to the geography of firms' innovation networks. Accordingly, we propose that:

H_2. Firms' cooperation with other partners is positively associated with university collaboration;

and

H_3. Firms' cooperation with other partners is positively associated with university collaboration at the same geographical scale.

3. Methodology

To explore the determinants of university-industry collaboration decisions, we use data from various sources. Firm characteristics are measured with data from the Norwegian CIS, supplemented with register data from Statistics Norway. Additionally, we utilize information from Scopus to measure the characteristics and, especially, the research intensity of Norwegian universities.

The CIS is the main data source employed in the analysis. This survey monitors innovation investments, processes and outputs of Norwegian businesses. It was first conducted in 1992 and has since been carried out biennially. The population of interest represents firms operating in manufacturing or service industries, as well as petroleum and aquaculture. The sampling is conducted on a tiered basis, such that the survey is a census for all businesses with 50 or more employees. For all firms with less than 50 employees, a random sample, stratified by industry and size class, is implemented. Two characteristics specific to the Norwegian CIS are worth stressing. First, participation is mandatory for sampled firms, with fines for non-respondents. This almost rules out non-response bias. Second, the routing structure ensures all firms report collaboration activities, even those with no innovation output. The total sample for each wave ranges between 6000 and 6500 with a response rate of over 95 percent. In this study, we rely on data from three waves of the survey: 2006, 2008, and 2010. This yields a combined sample of over 18,000 firms.

Scopus is an abstract and indexing database developed by Elsevier in 2004. It contains 75 million documents sourced from over 24,000 active titles and 5,000 publishers. The database covers contents from journals, conference proceedings, book series and trade publications in all scientific fields. Additionally, it offers enhanced sorting and searching features enabling researchers to access over one billion citations going back to 1970s. Perhaps the key strength of Scopus is the system of unique identifiers (profiles) that assist users to track research outputs of individual authors and organizations. Using the profiles of authors or institutions, one can compute the number of publications and citations for all subject areas within a particular period (Aldieri, Kotsemir, & Vinci, 2018).

3.1 Data and Variables

Dependent Variable

The dependent variable is created from questions in the CIS on the R&D collaboration activities of firms. In the survey, firms are asked whether they cooperated for R&D or innovation with various types of partners in the last three years. We focus on collaboration with universities (*All collaboration*). Firms that collaborate are asked to indicate if these were within the region (*Local university collaboration*); elsewhere in Norway (*National university collaboration*); or abroad (*International university collaboration*). Collaboration is a binary variable that assumes the value of one if a firm collaborated with a university, and zero otherwise.

Explanatory variables

Number of publications and *non-university collaboration* are the primary explanatory variables included in the analysis. The number of publications is an indicator representing the research output of regional universities in academic fields relevant for a particular firm. We develop this measure through the following steps: We first extract the scientific publications of Norwegian universities from the Scopus database for the period between 2006 and 2010. Given the heterogeneity of university research across disciplines, we group publications under one major subject area following the Scopus All Science Journal Classification (ASJC) system.[1] Next, we assign universities to labour market regions (NUTS 4) based on their address. We merge labour market regions without any universities with the closest region that has a university. This results in a total of 21 regions in the final classification, all having one or more universities. The idea is to match each firm to the university closest to it. We then sum up the publications in each discipline of all universities in a region. That is, we aggregate the data at the level of the region, not university. This creates a measure of the university research capacity available in the firm's own region within disciplines which are relevant to the local industry. Most regions have one main university, although Oslo and Hordaland host three or more universities.

In order to identify which disciplines are most relevant for each firm, we applied the science fields and economic sectors matrix developed by Schartinger, Rammer, Fischer, and Fröhlich (2002) to link scientific disciplines to specific economic sectors which use their knowledge output. We produced this by matching the regional aggregated data by discipline with the industrial sectors in that region at the NACE two-digit level. Applying this framework allows us to identify the number of publications (and citations) in disciplines considered relevant for a particular sector. Three different measures were applied. We first focus on the number of publications in the single most relevant discipline for each industry. As a robustness check, we extend the measure to include the sum of publications in all disciplines which have some relevance.

Finally, we additionally included the total number of citations to the research published between 2006 and 2010. This allows us to go beyond the purely quantitative measure of the number of publications in a particular discipline to also include a proxy for the quality of the research being conducted in the local university and its impact in the scientific community.

[1] Three subject areas (nursing, health professions, and multidisciplinary) were left out because they could not be matched to any industrial sectors included in the CIS.

Non-university collaboration measures the collaboration of firms with partners other than universities. Just like the dependent variable, it measures whether firms collaborated with other partners (sister companies, suppliers, customers, competitors, consultants, commercial laboratories, and research institutes) within their region, elsewhere in the country, or abroad. In the survey, firms are asked to indicate their responses for these other partners. We constructed an additive index for this variable. We produced this by, first, coding each collaboration as a binary variable. We assign a value of one if a firm collaborated with any of the seven partners and zero otherwise. We then sum up these collaborations such that a firm obtains zero if it had no collaboration with any type of partners, and seven if it collaborated with all types of partners. We build this measure separately for local, national, and international collaboration with non-university partners.

Control variables

Several control variables that have been shown to influence university-industry interactions are additionally included. Distance to university is a variable that measures a firm's proximity to the nearest university. We identify a firm's location based on the municipality where the majority of its employees works, and calculate the road distance from the City Hall (*rådhus*) to the nearest university. Driving distances range between 1 and 347 minutes, with an average and median driving time of 78 and 59 minutes, respectively. Twenty-six percent of firms in the dataset are located within 30 minutes' drive from the closest university. Fifty percent are located within a 60 minutes' drive. Finally, almost 19 percent of Norwegian firms included in the sample are farther away than 120 minutes from a university. This variable is skewed, therefore, we log transform it.

Other variables that capture firm characteristics include Research and Development (R&D) intensity, which is measured by the R&D expenditure of firms. Given its skewness, the variable is log transformed. We also control for firm size, in terms of log total number of employees, and human capital, using the log percentage share of employees with tertiary education. Finally, we include 62 dummies based on the NACE two-digit classifications to control for industry. Because disciplines are matched to industries, these industry fixed effects also account for differences across disciplines in industry interaction. In effect, we are comparing firms within the same industry located in regions with more or less research output in disciplines relevant for this industry. Year dummies were also added to account for variations in firms' collaboration activities in the different survey periods.

3.2 Estimation and model specification

We run logistic regression analyses separately for firms' collaboration with universities in general and their collaboration with universities at the local, national and international levels. The econometric model takes the following form:

$$Logit[Pr(Collaboration_{isrt})=1] = \alpha + \beta_1 \, Number\ of\ Publications_{sr} + \beta_2 \, Non\text{-}university\ Collaboration_{isrt} + \beta_3 \, Controls_{isrt} + \delta_s + \tau_t + \varepsilon_{isrt} \quad (1)$$

with *i*, *s*, *r*, *t*, denoting firm, sector, region and time, respectively. Collaboration represents the dependent variables measuring firms' cooperation with universities. Four models were estimated, one for each of the measures defined above (All collaboration, Local university collaboration, National university collaboration, and International university collaboration). The explanatory variables are the university and firm characteristics outlined above. Lastly, δ and τ denote the industry and time fixed effects respectively while ε is the error term.

4. Results

Table 1 and Table 2 present the descriptive statistics and the correlation matrix respectively for all variables employed in the analyses. Table 3 reports the results of the logistic regression analyses of firms' collaboration, using the number of publications in academic fields deemed relevant to local firms as the main explanatory variable. In Table 4, the number of publications is substituted by the number of citations to those publications as an indicator of the quality of the research being carried out in the region. An examination of all models shows the results are consistent in terms of the size and direction of the coefficients of the predictor variables.[2]

[2] As a robustness check, we substituted the variable "Number of publications in most relevant discipline" with a variable measuring the number of publications in all relevant disciplines. Overall, the results obtained – presented in Table A1 in the appendix – were not qualitatively different from the main analyses.

Table 1. Descriptive statistics

Variables	Obs.	Mean	S.D.	Min	Max
All collaboration	18,235	.070	.256	0	1
Local univ. collaboration	18,235	.035	.185	0	1
National univ. collaboration	18,235	.035	.184	0	1
International univ. collaboration	18,235	.020	.139	0	1
Number of publications (log)	18,235	4.107	2.733	0	8.544
Local non-univ. collaboration	18,235	.221	.788	0	7
National non-univ. collaboration	18,235	.215	.823	0	7
International non-univ. collaboration	18,235	.194	.778	0	7
Distance to university (log)	18,235	2.894	1.164	0	5.849
R&D intensity (log)	18,231	1.892	3.456	0	13.557
Firm size (log)	18,235	3.386	1.275	1.609	9.842
Human capital (log)	18,235	.212	.196	0	.693

Table 2. Correlation matrix of variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1.All collaboration	1.00											
2.Local univ. collaboration	0.70*	1.00										
3.National univ. collaboration	0.69*	0.22*	1.00									
4.International univ. collaboration	0.51*	0.22*	0.30*	1.00								
5.Number of publications (log)	0.05*	0.06*	0.02*	0.04*	1.00							
6.Distance to university (log)	-0.04*	-0.05*	-0.01	-0.03*	-0.34*	1.00						
7. Local non-univ. collaboration	0.52*	0.57*	0.27*	0.22*	0.05*	-0.03*	1.00					
8. National non-univ. collaboration	0.57*	0.29*	0.63*	0.32*	0.02*	-0.00	0.41*	1.00				
9. International non-univ. collaboration	0.53*	0.30*	0.37*	0.58*	0.06*	-0.02*	0.36*	0.46*	1.00			
10.R&D intensity (log)	0.43*	0.30*	0.32*	0.26*	0.15*	-0.08*	0.34*	0.38*	0.41*	1.00		
11. Firm size (log)	0.17*	0.10*	0.16*	0.11*	-0.00	-0.11*	0.12*	0.17*	0.19*	0.24*	1.00	
12. Human capital (log)	0.17*	0.14*	0.11*	0.12*	0.45*	-0.31*	0.12*	0.11*	0.14*	0.33*	0.00	1.00

Note: *p<0.05

Table 3: Logistic regression analyses of collaboration, using the number of publications as the main explanatory variable

Model	**(1)** All Collaboration	**(2)** Local univ. collaboration	**(3)** National univ. collaboration	**(4)** International univ. collaboration
Independent variables				
Number of publications (log)	-0.058**	-0.067**	-0.090***	-0.039
	(0.024)	(0.030)	(0.031)	(0.041)
Local non-univ. collaboration	0.776***	1.111***	-0.014	0.061
	(0.035)	(0.037)	(0.053)	(0.062)
National non-univ. collaboration	0.727***	0.015	1.067***	0.224***
	(0.037)	(0.045)	(0.042)	(0.052)
International non-univ. collaboration	0.588***	0.119***	0.161***	1.020***
	(0.040)	(0.043)	(0.042)	(0.049)
Control variables				
Distance to university (log)	-0.657***	-0.893***	-0.135	-0.051
	(0.136)	(0.164)	(0.175)	(0.250)
Distance to university (log)^2	0.106***	0.144***	0.025	-0.015
	(0.024)	(0.030)	(0.032)	(0.045)
R&D intensity (log)	0.182***	0.175***	0.210***	0.159***
	(0.015)	(0.018)	(0.021)	(0.029)
Firm size (log)	0.169***	0.107**	0.202***	-0.102
	(0.041)	(0.048)	(0.052)	(0.072)
Human capital (log)	2.715***	2.968***	2.704***	2.471***
	(0.394)	(0.472)	(0.482)	(0.655)
Survey year 2008	-0.296***	-0.229*	-0.112	-0.222
	(0.110)	(0.134)	(0.139)	(0.185)
Survey year 2010	-0.403***	-0.257**	-0.308**	-0.266
	(0.108)	(0.131)	(0.146)	(0.180)
Industry fixed effects	Included	Included	Included	Included
Constant	-3.847***	-3.901***	-5.851***	-4.727***
	(0.457)	(0.539)	(0.552)	(0.622)
N	18,178	18,178	17,561	17,232
Pseudo R^2	0.576	0.509	0.553	0.549

Note: Robust standard errors clustered over firms in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

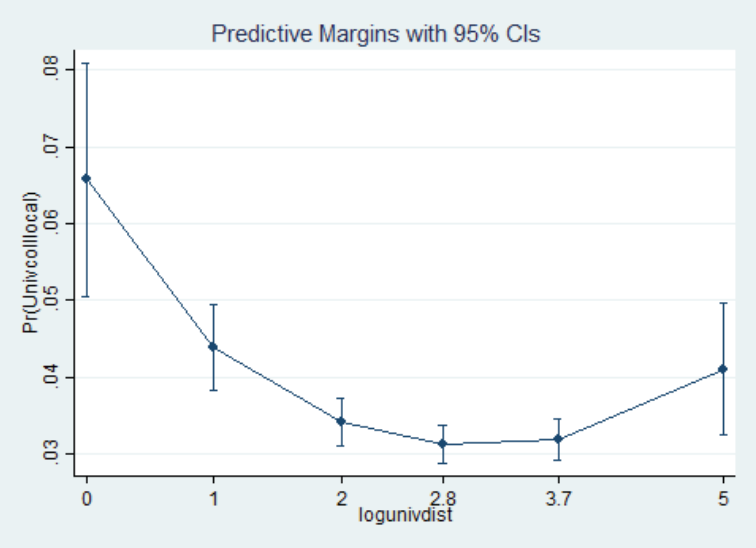
Contrary to expectations, firms located in regions with universities that have a high research output in related disciplines are less likely to collaborate with universities. Firms in these regions are less likely to collaborate with universities in general. They are also less likely to collaborate with these regional universities in particular. On top of that, they are also less likely to collaborate with universities in other regions of Norway, perhaps in part due to the inability of local universities to serve as a bridge into networks with universities in other regions. However, they are no less likely to collaborate with foreign universities. Overall, local universities' focus on the research excellence mission – proxied by their research intensity – is

associated with a decrease in local and national collaboration. Therefore, H_1 is not supported. This may be because pursuing international research excellence, as many universities in Norway and elsewhere in the world now prioritise, creates a gulf between the type of research being produced by universities and the needs of local firms.

Rather than university research intensity, the overall propensity of the firm to collaborate with external partners for innovation emerges as a much more important driver of university-industry collaboration, supporting H_2. Firms that collaborate with suppliers, customers, competitors and other types of partners are far more likely also to collaborate with universities. Furthermore, this effect is remarkably specific to collaboration with partners at the same geographical scale, providing support also for H_3. Specifically, collaboration of firms with other partners within the region is positively associated with local university collaboration. Collaboration of firms with national partners is strongly associated with collaboration with national universities, and collaboration with foreign partners is strongly associated with collaboration with foreign universities. The associations between collaborations at different scales are, conversely, either much weaker or not significant. There is no relationship between collaboration with other partners locally and collaboration with universities at the national and international scales. Moreover, there is no association between collaboration with other partners at the national level and local university collaboration. In contrast, positive associations emerge between both types of non-local collaboration. Finally, the relationship between firms' international collaboration with other partners and university collaboration is positive and significant across all the geographic scales.

The distance of firms to the local university also influences collaboration at the local level. As expected, distance to the local university has a significant and negative association with local collaboration, whereas the effects are insignificant for national and international collaborations. We introduced a quadratic term to establish whether this relationship is non-linear. The coefficient for squared distance is positive and significant, indicating a curvilinear relationship. This implies that distance to the university decreases collaboration up to a point, after which it no longer matters. Figure 1 plots this relationship. The predicted likelihood of collaboration falls rapidly from around 6.5 percent for an average firm that is co-located with the university to around 3.5 percent for firms located more than 7 minutes (e^2=7.3) drive away from the university. Beyond this distance, there is no significant difference in the predicted likelihood of collaboration between firms located closer or farther away from the university.

Figure 1. The relationship between collaboration and distance to university



The firm-level control variables (R&D intensity, firm size and human capital) also have the expected impact on university collaboration. Firm R&D intensity has a positive and significant effect on university collaboration in all the models. In other words, firms that allocate a high share of their budget to R&D activities are more likely to cooperate with universities, other things being equal. Consistent with the findings of prior studies, the size of a firm is positively related to university collaboration in all the models except model 4 (e.g. Fontana et al., 2006; Levy, Roux, & Wolff, 2009). This means larger firms are more likely to collaborate with universities within their localities and with other national universities. Surprisingly, firm size appears not to matter when it comes to collaboration with universities abroad. Lastly, firms' human capital influences collaboration with universities. The coefficients are positive and significant across all the models, in line with results from other studies (Laursen & Salter, 2004; Muscio, 2007; Tartari & Breschi, 2012).

What about if the collaboration between local universities and firms is not driven by the intensity of this research but, as indicated among others by D'Este and Patel (2007) and Giunta et al. (2016), by the quality of the research? In order to check whether this is the case, we substitute (in Table 4) the number of publications by the overall number of citations to research published by local universities during the period of analysis. This serves as a proxy of the

quality and impact of local university research. The results highlight that the university's excellence in research is no different from its research intensity for the development of UIC. When universities actively pursue research intensity and achieve success in terms of quality – proxied by the number of citations to the papers produced by researchers at the university – the links with local and national firms are weakened (Table 4). Focusing on excellence in research seems to drive universities apart from the problems of local firms, rendering them less valuable partners for firms.

Table 4. Logistic regression analysis of collaboration, using the number of citations as the main explanatory variable

Model	**(1)** All collaboration	**(2)** Local univ. collaboration	**(3)** National univ. collaboration	**(4)** International univ. collaboration
Independent variables				
Number of citations (log)	-0.047**	-0.051**	-0.074***	-0.025
	(0.019)	(0.024)	(0.024)	(0.032)
Local non-univ. collaboration	0.777***	1.111***	-0.013	0.061
	(0.035)	(0.037)	(0.053)	(0.062)
National non-univ. collaboration	0.727***	0.017	1.068***	0.224***
	(0.037)	(0.045)	(0.042)	(0.052)
International non-univ. collaboration	0.587***	0.118***	0.160***	1.019***
	(0.040)	(0.043)	(0.042)	(0.049)
Control variables				
Distance to university (log)	-0.653***	-0.886***	-0.129	-0.045
	(0.136)	(0.164)	(0.175)	(0.250)
Distance to university $(\log)^2$	0.105***	0.143***	0.024	-0.015
	(0.024)	(0.030)	(0.032)	(0.045)
R&D intensity (log)	0.182***	0.175***	0.210***	0.159***
	(0.015)	(0.018)	(0.021)	(0.029)
Firm size (log)	0.169***	0.106**	0.202***	-0.102
	(0.041)	(0.048)	(0.052)	(0.072)
Human capital (log)	2.713***	2.958***	2.713***	2.454***
	(0.393)	(0.471)	(0.480)	(0.656)
Survey year 2008	-0.296***	-0.230*	-0.112	-0.222
	(0.110)	(0.134)	(0.139)	(0.185)
Survey year 2010	-0.403***	-0.258**	-0.308**	-0.267
	(0.108)	(0.131)	(0.146)	(0.180)
Industry fixed effects	Included	Included	Included	Included
Constant	-3.860***	-3.933***	-5.861***	-4.766***
	(0.455)	(0.535)	(0.550)	(0.621)
N	18,178	18,178	17,561	17,232
Pseudo R^2	0.576	0.509	0.553	0.549

Note: Robust standard errors clustered over firms in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

5. Conclusions

Universities are often regarded – especially in many regional innovation and development strategies – as a beacon for innovation at firm level. University-industry partnerships are being recommended as a way to improve the innovation capacity, productivity and competitiveness of firms. Hence, local firms and universities are regularly urged to engage in collaboration. Yet, this collaboration is often proving elusive. One reason for this may be that, although the pursuit of excellence in research is desirable for society as a whole, it may widen the gap between the production of knowledge and the needs of local firms. This is corroborated by our research, which finds that increasing the intensity and quality of the research of universities is not conducive to greater collaboration with local firms. When analyzed at the firm level, university-industry collaboration appears to be fundamentally driven by the characteristics of the firm rather than by the intensity and quality of the research conducted at the university. All firm-related factors are much stronger predictors of collaboration with universities across all scales than the type, intensity and quality of the research being conducted at the university. Notably, firms collaborate with universities when they already engage with other partners. The decision of Norwegian firms to collaborate with the local university appears to be driven more by the strategic decision of the firm to develop its innovation process in localized networks than by what the local university itself has to offer. Similarly, firms that collaborate with national or international universities often do so as part of broader approaches involving various other types of national or international partners.

At the university side, its research intensity in disciplines relevant for the firm and the quality of this research appear not to be major drivers of collaboration. On the contrary, the analysis shows that the research intensity of local universities has an adverse impact on local firms' participation in university collaboration. Firms located in regions with research-intensive and high-quality universities are less likely to collaborate with these local universities. Because university-industry collaboration is often local, this implies that they also tend to collaborate less with universities in general. In addition, because local universities may help firms enter networks involving other national universities, these firms also tend to collaborate less with other Norwegian universities outside their region.

What are the implications of all this? For higher education policy, it is important to realize that university-industry collaboration may be more about the strategies and characteristics of firms than those of universities. Hence, measuring universities' performance on their ability to collaborate with local firms runs the risk of placing the credit for collaboration (or the blame

for lack of collaboration) on the wrong end of the partnership. Beyond stimulating universities to interact with firms, policy-makers who want to foster university-industry collaboration need to think about how firms' strategies and networks can be geared in the direction of promoting greater collaboration with universities as well.

For universities, the lesson is that research quality or intensity may contribute to pulling the university closer to the research frontier and farther up the rankings, but may do little to make it an attractive partner for local firms. Additional actions are needed to bridge the gap between the worlds of academia and industry. Indeed, universities that focus exclusively on their research mission may experience a reduction in firm collaboration. In order to ensure that firms have access to high-quality research, it is important that leading research universities in particular manage to reach out to firms. Finally, for firms seeking to enter into collaborations with universities, existing networks with other firms often serve as bridges to the university. Building on their local, national or international networks can help to identify suitable university partners with whom to connect.

The findings also come with limitations that must be acknowledged. First of all, we do not know with which specific university the firms collaborate, only at which scale university collaboration occurs. Hence, we cannot use specific details on the university's characteristics in the model, but rely on the characteristics of the local universities (or the sum over all local universities in regions with more than one). Second, we do not know the outcome of collaboration and hence do not know which types of collaborations with which universities are more or less successful. Finally, the study is limited to R&D collaboration and is not able to identify other ways in which firms interact with universities.

The limitations notwithstanding, this research raises a word of caution about the role of universities for creating partnerships within the local environment and, therefore, for innovation activity and growth. Increasingly, universities in Norway and around the world are racing to produce more and better research. This competition is in itself good, as it can result in more knowledge generation. However, not all universities can be at the research frontier in all fields. Pursuing research intensity and quality may, as we have seen, come at the price of limiting the capacity of universities and firms to build bridges. This in turn has implications for the innovativeness of local firms and the economic development potential of the regions hosting universities. Hence, universities have to strike a difficult balance about what their mission in society is, as any decision regarding the balance between the functions of teaching, research and outreach to society will have significant implications. This requires universities to think

hard about how, through the mix of activities they do, they can maximise their benefits to society. Different universities would need to pursue different mixes of objectives in order to achieve this goal. What is becoming increasingly clear is that pursuing the same objective of prioritising research intensity and excellence above all other functions and purposes across the board has consequences that have deep impacts on the local environment and on society as a whole.

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Appendix A

Table A1: Logistic regression analysis of collaboration, using the number of publications in all relevant disciplines as the main explanatory variable

Model	**(1)** All collaboration	**(2)** Local univ. collaboration	**(3)** National univ. collaboration	**(4)** International univ. collaboration
Independent variables				
Number of publications (log)	-0.062***	-0.066**	-0.085***	-0.045
	(0.024)	(0.030)	(0.031)	(0.041)
Local non-univ. collaboration	0.770***	1.101***	-0.009	0.054
	(0.035)	(0.038)	(0.053)	(0.062)
National non-univ. Collaboration	0.726***	0.019	1.073***	0.220***
	(0.037)	(0.045)	(0.042)	(0.052)
International non-univ. collaboration	0.595***	0.128***	0.156***	1.023***
	(0.040)	(0.044)	(0.042)	(0.049)
Control variables				
Distance to university (log)	-0.648***	-0.877***	-0.134	-0.052
	(0.136)	(0.164)	(0.175)	(0.252)
Distance to university $(log)^2$	0.104***	0.143***	0.024	-0.017
	(0.024)	(0.030)	(0.032)	(0.045)
R&D intensity (log)	0.182***	0.175***	0.210***	0.159***
	(0.015)	(0.018)	(0.021)	(0.029)
Firm size (log)	0.168***	0.102**	0.208***	-0.098
	(0.041)	(0.048)	(0.052)	(0.072)
Human capital (log)	2.598***	2.737***	2.764***	2.551***
	(0.410)	(0.514)	(0.483)	(0.658)
Survey year 2008	-0.275**	-0.197	-0.108	-0.227
	(0.112)	(0.137)	(0.139)	(0.185)
Survey year 2010	-0.409***	-0.262**	-0.302**	-0.286
	(0.108)	(0.131)	(0.146)	(0.181)
Industry fixed effects	Included	Included	Included	Included
Constant	-3.788***	-3.857***	-5.847***	-4.648***
	(0.458)	(0.544)	(0.556)	(0.629)
N	18,278	18,278	17,654	17,317
Pseudo R2	0.576	0.507	0.556	0.551

Note: Robust standard errors clustered over firms in parentheses. *** p<0.01, ** p<0.05, * p<0.1.