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Why do firms collaborate with local universities?

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Abstract

This paper examines why firms sometimes collaborate locally rather than with higher-quality universities at a distance. Existing research has mostly relied on the localised knowledge spillover, or LKS, model to explain this. This model holds that knowledge transfer across distance is costly, and collaborating locally reduces the risk of information loss when the knowledge is transferred. However, there are various other reasons that could also explain the pattern. If the local university can make a useful contribution, firms might choose to look no further. Firms may also see collaboration as a long-term investment, helping to build up research quality at the local university with the hope of benefiting in the future. Finally, firms may want to contribute to the local community. We extend the LKS model with these additional motivations and explore their validity using data from 23 semi-structured interviews of firms that collaborate intensively with lower-tier local universities.

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Keywords

University-industry linkages, Knowledge spillovers, Geographical proximity, Collaboration

Introduction

University-industry collaboration is often local (Mansfield and Lee 1996; D'Este and Iammarino 2010). Previous research has been interested in the collaboration patterns of firms located away from high-quality universities in response to this: Do they still collaborate locally, or do they prefer more distant collaboration with higher-quality universities? (Laursen et al. 2011). This research has especially focused on firms' willingness to accept geographical distance in return for access to higher-quality research (D'Este et al. 2013; Muscio 2013). However, if there is an inverse relationship between university quality and geographical distance in university-industry collaboration (Garcia et al. 2015), this implies the existence not just of long-distance collaboration with high-quality universities, but also of local collaboration with lower-quality universities. The latter choice is less well understood, as little research has specifically explored why firms collaborate with lower-quality local institutions. This paper presents such an analysis.

The choice to collaborate with a lower-quality local partner over a higher-quality distant partner is typically explained with reference to localised knowledge spillovers (LKS). Knowledge transfer from universities to firms is costly, and the costs rise with geographical distance. Collaboration in geographical proximity can benefit from frequent face-to-face contact that is helpful in transferring tacit knowledge. Thus, university quality must be weighed against the decreasing utility of distant knowledge.

However, there may be other explanations for local collaboration in such settings. This paper extends the LKS model in three directions. First, we consider the role of localised

partner choice: Firms do not necessarily seek to maximise knowledge spillovers, but want to satisfy their requirements for external knowledge. Thus, they search for partners until they find a suitable candidate. If the partner is good enough, they need not look any further. These searches often start locally. Second, we consider more long-term orientation in a dynamic knowledge spillovers model, recognising that knowledge does not flow exclusively from universities to firms, but also the other way. By collaborating with local universities, the firm may help build up regional research capacity from which it can benefit in the future. Finally, we consider that the motivation to access new knowledge may be bundled with broader considerations, such as the desire to contribute to the community, in a local communitarian model.

The paper builds on two data sources: First, we briefly report survey data on firm collaboration with local and distant universities to explore the prevalence and characteristics of firms engaged in such collaboration. Second, as our main data source, we specifically examine firms' motivations for collaborating with lower-ranked local universities, using qualitative interview data. We examine firms which are located in the proximity of lower-ranked universities and which actively collaborate with them. The survey data is drawn from Norway and the qualitative interviews from four Norwegian regions with lower-ranked universities or polytechnics. Norwegian firms tend to collaborate mainly with local universities. The survey shows that 21.6 percent of firms collaborate with universities in total, and 16.1 percent with local universities. Even outside the four largest city regions where the main research universities are located, 72 percent of firms that collaborate with universities do so locally. In most cases, these universities are not world-leading in the areas of knowledge that local firms wish to access. Why do firms nonetheless go for local collaboration?

The interviews indicate that while the LKS model plays a part in the decision of many firms to collaborate locally, it is not a sufficient explanation. The three extensions are all reflected: Firms often start partner searches locally and follow satisficing principles, rather than trying to maximize knowledge spillovers (localised partner search model). Some take a more long-term perspective and want to contribute to building a good research group locally, which may become useful in the future (dynamic knowledge spillovers model). Finally, collaboration with the university is not always instrumental even in the long-term, but driven by a desire to contribute to the local community (local communitarian model).

The geography of firm-university interaction

Universities produce codified knowledge (e.g. papers and patents) that in theory could be transferred more or less costlessly across a distance. However, they also produce a great deal of tacit knowledge, which requires physical proximity for successful knowledge transfer (Audretsch et al. 2005). Access to tacit knowledge is arguably more important for firms than knowledge available to everybody. Furthermore, even codified knowledge may not be easily accessible. Understanding scientific knowledge and putting it into practical use often requires a fundamental understanding of the underlying research. Access to the researchers who produced the work can be helpful in this regard. Consequently, even firms in industries which draw predominantly on codified knowledge tend to locate close to universities. Asheim et al. (2007) note that firms with analytical knowledge bases cluster around major universities to get personal access to leading researchers.

This co-location is conducive to local collaboration. Mansfield and Lee (1996) find that 55-63 percent of research funding by US firms goes to universities within 100 miles of the firm, with even stronger distance effects for funding to lower-quality universities. Similarly, half of university-industry collaborations in Brazil occur within a distance of 82.4 km (Garcia et al. 2015), while the median distance between firm and university partners in the UK is 148 km (D'Este and Iammarino 2010). D'Este et al. (2013) find a strong and significant effect of geographical proximity on the likelihood of university-industry collaboration in the UK. Arundel and Geuna (2004) find that firms tend to rate proximate sources as more important when sourcing from research than from industrial sources, while Fitjar and Rodríguez-Pose (2013) find higher shares of local collaboration with universities and research institutes than with industrial partners.

For firms benefiting from knowledge spillovers from universities, the optimal location would be close to a high-quality university, allowing it to access cutting-edge research while also benefiting from local proximity to ease knowledge transfer. Indeed, firms tend to cluster in the proximity of excellent universities, in particular in sectors where this is important (Audretsch et al. 2005; Woodward et al. 2006; Abramovsky and Simpson 2011). This does not drive all firms to the same location, as university research output and firm knowledge demands are heterogeneous in terms of academic fields. Universities may also adjust to local industry's demands by specializing in relevant areas, generating world-class knowledge in these particular fields. As universities and firms in a region co-evolve, the match between university research output and firm knowledge demands may improve. Finally, firms demand knowledge that is economically useful, meaning that quality in this context does not necessarily equate to

scientific excellence, but depends on its value to the recipient. A lower-ranked university excelling in the application of knowledge may produce knowledge of higher quality to the firm than a higher-ranked university whose scientific output is more difficult to apply. The collaboration objectives will also vary, and different universities may be superior depending on whether the purpose is e.g. R&D collaboration, problem solving or consultancy (Rossi et al. 2015).

For many firms, there is nonetheless a trade-off between geographical proximity and the research quality that can be accessed. After all, proximity to universities must be weighed against other factors in firm's location decision, such as costs and proximity to customers, suppliers or labour pools. Consequently, not all firms will be located close to the leading centres of expertise in their fields.

The localised knowledge spillovers model

Laursen et al. (2011) highlight the trade-offs that firms make between geographical proximity and university quality in these contexts. Building on data from the UK, they find that being located close to a lower-tier university reduces the propensity of firms to collaborate locally and increases the probability of collaborating with universities outside the region. Other studies have measured geographical distance within existing collaboration projects or examined the impact of distance on the likelihood of forming new linkages. Most find that the higher the university's quality, the more firms are willing to accept geographical distance (e.g. D'Este and Iammarino 2010; D'Este et al. 2013; Muscio 2013; Garcia et al. 2015; Johnston and Huggins 2017). Conversely, firms are less willing to accept geographical distance when collaborating with lower-tier

universities and will mainly do this locally. This implies that firms weigh the quality of knowledge production against the costs of transferring knowledge across geographical distance. We refer to this as the localised knowledge spillovers (LKS) model.

While this model is not normally presented in formal terms, some notation is helpful in expressing it precisely. Assume firm n decides to collaborate with a university to gain access to new knowledge¹. It can choose between J universities as its partner, with each potential partner providing a certain utility. The utility derived from collaborating with university j is thus U_{nj} , $j = 1, \dots, J$. The choices are mutually exclusive: for a defined instance of selection, the firm can only choose one university². It cannot observe the utility directly as the project outcome is unknown in advance and will maximize its expected utility $E(U_{ni})$.³ The firm will choose university i iff

$$E(U_{ni}) > E(U_{nj}) \quad \forall j \neq i \tag{1}$$

The utility of collaborating with i can be expressed as follows: Let K be a measure of the relevant knowledge⁴ possessed by i which is potentially attainable by the firm, and D be a measure of the cost of transferring this knowledge across a distance. D will depend on the type of knowledge (e.g. how codifiable it is), and on the geographical distance to the university. X is a vector of other factors affecting the expected utility of collaboration.

The impact of each factor may vary across firms depending on e.g. absorptive capacity.

The expected utility of collaboration then becomes:

$$E(U_{ni}) = f_n(K_i, D_i, X_i) \tag{2}$$

The LKS model represents the state of the art on this topic, and most studies cited above implicitly or explicitly build on this framework. Mansfield and Lee (1996) present a formal model with a similar right-hand side, although with a linear rather than a discrete-choice outcome. Several other papers estimate empirical models in which collaboration is a function of quality and distance (e.g. D'Este and Iammarino 2010; Laursen et al. 2011; D'Este et al. 2013; Garcia et al. 2015). However, the model is potentially not sufficient to explain why firms collaborate with lower-ranked local universities. We therefore extend the model in three alternative ways.

Localised partner search

First, we consider that firms may have limited search scope, either because this is optimal when search is costly, or because they are satisficing rather than maximising utility. Firms often have more information about research activities at the local university and will not have time to scan all possible research groups for potentially superior partners. Considering the potential utility of all possible universities requires information, which is costly to collect. These costs increase rapidly when firms do not make these choices at the level of universities, but at the level of departments, research groups or even individual academics. Indeed, various studies have found that individual characteristics are more important than university characteristics in determining university-industry collaboration (D'Este and Patel 2007). The search scope may also be limited to partners considered trustworthy, constraining connections to unknown universities and driving local collaboration through existing social ties or generalised social capital in the community.

Acting on available information, firms will collaborate with the local university – or other universities known from educational background, prior experience or existing networks (Thune 2007; Johnston and Huggins 2016) – if the knowledge inputs it expects to obtain from this university meet their needs. In particular, smaller and less R&D intensive firms may have fewer resources to look beyond the locality. Firms' knowledge demands can be relatively modest and oriented towards immediate problems, meaning that a higher-quality partner would at best offer a very small utility gain, while increasing the search costs and risks. Under such conditions, it can be an optimum choice to collaborate with a local university. Firms will try to access other universities only if required inputs are not available from the local university or other well-known universities. We extend the LKS model to reflect that only some universities may be considered as partners, labelling this the localised partner search model.

In the localised partner search model, firms do not choose among all possible universities. They consider only universities from a more limited subset $J^* \subseteq J$ of known and trusted universities, which are also willing to collaborate with them. This subset makes up the firm's consideration set (Carson and Louviere 2014), which is partly endogenously determined⁵. The probability π of considering university i is a function of geographical distance to this partner, as well as its stock of relevant knowledge and other characteristics, such that if J^* denotes the subset of universities considered by the firm,

$$\pi(i \in J^*) = f_n(K_i, D_i, X_i) \quad \forall J^* \subseteq J \quad (3)$$

Geographical distance affects the probability that i will be part of the firm's consideration set, and expected utility is maximised over this subset of universities. In the most restrictive formulation, the firm's consideration set may contain only one university ($J^*=i$), with other universities considered if the expected utility of collaborating with i does not exceed a minimum level of utility. This model relaxes the assumption of utility maximisation, assuming simply that firms are utility satisficing⁶. In the least restrictive version, the minimum utility required can be 0, such that any positive expected utility from collaborating with i will lead n to select i and stop the search process. The firm will then collaborate with i iff $E(U_{ni}) > 0$ and will not investigate potential utility of any other potential partner j . Only if $E(U_{ni}) \leq 0$ does the firm extend its consideration set J^* to pick another university for which U_{nj} can be estimated. The consideration sets are then formed in a sequential process where potential candidates are considered until a partner that satisfies n 's utility demands is found.

Dynamic knowledge spillovers

Firms may also take a more long-term perspective, investing in research capacity for the future. The local university is a prime candidate, as the firm would be well-positioned in geographical and relational space to benefit from higher quality research in the region. By investing in local research, the firm helps build a stronger research community that may become of greater benefit in the future. Extending the LKS model to encompass this, we propose a dynamic knowledge spillovers model.

In the simplest two-period model, expected utility $E(U_{ni})$ is a function of the firm's expected knowledge gain in the current period t and in the next period $t+1$. The function

$f_{n(t+1)}$ includes a factor discounting for future utility. The stock of relevant knowledge at i is allowed to vary across time, while the geographical distance does not vary:

$$E(U_{ni}) = f_{nt}(K_{it}, D_i, X_{it}) + f_{n(t+1)}(K_{i(t+1)}, D_i, X_{i(t+1)}) \quad (4)$$

If the firm collaborates with i at t , i 's stock of knowledge increases for the next period, such that $K_{i(t+1)} > K_{it}$. Consequently, in the next period, the firm can select a university with a higher value of K and the same value of D , increasing its expected utility. Funding and/or data obtained through joint research projects boost the research capacity at the university in general, and specifically in the fields most valuable to the firm (Gulbrandsen and Smeby 2005). Collaboration may also increase the relevance of the university's knowledge production, as its researchers increasingly learn more about the firm and its needs.

Local communitarian model

Finally, university interaction may serve other purposes besides access to new knowledge, such as firms' need to appear socially responsible and embedded in the community. Corporate social responsibility is increasingly popular, creating new expectations for firms to contribute to society, which may include contributions to academic research. Corporate social responsibility is often directed towards local communities in particular, rather than to society at large (Marquis et al. 2007; Lähdesmäki and Suutari 2012). Firms' and indeed individuals' responsibilities towards society are tied to membership of communities with which they identify and to which they should contribute their fair share. This may include contributions to the local

university's development. Academia is an important beneficiary of place-based philanthropy, based on regional affection and commitment (Glückler and Ries 2012). However, contributions to the university may take place through various mechanisms, from pure philanthropy to joint research projects that benefit the university as much as the firm. Besides its own needs, firms may accept invitations to collaborate in research projects to help the university. Extending the LKS model to allow for this, we propose a local communitarian model. This includes a parameter R , referring to utility not related to access to new knowledge. R is itself partly a function of the distance to the partner, insofar as firms may derive more utility from contributing to the local community due to local reputation or branding effects, or to regional affection or attachment.

$$E(U_{ni}) = f_n(K_i, D_i, R_i(D_i), X_i) \quad (5)$$

Summary

This review has highlighted three extensions to the hegemonic LKS model to explain why firms collaborate most frequently with local universities⁷. In the LKS model, the difficulties of transferring knowledge across geographical distance drive local collaboration. In the localised partner search model, firms can more easily access information and establish trust-based relations with local universities. In the dynamic knowledge spillovers model, collaboration increases the university's relevant knowledge for the future, contributing to the firm's expected future utility. In the local communitarian model, firms want to contribute to the university's – and thereby the community's – development, regardless of whether they themselves benefit. These models are not mutually exclusive: All considerations may be present in the decision to

collaborate with the local university. Indeed, as the latter three are extensions of the first model, they could all be combined in an integrated model. However, in the empirical analysis, we examine them one by one to assess which extensions are relevant and under which circumstances.

Method

To examine the models' empirical relevance, we rely on two data sources: First, we briefly report findings from a 2013 survey of 2000 Norwegian firms (for details on the survey, see Fitjar and Rodríguez-Pose 2017). This provides information on how many firms collaborate with local and non-local universities, giving insights into how widespread this is, and which firms collaborate locally and non-locally. For information on the firms' motivations for collaborating with local universities, we employ our second, and main, data source: qualitative interviews with firms involved in such collaboration. To specifically address the question of interest, we study firms facing a potential trade-off between research quality and distance in their choice of partner. These are firms located in the vicinity of lower-ranked institutions, and which collaborate with these universities. We examine their motivations for doing so, building on in-depth discussions with individuals involved in these collaborations. Several firms also collaborate with non-local universities and provide insights on when they work with the local university and when they opt for a more distant partner.

The interviews are conducted in four Norwegian regions: Stavanger, Tromsø, Bodø and Haugesund, which all have a university or polytechnic located in the central city. The universities are fairly small and less research intensive than the largest Norwegian

universities, with the University of Tromsø alone in making it into the 2016/17 Times Higher Education Rankings – in the 401st-500th ranking band. All are generalist institutions, although with different specialisations, partly reflecting the composition of local industry. The University of Tromsø specialises in Arctic research and other areas where its northern location is an asset, such as biotechnologies, fisheries, space science and indigenous linguistics. Bodø's Nord University focuses on aquaculture and seafood. The University of Stavanger specialises in petroleum engineering and related technical and social science subjects, such as risk management and societal safety. Stord Haugesund University College specialises in petroleum and maritime subjects, reflecting the region's petromaritime industrial specialisation.

These cases are appropriate for studying why firms collaborate with their local universities, even if the research quality available in other universities – elsewhere in Norway or abroad – may be superior. In each university, we first interviewed 5-7 representatives of university management and senior faculty involved in collaboration with industry (total of 16 interviews). During these interviews, informants were asked to identify firms with whom they were currently collaborating, including individuals in these firms who were involved in the collaboration. Subsequently, we conducted semi-structured interviews with these individuals. We conducted 24 interviews with 28 individuals, representing 23 different firms. These are not intended to be representative of the broader regional population of firms, or even of the universities' collaboration partners. Rather, they represent a targeted selection of firms close to lower-ranked universities which collaborate actively with these universities. By exploring their various rationales, we can directly address the research question. The intention is to explore a broad range of motivations for collaborating with local universities, building

on the principle in qualitative research of maximizing the variety of representations rather than studying a representative sample (Bauer and Aarts 2000). The idea is not to compare these firms to firms which don't collaborate with local universities, but to examine a broad variety of rationales among firms which actually do so. This is furthermore not a comparative study which compares regions or universities. The rationale for including four regions is also to maximize variety, in order to avoid particular regional or university contexts limiting the range of explanations for local university collaboration.

Two researchers participated in each interview to enhance reliability. The same two researchers conducted all interviews within any single region, and one researcher (Gjelsvik) took part in all interviews across regions. The interviews were recorded and transcribed to ensure comparability and sharing of data within the project team. The interviews were analysed in a joint project workshop, including all interviewers. The project team included faculty from all four case universities with close knowledge of the local context.

Findings

Table 1 reports the survey findings. In total, 1994 firms answered the question about university collaboration, of which 21.7 percent collaborated with universities - 16.1 percent with local and 9.8 percent with non-local universities. In total, 11.9 percent collaborated with local universities only, 5.6 percent with non-local universities only and 4.2 percent with both. Comparing regions with leading universities (Oslo, Bergen and Trondheim) and other regions, non-local collaboration is similar in the two groups,

while local collaboration only - and both local and non-local collaboration - is respectively 1.8 and 1.2 percentage points higher in regions with leading universities. As in Laursen et al. (2011), being located close to a leading university increases the propensity to collaborate locally. However, the difference in local collaboration is statistically significant only at the 90 percent level ($P=0.06$), and the share collaborating locally remains quite high in regions without leading universities.

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

Firms that collaborate with universities – especially those which collaborate both locally and non-locally – are larger and spend more on R&D, have more educated workers, and are more innovative. However, non-local collaboration is associated with the highest rate of new-to-market innovation.

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

Table 2 shows the interviewed firms and their collaboration with the local university. The firms differ on several dimensions, including sector, size and ownership, ensuring variability in the data. There are regional differences reflecting local industry structure and university profiles, highlighting the importance of including several regions and universities in the study. Informants were individuals in managerial positions closely involved in university collaboration. Collaborations span various types, from research and/or development to educational activities. Departments involved are mainly in areas where the university is specialised: engineering in Stavanger and Haugesund, biology in

Bodø, and various natural sciences in Tromsø, although other departments are also involved.

To assess research group quality, we draw on the Research Council of Norway's subject-specific evaluations⁸. These are broad peer-review processes by panels of international scientists, covering several different disciplines every year. Research groups are rated on a scale from 1 to 5, where 5 denotes an excellent and internationally leading research group and 1 a weak group. The table shows the score (with the evaluation year in parentheses) of the most actively involved research group within the department. Most collaborations were with research groups ranked as "good" (3) or "fair" (2), although some were with "very good" (4) research groups. The research groups in Haugesund were not included in these evaluations, reflecting lower research activity compared to the other universities. The final column shows the firms' collaboration with other, non-local, universities. Many firms also collaborate with other national universities, and some – in particular the multinationals – with international universities. As these have several partners to choose from, a question of interest is why they also collaborate with the local university.

Localised knowledge spillovers

Unsurprisingly, knowledge spillovers were an important motivation for collaborating with universities for all informants. Most informants emphasised university quality in selecting partners. "We primarily go after the best expertise" [7] and "we are always chasing quality" [5] were typical criteria for partner selection. The local university's research excellence is highlighted: "We have some world-class milieus" [5]. Most

informants highlighted access to universities' knowledge as driving collaboration. Opinions were divided on whether this required geographical proximity. Some emphasized the benefits of local collaboration, as in the localised knowledge spillovers model, and assessed costs of geographical distance: "Proximity is important; the greater distance, the harder it is to maintain continuous contact beyond ongoing projects. The informal communication is very important" [14]. For others, geographic proximity is not essential, but makes things easier: "It's easiest for us to collaborate with communities in Bodø due to the proximity, but we are happy to collaborate with the University of Stavanger, which also has competence" [8]. Another firm, when asked whether they looked for the best quality or mainly for regional partners, stated: "Of course, I am from Haugesund. Besides, accessibility is incredibly important to us. We can say: 'Let's meet in half an hour'. It's amazing. You can't do that with someone from Bergen or Stavanger. Then you have to plan and travel" [21].

Several others explicitly said geographical distance does not matter in non-local collaboration: "There are planes all the time. We spend a lot of time travelling, especially to Asia, the US and Canada" [20]. Occasional physical meetings are important, but international business travel is used to achieve this, and "distance is just something we have to live with". Another informant says: "The world has become smaller and distance matters less. We are active with firms in [20+] countries and may be in contact daily, and we travel a lot" [2]. This firm combines occasional physical meetings with regular e-mail and telephone contact. Asked whether distance matters when collaborating with non-local universities, one informant answered simply "no" [16]. Another said "no, not in projects" [6], explaining that their firm had activities in several regions and mainly communicated through web and video, with some physical travel. These firms work

with many distant partners and can also handle collaboration with distant universities. They all work with non-local as well as local universities.

The LKS model does not seem to be important in all cases. While some firms express motivations for local collaboration that follow the model's expectations, others seem less sensitive to geographical distance, but nonetheless collaborate with the local university. To explain this, we turn to the three proposed extensions of the LKS model.

The localised partner model

While quality considerations were important, firms appeared satisfied if universities had sufficient quality. The word "competence" was brought up 170 times during the 23 interviews, e.g. "it's exclusive, we research where the competence is the best" [4], or "if the competence exists [at the University of Tromsø], we go there" [16]. The word "quality" was used less frequently, 27 times. Firms mainly want partners that are competent enough, and do not necessarily try to maximise quality. This follows the principle of satisficing from the localised partner search model, insofar as firms may stop searching when they have found a competent partner. Lack of competence may cause them to look further: "Today, the University of Tromsø has little competence associated with our activities [...] but we are collaborating with Bergen" [14] and "the University of Stavanger does not have a large community which is relevant to us" [2].

Several informants emphasise relations to individual academics rather than the university itself. According to one, geographical distance to the university doesn't matter; it's all about relational proximity to individuals: "That they are in Haugesund is very accidental. It's because some of us had a relation from before" [17]. Informants

often named individual academics who possessed precisely the competence required. Individual researchers are seen as contract partners: “We have a multi-year contract with NN which we spend several millions on [...] NN is a leader in his area globally” [5]. This informant mentioned three other professors whom they were currently contacting, concluding that “we are vulnerable because large alliances are person-based, and what happens when they aren’t here anymore?” Another said: “We knew NN was still in Haugesund. There’s not so many years left before he retires” [17]. An academic spin-off in Tromsø noted the original academic entrepreneur’s importance: “We had the researcher NN, it’s his scientific clout” [12], while another academic spin-off explicitly said that “private relations to NN and a few others mattered more than the University of Tromsø [during commercialisation]” [13]. This informant also noted another individual, emphasizing his unique qualities: “The only positive person was NN, who’s still here, who’s Norway’s best entrepreneur in fisheries”. Here, geographical proximity matters less for knowledge transfer than for the environment in which people can meet. When searching for individual academics, it is unmanageable to scan the global field. This reinforces the need for a manageable consideration set, as in the localised partner search model. Searches start at a well-known university, and continue until a competent partner is found. Local universities may benefit, as firms tend to know their faculty better.

Personal experience as a student may matter: “I had NN [as a lecturer] myself when I studied and therefore knew him” [17]. This can also come from others in the firm: “[The initiative was taken based on] relations between former students and the university” [7], and “we have relations to universities through people who are educated there” [8]. Regions also have other arenas where academics and industry professionals meet:

“Haugesund isn’t the world’s largest city, so there are quite a few arenas where most people meet” [18], and “I guess it started at Skarven [a pub] at some point” [15]. Relationships are often ongoing, feeding further collaboration: “It’s reasonable to contact NN at UiN. We’ve worked with him before” [8].

Contact was frequently initiated by universities rather than by firms: “Often, the universities come to us” [1]. When asked who took the initiative to new projects, another informant simply answered “it’s the research institutions, every time” [6]. These contacts are often maintained through individual liaisons at the universities: “[Liaison] NN’s entry at UiS has eased the relations with UiS tremendously” [5], and “NN is a very good ambassador to the part of industry that I am part of” [18]. However, universities do not approach all firms. In these cases, collaborations may fail to emerge due to a lack of initiative from the university: “Researchers with good ideas don’t come to us” [14]. Because the university rarely makes contact, this firm is less active in collaborating with the university. Firms may consider these proposals based on cost-benefit assessments, where the consideration set consists of the universities proposing projects. They evaluate the expected utility of these proposals. A large multinational’s research director describes a typical process: “Through the year, we have collected all the project propositions in a database and each project is sent to the organisation as they come in. Depending on their recommendations, we develop a proposal with all the propositions. We ask each person to present the project and give an assessment of [its] value” [1]. These considerations are often based heavily on potential short-term benefits, in particular whether the project can contribute to ongoing activities: “We have limited time and capacity, we prioritise what’s closest to our value-added” [6]. This can be at odds with academics’ priorities, and firms mainly pick individuals who understand this:

“We work maybe best with those who want results in the short term and primarily want results based on making it work rather than those who want to publish an article” [19]. This may lead collaboration to break down: “To the extent that we see that there is no collaboration between the university and industry, the university might dislike this, but industry is characterised by pure cynicism. If we don’t see that it is useful for us to work closely and see the results...” [19].

To sum up, most firms have limited consideration sets and follow satisficing principles, providing support for the localised partner search model. Consideration sets are built from personal networks, educational background or proposals from universities. All three mechanisms increase the likelihood that local universities are part of these consideration sets. The utility of collaborating is evaluated using satisficing principles, where firms choose partners which are competent and add value. If the local university is not sufficiently competent, collaboration with non-local universities becomes more important. In these cases, local collaboration takes place for other reasons, bringing us to the two other extensions to the LKS model.

The dynamic knowledge spillovers model

While most firms emphasized short-term value-added, some noted potential benefits in the longer term from developing research communities at the local university, as per the dynamic knowledge spillovers model. A company that finances PhD positions notes that “we wanted to have a university with stronger quality and research” [5]. Another explains that “we want to build competence at the universities” [4], calling its programme “a tool to nurse a long and good relationship to strategically important universities”. Such relationships to universities are important for access to research,

technology scouting and recruitment. In Bodø, a motivation for project participation is that “we wanted to build up a real-time lab in the local area” [7]. Others participate in joint research centres or regional cluster projects where the university is the initiator or a key partner, with an ambition to build university research capacity in a field. This provides access to government funding, which is often more important for the universities than for the firms.

These firms see collaboration with the local university as an investment in developing regional competencies. Better local university research quality on relevant topics might in the future benefit the firm, which is well-placed geographically and relationally to reap the rewards. The localised partner search model is not sufficient to explain these cases, as the immediate value of the project might be low. The dynamic knowledge spillovers extension is necessary to understand the long-term perspective taken by these firms.

The local communitarian model

In other cases, explicit cost-benefit assessments – even in the long run – are absent, and the desire to contribute to regional development is highlighted as an important motivation, supporting the local communitarian model. Several firms explained their engagement with the local university in these terms. One informant describes how collaboration started: “NN owned [the firm] and wanted to support employment in the region. He had an idealistic perspective and identified the best people at the University of Stavanger and Rogaland Research. He had a glowing passion for the region. He wanted this region to be the most innovative” [3]. Another informant says: “Personally, I care about having a strong academic institution in the local community for the

consciousness of being a city, but also for educating exciting people who will work and live in the city that we love” [23].

This was sometimes part of the rationale for starting a business: “We have an owner who thinks it is fun to build new things, get more hands to work and develop local communities” [8]. Such attitudes can be harnessed by universities as important regional institutions. This can take the form of pure donations: “[The founder] was very interested in getting a university to Tromsø and donated quite a bit of money” [14]. However, it is more commonly expressed indirectly, e.g. in a positive approach to the university’s proposals. When university researchers invite firms to participate in research projects, the direct benefit may be missing, but some firms nonetheless want to support the activity. An informant discussed a project where “we feel that we have gotten very little out of it. We have put quite a bit of money into that”. However, asked why they nonetheless participated, he explains that: “We want to have a role locally because we are a local firm, so when you participate in something like this, you don’t always do it to get something back, but to support Stord Haugesund University College. It’s not like every *krone* we put in gives us 1 percent additional turnover a year” [18]. The firm hoped to benefit from the project, but the researchers defined the content, and the firm mainly wanted to support the university’s research activities. Responsibility to the local community may be part of the reason for collaborating with the local university, even in research projects. Models focusing exclusively on knowledge transfer as the driver of university-industry interaction may miss such motivations, which are often bundled with other aims rather than expressed as pure philanthropy.

Conclusion

While local university-industry interaction is an important topic in regional studies, few studies specifically discuss why firms collaborate with local universities even when these are second-tier. This paper shows that firms collaborating with universities often do so locally, for various reasons. The literature mainly explains this phenomenon using the LKS model, where collaboration with universities is a function of their research quality weighed against the cost of transferring knowledge across a distance. We find some support for this: Informants highlight access to knowledge from universities, often for short-term benefits, as a main driver of collaboration. Some emphasize geographic proximity, which enables informal communication and frequent meetings, although others see this as less important. However, the LKS model is not sufficient to explain why firms collaborate with local universities. It must be extended with other considerations expressed by firms.

Firms consider a limited number of universities as potential partners, and often seek to satisfy rather than maximize research quality. Cooperation may be the result of ongoing relations and prior experiences of successful collaboration, usually at the individual level, or of initiatives taken by the university. Geography matters less because of the costs of knowledge transfer, and more because the local area is often where the partner search starts – by the firm or the university. If local researchers are competent enough, firms may engage with them and look no further. The need for a manageable consideration set is reinforced as firms look for individual academics rather than whole departments or universities, as highlighted in this and other studies (e.g. D'Este and Patel 2007). Quality may not matter beyond a certain level: It is sufficient if the partner is competent and can do the job, as the marginal value of additional quality is negligible.

Even when the local university is not sufficiently competent, firms may still collaborate, as other motivations can come into play. Firms may hope to benefit in the long term from the development of research capacity in the region, even if they don't see much short-term benefit in the project. Knowledge does not exclusively spill over from universities to industry, but also flows the other way. A more dynamic view, as in the dynamic knowledge spillovers model, is therefore required. These dynamics typically take place in long-term relationships, facilitated by proximity. Other firms simply want to contribute to the community. Local owners in particular may view themselves as part of a community where they want to make a difference. Local universities are important institutions in the community and well-placed to benefit. These contributions rarely take the form of pure philanthropy, but may be expressed in a positive attitude to spending time and money on projects with limited value to the firm. The motivations for collaborating with the university may thus go beyond knowledge exchange, even when organised through mechanisms where this is central, such as research contracts.

The three alternative models all build on and extend the LKS model. However, even in the absence of localised knowledge spillovers, all would still predict a pattern of predominantly local university-industry collaboration, combined with some long-distance collaboration with high-quality universities. This is the case if the partner search starts locally (as in the localised partner search model), if the partnership is long-term (as in the dynamic knowledge spillovers model) and if community contributions are mainly directed to the local community (as in the local communitarian model). The implication is that existing empirical evidence showing such patterns is not sufficient to demonstrate the veracity of the LKS model. Further research is needed to examine

whether knowledge spillovers in university-industry partnerships do indeed depend on geographical proximity.

Notes

¹ Following Laursen et al. (2011), this is a two-step process: First, the firm decides whether or not to collaborate with a university. Second, it decides whether to collaborate with a local or non-local university. We model the second step more generally as a decision about which university to collaborate with.

² Firms can of course collaborate with more than one university simultaneously, also within a specific project. However, we model these as separate instances of partner selection, such that the same model applies for selecting additional partners.

³ A risk averse firm will take into account the probability distribution of outcomes, not only the mean outcome in its utility maximisation process (von Neumann and Morgenstern 1953). The risks of collaborating with a well-known local university may be lower than for a more unknown distant university. The firm may therefore prefer local collaboration even when the mean expected utility of long-distance collaboration is somewhat higher. Geographical proximity may be particularly important in reducing uncertainty associated with university collaboration (Johnston and Huggins 2016). Distance could thus affect the expected utility not only because it eases the knowledge transmission process, but also because a local partner is seen as a safer choice than a more distant one.

⁴ "Relevant knowledge" refers to knowledge that – if successfully transferred – would actually help the firm to achieve its goals. This does not equate to basic research excellence, but will also include applied research. Furthermore, it does not involve all

knowledge at the university, but is specific to the problem that the firm is seeking to address.

⁵ The firm defines its consideration set through deciding which universities they know and trust enough to consider potential partners. The consideration set is partly also exogenously determined, being limited to universities that would collaborate with the firm. Universities have their own expected utility function which may constrain firms' choices. For formal models of knowledge transfer under communication costs from the sender's perspective, see Dewatripont and Tirole (2005), Niehaus (2011) or Acemoglu et al. (2014). Public policy may also be a constraint, e.g. if funding bodies require collaboration with national or regional universities.

⁶ We present this as a utility satisficing model, although under search costs, the choice can also be utility maximising. The main difference with the LKS model is that the costs of knowledge transfer itself is not the only driver of local collaboration; the search process also matters.

⁷ The models do not seek to outline all the factors that influence decisions to collaborate with external partners or the choice of partner. Rather they focus specifically on reasons which may lead firms to prefer collaborating with a local university over a potentially higher-quality institution located further afield.

⁸ Available at

http://www.forskningsradet.no/en/Subjectspecific_evaluations/1233557971734

(accessed 22.02.2017). The evaluations for research in technology, ICT, biology, clinical medicine and health science, physics and economics were consulted.

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Table 1: University collaboration by Norwegian firms, 2013 survey data

	Share	Leading university regions, share	Other regions, share	Mean empl. size	R&D exp., % of turnover, mean	% univ. educated, mean	% new-to-market innovators
None	78.3	76.8	80.0	46	2.5	24.8	23.8
Local only	11.9	12.8	11.0	78	4.3	36.6	35.6
Non-local only	5.6	5.6	5.6	108	5.2	42.5	55.7
Local and non-local	4.2	4.8	3.6	158	14.7	59.2	46.1
Total	100.0	100.0	100.0	58	3.4	28.5	27.9
N	1994	1040	954				

Table 2: Characteristics of the interviewed firms and their university collaboration

#	Region	Empl.	Ownership	Industry	Respondent	Collaboration type	University department	Quality (RCN, 1-5 scale)	Other university collaboration
1	Stavanger	> 500	MNE	Oil & gas	Res. Dir.	Joint industry proj., res. centres	Engineering	2 (2015)	Several, nat+int
2	Stavanger	50 - 500	Local MNE	Manuf.	IP Dir.	Joint res. centre, ind. PhD, prod. dev.	Health	2-3 (2011)	2 nat + some int
3	Stavanger	> 500	MNE	Oil services	Res. Dir.	Res. projects, commercialisation	Engineering	2 (2015)	2 nat and 4 int
4	Stavanger	> 500	National MNE	Oil & gas	Prog. Dir.	Res. proj+centres, PhDs, educ. prog,	Engineering	2 (2015)	Several, nat+int
5	Stavanger	> 500	MNE	Oil & gas	Ext Aff Advisor	Research projects, PhD programme	Engineering	2 (2015)	Several, nat+int
6	Bodø	50 - 500	Local	IT	CEO	Dev. projects, guest lecturing	Engineering	2 (2015)	3 nat
7	Bodø	> 500	Local	Aquaculture	CEO	Res. projects, staff training, lab	Biology	4 (2011)	3 nat
8	Bodø	50 - 500	Local	Aquaculture	Proj. Dir.	Cluster proj., res. proj., guest lect.	Biology	4 (2011)	3 nat
9	Bodø	50 - 500	Local MNE	Maritime	CEO	Master theses, trainees, mentoring	Business	3 (2007)	1 nat
10	Bodø	50 - 500	Local MNE	Oil services	CEO	Res. proj., thesis superv., prod. dev.	Business	3 (2007)	1 nat
11	Tromsø	< 50	Local	IT	CEO	Commercialisation of research	ICT	3 (2011)	2 int
12	Tromsø	< 50	Local	Biotech	CEO	Commercialisation of research	Biology	3 (2011)	No
13	Tromsø	< 50	Local	IT	CEO	Commercialisation of research	ICT	3 (2011)	No
14	Tromsø	< 50	Local	Various	CEO + 2 Dir.	Lab, industry PhD	Biology	3-4 (2011)	2 nat
15	Tromsø	< 50	Local	Biotech	CEO	Commercialisation of research	Chemistry	3-4 (2011)	No
16	Tromsø	50 - 500	National MNE	IT	Sales Dir.	Res. proj., master theses, PhD proj.	Physics	3 (2010)	3 nat
17	Haugesund	> 500	National MNE	Oil services	Proj. Dir.	Staff training prog., thesis superv.	Business	-	3 nat
18	Haugesund	> 500	MNE	Oil services	Inn. Dir.	Thesis supervision, res. proposal	Engineering	-	Some nat
19	Haugesund	50 - 500	Local	Maritime	CEO	Research proj., development proj.	Engineering	-	No
20	Haugesund	50 - 500	Local	IT	Product manager	Thesis supervision	Engineering	-	One int
21	Haugesund	> 500	Local MNE	Maritime	Dep. CEO + Dir.	Research projects, lab, thesis superv.	Engineering	-	
22	Haugesund	> 500	National MNE	Oil services	Dep. CEO + 2 Dir.	Collaboration forum, staff training	Engineering	-	3 national
23	Haugesund	< 50	Local	Finance	CEO	Guest lecturing, dev. projects	Engineering	-	No

Note: Abbreviations: Res: Research; Prog: Programme; Ext Aff: External affairs; Proj: Project; Inn: Innovation; Dep: Deputy; Dir: Director(s); Ind.; Industry; Educ: Education; Dev: Development; Lect: Lecturing; Superv.: Supervision; Nat: National; Int: International