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Ctra. Colmenar Viejo km. 14, 28049 Madrid, Spain

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Sources of firm innovation in urban Norway

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Rune Dahl Fitjar[a] and **Andrés Rodríguez-Pose**[b]

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[a]Stavanger Centre for Innovation Research
International Research Institute of Stavanger
Stavanger, Norway

[b]London School of Economics and Political Science
London, United Kingdom
and IMDEA Social Sciences Institute, Madrid, Spain

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When local interaction does not suffice: Sources of firm innovation in urban Norway

Abstract

The geographical sources of innovation of firms have been hotly debated. While the traditional view is that physical proximity within city-regions is key for the innovative capacity of firms, the literature on 'global pipelines' has been stressing the importance of establishing communication channels to the outside world. This paper uses a specifically tailored survey of the level of innovation of 1604 firms of more than 10 employees located in the five largest Norwegian city-regions (Oslo, Bergen, Stavanger, Trondheim, and Kristiansand) in order to determine a) the geographical dimension of the sources of innovation and b) the factors behind the propensity to innovate in Norwegian firms. The results stress that while interaction with a multitude of partners within Norwegian city-regions or with other national partners has a negligible effect on firm innovation, those firms with a greater diversity of international partners tend to innovate more and introduce more radical innovations. The results also highlight that the roots of this greater innovative capacity lie in a combination of firm – size of firms, share of foreign ownership, and sector – and cultural – the level of open-mindedness of managers – characteristics.

Keywords: Innovation, radical innovation, interaction, pipelines, partnerships, firms, city-regions, Norway.

Introduction

The sources of innovation in regions have been hotly debated in recent years. While the traditional view supports local interaction as the main source of knowledge exchange and innovation (e.g. Becattini, 1987; Porter, 1990), the more recent theories of 'pipelines' have looked for the roots of innovation and knowledge diffusion outside the region. International connections (Bathelt et al., 2004; Doloreux and Parto, 2005) and exchanges within the national context (Gertler and Wolfe, 2006; Isaksen, 2009) have come to the fore as important vehicles for the generation and diffusion of innovation.

The consensus emerging from these strands is that local and global interaction operate together in fostering firm-level innovation within regions and are perfectly complementary. Dynamic regions combine high levels of local interaction with specific knowledge communication channels between individual firms located in the region and the outside world (Malecki, 2000; Bathelt et al., 2004; Wolfe and Gertler, 2004; Maskell et al., 2006). Pipelines to the outside world are regarded as a key source for radical innovation, channelling new knowledge and practices to local firms, while local interaction represents a more genuine vehicle for incremental innovation.

However, whether local interaction and global pipelines are complementary and whether they are linked to fundamentally different types of innovation has seldom been demonstrated. Studies analysing the sources of innovation in regions abound. Most of these studies tend to use the cluster as the unit of analysis, relying on case studies based on targeted interviews and surveys of representative firms (e.g. Onsager et al., 2007; Doloreux and Dionne, 2008; Isaksen, 2009; Trippl et al., 2009), to provide what are interesting insights into how knowledge flows take place within and outside the cluster and how this triggers the diffusion of knowledge among firms. Yet the excessive reliance on cluster overviews, elite interviews,

surveys of representative firms, and the emphasis on networks and interactions, somewhat overlooks the micro-picture of what is happening at the level of the firm. We know a lot about how the cluster behaves as a system, but relatively little about which types of firms engage in which type of interaction, beyond a small number of representative firms. Do all firms in a region benefit from local knowledge flows and engage in global pipelines? Or is there a clear division depending on firm characteristics (e.g. size, ownership), sector, and characteristics of the manager? Do all types of interactions lead to innovation or are some more likely to generate innovation than others? And is extra-local interaction more prone to radical innovation while local contacts facilitate incremental innovation?

This paper addresses these questions by looking at the geographical sources of innovation of firms in the five largest Norwegian city-regions – Oslo, Bergen, Stavanger, Trondheim, and Kristiansand – and what determines how individual firms access specific sources of knowledge. The analysis relies on a tailor-made telephone survey of 1604 business managers of firms with more than 10 employees, guaranteeing a substantial coverage of firms in the five main city-regions in Norway. The survey includes three sections: the first one looks at the level of innovation of firms in Norwegian city-regions, making a distinction between incremental and radical innovation, and between product and process innovation. The second focuses on the partnerships established by the firms surveyed, distinguishing between partnerships with local actors and with actors at the national and supra-national level. The third section covers factors which may determine differences in interactions among firms, concentrating on firm-specific characteristics, such as size, ownership, and sector, and in manager-specific socio-psychological traits.

Norwegian city-regions provide a useful environment for this type of study. While it is a small and open economy (Norman 1983), guaranteeing the presence of considerable interaction with the outside world, it is also a high trust country (Inglehart 2000) with well-

functioning institutions (Mehlum et al., 2006). This provides good conditions for local knowledge-sharing, avoiding the institutional drawbacks which may affect interfirm interaction elsewhere in the world. The combination of a high-trust society in an open economy ensures a strong presence of both frequent contacts internal and external to the city-region.

The results indicate that firm innovation in urban Norway is mainly driven by global pipelines, rather than local interaction. The most innovative – both in terms of basic product innovation and radical product and process innovation – firms are those with a greater diversity of international partners. Local and even national interaction seems to be irrelevant for innovation. Furthermore, the individual attitudes of the manager make a difference for the firms' engagement with the outside world. More open-minded managers have a greater diversity of international partners and rely more on global pipelines, whereas those with higher levels of regional trust depend on local and, to a lesser extent, national contacts.

The paper is structured as follows. The next section reviews theoretical discussions about the sources of innovation in agglomerated firms, paying special attention to the debate between local interaction and global pipelines. Section 3 presents the key results of the survey of innovation in Norwegian firms. Section 4 asks which type of interaction leads to which type of innovation in specific firms, before looking at the motives behind the different types of engagement in cooperation among Norwegian firms. The final section concludes by linking the results of the analysis to the expectations of the scholarly literature.

Local interaction, global pipelines, and the genesis of innovation

Traditionally, innovation within clusters, industrial districts, innovative milieus, or regional innovation systems has been considered – from a pure Marshallian perspective – a direct consequence of the co-location of firms. The myriad of small and medium-sized firms (SMEs), often supplemented by a number of large firms (Markusen, 1996), in the same or in related sectors and located in close geographical proximity can give rise to the interactions, networks, and institutional settings at the heart of the generation and diffusion of tacit knowledge and, ultimately, the spread of innovation (Maskell et al., 1998; Gordon and McCann, 2000). Geographical and sectoral proximity among firms generates agglomeration economies which compensate for the limited economies of scale internal to SMEs and reduce the costs of co-ordinating sources of knowledge (Maskell, 2001). The high level of competition, combined with co-operation, through formal and informal channels, facilitates the flow of knowledge among agents, keeping firms on their toes and making them more innovative than if they were geographically isolated (Becattini, 1987; Porter, 1990). Meanwhile, sectoral proximity or 'related variety' contributes to constant exchanges among firms that also lead to greater innovation and dynamism (Frenken et al., 2007; Boschma et al., 2008; Boschma and Iammarino, 2009; Eriksson and Lindgren, 2009).

But even more important than the geographical co-location and the sectoral proximity for the genesis of innovation are the socio-institutional networks created within local economies (Rodríguez-Pose and Crescenzi, 2008). Industrial districts, innovative milieus, and the like are often the cause and consequence of institutional environments that generate dense institutional networks – or 'institutionally thick' (Amin and Thrift, 1995) environments – contributing to the build-up and the diffusion of trust. The close interaction among economic actors, with local social and political stakeholders and the civil society as a whole, help create the sort of

'institutionalized' market (Bagnasco 1988; Trigilia, 1992) on which the diffusion of tacit knowledge thrives.

Geographical co-location (physical proximity) and 'related variety' (sectoral and cognitive proximity) in homogenous and institutionalized high-trust environments (institutional and social proximity) facilitate constant, often face-to-face, interaction (Boschma 2005). The literature on the benefits of local interaction in promoting innovation and economic development has mostly focused on what Storper and Venables (2004) have named 'buzz' – or "the information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place or region" (Bathelt et al., 2004: 38). Buzz tends to generate "increasing returns for the people and activities involved" (Storper and Venables, 2004: 365) and is at the root of innovation in agglomerated environments[1].

The general belief that while codified knowledge – that available to all through existing information channels – travels well and can be accessed almost costlessly from anywhere in the world, but that tacit knowledge travels badly and its returns can only be maximized through constant face-to-face interactions in 'buzz' environments, leads to a simple conclusion: city-regions and localities can be considered the ideal spaces for the formation, diffusion, and assimilation of innovation. Everything else being equal, firms in urban agglomerations would simply benefit from 'being there' (Gertler, 1995): they will enjoy significant innovative capacity advantages vis-à-vis firms in isolated environments (Baptista and Swann, 1998).

1 The concept of local buzz includes informal contacts and mouth-to-ear type of knowledge diffusion, making it difficult to observe, let alone measure. As a consequence our analysis, while acknowledging the importance for innovation of local informal interactions, concentrates solely on local formal exchanges as the system for the diffusion of knowledge within Norwegian city-regions.

The potential drawbacks of agglomeration have, however, attracted less attention. There is no doubt that constant face-to-face interaction can be a boon for the diffusion of knowledge and for innovation, provided that the ideas and the information in circulation are renovated constantly. But if the information exchanged is neither novel, nor varied, repeated local interaction may not only not be conducive to innovation, but can also stifle change (Malecki and Oinas, 1999; Malecki, 2000; Gertler, 2003; Moodysson and Jonsson, 2007; Moodysson, 2008). Excessive cognitive and sectoral proximity – in contrast to the existence of related variety – can represent a serious handicap for the innovative capacity of firms. The size of agglomerations is also of paramount importance. Whereas in large agglomerations the variety of exchanges is likely to be larger, limiting the circulation of repetitive information, in smaller agglomerations there may be limited opportunities for the renovation of knowledge and thus limited scope for innovation. And, finally, repeated face-to-face interaction is not necessarily an equivalent of buzz (Asheim et al., 2007).

This has led scholars to challenge the view that local learning is the best channel for generating an innovative environment and innovative firms (Bathelt, 2001; Gertler, 2003). Bathelt et al. (2004) were among the first to question the assumption that tacit knowledge travelled with difficulty and therefore its benefits could not be reaped without the presence of repeated interactions. They used the concept of 'global pipelines' to identify extra-local knowledge flows which overcome distance in order to promote innovation in far-away locations. These 'pipelines' are purpose-built connections between a given local firm and partners in the outside world. Partners can range from other firms, suppliers or clients, to universities or research centres. They can be engaged through direct point to point contact or approached in fairs, exhibitions, and conferences (Maskell et al., 2006: 999). Global pipelines are conceived as a connection between the local environment and the outside world, implying fundamentally the establishment of international connections. Pipelines, however, can also

link the firm with other national actors, especially in the presence of strong national innovation systems (Gertler and Wolfe, 2006; Isaksen, 2009).

Interaction through global pipelines is costlier than interaction in localized environments (Bathelt et al., 2004). It shuns the Marshallian notion that 'something is in the air' and can be easily reaped, for one in which "the establishment and maintenance of external linkages requires substantial time and effort" (Bathelt et al., 2004: 42). Global pipeline interaction thus implies a conscious effort on the part of partners at both ends of the pipeline, making the exchange highly targeted towards specific pre-defined goals. The conscious effort and the costs behind the establishment of pipelines means that the individual rewards may be greater and interaction may result in "decisive, nonincremental knowledge flows" (Bathelt et al., 2004: 40). As Trippl et al. (2009: 458) indicate when referring to the Vienna software cluster, "the more radical the innovation, the larger the variety of sources of knowledge and the stronger the diversity of mechanisms for transferring knowledge". Pipelines may therefore be better suited for radical innovations, while local interaction may trigger more incremental innovation.

The conscious act and the time and effort involved in establishing connections with the outside world also imply that, in contrast to the general potential for local interaction, not all firms have equal accessibility to pipelines. Three dimensions are likely to play a role in this respect. The first is related to geography and sectors. Firms in particular geographical settings and industries will have a greater tendency to bypass the local environment and set up extra-local connections. Firm characteristics are also crucial. Large firms and firms with a greater share of foreign ownership will be more prone to establishing supra-local links. Finally, characteristics of the manager also count. Younger, more educated and open-minded managers will, in all likelihood, be more favourable and/or receptive to contacts with the outside world.

Hence, local interaction and global pipelines can be perfectly complementary as sources of innovation (Bathelt et al., 2004; Maskell et al., 2006). On the one hand, local interaction – both in its formal and in its more informal 'buzz' dimension – contributes to making individual firms more innovative, often through small incremental innovations and the generation of synthetic knowledge. On the other, global pipelines channel analytical and radical new knowledge which helps firms to introduce more radical innovations (Moodysson et al., 2008). These innovations are later diffused locally through interaction. As Maskell et al. (2006: 1007) indicate, "when one firm [in the cluster] is successful, the result, or parts of the applied knowledge, will sooner or later leak out to the firm's nearby competitors".

But whether local interaction or global pipelines prevail in the generation of innovation and whether this relationship is complementary or mutually exclusive still remain to be demonstrated. This is particularly true for firms outside global agglomerations, which cannot benefit from the sheer size and the existence of both strong specialisation and diversification externalities which make innovation much more viable (Doloreux and Dionne, 2008). Bathelt et al. (2004: 40) already regretted the fact that "relatively few empirical studies have actually provided convincing empirical evidence of the superiority of local over non-local interaction".

The gap has been partially covered by a large number of studies devoted to the buzz vs. pipelines debate (e.g. Moodysson, 2008; Moodysson et al., 2008; Trippl et al., 2009). While these analyses provide evidence of the relationship between local and extra-local interaction as a source for learning processes, the information tends to be extracted from case studies which generally include interviews with key actors and surveys of representative firms. This type of approach offers a wealth of information about the interaction among different economic actors locally and beyond, but often raises the question of to what extent the findings are relevant to all local firms. Quantitative analyses which could provide a useful complement to understanding the mechanisms that promote collective learning within

agglomerations have, by contrast, been generally used for issues such as cluster identification and cluster mapping (Wolfe and Gertler, 2004: 1081). The potential of quantitative methods to uncover the mechanisms through which firms in clusters reap knowledge and innovate has been largely overlooked.

This paper covers this gap by surveying the innovative capacity and the internal and external links of 1604 firms with more than 10 employees located in the five largest Norwegian city-regions – Oslo, Bergen, Stavanger, Trondheim, and Kristiansand. The survey measures – given the difficulties of gauging the informal contacts present in the concept of local buzz – the formal contacts of firms with local and non-local (national and foreign) partners. We assume that firms embedded in the local community through extensive formal contacts with local business and/or research partners are likely to be in a good position to tap into informal knowledge flows. The survey also includes information about the socio-cultural characteristics of the managers, in order to examine what individual traits help the establishment of different types of interactions, as well as information about the structural characteristics of the firm.

In earlier research on the impact of local and non-local interaction for innovation in Norway, the focus has been on relatively small clusters (Onsager et al., 2007; Isaksen, 2009), with a number of firms in each of the clusters which ranged between 25 and 90 (Isaksen, 2009: 1157). Instead, we focus on the largest urban centres in the country, which are expected to be sufficiently large to allow for the development of significant local interactions and local buzz, but also sufficiently small for the genesis of strong interpersonal bonds among actors.

Studying these phenomena in Norway is also useful for other reasons. First, Norway is a high-trust society with few institutional pitfalls which have elsewhere allowed the capture of institutions by corrupt elites (Mehlum et al., 2006). Second, Norway has a strong national identity and strongly developed national education and innovation systems which guarantee

*the presence of highly skilled workers and access to quality research centres and universities virtually in every relatively large urban agglomeration. Third, and somewhat in contradiction with the two previous points, geography and history have shaped a strong local identity and local character. Cities are isolated from one another by relatively large distances and rugged terrain, which has made communication in the past difficult and has contributed to building a sense of strong local communities. Finally, Norwegians are an open and outgoing people, many of whom are likely to have spent considerable stints outside the country, including study and work periods.

Innovation in Norwegian city regions

This paper draws on data from a survey of 1604 business managers conducted in the spring of 2010. The survey used a questionnaire developed by the authors, including indicators from the Community Innovation Surveys and from values surveys (such as the World Values Survey and the Norwegian Monitor survey series), as well as some original questions specifically tailored to the needs of the present analysis. Data was collected through telephone interviews conducted by Synovate, which also sampled the companies randomly from the Norwegian Register of Business Enterprises, where all companies are required by law to register. The sampling frame included all companies registered as having 10 or more employees in the city-regions of Oslo, Bergen, Stavanger, Trondheim, and Kristiansand. Any municipality in which 10 percent or more of the population commuted into the urban core were defined as forming part of the city-region, consistent with the definition applied by the Norwegian government in its *Greater Cities Report* (Ministry of Local Government and Regional Development, 2003). The definition was based on Statistics Norway data from 2009, presented in Leknes (2010). 5887 companies were approached, with a response rate of 27.2 percent. Table 1 shows the

most relevant descriptive statistics on the sample's composition in terms of company size, sectors, ownership, and geographical distribution.

Table 1: Descriptive data on the firms included in the sample

Sector	N	% of sample	No. of employees	N	% of sample
Mining / quarrying	31	1.9	0 – 19	663	41.3
Manufacturing	296	18.5	20 – 49	523	32.6
Elect./gas/water supply	12	0.8	50 – 99	205	12.8
Construction	258	16.1	100 – 999	200	12.5
Wholesale/retail trade	276	17.2	1000 or more	13	0.8
Hotels and restaurants	129	8.1			
Transport/communic.	124	7.7			
Financial services	45	2.8			
Other services	432	27.0			

Ownership	N	% of sample	City region	N	% of sample
Fully foreign owned	174	10.9	Oslo	403	25.1
Partly foreign owned	69	4.3	Bergen	401	25.0
Fully Norwegian owned	1361	84.9	Stavanger	400	24.9
Fully regionally owned	1140	71.1	Trondheim	300	18.7
Partly regionally owned	178	11.1	Kristiansand	100	6.2

As a measure of the innovativeness of the companies, managers were asked if their business had introduced any new or significantly improved products ('product innovation') and/or methods or processes for production or delivery of products ('process innovation') during the last three years. 53 percent of managers reported a product innovation in this period, while 47 percent reported a process innovation. 33 percent of firms reported both process and product innovations, while 32 percent had not introduced any form of innovation. In order to analyse

whether different forms of collaboration lead to different forms of innovation, the successful innovators were then asked whether the products were new to the market ('radical product innovation') or, in the case of process innovation, whether the products were new to the industry ('radical process innovation'). 57 percent of product innovations and 40 percent of process innovations were radical. Table 2 shows the share of innovative companies within each category.

Table 2: Innovations developed in the last 3 years, % of surveyed companies

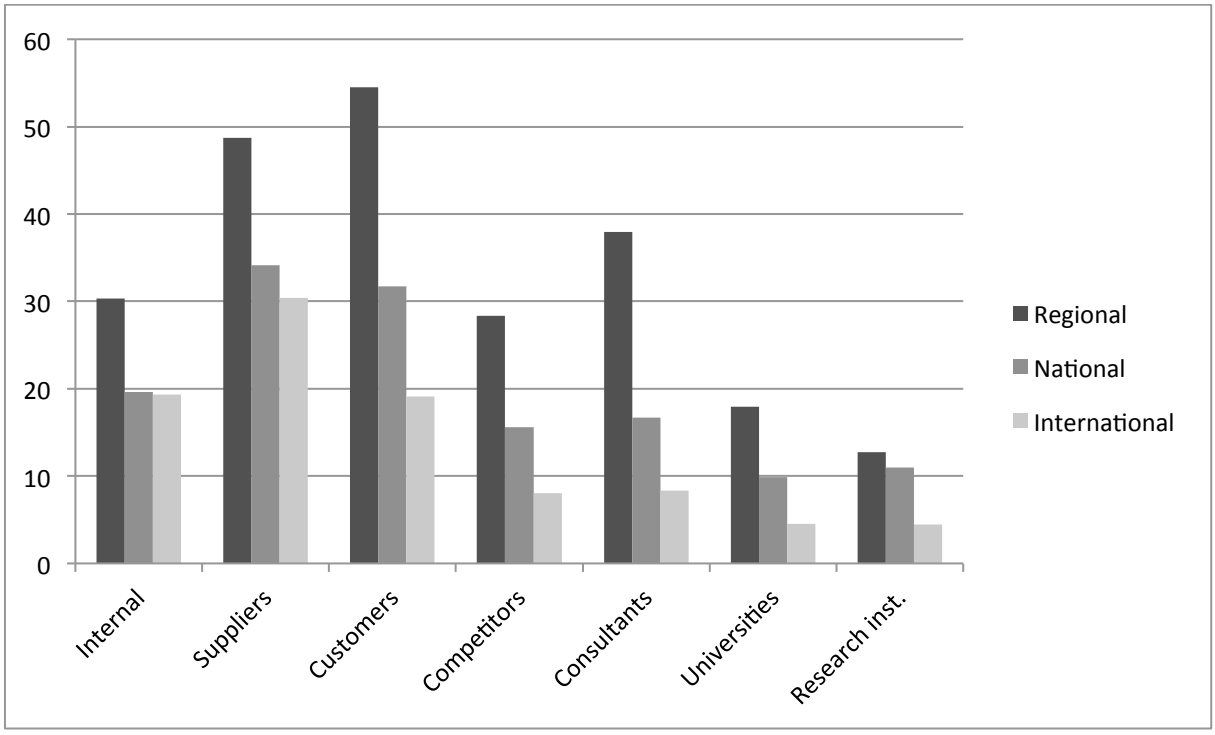
	Product innovation	**Process innovation**
Type of innovation: (% of all companies)		
Total innovation	53.4 (1.2)	47.0 (1.2)
Radical innovation only	30.6 (1.2)	18.8 (1.0)
N	1604	1604
Innovations were developed… (% of innovative companies)		
mainly by our company	47.3 (1.7)	36.0 (1.8)
in cooperation with other companies or organisations	36.5 (1.6)	40.4 (1.8)
mainly by other companies or organisations	14.8 (1.2)	22.7 (1.5)
Don't know	1.4 (0.4)	0.9 (0.0)
N	857	753

The top number in each cell denotes the percentage share, with the standard error listed below in parentheses.

Companies reporting product and/or process innovations were also asked how these had been developed – whether by the company itself, by someone else, or in cooperation between the company and others. The bottom half of Table 2 shows the distribution of responses for product innovations and process innovations, respectively. Nearly half (47 percent) of product innovations were developed by the innovating company itself, with 37 percent developing the innovation in cooperation with others, and 15 percent outsourcing product development to other companies or organisations. The development of process innovations was more collaborative, with only 36 percent of companies developing process innovations mainly within their own company. 40 percent cooperated with other companies or organisations on the development of process innovations, while 22 percent outsourced process development.

All managers were required to specify which (if any) of seven types of partners (other businesses within the conglomerate, suppliers, customers, competitors, consultancies, universities, and research institutes) they had collaborated with. In order to determine the impact of geographical distance on knowledge flows, managers were asked whether the partners were located within the region, elsewhere in Norway, and/or abroad. Figure 1 shows the proportion of companies that used a particular partner type by geographical distance. For each type of partner, regional partners were most common and international partners least common. Suppliers and customers were the most frequently used partner types, with customers being more frequently used than suppliers within the region, whereas the opposite was true for national and, particularly, international cooperation. Consultancies and competitors within the region were also frequently used as partners, as were internal partners within the conglomerate both within and outside the region. Fewer companies drew on partnerships with competitors, consultancies, universities and research institutes from outside their own region.

Figure 1: Percentage share of companies that have cooperated with partner type



Overall, 81 percent of companies collaborated with at least one partner type within the region, with an average of 2.3 partner types. 60 percent collaborated with partners from elsewhere in Norway (average 1.4), and 45 percent with partners located abroad (average 0.9).

The impact of geographical distance

The question of interest is whether these cooperative relationships matter for companies' innovation activities, and if so, if the geographical location of partners makes a difference. In order to address this question, we ran a series of logistic regression analyses using the four innovation outcomes presented in the first half of Table 2 as the dependent variables and the number of partner types used at the different geographical levels as predictors.

The regression model takes on the following form:

$$\text{logit}(\pi_i) = \alpha + \beta_1 \text{Partners}_i + \gamma_2 \text{Controls}_i + \delta_3 \text{Region}_i + \varepsilon_i \qquad (1)$$

where π refers to the probability that the company *i* has introduced an innovation within the past three years. Four different models are run – one for each dependent variable (product innovation, radical product innovation, process innovation, and radical process innovation). The independent variable being studied is *Partners*, where three different indicators are included, referring respectively to the number of regional, national, and international partners used by the company.

The model controls for a set of factors that may influence both innovation and the likelihood of a firm establishing extra-regional connections. These include the manager's education level (no. of years beyond compulsory primary and lower secondary education), age, and number of directorships held in other companies. On the company level, the model controls for the company's size (no. of employees of the company)[2], ownership (share of company held by non-Norwegian owners) and industry (a categorical variable distinguishing between 9 different NACE codes[3], with fixed effects for each category included in the model). For the manager level variables, a positive effect is expected for level of education and company directorships, the latter being a proxy of the manager's personal network in other companies. Age is expected to have a negative effect, with young managers likely to be less risk-averse and more creative. For the company level variables, we expect a positive effect of company size – larger companies enjoying greater access to resources – and of foreign ownership, with foreign-owned companies tending to be more technologically advanced. Different levels and types of innovation are expected across different industries.

2 The log number of employees is used for two reasons: Firstly, because the effect of an additional employee is expected to decline with increasing company size, and secondly, because the distribution of the company size variable is highly skewed (median = 22, mean = 70, skewness = 10). The measure of company directorships is also logged for precisely the same reasons.

3 The categories used are (1) mining and quarrying, (2) manufacturing, (3) electricity, gas and water supply, (4) construction, (5) wholesale and retail trade, (6) accommodation and food service activities, (7) transporting, storage, information and communication, (8) financial and insurance activities, and (9) other services. The categorisation is based on the company's listing in the Norwegian Register of Business Enterprises.

The model also includes fixed effects for the city-regions, with the aim of measuring whether there are any significant differences in the success rates of companies in the different regional innovation systems when other factors have been controlled for. Finally, ε represents the error term.

Table 3 presents the results for the logistic regression analysis of model (1) for each of the four measures of innovation. The models have been tested for multicollinearity, non-linearity of the linear predictor, and significant outliers, with no problems detected.

Table 3: Logit regression estimation of the empirical model. Innovativeness

	Product innovation	Radical product innovation	Process innovation	Radical process innovation
Diversity of regional partners	0.05 (0.03)	0.05 (0.04)	0.03 (0.03)	0.01 (0.04)
Diversity of national partners	0.05 (0.04)	0.03 (0.04)	0.07 (0.04)	0.07 (0.05)
Diversity of internat'l partners	0.19*** (0.05)	0.23*** (0.05)	0.09 (0.05)	0.13** (0.05)
Manager's education level	-0.01 (0.02)	0.02 (0.03)	0.00 (0.02)	0.04 (0.03)
Manager's age	-0.01* (0.01)	-0.01 (0.01)	-0.01 (0.01)	0.01 (0.01)
Manager's log no. company dir.ships	0.22** (0.07)	0.16 (0.08)	0.08 (0.08)	0.08 (0.09)
Log no. of employees	0.22*** (0.06)	0.15* (0.06)	0.25*** (0.06)	0.18** (0.07)
Share held by foreign owners	0.50* (0.21)	0.43* (0.19)	0.28 (0.19)	0.13 (0.22)
Industry	Controlled***	Controlled***	Controlled***	Controlled***
Region	Controlled	Controlled	Controlled	Controlled
Constant	-0.11 (0.44)	-1.65*** (0.47)	-0.60 (0.43)	-2.66*** (0.55)
N	1602	1602	1602	1602
Pseudo R^2	0.09	0.09	0.07	0.07

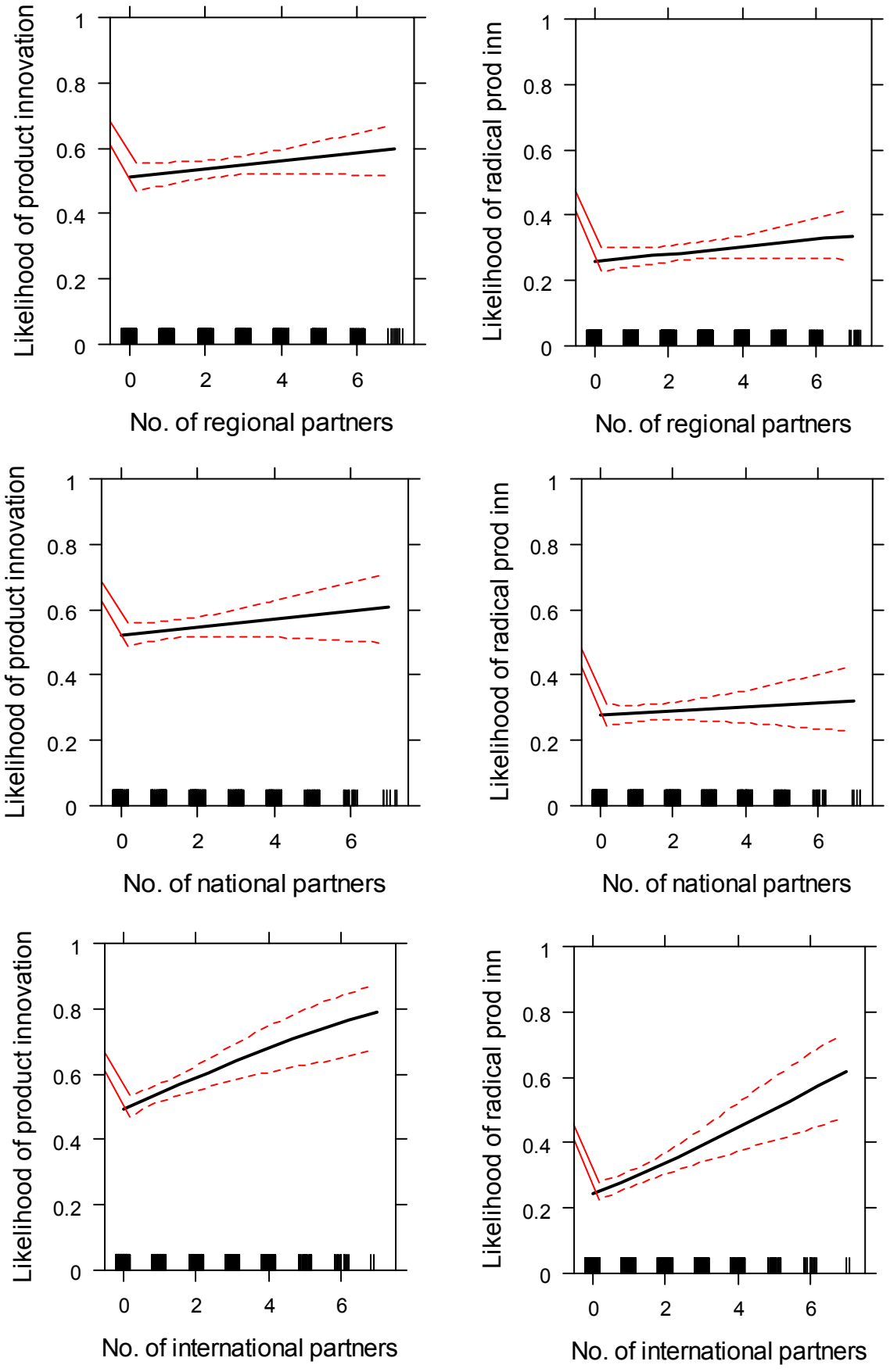
Note: * = P < 0.05 ** = P < 0.01 *** = P < 0.001

The top number in each cell denotes the coefficient, with the standard error listed below in parentheses.

The analysis shows that the number of regional and national partner types used does not significantly impact the likelihood of any form of successful innovation outcome, be it product or process, radical or incremental innovation. However, the number of international

partner types used has a significant positive impact on both overall and radical product innovation, as well as on radical process innovation. For product innovation, using one more type of international partner improves the odds of successfully introducing innovation by $e^{0.19}$ = 21 percent, controlling for other variables. The effect increases to $e^{0.23}$ = 26 percent for radical product innovation. For process innovation, the diversity of international partners has a non-significant ($p = 0.06$), but still positive effect, and also a statistically significant positive effect on radical process innovation, with a predicted increase in the odds of innovation of $e^{0.13}$ = 14 percent for every new type of partner. Figure 2 shows the predicted likelihood of innovation at different levels of collaboration with regional, national, and international partners, respectively, for a firm with average values on all other variables in the model. The effects displays in the first column of the figure show the impact of the different forms of collaboration on the likelihood of total product innovation, while those in the second column show the impact on the likelihood of radical product innovation. The dotted lines in the displays represent 95 percent confidence bands of the estimates.

Figure 2: Effects of cooperation on total and radical product innovation, by distance



Local interaction does not seem to be driving innovation among agglomerated firms in Norway (Figure 2). The benefits of face-to-face collaboration, which is likely to be more frequent among regional partners, are outweighed by the gains from seeking out targeted international partners that possess the knowledge needed by the firm in order to innovate. The positive slope of the likelihood to innovate or to produce radical innovation as the number of partners increases is much more pronounced for international partners than when local or national partners are considered (Figure 2). These findings challenge the assertion that innovation takes place in institutionally thick environments with a multitude of connections among partners operating in close geographical proximity, especially in a small and peripheral country such as Norway.

These results somewhat contradict the findings of Isaksen (2009) from a study of six knowledge-intensive clusters defined as Norwegian Centres of Excellence, where he emphasizes the importance of national collaboration in innovation processes. Similar to Isaksen's results, we find that firms find most of their partners inside Norway, even when it comes to universities and research institutes (Figure 1), but these types of collaboration do not significantly impact the likelihood of successful innovation. We also discover no evidence that local collaboration and national partners complement each other in innovation processes, as neither seem to significantly affect innovation outcomes.

Manager characteristics do not have a big impact on the likelihood of innovation. Only for product innovation do younger managers and those with large personal networks in other firms significantly improve the odds of innovation, while the manager's education level never has a significant impact on innovation when other factors are controlled for. However, firm characteristics do matter. Company size has a significant positive impact on all forms of innovation, while foreign ownership improves the odds of both overall and radical product innovation, even controlling for the use of international partners, but does not significantly

impact the odds of process innovation. There are also relevant differences across industries, but no evidence that geographical location in any of the five city-regions considered affects the propensity of a firm to innovate, once other factors are controlled for.

Determinants of local and non-local collaboration

While most analyses about the role of cooperation within and outside the region stop at this stage, it is also useful to investigate which firms engage in the different forms of geographical collaboration in their pursuit of innovation. Are the same factors driving both local and non-local collaboration, or is there a different set of factors responsible for driving international linkages compared to local networks? Furthermore, is the decision by firms to engage in collaboration mainly a function of the characteristics of the firm – such as sector, size, and ownership – or do characteristics of the manager also matter? In order to examine the extent to which firm-level and manager-level characteristics affect the use of regional, national, and international partners by firms, we conduct a negative binomial regression analysis for overdispersed count data, using the number of partners – both in total and within each geographical level – as the dependent variable.

The regression model takes on the following form:

$$g(\hat{Y}_i) = \alpha + \beta_1 \text{ Characteristics of firm}_i + \beta_2 \text{ Characteristics of manager of firm}_i + \gamma_3 \text{ Region}_i + \varepsilon_i \quad (2)$$

where $g(\hat{Y}_i)$ is a negative binomial generalisation of the number of partners used by the company. Four different models are run, referring to the total number of partners (Total) used by firm *i*, and to the number of partners located regionally (Regional), elsewhere in the country (National), and abroad (International), respectively. β_1 and β_2 are the coefficients for the independent variables related to firm *i* and its manager, further specified below. We once

again include fixed effects for the five city-regions in which firms are located, and ε depicts the error term.

Three different firm-level characteristics are considered in the model. First, we expect the levels and geographical patterns of collaboration to vary across industries. There may be larger and more specialised regional networks in certain industries, and the viability of long-distance knowledge flows may also depend on industry characteristics. Second, company size will affect the capacity of firms to develop extensive networks at all levels. Third, partly or fully foreign owned companies will collaborate more internationally than domestically owned companies.

For the manager, we include indicators related to age and level of education, as well as directorships held in other companies, expecting these personal networks in which the manager participates to shape collaboration at the firm level. Last, but not least, we examine the influence of cultural factors, specifically the values and attitudes of the firms' managers. In the existing literature, culture has particularly been connected with local interaction. Trust and social capital are increasingly seen as key to the diffusion of tacit knowledge in localised environments (Amin and Thrift 1995; Trigilia 1992). However, cultural factors are probably at least as important in setting up global pipelines, considering that the ability to connect with partners in far-away locations requires open-mindedness to the potential for learning from foreign cultures and sufficient cultural competence to connect with people from other countries.

The model includes four value dimensions derived through principal components analysis from twelve survey questions capturing managers' value orientations. All twelve indicators of manager's values are entered into the analysis, and components with eigenvalues above 1 are

extracted and varimax rotated[4]. The analysis returned four components that altogether explain 51 percent of the variance in the data. Based on an examination of indicators' factor loadings on each component, we have labelled components 1 – 4 'regional trust', 'open-mindedness', 'regional-mindedness', and 'work-related trust', respectively. The regional trust dimension encompasses indicators capturing trust in regional business managers, politicians, and public officials, and on general trust in other people. The open-mindedness dimension mainly captures openness towards foreign cultures, change, and new ideas. Regional-mindedness refers to a pro-regional sentiment, including a preference for maintaining regional employment at the expense of company profits, and finding it easier to cooperate with local and regional actors. However, this dimension also includes conservatism towards new ideas. Finally, work-related trust captures trust in employees and inclusion of staff in decision-making processes, as well as general trust in other people (Fitjar and Rodríguez-Pose, 2011). The appendix table provides further details on the principal components analysis.

Table 4 presents the results for the negative binomial regression analysis of model (2) for each of the four measures of cooperation. The models have been tested for multicollinearity, non-linearity of the linear predictor, and significant outliers, with no problems detected.

4 The regression analysis was also run using the indicator variable with the highest factor loading within each component instead of the rotated component itself. This analysis yielded broadly the same findings as the analysis reported in Table 4.

Table 4: Negative binomial regression estimation of the empirical model. Diversity of partners by geographical distance

	Total	Regional	National	Internat'l
Manager characteristics				
Value: regional trust	0.04** (0.01)	0.07*** (0.02)	0.06* (0.03)	-0.00 (0.03)
Value: work-related trust	0.01 (0.01)	0.02 (0.02)	-0.01 (0.03)	-0.03 (0.03)
Value: open-mindedness	0.04** (0.01)	0.02 (0.02)	0.01 (0.03)	0.23*** (0.04)
Value: regional-mindedness	-0.05** (0.02)	0.00 (0.02)	-0.16*** (0.03)	-0.20*** (0.04)
Education level	0.01* (0.01)	-0.00 (0.01)	0.03* (0.01)	0.07*** (0.02)
Age	-0.01*** (0.01)	-0.01*** (0.00)	-0.00 (0.00)	-0.01 (0.00)
Log no. of company directorships held	0.03 (0.02)	0.01 (0.03)	0.06 (0.04)	-0.01 (0.05)
Firm characteristics				
Log company size (no. of employees)	0.06*** (0.02)	0.06** (0.02)	0.16*** (0.03)	0.15*** (0.03)
Share held by foreign owners	0.14** (0.04)	-0.14* (0.07)	-0.08 (0.09)	0.80*** (0.09)
Industry	Controlled***	Controlled***	Controlled***	Controlled***
Region	Controlled*	Controlled***	Controlled*	Controlled
Constant	1.31*** (0.11)	1.29*** (0.15)	0.10 (0.22)	-0.91*** (0.26)
N	1602	1602	1602	1602
R^2	0.02	0.02	0.04	0.12
Alpha	0.00	0.11*** (0.02)	0.42*** (0.05)	0.43*** (0.06)

Note: * = P < 0.05 ** = P < 0.01 *** = P < 0.001

The top number in each row denotes the coefficient, with standard errors listed below in parentheses.

The analysis suggests that three of the four value dimensions – regional trust, open-mindedness, and regional-mindedness – have a significant impact on the total number of partner types used by the company. The effect is positive for regional trust and open-mindedness, and negative for regional-mindedness. However, the effect of these value dimensions is different for local interaction compared to global pipeline collaboration. These results are displayed graphically in Figure 3, which shows the effects of manager values on regional and international collaboration (shown in the first and second column, respectively). The figure shows the predicted number of partners used by firms at different levels of trust, open-mindedness, and regional-mindedness of their managers. All other variables are controlled at their means, and the dotted lines represent 95 percent confidence bands.

In line with earlier findings on the importance of trust for knowledge flows in local networks, regional trust has a positive effect on cooperation with regional partners. Regional trust also spills over into collaboration with partners from elsewhere in the country, having a weaker, but still positive effect on the number of national partner types used. However, regional trust does not significantly affect the use of international partners. Holding the values of all the other variables to their means, while increasing the manager's level of regional trust from its minimum to its maximum observed value, the predicted number of regional partner types used by the company increases from 1.8 to 2.6, while the predicted number of national partner types increases from 1.0 to 1.4.

Conversely, open-mindedness does not matter for regional and national cooperation, but has a strong and significant positive effect on international cooperation. Within the country and the national cultural sphere, levels of trust seem more important than open-mindedness. However, for global pipeline collaboration, trust ceases to make a difference and open-mindedness becomes more important for managers in establishing international connections. Increasing

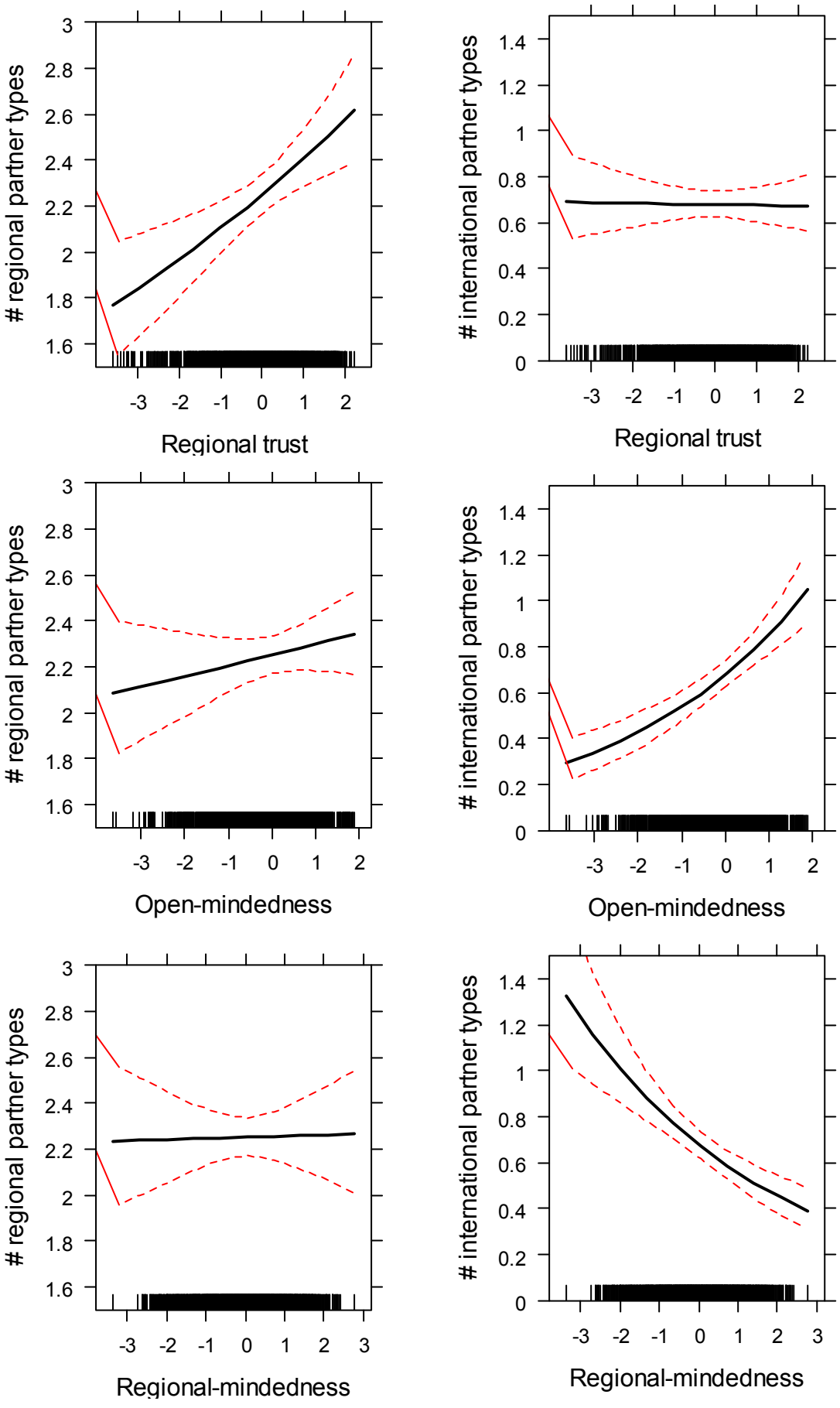
the value of the open-mindedness dimension from the minimum to the maximum level, while controlling all other variables at their means, results in an increase in the predicted number of international partner types from 0.3 to 1.0.

Both the above findings are in line with expectations, but the managers' level of regional-mindedness has more surprising effects on their firms' patterns of collaboration. A higher level of regional orientation by managers does not seem to result in higher levels of regional collaboration by their firms. However, regional orientation does have a significant negative impact on cooperation with partners from outside the region. Increasing the level of regional-mindedness from the minimum to the maximum value reduces the predicted number of national partner types from 2.2 to 0.8 and the predicted number of international partner types from 1.3 to 0.4. Finally, work-related trust does not have a significant impact on any of the types of cooperation.

Overall, manager values have a significant impact on the company's level of cooperation[5], and they work in fundamentally different ways for local compared to international interaction.

5 As is often the case in social science research, the direction of causality is not straightforward. There are at least two concerns that suggest some degree of reverse causality may be captured in these empirical relationships. Firstly, a successful history of collaboration with partners will make managers more trusting and, in the case of international collaboration, more open-minded. Secondly, internationally oriented firms may purposely recruit managers that possess certain values, e.g. open-mindedness (we owe the latter point to an anonymous referee).

Figure 3: Managers' value orientations and their firms' patterns of collaboration



Other manager characteristics also matter for their firms' engagement in local and non-local collaboration. More educated managers cooperate with a significantly higher number of national and, particularly, international partners, but education does not count for regional cooperation. Conversely, age has a significant negative impact on the use of regional partners, but not on national or international cooperation. The manager's personal network in terms of directorships held in other companies does not significantly affect any type of cooperation.

When it comes to firm characteristics, company size has a significant positive effect on all forms of cooperation, but, in line with expectations, seems to matter even more for the costlier pipeline-type collaboration than for regional collaboration. Ownership also has an effect on the choice of partners: Foreign-owned companies are, not surprisingly, likely to cooperate with a higher number of foreign partners. They also engage less in local collaboration, while not differing from domestically owned companies when it comes to national collaboration outside the region. There are also significant differences between industries. The highest levels of international collaboration are found in the mining, manufacturing, trade and services sectors, whereas the supplies and mining sectors have the highest levels of regional collaboration.

There are also significant differences between regions in their levels of cooperation, even controlling for all the other variables in the model. For total partners, businesses in Trondheim cooperate with a significantly higher number of partner types than those in Oslo. When it comes to regional partners, the number of partner types used by companies in Oslo was significantly lower than all the other four city regions. For national partners, being located in Oslo, Bergen, and Stavanger has a significant negative impact on the number of partner types used compared to Kristiansand. However, there were no significant differences between city-regions in the number of international partner types used, controlling for the effects of other

variables. The region in which a company is located seems to matter more for local collaboration than for international interaction.

Conclusion

Recent analyses of clusters and agglomeration have looked for the sources of innovation of firms in the combination of the multiple interactions of firms within the region and in the connections of certain firms in the region with the outside world. The story emerging was one of complementarity. Local interaction took place without much effort through frequent face-to-face interaction in high trust environments, while global pipelines implied a conscious and often costly attempt by individual firms to engage with external actors in order to generate greater innovation and reap economic benefits. The reward of creating or engaging in global pipelines was radical innovation in individual firms. Radical innovation benefited first the firms involved in the global pipeline, but was ultimately diffused almost effortlessly within the region through local interaction or local buzz.

The problem with the view of global pipelines and local interaction reinforcing one another is that it has always been tested in specific case studies where it often seems to have worked. There is a dearth of analyses that have systematically addressed whether the complementarity of these two types of interaction holds across a large number of firms. This has been the main aim of this paper, which has looked at the sources of innovation of 1604 firms across the five main urban agglomerations in Norway.

The picture which emerges from the analysis does not conform to that generally stemming from the theoretical literature and from case-studies. The starting point is similar: once other characteristics are controlled for, international cooperation appears as the main source of radical product and process innovation. However, pipeline-type interactions are also

conducive to incremental product innovation. In contrast to most previous analyses[6], local (e.g. Porter, 1990) and, more specifically for the case of Norway, national (Onsager et al., 2007; Isaksen, 2009) interactions do not seem to promote firm-level innovation. There is also little evidence of complementarity between global pipelines and local interaction within Norwegian agglomerations. Firms that develop international partnerships are likely to innovate, firms that rely on national and local interaction are not, meaning that the transfer mechanisms of knowledge and innovation within close geographical proximity are either broken or less prominent than previously thought. Firms can therefore not expect to rely on local interaction for new knowledge. The creation and engagement in pipelines is a must if they are to remain innovative and competitive.

We can only speculate as to why this is the case. Part of the reason may be that frequent and repeated interactions with other socioeconomic actors in relatively small and high trust environments may not yield the expected returns. High cognitive, social, and institutional proximity may end up creating a relatively homogenous environment in which new ideas find it difficult to take hold and diffuse. It may also be the case that firms in the same sector, which by definition are bound to be competitors, may be less prone to interact and collaborate than previously thought. But what this study has demonstrated is that the attitudes of individual managers play an important part in the innovative capacity of their firms. Open-minded managers without excessive regional orientations are often in charge of firms which develop a greater number of international interactions of the sort that promote greater innovation. In contrast, managers who exhibit a greater regional trust are better at establishing local, regional, and national channels of cooperation which do not necessarily result in greater innovation.

6 Only a limited number of theoretical contributions (e.g. Bathelt et al, 2004) and empirical studies (e.g. Malmberg and Power, 2005) have upheld relatively similar views.

The contrasting results between our firm-based quantitative approach and the more traditional case-study approaches open new challenges and new avenues for research. The reasons for the contrast between our results and those of previous cluster-based studies, which, in the case of Norway (Onsager et al., 2007; Isaksen, 2009), tend to highlight, with different nuances, the relevance of the local, international, and, especially, national scales in generating the interactions to ensure the dynamism of the region, deserve closer scrutiny. Do firms in all regions behave in a similar way? Or do place-specific historical, institutional, or socioeconomic distinctions render the archetypical sources of innovation identified in this paper nothing more than statistical artefacts far removed from the reality in Norwegian cities? Are there significant differences across Norwegian regions? And why does local interaction seem to be less conducive to innovation than previously thought? All these questions demand answers and a more concerted effort to analyse how firms in agglomerations innovate using different theoretical approaches and methods.

References

Amin A, Thrift N, 1995, "Globalization, institutional thickness and the local economy" in P Healy, S Cameron, A Davoudi, eds., *Managing Cities: The New urban Context*, pp. 91-108, Chichester: J. Wiley.

Asheim B, Coenen L, Vang J, 2007, "Face-to-face, buzz, and knowledge bases: sociospatial implications for learning, innovation, and innovation policy" Environment and Planning C: Government and Policy 25(5) 655 – 670.

Bagnasco A, 1988, "*La costruzione sociale del mercato. Studi sullo sviluppo di piccola impresa in Italia*", Bologna: Il Mulino.

Baptista R, Swann, P, 1998, "Do firms in clusters innovate more?" *Research Policy* 27, 525-540.

Bathelt H, 2001, "Regional competence and economic recovery: divergent growth paths in Boston's high technology economy" *Entrepreneurship and Regional Development* 13, 287–314.

Bathelt H, Malmberg A, Maskell P, 2004, "Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation" *Progress in Human Geography* 28, 31-56.

Becattini G, 1987, "*Mercato e forze locali. Il distretto industriale*" Bologna: Il Mulino.

Boschma RA, 2005, "Proximity and innovation: a critical assessment" *Regional Studies* 39, 61-74.

Boschma RA, Eriksson R, Lindgren U, 2009, "How does labour mobility affect the performance of plants? The importance of relatedness and geographical proximity" *Journal of Economic Geography* 9(2), 169-190

Boschma RA, Iammarino S, 2009, "Related variety, trade linkages and regional growth in Italy" *Economic Geography* 85(3), 289-311.

Doloreux D, Dionne S, 2008, "Is regional innovation system development possible in peripheral regions? Some evidence from the case of La Pocatière, Canada" *Entrepreneurship and Regional Development* 20, 259-283.

Doloreux D, Parto S, 2005, "Regional innovation systems: Current discourse and unresolved issues" *Technology in Society* 27, 133-153.

Eriksson R, Lindgren U, 2009, "Localized mobility clusters: Impacts of labour market externalities on firm performance" *Journal of Economic Geography* 9(1), 33-53.

Frenken K, Van Oort F, Verburg T, 2007, "Related variety, unrelated variety and regional economic growth" *Regional Studies* 41(5), 685-97.

Fitjar RD, Rodríguez-Pose A, 2011, "Innovating in the periphery: Firms, values, and innovation in Southwest Norway" *European Planning Studies*, forthcoming

Gertler MS, 1995, "'Being there': Proximity, organization, and culture in the development adoption of advanced manufacturing technologies" *Economic Geography* 71, 1-26.

Gertler MS, 2003, "Tacit Knowledge and the Economic Geography of Context, or, the Undefinable Tacitness of being (there)" *Journal of Economic Geography* 3, 75–99.

Gertler MS, Wolfe D, 2006, "Spaces of knowledge flows: Clusters in a global context" in B Asheim, P Cooke, R Martin, eds., Clusters and regional development: Critical reflections and explorations, pp. 218–35. London and NewYork: Routledge.

Gordon IR, McCann, P, 2000, "Industrial clusters: complexes, agglomeration and/or social networks?" Urban Studies 37, 513–532.

Inglehart R, 2000, "Culture and democracy" in LE Harrison and SP Huntington, eds., *Culture matters: How values shape human progress*. New York: Basic Books.

Isaksen A, 2009, "Innovation dynamics of global competitive regional clusters: The case of the Norwegian Centres of Enterprise" *Regional Studies* 43, 1155-1166.

Leknes E, 2010, "Fremveksten av byregioner i Norge" in AA Farsund and E Leknes, eds., *Norske byregioner: Utviklingstrekk og styringsutfordringer*. Kristiansand: Høyskoleforlaget.

Malecki EJ, 2000, "Knowledge and regional competitiveness" *Erkunde* 54, 334-351.

Malecki EJ, Oinas P, eds., 1999, "Making connections. Technological learning and regional economic change" Aldershot: Ashgate.

Malmberg A and Power D, 2001 "(How) do (firms in) clusters create knowledge?" *Industry and Innovation* 12, 409-431.

Markusen A, 1996, "Sticky places in slippery space: A typology of industrial districts" *Economic Geography* 72(3), 293-313.

Maskell P, 2001, "Towards a knowledge-based theory of the geographical cluster" *Industrial and Corporate Change* 10, 921-943.

Maskell P, Bathelt H, Malmberg A, 2006, "Building global knowledge pipelines: the role of temporary clusters" *European Planning Studies* 14, 997-1013.

Maskell P, Eskelinen H, Hannibalsson I, Malmberg A, Vatne E, 1998, "*Competitiveness, localised learning and regional development : specialization and prosperity in small open economies*" Routledge: London.

Mehlum H, Moene K, Torvik R, 2006, "Institutions and the Resource Curse" *The Economic Journal* 116, 1-20.

Ministry of Local Government and Regional Development, 2003, "Greater cities report: On the development of greater city policies" Government White Paper no. 31, 2002-2003.

Moodysson J, 2008, "Principles and practices of knowledge creation: On the organization of 'buzz' and 'pipelines' in life science communities" *Economic Geography* 84, 449-469.

Moodysson J, Jonsson O, 2007, "Knowledge collaboration and proximity: The spatial organization of biotech innovation projects" *European Urban and Regional Studies* 14, 115-131.

Moodysson J, Coenen L, Asheim B, 2008, "Explaining spatial patterns of innovation: analytical and synthetic modes of knowledge creation in the Medicon Valley life-science cluster" Environment and Planning A 40(5) 1040-1056.

Norman, VD, 1983, "*Næringsstruktur og utenrikshandel i en liten, åpen økonomi*" Oslo: Gyldendal.

Onsager K, Isaksen A, Fraas M, Johnstad T, 2007, "Technology cities in Norway. Innovating in glocal networks" *European Planning Studies* 15, 549-566.

Porter M, 1990, "*The competitive advantage of nations*". London: Macmillan.

Rodríguez-Pose A, Crescenzi R, 2008, ``Research and development, spillovers, innovation systems, and the genesis of regional growth in Europe" Regional Studies 42, 51-67.

Storper M, Venables AJ, 2004, "Buzz: face-to-face contact and the urban economy" *Journal of Economic Geography* 4, 351-370.

Trigilia C, 1992, *Sviluppo senza autonomia. Effetti perversi delle politiche nel Mezzogiorno*. Bologna: Il Mulino.

Trippl M, Tödtling F, Lengauer L, 2009, "Knowledge sourcing beyond buzz and pipelines: evidence from the Vienna software sector" *Economic Geography* 85, 443-462.

Wolfe DA, Gertler MS, 2004, "Clusters from the inside and out: Local dynamics and global linkages" *Urban Studies* 41, 1071-1093.

Appendix 1: Principal components analysis

Table A1: Principal components analysis

Dimension	*Comp. 1*	*Comp. 2*	*Comp. 3*	*Comp. 4*	*Unexpl*
'Most people can be trusted' (dichotomy).	0.37	-0.13	-0.29	0.37	0.64
'I trust other business managers in this region'.	0.67	-0.00	0.06	0.05	0.54
'I trust politicians in this region'.	0.77	0.07	-0.02	-0.04	0.40
'I trust public officials in this region'.	0.74	0.08	-0.02	0.10	0.44
'It is important to maintain employment in the region, even when it hurts company profits'	0.06	0.06	0.65	0.11	0.56
'I find it easier to cooperate with local and regional actors than people from other parts of the country'	0.04	-0.07	0.70	-0.00	0.51
'It is right to include employees in decision-making, even if the processes take longer'.	0.12	0.14	-0.02	0.72	0.45
'It can be right to let the employees get their way even in cases where other options in my opinion would have been better'.	-0.04	0.04	0.17	0.72	0.45
'The old and proven is usually better than newfangled ideas'	-0.09	-0.11	0.54	0.00	0.69
'I need to improve my understanding of other countries' cultures'.	0.07	0.69	-0.20	-0.06	0.48
'I wish Norway and Norwegians were more open to the world around us'.	0.09	0.76	-0.03	0.02	0.41
'I'm most comfortable around people who are open to change and new ideas'.	-0.05	0.62	0.09	0.22	0.56
Eigenvalue	1.77	1.49	1.36	1.25	
% of variance	14.7	12.5	11.3	10.4	51.0

Components with eigenvalues > 1 were extracted and rotated using the varimax with Kaiser normalisation procedure. Missing values and ‘don’t know’ were replaced with series means for individual indicators before the analysis was run.