

DISCUSSION PAPER SERIES

No. 11067

NOTHING IS IN THE AIR

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***INTERNATIONAL TRADE AND
REGIONAL ECONOMICS***



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Discussion Paper No. 11067

January 2016

Submitted 11 January 2016

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NOTHING IS IN THE AIR

Abstract

It has often been argued that ‘there is something in the air’ which makes firms in high-density environments – such as cities or clusters – more innovative. The co-location of firms facilitates the emergence of serendipity and casual encounters which promote innovation in firms. We assess this hypothesis using data from a survey of Norwegian firms engaged in innovation partnerships. The results indicate that there may be ‘much less in the air’ than is generally assumed in the literature. The relationships conducive to innovation by Norwegian firms emerged as a consequence of purpose-built searches and had little to do with chance, serendipity, or ‘being there’.

JEL Classification: O31 and O33

Keywords: agglomeration, externalities, firms, innovation, Norway, spillovers and tacit knowledge

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“Love [*knowledge*] is in the air
Everywhere I look around
Love [*knowledge*] is in the air
Every sight and every sound

And I don't know if I'm being foolish
Don't know if I'm being wise
But it's something that I must believe in
And it's there when I look in your eyes”

George Young and Harry Vanda [performed by John Paul Young] (1977)

1. INTRODUCTION

It has often been assumed that knowledge is like love in the famous 1977 John Paul Young disco hit: “in the air, everywhere I look around”. This assumption has its origins in the work of Alfred Marshall, who stated in his 1890 book *The Principles of Economics* that “When an industry has thus chosen a locality for itself, it is likely to stay there long [...]. The mysteries of the trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously” (Alfred Marshall, 1890: 198).

Although Marshall may more likely have been referring to processes such as learning-by-doing and learning-by-observing in clusters, his famous sentence has been frequently used to suggest that the knowledge which allows individuals and firms to innovate can be found ‘in the air’. Especially in high-density environments, such as cities or clusters, the co-location of firms, researchers, and workers is assumed to facilitate the generation and transfer of knowledge – and, in particular, tacit knowledge – through mechanisms such as demonstration, face-to-face interaction, and social relations (Gertler, 2003; Maskell and Malmberg, 1999; Martin and Moodysson, 2011). The geographic proximity between innovating actors in clusters or urban environments creates the ideal conditions and the necessary externalities not only for the generation, but particularly for the rapid diffusion of new knowledge (Krugman, 1998: 8), allowing ideas to travel more rapidly (Glaeser, 1998: 147). Hence, in these high-density environments, tacit knowledge, which is difficult to diffuse through formal channels (Cooke and Morgan, 1998; Maskell and Malmberg, 1999; Morgan, 1997), can be somewhat effortlessly reaped through social interaction, because it is “in the air, [in] every sight and every sound”.

One particularly pervasive claim related to the idea that knowledge is ‘in the air’ is the conviction that physical proximity promotes the emergence of casual or chance encounters which, in turn, lead to the formation of partnerships and facilitates the circulation of new, often tacit, knowledge within the cluster or the city. When entrepreneurs and managers look for innovative solutions to firm-level problems, these solutions are often “more likely to come from local sources – either through tapping networks of people working on similar things or through serendipitous encounters” (Feldman and Kogler, 2010: 386). Serendipity and chance encounters, consequently, contribute to making high-density environments more innovative than remote and/or isolated places.

Yet, whether chance encounters and serendipity can be easily transformed into innovation and new economic activity is, as in the case of John Paul Young’s song, “something that [we] must believe in”. Whereas the mechanisms through which tacit knowledge is disseminated in high-density environments have been richly described, the main caveat with the literature that emphasizes chance and casual

encounters as a mechanism for the diffusion of knowledge is that the connection between these exchanges and actual innovation and economic activity has not really been demonstrated. It has been argued that the co-location of economic actors leads to greater face-to-face interaction (Bathelt, Maskell and Malmberg, 2004; Depner and Bathelt, 2005: 58; Gertler, 2003: 84; Rekers and Hansen, 2015) and that much of the face-to-face interaction is not planned, but mostly the result of happenstance and chance meetings associated with living and working in high-density and diverse environments. Density generates opportunities “for repeated contacts and the serendipity of casual exchange in a known local milieu” (Amin and Cohendet, 2005: 466). Diversity, in turn, “facilitates haphazard, serendipitous contact among people” (Storper and Venables, 2004: 352). But, to what extent can these serendipitous events be transformed into economically viable innovation? There is little evidence in the literature that demonstrates that serendipity is behind the introduction of new or incremental innovations in specific firms. Most of the casual interaction within cities or clusters will have no economic purpose and/or value. Even in cases in which interaction leads to economically viable knowledge being exchanged, the knowledge in circulation may be not new or even redundant. In addition, in relatively closed systems the knowledge exchange may be at risk of lock-in, effectively limiting the potential for implementation of new technologies or the identification of new market possibilities (Boschma, 2005: 64). Consequently, firms in regions with high levels of social capital may come to rely too much on local knowledge circulation at the expense of international connections (Laursen, Masciarelli and Prencipe, 2012).

In this paper, we address this gap in the literature by directly asking entrepreneurs and managers of firms about the extent to which the introduction of innovation in the firm responds to partnerships which emerge as a consequence of casual and/or serendipitous events and interactions or, by contrast, is the result of partnerships resulting from purpose-built planning and a careful assessment of the needs and possibilities of the firm. In particular, we focus on three specific questions: a) do partnerships emerge casually?; b) do local partnerships emerge casually?; and c) do casual encounters result in innovation? We aim to answer these questions by using a unique, tailor-made survey of 542 firms in Norway, in which entrepreneurs and firm managers are explicitly asked about their most important relationship for the introduction of new products and processes over the last three years and about how this relationship emerged. We distinguish between purpose-built relationships, resulting from research done in-house or on advice of other partner organizations, and serendipitous or casual relationships, based on personal connections, social capital, casual interactions, and chance encounters.

The results of the analysis indicate that, at least in the case of Norway, there may be ‘much less in the air’ than is generally assumed in the literature. Most of the relationships conducive to innovation in Norwegian firms emerged as a consequence of purpose-built searches and had little to do with chance, serendipity, or ‘being there’. In addition, the limited numbers of relationships that result from casual encounters tend, with the exception of new-to-the-industry process innovations, not to be associated with higher levels of actual innovation, while purpose-built relationships are more clearly associated with innovation outcomes.

The paper is structured along the following lines: In the next section, we make a case for the ‘there is something in the air’ hypothesis. In section 3 we, however, underline that the belief that ‘there is something in the air’ has been mainly built on assumptions, rather than demonstrated empirically. Section 4 presents the empirical analysis and gives an answer to the three main questions of the paper. Finally, section 5 gives the conclusions.

2. THE CASE FOR ‘SOMETHING IN THE AIR’

Innovation is never an easy, linear process. Why a firm is more capable of introducing new products and processes than a neighboring firm with similar characteristics is often shrouded in mystery. Factors such as the size of the firm, the level of education of its employees, the management structure,

or the investment of the firm in research and development are often mentioned as essential for the innovative capacity of the firm. However, once these factors are taken into account, a great deal of uncertainty remains about what determines the innovativeness of firms.

This uncertainty has fueled the interest of researchers in alternative explanations. Many have focused on the role of geographical concentrations of firms in clusters and/or cities and on their capacity to create the right ‘industrial atmosphere’ (Marshall, 1919) for the development of innovation. It has been frequently documented that firms tend to thrive and become much more innovative in densely populated and diverse environments, such as cities or clusters (Huijbens, Jóhannesson, and Jóhannesson, 2014: 65). As knowledge – and, especially, tacit knowledge – travels with difficulty, the geographical clustering of firms generates a number of externalities (Gertler, 2003). Firms in dense environments, such as clusters, benefit from localization economies, or the externalities arising from the concentration of firms in the same or in related sectors. Firms in cities – on top of profiting from localization economies – also benefit from urbanization externalities related to urban diversity. The main indications of the existence of both types of externalities include the frequent exchange of ideas through formal and informal channels and the production of knowledge spillovers. As Marshall himself put it, in these dense and diverse environments “if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas” (Marshall, 1890: 198). Firms gain from greater knowledge creation and from a faster flow of ideas across firms and workers than in other environments (Glaeser et al., 2001: 31), producing what Giuliani and Bell (2005: 64) describe as “complex economic and cognitive space[s] where firms establish knowledge linkages not simply because of their spatial proximity but in ways that are shaped by their own particular knowledge bases”.

Consequently, firms embedded in clusters and cities – and depending on their absorptive capacity (Giuliani and Bell, 2005) – gain from non-traded inputs which are supplied in greater variety and at a lower cost (Audretsch and Fritsch, 1994: 360). Innovation in these environments is also a consequence of the greater opportunities and possibilities of worker mobility (Agrawal et al., 2006; Breschi and Lissoni, 2009), and of the presence of upstream activities breeding innovation and productivity gains (Rigby and Essletzbichler, 2002: 428). In sum, firms profit from just ‘being there’ (Gertler, 1995; 2003). And no type of firms profit more from cluster and urban externalities than small new firms, which can substitute in-house generated knowledge by the knowledge and spillovers diffused in these tightly knit environments (Audretsch and Fritsch, 1994).

According to Martin and Moodysson (2011), the advantages of ‘being there’ are based on two types of assumptions. First, simple accessibility constraints limit the capacity to access knowledge generated at a distance. Second and more importantly, the transmission of tacit knowledge is likely to only take place through direct face-to-face interaction. As tacit knowledge is “person-embodied, context-dependent, spatially sticky, and socially accessible only through direct physical interaction” (Morgan, 2004: 12), face-to-face exchanges are at the root of reciprocity and processes of localized learning (Martin and Moodysson, 2011: 1186). Hence, co-location reduces transaction costs and contributes to generating the localized trust and shared culture that make face-to-face interaction and knowledge transfer not only possible, but often easy. Co-location has, however, the additional advantage of enabling informal and chance encounters between diverse individuals. Co-presence in cities and clusters is considered to encourage the formation of weak ties, that is “access to information and resources [by individuals and firms] beyond those available in their own social circle” (Granovetter, 1983: 209). Firm learning processes hence draw heavily on “the serendipity of co-presence” (Amin and Cohendet, 2005: 466). The assumption has generally been that co-location creates serendipitous environments where tacit knowledge becomes a public, freely available good. This very serendipity – or the aptitude for making desirable discoveries by accident – is supposed to facilitate the generation of incremental innovation through partnerships created following casual interaction, conversation, imitation, and joint problem-solving by co-localized economic actors (Glaeser, Kolko, and Saiz, 2001). Constant interaction in reduced geographical spaces thus further facilitates trust and additionally contributes to the reduction of transaction and communication costs associated with dense environments (Hansen, 2015: 1675). The ultimate result is the emergence of cities and clusters as

'innovation prone' environments (Rodríguez-Pose, 1999). In these conditions, the formation of partnerships that enable the transfer of knowledge from one firm to another is critically improved. "Constant flows of information and updates of this information, intended and unanticipated learning processes in organized and accidental meetings, based on the same understanding, interpretative schemes, and attitudes toward technology within a particular value chain" foster new innovation (Depner and Bathelt, 2005: 57).

Knowledge generation accordingly happens almost effortlessly through interaction and the formation of partnerships in a serendipitous way, facilitating the adoption of innovations by firms in the city and/or cluster (Audretsch and Feldman, 1996; Currid, 2007). As indicated by Depner and Bathelt (2005: 57) "actors do not have to search their environment or make particular investments to get access to this information"; knowledge generation can just happen both through planned interaction, as well as through chance, casual, and unintended encounters. Rauch (1993: 381f) similarly notes that "[i]t certainly seems reasonable to think that random meetings, as opposed to costly, prearranged ones, would take place within a limited spatial area". Hence, knowledge is perceived to be 'in the air'. It can be easily assimilated and its transmission is accelerated by the presence of certain common mechanisms within these dense ecologies, such as public codes of communication, shared cultural traditions and habits, past histories of collaboration, and personal knowledge based on years of interaction (Gertler, 2003: 84; Malmberg and Maskell, 2006: 7). Social capital is also key in this transmission (Staber, 2007). The transfer of knowledge is therefore not necessarily conducted through formal channels, but most often through "chatting, gossiping, brainstorming, in-depth discussions" and other informal ways (Bathelt et al, 2004: 39; see also Dahl and Pedersen, 2004). In brief, "firms and cities do feed off each other" (Greene et al., 2007: 5) and density and diversity lead to greater innovation.

According to Feldman et al. (2015: 7) "the process of innovation still requires debating ideas, unpredictable epiphanies and chance encounters. Innovation is essentially unpredictable – rooted in the creative sparks that make us human and the serendipity that makes life interesting". Similarly, Kakko and Inkinen (2009: 540, emphasis in the original) note that "*incidental* encounters and beneficial collisions also play a significant role in innovation processes", while Johannisson (2011: 142) advocates "[s]earching for a partner as an adventure and learning experience, guided by a belief in serendipity". In this context, 'being there' becomes crucial, as transferring the tacit knowledge at the base of innovation across geographical distances or organizational boundaries is not only costly, but also difficult. The existing channels – mobile communities of practice – "do not offer the same scope for reciprocity, serendipity, and trust that is afforded by sustained face-to-face contact" (Morgan, 2004: 12). Although it is true that this body of work does not claim that chance encounters and serendipity are the sole or even the most important factor behind the positive externalities associated with urban environments and clusters, they do award accidental and fortuitous meetings and happenstances a non-negligible role in explaining why physical co-location is considered to be a key driver of innovation.

By contrast, 'not being there' limits the innovation process. For outsiders, access to local knowledge can only be achieved through purpose-built contacts, meaning that innovation is costlier and less likely. In other words, outsiders cannot benefit from the chance encounters associated with innovation in densely populated environments (Cantwell and Mudambi, 2011: 209). Empirical studies on the emergence of international exchanges have found that "these discoveries were far from accidental and in no case was the meeting of exchange partners based on pure luck" (Ellis 2011: 121). Because of the space boundedness of tacit knowledge, isolated firms have to rely on either planned and deliberate approaches to potential partners with specific competencies, or on casually targeted encounters during situations of temporary proximity (e.g. in trade fairs or conferences) in order to build viable relationships for innovation (Maskell, Bathelt, and Malmberg, 2006; Torre, 2008).

3. DEMONSTRATING THAT THERE IS ‘SOMETHING IN THE AIR’

While the literature provides a compelling case for confirming that ‘there is something in the air’ and that local chance encounters in densely populated environments may create favorable conditions for innovation, the actual demonstration of whether the serendipity associated with ‘being there’ is an important and/or relevant factor behind innovation is still up for debate. There are several assumptions that, although taken for granted in the theoretical literature, are still under scrutiny in the empirical literature.

First, are firms in clusters or in urban environments more innovative? Although there is plenty of empirical evidence that supports that this is the case (e.g. Duranton and Puga, 2001; Feldman and Audretsch, 1999; Knudsen, Florida, Stolarick, and Gates, 2008; Lee and Rodríguez-Pose, 2013), other analyses have come to support the idea that this may not always be the case and that, particularly in the creative industries (those more likely to benefit from local ‘buzz’), urban or highly clustered firms may not enjoy an innovative advantage (Chapain et al., 2010; De Propris et al., 2009).

Second, do firms in clusters or cities collaborate more and is this collaboration the result of casual face-to-face interaction? This has been a widespread assumption. Geographical proximity is considered essential for collaboration. Recent research on firms in Sweden has, however, challenged this assumption. Grillitsch and Nilsson (2015) demonstrate, based on a sample of more than 2000 Swedish firms, that firms in peripheral locations collaborate more to compensate for what they believe to be a lack of access to positive externalities and spillovers. The evidence that greater density leads to more face-to-face casually-generated collaboration is also limited. Most analyses of face-to-face interaction have simulated rather than actually empirically measured the degree of interaction generated in densely populated environments (e.g. Farber et al., 2014; Isella et al., 2011).

Finally and most importantly for the purpose of this paper, we know next to nothing about whether frequent chance, casual, and/or serendipitous interaction between economic actors in urban environments and clusters leads to greater innovation. Does frequent interaction in high-density environments facilitate firm-level innovation? Despite significant recent progress in network analysis (e.g. Balland et al., 2012; Giuliani, 2013; Glückler, 2007), whether urban or cluster networks, in general, and the partnerships generated through casual interaction, in particular, facilitate innovation remains basically an assumption and a matter for future research agendas (Boschma and Fornahl, 2011). Frequent informal interaction may indeed smooth out the transmission of new, economically viable knowledge, enabling the rapid and relatively costless adoption of new innovation at firm level. But if the knowledge being circulated is unrelated to local production (as would often be the case) or neither new nor economically useful, frequent face-to-face interaction may just, in the best cases, represent a pleasant interlude and, in the worst case, a complete waste of time and of scarce resources. The latter may be the prevailing feature in situations of lock-in (Boschma, 2005). In relatively closed systems, the knowledge in circulation may be processed numerous times without being renewed, making it ineffectual in order to produce new innovations. As Shearmur (2012: S14) stresses, “although the laws of probability seem to suggest that there will be more chance encounters in cities than in less dense areas, the inherent social and cultural structuring of inter-personal encounters renders moot this type of reasoning [that local chance interaction leads to innovation], since encounters are rarely the result of chance”.

Consequently, the idea that “information spillovers which are typical of serendipitous networks provide cumulative advantage for co-location and cluster growth in technology and knowledge-intensive industries” (Glückler, 2007: 625) is still more often than not assumed, rather than demonstrated. This assumption has, however, rarely been challenged and existing challenges have tended to focus on clusters (e.g. Moodysson, 2008) rather than on urban environments.

4. MEASURING WHETHER THERE IS ‘SOMETHING IN THE AIR’

In this paper, we try to overcome this latter limitation in the literature by measuring whether there is ‘something in the air’ that leads to greater innovation. In particular, we concentrate on the numerous claims connecting serendipitous and chance encounters in highly dense economic environments with the formation of innovation partnerships and, subsequently, with innovation. There are numerous factors which make the ‘mysteries in the air’¹ and it is unfeasible to cover all of them in the space of a single paper. Thus, we focus on one mechanism that has been frequently heralded as a fundamental source of new innovation in clusters and urban environments: knowledge exchange in partnerships emerging from chance, casual, and/or serendipitous interaction. Consequently, the paper examines whether the presence of potential partners ‘in the air’ does indeed represent a major input in the innovation process of firms. In addressing this question, we put the emphasis on an area which has attracted relatively little systematic attention to date: how the relationships leading to innovation emerge. Three key questions drive our analysis:

- a) Do partnerships emerge casually?
- b) Do local partnerships emerge casually?
- c) Do casual encounters result in innovation?

We address these questions using data derived from a unique tailor-made survey of Norwegian firms, conducted in 2013. The survey consisted of two parts: first, 2002 CEOs of different firms participated in a telephone interview examining their firm’s innovation activities and partnerships. Second, all respondents were invited to complete a follow-up questionnaire, circulated via e-mail. In total, 542 firms participated in both the web questionnaire and the telephone interviews. Table 1 shows descriptive statistics for the firms that participated in each section. The firms were sampled among all firms with more than ten employees listed in the compulsory Norwegian Register of Business Enterprises. In order to probe the importance of location within dense urban clusters, we imposed quotas for the four largest urban regions of Norway: Oslo (quota 500 firms), Bergen (300), Stavanger (350) and Trondheim (250). In addition, we interviewed 600 firms located outside any of these city regions. The sampling and telephone interviews were conducted by an external market research firm with extensive experience, Ipsos MMI.

The follow-up questionnaire asked a series of questions about the firms’ relationship to their most important partner, which are of particular interest to this analysis. The introduction to these questions asked respondents to answer with reference to the external partner that had been most important for the firm’s development of new products or processes during the past three years. Consequently, the results reported pertain to how the partnership with the firm’s (self-reported) single most important partner emerged, while the questionnaire does not contain information about how the firm’s other partnerships (if any) emerged.

Of the 542 firms participating in the web survey, 458 firms – 84.5 percent – had collaborated with partners in innovation processes. Most of the partners considered most important were other firms – mainly suppliers (31.9 percent), customers (26.0 percent), or other units within the same business group (26.9 percent). Only 2.8 percent of the partners considered most important were universities or research institutes, and 2.0 percent were competitors. This predominance of industrial over scientific partners is reflective of the broader pattern among Norwegian firms of reliance on an experience-based, DUI-mode of innovation in which learning and user-producer interaction is important (e.g. Fagerberg et al. 2009; Fitjar and Rodríguez-Pose, 2013). While 41.0 percent of the collaborating firms

¹ While our paper focuses exclusively on partnerships emerging from chance, casual, and/or serendipitous encounters, it has to be acknowledged that ‘something is in the air’ refers to a lot of other types of interactions and benefits arising from geographical proximity. Worker mobility, social networks, and industrial culture, among others, are essential elements in the generation and diffusion of knowledge within densely inhabited areas (see Agrawal et al., 2006) that are not explicitly considered in the analysis.

reported also partnering with either a university or research institute, very few considered this their most important partner in innovation processes.

In the following three sections, we use the data from the survey in order to address each of the questions in turn.

4.1. Do Partnerships Emerge Casually?

The first question of interest is whether firms' relationships to their most important partners emerge casually – as suggested by theories supporting the idea that 'there is something in the air' – or are mostly planned and purpose-built. In order to examine this question, we asked firms how the relationship with their most important partner first came into being. Respondents had two options; first, by coincidence or an informal meeting, which we call casual partnerships, and second, as a result of deliberate targeting of this particular partner, either by the firm or by the partner, which we call purpose-built partnerships. In the vast majority of cases, managers responded that the partnership was purpose-built (82.2 percent), while the relationships were a result of casual encounters in less than a fifth (17.8 percent) of cases. Casual encounters were more common when the most important partner was a customer, accounting for the emergence of 37.9 percent of partnerships in these cases. When the most important partner was a supplier, 13.1 percent of partnerships emerged through casual encounters, and when the partner was another unit in the business group, 94.1 percent of partnerships were purpose-built.

Probing the emergence of partnerships a little further, firms were asked a follow-up question which depended on their answer to the original question: if the relationship had emerged by coincidence or through an informal meeting, respondents were asked whether this was the result of a casual encounter at a conference, trade fair, congress or other work-related event, or, rather, the result of personal contacts or meeting outside of work (e.g. at a social event), often building on pre-existing social networks and capital. This enables us to further sub-divide the casual encounters into two categories: *Pure casual* encounters are those which emerge at random through serendipity and/or personal contacts or non-work-related meetings, whereas *casual targeted* encounters take place at random, but within a work-related context where the firm actively seeks out such casual encounters. Pure casual encounters are slightly more prevalent in the data, with 56.5 percent of casual encounters falling within this category, while 43.6 percent of casual encounters are of the casual targeted type. This distribution is similar for all types of partner.

If, on the other hand, the relationship had been purpose-built, we probed its emergence by asking why the firm had approached this particular partner. In this case, the options were a) as a result of in-house research, b) following advice from customers or suppliers, c) following advice from consultants or external researchers, or d) following advice from others with no business relationship to the firm.² In this case, the modal category was using in-house research, comprising 77.9 percent of purpose-built partnerships. Furthermore, 12.7 percent of purpose-built partnerships emerged following advice from suppliers or customers, 2.8 percent following advice from consultants or researchers, and 6.7 percent following advice from non-work-related sources. Combining the three latter categories, 22.1 percent of purpose-built partnerships came about as a result of advice from people outside the firm. External advice was particularly important when the most important partner was a supplier, accounting for 28.7 percent of the purpose-built partnerships in these cases, compared to 17.7 percent in the case of customers and 11.4 percent for other units in the business group.

Combining the two questions, we derive four categories. First, pure casual partnerships, which emerge through encounters outside of a work-related environment. Second, casual targeted partnership emerge casually, but as a result of the firm actively seeking out situations where such encounters are likely to

² This category represents a further indication of the potential importance of social networks and/or serendipity to influence or guide the formation of innovation-leading connections.

occur, e.g. through situations of temporary proximity (such as in trade fairs). Third, purpose-built partnerships following advice from outsiders occur as a result of planning by the firm, although these relationships could also involve some element of serendipity in how the firm came about information about the partner. Finally, purpose-built partnerships based on in-house research are the most thoroughly planned relationships. The latter category is also the most prevalent in our data, including a majority – 51.2 percent – of firms. This type of partnership is more common than the other three types combined. Table 2 shows the frequency distribution of this variable.

The study only provides data on the firm's most important partner, which does not rule out the opportunity that other partnerships might have emerged through casual encounters, or that firms could have benefited from knowledge exchange through other channels than direct collaboration. Nonetheless, if the managers' answers are to be believed, these findings do suggest that, in the case of Norway, serendipity, casual encounters and randomness tend to play a minor role in the emergence of relationships that lead to innovation. The meagre incidence of purpose-built partnerships emerging following advice from others with no business relationship to the firm (6.0 percent of all partnerships) is an additional indication that the role of chance and casual encounters or social networks for innovation may be limited as a mechanism bringing about partnerships leading to innovation.

Table 2 about here

Table 3 shows the emergence of partnerships contingent on the location of the firm in one of three types of regions: The Norwegian capital and largest city region Oslo; one of the other major city regions of the country (Bergen, Stavanger, or Trondheim); or a non-urban region (outside any of these four city regions). Overall, there is no statistically significant relationship between the location of the firm and how its most important partnership emerged, as shown by the chi-squared statistic. To the extent that a pattern can nonetheless be observed in the data, it seems mainly contrary to predictions in the literature. Pure casual encounters were most common for firms in non-urban regions, accounting for more than twice as many partnerships as for firms in the urban regions. Firms in Oslo tend to rely slightly more on purpose-built partnerships following advice than those in other regions, while this type of partnership is slightly less common for firms in second-tier city regions. In the latter regions, in-house research and casual targeted encounters account for a little more than the sample average.

Table 3 about here

4.2. Do Local Partnerships Emerge Casually?

The 'something in the air' theory emphasizes physical proximity as the main driver of serendipitous and casual encounters. Partnerships at a distance are, more often than not, likely to be the result of conscious and careful planning and, therefore, purpose-built (Bathelt et al., 2004; Fitjar and Rodriguez-Pose, 2013; Morgan, 2004). However, the story may be different for local partnerships, where casual meetings within confined geographical spaces are expected to play a greater role than for distant partnerships. In order to examine this question, we asked firms where the partner was located. Overall, 50.0 percent of the partners were located within the same region, while 28.3 percent were located elsewhere in Norway and 21.7 percent abroad. The question of interest is whether the emergence of relationships differs when the partner is based within the same region compared to when the partner is located at a distance.

Regardless of the location of the partner, the relationship emerged as a result of a planned approach in a clear majority of cases. Table 4 shows a cross-tabulation of the partnership type and the location of partners. Firms with no partners are not included. Hence, the percentage shares are now calculated on the basis of firms having partners, rather than all firms as above. Regardless of the distance to the partner, the relationships were purpose-built based on in-house research in a majority of cases. This is the case for 70 percent of international and 65 percent of national partnerships, but also for 59 percent of regional ones. An additional 18.5 percent of partnerships were purpose-built, but based on advice from others – a proportion that remained fairly similar across all distances to partners. In total, therefore, more than 77.6 percent of regional partnerships and 90 percent of international ones emerged as the result of a planned approach by at least one of the partners, rather than following from a casual encounter or chance meeting.

Table 4 about here

Nonetheless, casual partnerships are more widespread when connecting to regional partners than to faraway ones. This is particularly the case for the pure casual partnerships. While only 2.9 percent of international relationships emerge through pure casual encounters, this type of happenstances account for 15.6 percent of regional partnerships. Of the 35 relationships that emerged through pure casual encounters, 25 were with local partners, compared to only 2 with international partners. The share of purpose-built partnerships based on research is equivalently smaller, accounting for 11 percentage points less of the regional than the international partnerships. For the two intermediate categories – casual targeted and purpose-built following advice – the differences are small. Hence, random encounters in a work-related setting appear equally common at a distance as in close geographical proximity, as does the selection of partners based on input from others. Furthermore, the chi-squared test of independence does not produce a significant result and consequently, we cannot reject the null hypothesis that the emergence of the relationship is independent of the distance to the partner.

There is also no evidence that local partnerships result more frequently from casual encounters in urban regions. On the contrary, casual encounters account for 19.6 percent of the regional partnerships in non-urban regions, compared to 13.8 percent in Oslo and 14.1 percent in other city regions. Firms in Oslo in particular tended to rely more on purpose-built local relationships, based on either in-house research (62.1 percent of local relationships) or external advice (20.7 percent).

4.3. Do Casual Encounters Result in Innovation?

The final question of interest is whether these partnerships are important for innovation. Do casual encounters actually lead to innovation? In order to explore this question, we first examined the share of firms reporting innovation across the different types of partnerships, comparing with firms that used no partners at all.

As a measure of innovation, we included four questions from the Community Innovation Survey examining new-to-firm and new-to-market product and process innovation: (1) Has your company introduced any goods or services into the market during the past three years that were new to the company or significantly improved compared to your existing products? (2) If yes, were any of these product innovations new to the market, or were they only new to your company and very similar to a product that already existed in the market? (3) Has your company introduced any methods or processes for production or delivery of products during the last three years that were new to the company or significantly improved compared to the company's existing methods? (4) If yes, were any of these innovations of methods or processes new to the industry? These four questions formed the

basis for operationalizing four measures of innovation, indicating product innovation, new-to-market product innovation, process innovation, and new-to-industry process innovation, respectively.

Table 5 shows the share of firms reporting each of the four types of innovation among firms grouped according to their partnership type. The overall story emerging from the analysis is that cooperating with partners is associated with higher levels of innovation. In three of the four categories, the share of innovative firms is lowest among firms that do not use partners in innovation processes. However, the type of partnership is not trivial, as there are large differences in the share of innovative firms across different partnership types. In particular, using pure casual partners is associated with only a slightly higher level of product innovation and new-to-market product innovation over not using any partners at all, and the share of firms reporting process innovation is actually lower than among firms using no partners. The only area in which pure casual partnerships are associated with higher levels of innovation than having no partners is for new-to-industry process innovation.

Table 5 about here

Conversely, all the three other types of partnerships are associated with substantially higher levels of innovation than having no partners. The share of firms reporting product innovation is between 15 and 20 percentage points higher among those that use purpose-built or casual targeted partnerships, compared to firms using no partners. For process innovation the difference in percentage points is slightly higher than for product innovation. For radical innovation, the differences are even greater: Firms using one of these three types of partners introduce new-to-market product innovations more than twice as often as firms with no partners, and new-to-industry process innovations between three and six times more often.

While these bivariate analyses certainly suggest that some types of partnerships are associated with higher levels of innovation, these associations may be spurious for several reasons. Some partnership types may only be open to firms that have considerable resources to e.g. invest in in-house research to find the right partners. The use of certain types of partnerships could also be more prevalent in particular industries, perhaps those with higher levels of innovation. For these reasons, we fit a series of logit regression models in which we examine the associations between the partnership types and each of the four innovation outcomes when controlling for potentially confounding variables. The regression model takes the following form:

$$\text{logit}(\pi_i) = \alpha + \beta_1 \text{Partnership type}_i + \beta_2 \text{Controls}_i + \varepsilon \quad (1)$$

In this model, π_i represents the probability π of firm i introducing an innovation during the preceding three years. We fit four different regression models, one for each of the four innovation outcomes outlined above. Partnership type is a vector of four dummy variables that represent the different types of partnerships discussed above: Pure casual, casual targeted, purpose-built based on advice, and purpose-built following research. These four partnership types are compared against a baseline of having no partners in innovation processes.

Controls is a vector of control variables which may potentially affect both firm innovation and its choice of partnership type. We include five control variables in the analysis: (1) *Firm size*, measured in terms of the natural log of the number of employees in the firm; (2) *R&D expenditure*, measured as the natural log of the share of the firms' budget that is spent on research and development; (3) *Human capital*, measured as the natural log of the share of company staff holding university-level degrees; (4) *Foreign ownership*, measured as the share of stock held by people or companies located outside Norway; (5) *Industry*, measured by ten dummy variables related to different industries: Mining and quarrying; manufacturing; utilities; construction; wholesale and retail trade; transport and storage; food and accommodation services; information and communication services; financial and insurance services; and other services, the latter variable being the baseline.

Table 6 about here

Table 6 shows the results of regression analyses. Examining the effects of the partnership types, purpose-built partnerships following in-house research are the most consistently associated with innovation. This type of partnership has a significant positive effect on three of the four innovation outcomes – new-to-market product innovation, process innovation, and new-to-industry process innovation – relative to having no partners. It is also positively, but not significantly, associated with product innovation. The other three types of partnership are each only positively associated with one of the innovation outcomes. Casual targeted partnerships and purpose-built partnerships based on advice are both associated with a significantly higher probability of new-to-market product innovation compared with having no partners. These two types of partnership are also positively, but not significantly, associated with the three other innovation outcomes. For pure casual partnerships, the positive association is for new-to-industry process innovation, whereas it is only weakly and non-significantly associated with the other three outcomes, in one case with a negative coefficient.

In order to get a better understanding of the magnitude of the effects shown in Table 6, Table 7 shows the predicted probabilities of each type of innovation on the basis of the regression model for a firm with average values on all other variables. While the predicted probabilities of innovating for firms with no partners tend to be slightly higher when their size, R&D expenditure, human capital, foreign ownership level and industry is taken into account, the pattern emerging from the table is nonetheless similar to that found in Table 5. For new-to-market product innovation, the predicted probability of innovating is between 1.6 and 2.3 times higher for firms that use either casual targeted or any form of purpose-built partnerships. For process innovation, purpose-built partnerships based on research is associated with an 11 percentage points higher probability of innovating than using no partners. For new-to-industry process innovation, using pure casual partnerships or purpose-built partnerships based on research are associated with a probability of innovation that is four times higher than using no partners. The effects of building partnerships of the right type are thus not just positive and significant, but also fairly large in terms of a substantial increase in the probability of innovation.

Table 7 about here

Put together, the results of the analysis paint, for the case of Norway, a very different picture from that which emerges from a ‘there is something in the air’ type of scenario. In first place, only a fraction of the partnerships that firms in Norway deem most important for innovation emerge through the serendipitous and casual channels that are assumed to play a role in the ‘there is something in the air’ approach. Face-to-face, chance encounters, and social capital count for little in comparison to purpose-built relationships based on conscientious in-house research. Assuming that their answers are truthful, it seems that Norwegian firms when it comes to forging important partnerships and innovating leave little to chance and to fortunate happenstances which may be easily reaped from the ‘air’ and prefer the hard work of doing research in order to properly identify the right partners and minimize the risks involved in new partnerships.

The results do not really change depending on where the partner is located. More than three quarters of all local partnerships are purpose-built, rather than casual. Nor do they change depending on the location of the firm itself– be it in dense clusters and urban environments or in rural locations. More than three quarters of partnerships are purpose-built in each type of location. Casual encounters and non-work-related advice also seem to have a limited role in spawning purpose-built partnerships beyond the advantages afforded by co-location. And partnerships forged through pure casual encounters tend to be the least conducive to innovation of all types of partnership. In fact, relying on

serendipity and pure casual encounters is not associated with significantly higher levels of innovation than having no partners whatsoever, with the exception of new-to-market process innovations (Table 7).

5. CONCLUSION

We started this research from the Marshallian premise that knowledge was like love in John Paul Young's song: "in the air, everywhere I look around". If knowledge were indeed 'in the air' in densely populated areas or in clusters of firms, it could be easily reaped by firms through partnerships and effortlessly transformed into innovation. We also assumed, following the majority of the literature on urban innovation and clusters, that agglomeration would lead to externalities that would make tacit knowledge public and freely available to all through serendipitous mechanisms, like face-to-face interaction, casual encounters, and social capital. The consequence would have been that firms in cities and/or clusters would always be more innovative, as they would have access to easier and cheaper sources of knowledge, while isolated firms would be at a disadvantage (see Shearmur, 2012).

However, we were also aware that, as in John Paul Young's song, this was something 'believed' in, as consistent demonstrations of the value of chance, casual encounters, and serendipity for the transformation of tacit knowledge into innovation were, to say the least, scarce.

We have addressed this gap in the literature by creating our own purpose-built survey of how the most important partnerships for firm innovation emerged in the case of Norway. Our survey asked managers of firms across Norway about their most important relationship for innovation and about whether this relationship arose by chance or through casual encounters or was purpose-built. This approach cannot measure the emergence of partnerships with other partners than the firm's most important contact (although we do measure purpose-built partnerships derived from additional advice from others with no business relationship to the firm), nor knowledge exchange through other channels than direct collaboration. However, it does shed light on the question of how partnerships emerge, which addresses an important assumption in the literature on urban economies and one which we know little about.

The results of the analysis show that, at least in the case of Norway, when firm-managers are directly asked and if their answers are accurate, there seems to be very little 'in the air'. The relationships that are responsible for the bulk of innovation in Norwegian firms did not emerge from casual encounters, personal relationships, or serendipitous events, but were fundamentally purpose-built. There is also a very limited incidence of the development of partnerships following advice from others with no direct business relationship to the firm. This implies that the partnerships that have generally led to innovation in Norwegian firms have overwhelmingly involved a conscious action by firms and their managers to assess the innovation problems of their firms and identify the right partners to address those problems. In particular, local relationships that have any bearing on firm-level innovation do not show a significantly different origin from those that involved relationships based on 'pipelines', that is, with international or other national partners located outside the region. The majority of relationships in both cases tend to be purpose-built.

The few serendipitous important relationships in which Norwegian firms engage are also not very conducive to innovation. Firms that rely on partnerships based on casual encounters hardly innovate any more than firms without any self-declared important partners, once other factors leading to innovation are controlled for. The only exception is new-to-market process innovations – the least common of all innovation categories – where 'in the air' serendipitous relationships make the greatest difference of any type of relationship.

It may be the case that Norway is exceptional: it is too rich, too remote, and lacks the agglomerations for 'buzz'-driven innovation to take hold. Consequently, the results of our analysis may not

necessarily be transferable to other contexts. It may be also the case that serendipitous and chance encounters may lead to partnerships which are not perceived as the most important for innovation by managers, but that may nonetheless still lead to innovation or that institutional constructs may facilitate knowledge spillovers in the partnerships that are established. But it may also be the case that, by actually asking a large number of firm managers about how the relationships that are key to innovation within their firm emerged, we are finding that something that has been long assumed may require further scrutiny. By constantly assuming that there was something ‘in the air’, we might have ended up like John Paul Young believing it, rather than testing it. We have wanted to believe that ‘there is something in the air’, overlooking that, as stressed by Shearmur (2012: S14), many types of “innovation may be developed internally, at a slower pace, relying on research and development, secrecy, a stable workforce, and controlled interactions with the outside”. Consequently, as a research community, we may have overstated “the importance of cities in generating serendipitous interactions” (Shearmur, 2012: S14). More research – and research in different places and using different methods – is therefore needed in order to validate whether the truth about innovation in high-density environments is closer to the dictum that ‘there is something in the air’ or, by contrast, to the idea is that ‘little is in the air’ or ‘nothing is in the air’.

ACKNOWLEDGEMENTS

We would like to thank Dan Rickman, and two anonymous referees for their very thorough and challenging suggestions to earlier versions of the article. We are also grateful to participants at seminars in Amsterdam, Stavanger, Tampa, and St. Petersburg, where earlier versions of the paper were presented. We would also like to acknowledge the generous financial support of the European Research Council under the European Union Seventh Framework Programme (FP7/2007-2013)/ERC Grant Agreement No. 269868 and of the programmes VRI (project no. 233737) and Demosreg (project no. 209761/H20) of the Research Council of Norway.

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Table 1: Summary statistics

	Telephone survey		Web survey	
<i>Company size</i>				
Median	23		24	
Interquartile range	32		30	
Mean	71.8		68.7	
<i>Industry</i>				
	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>
Mining and quarrying	32	1.6	16	3.0
Manufacturing	339	16.9	119	22.3
El., gas and water supply	56	2.8	16	3.0
Construction	341	17.0	59	11.1
Trade	402	20.1	98	18.4
Transport and storage	115	5.7	29	5.4
Hotels and restaurants	153	7.6	29	5.4
Information and communications	122	6.1	28	5.3
Financial services	130	6.5	32	6.0
Other services	312	15.6	107	20.1
Total	2002	100.0	417	100.0
<i>Region</i>				
	<i>N</i>	<i>Percent</i>	<i>N</i>	<i>Percent</i>
Oslo	501	25.0	127	23.8
Bergen	308	15.4	74	13.9
Stavanger	351	17.5	115	21.6
Trondheim	234	11.7	60	11.3
Rest of Norway	608	30.4	157	29.5
Total	2002	100.0	533	100.0

Table 2: Emergence of relationships, frequency distribution

<i>Relationship type</i>	<i>Number of firms</i>	<i>Percent</i>	<i>Standard error</i>
Pure casual	35	8.2	1.3
Casual targeted	27	6.3	1.2
Purpose-built following advice	62	14.6	1.7
Purpose-built based on research	218	51.2	2.4
No partners	84	19.7	1.9
N	426		

Table 3: Emergence of relationships and location of firm, contingency table

<i>Relationship type</i>	<i>Oslo</i>	<i>Other cities</i>	<i>Non-urban</i>	<i>Total</i>
Pure casual	6.1 %	6.3 %	13.2 %	8.2 %
Casual targeted	4.0 %	7.8 %	5.8 %	6.3 %
Purpose-built following advice	19.2 %	11.7 %	15.7 %	14.6 %
Purpose-built based on research	50.5 %	53.9 %	47.1 %	51.2 %
No partners	20.2 %	20.4 %	18.2 %	19.7 %
Total	100 %	100 %	100 %	100 %
N	99	206	121	426

$\chi^2 = 10.38$, $df = 8$, $p = 0.240$.

Table 4: Emergence of relationships and location of partner, contingency table

<i>Relationship type</i>	<i>Regional</i>	<i>National</i>	<i>International</i>	<i>Total</i>
Pure casual	15.6 %	9.0 %	2.9 %	11.0 %
Casual targeted	6.9 %	9.0 %	7.1 %	7.5 %
Purpose-built following advice	18.8 %	16.9 %	20.0 %	18.5 %
Purpose-built based on research	58.8 %	65.2 %	70.0 %	63.0 %
Total	100 %	100 %	100 %	100 %
N	160	89	70	319

$\chi^2 = 9.32$, $df = 6$, $p = 0.156$.

Table 5: Emergence of partnerships and innovation, share of firms reporting innovation

<i>Partnership type</i>	<i>Product innovation</i>	<i>New-to-market</i>	<i>Process innovation</i>	<i>New-to-industry</i>
Pure casual	51.4 %	20.0 %	31.4 %	17.1 %
Casual targeted	63.0 %	44.4 %	55.6 %	22.2 %
Purpose-built following advice	67.7 %	38.7 %	50.0 %	11.3 %
Purpose-built based on research	62.8 %	36.7 %	52.8 %	20.6 %
No partners	47.6 %	15.5 %	33.3 %	3.5 %
Total	59.6 %	31.9 %	46.9 %	15.7 %

Table 6: Logit regression analysis, partnership type and innovation

	Product innovation	New-to-market innovation	Process innovation	New-to-industry
<i>Pure casual</i>	0.05 (0.45)	0.32 (0.57)	-0.23 (0.46)	1.86** (0.76)
<i>Casual targeted</i>	0.64 (0.52)	1.49*** (0.57)	0.50 (0.50)	1.33 (0.84)
<i>Purpose-built based on advice</i>	0.31 (0.41)	0.78* (0.46)	0.24 (0.40)	0.99 (0.76)
<i>Purpose-built following research</i>	0.43 (0.31)	0.95** (0.38)	0.53* (0.31)	1.75*** (0.64)
<i>No partners</i>	Baseline	Baseline	Baseline	Baseline
<i>Firm size</i>	0.04 (0.14)	0.13 (0.13)	0.55*** (0.14)	0.36** (0.16)
<i>R&D expenditure</i>	0.64*** (0.14)	0.66*** (0.13)	0.49*** (0.12)	0.43*** (0.16)
<i>Human capital</i>	0.27*** (0.10)	0.09 (0.11)	0.05 (0.10)	0.16 (0.15)
<i>Foreign ownership</i>	0.29 (0.38)	0.54 (0.36)	-0.06 (0.35)	0.17 (0.46)
<i>Industry dummies</i>	Included	Included	Included	Included
<i>Constant</i>	-1.98*** (0.61)	-3.33*** (0.69)	-3.14*** (0.62)	-5.64*** (1.01)
<i>N</i>	396	396	396	377
<i>Pseudo R²</i>	0.16	0.18	0.13	0.14

Note: * = $p < 0.10$ ** = $p < 0.05$ *** = $p < 0.01$ (two-tailed t-tests).

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

The number of observations is lower than 426 due to 30 missing observations in total for the variables R&D expenditure (25 missing values) and human capital (7 missing values). In the model for new-to-industry process innovation, the industry dummy for food and accommodation services predicts failure perfectly. Firms in this industry therefore had to be omitted, accounting for the lower N in this analysis.

Table 7: Emergence of partnerships and innovation, predicted probability of innovation

<i>Partnership type</i>	<i>Product innovation</i>	<i>New-to-market</i>	<i>Process innovation</i>	<i>New-to-industry</i>
Pure casual	55.5 %	24.6 %	35.2 %	21.8 %
Casual targeted	66.7 %	45.8 %	50.5 %	14.7 %
Purpose-built following advice	60.5 %	32.3 %	44.9 %	11.2 %
Purpose-built based on research	62.9 %	35.4 %	51.0 %	20.3 %
No partners	54.4 %	19.9 %	39.9 %	4.7 %
Total	59.6 %	31.9 %	46.9 %	15.7 %