BRIDGING OR BONDING? A MULTILEVEL STUDY ON THE EFFECT OF REGIONAL CIVIC ENGAGEMENT IN FIRMS' INNOVATION PROCESS

Schmutzler, Jana

Universidad del Norte, Barranquilla, Colombia

INTRODUCTION

Due to the complex, interactive nature of the innovation process (Lundvall, 2007, 2010) the open innovation strategy (Chesbrough, 2003) has gained importance during the past years. At the same time, empirical research provides evidence that in presence of social capital, knowledge exchanges among firms is facilitated (Saxenian, 1991, 1994). Against this background, the present study focuses on the effect of external knowledge sources on firm's innovation performance taking into account the moderating effect of one aspect of regional social capital. This topic is important due to the complex, interactive nature of the innovation process (Lundvall, 2007, 2010) and the deriving importance of an open innovation strategy (Chesbrough, 2003). Changing environments with increased market competition and rising technological complexity resulting in augmented R&D costs and shorter product life cycles force managers to rethink their innovation strategy. No longer can firms innovate in isolation; rather they need to look beyond their boundaries drawing on a wide array of new and existing knowledge bases (Chesbrough, 2003; von Hippel, 1988). As a result, the sourcing and acquisition of external knowledge in form of acquisition of external R&D (Bönte, 2003; Cassiman & Veugelers, 2006; Laursen, Masciarelli, & Prencipe, 2012), formal research cooperation (Barge-Gil, 2010; Belderbos, Carree, & Lokshin, 2004; Miotti & Sachwald, 2003; Vega-Jurado, Gutiérrez-Gracia, & Fernández de Lucio, 2009), and informal knowledge sourcing (Amara & Landry, 2005; Bönte & Keilbach, 2005; Caloghirou, Kastelli, & Tsakanikas, 2004; Laursen & Salter, 2006) have emerged as rising phenomena and important topics in academic research during the last years.

Most empirical research focuses on the impact external knowledge sourcing has on the innovation performance of a firm (K.-H. Tsai, 2009) and tends to identify a positive influence of relationships with suppliers, customers, competitors, universities or research centers (Becheikh, Landry, & Amara, 2006). However, the results are far from consistent and point towards potential moderation variables (K.-H. Tsai, 2009). At the same time, a varied effectiveness of collaboration patterns across countries (e.g. Bodas Freitas, Clausen, Fontana, & Verspagen, 2011) suggests the influence of contextual variables. The notion that the innovation process is embedded in an institutional context has been stressed by the literature regarding the national (Lundvall, 1992; Nelson, 1993), regional (Asheim & Isaksen, 1997; Isaksen, Asheim, & Isaksen, 2002) and the sectorial (Malerba, 2002) system of innovation.

Despite this recognition, few studies analyze the influence of the institutional context as a potential contingency factor (Bodas Freitas et al., 2011; van Waarden, 2001). The recent investigation by Laursen and colleagues (2012) observed that regionally bound social capital positively moderates the effectiveness of externally acquired R&D for a firm's propensity to innovate. We position this research in the growing research strands on external knowledge

sharing and the influence of social capital for innovation and intend to make three key contributions. We extent the findings of Laursen and colleagues (2012) by focusing on the effect of bridging and bonding social capital[1] at the regional level and by taking into account informal collaboration strategies.

Second, to the best of our knowledge, this is the first research investigating the influence of regional social capital on the firm's innovation performance in a developing country usually characterized by weak institutions which are argued to increase transaction costs (Meyer, Estrin, Bhaumik, & Peng, 2009). As such, this investigation may shed some light on the discussion of whether social capital substitutes weak institutions leading to inefficient markets (Knack & Keefer, 1997). Additionally, contextualizing research collaboration in developing countries, McCormick and Atieno (2002) argument that research collaboration are especially important to overcome the various barriers that firms encounter in these contexts. At the same time, the propensity to interrelate with actors external to the firm has shown to be relatively low among Latin American companies (Melo, 2001). This research may contribute to an understanding why that is the case.

Lastly, our research applies a multi-level design, thus taking into account the hierarchical structure of the above mentioned relations. Although the systemic perspective on innovation calls for the adoption of a multi-level design (Edquist & Johnson, 1997; Lundvall, 1992; Nelson, 1993), quantitative research adopting such a methodology remains scarce (Srholec, 2011). Applying a multi-level analysis, we avoid the ecological fallacy present when assuming that attributes at the regional (or national) level are directly reflected in the behavior of firms (Robinson, 2009). Additionally, we also forego the individualistic fallacy which consists in incorrectly imputing firm-level innovative behavior to the regional or national level (Seligson, 2002).

1. THEORY DEVELOPMENT

1.1. Civic participation, social capital and the institutional context

Innovation is a multi-level phenomenon; simultaneously firm's resources, competences, and capabilities as well as the context in which the firm operates influence the innovation behavior and performance of enterprises (Srholec, 2010). For example, a firm's institutional context, defined as the rules of game by which economic actors play, solves problems of cooperation and coordination by shaping perceptions and dictating the payoffs of engaging in different activities (North, 1990). As such, context is also argued to influence the networking behavior of innovating firms (Saxenian, 1991). Geographically bound social capital can

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[1] The importance of differentiating between bridging (inclusive) and bonding (exclusive) social capital has been stressed by scientific political research, such as Narayan-Parker (1999), Putnam (2000), Woolcock and Narayan (2000). This notion has recently been emphasized for the study of innovation at the regional level as well (Hauser et al., 2007; Kallio et al., 2010).

generally be defined as localized norms and networks which enable collective action within a region (Woolcock & Narayan, 2000). It therefore captures certain aspects of the firm's institutional context.

Since Pierre Bourdieu's first systematic, contemporary analysis (Bourdieu, 1986), the term social capital has been characterized by heterogeneity (Cainelli, Mancinelli, & Mazzanti, 2007) with a lack of clear definition. Instead, a wide array of definitions exists.[2] These vary on the one hand depending on whether the authors focus on the substance, sources or effects of social capital (Robison, Schmid, & Siles, 2002). On the other hand, they diverge because social capital is a multidimensional concept with each dimension contributing to its meaning (Hean, 2002). Though it has been described and operationalized in multiple ways, a commonly used framework in the management literature is that of Nahapiet and Ghoshal (1998), proposing the structural, relational and cognitive dimension of social capital.3 While the relational dimension refers to norms, expectations and levels of trust developed through repeated interactions within a social network, the cognitive dimension concerns a set of interpretive schemes, codes and languages which the actors of a social network share, enabling them to make sense of their behaviors (Nahapiet & Ghoshal, 1998). Lastly, the structural dimension of social capital according to these authors comprises the overall configuration of the social network, including the resources actors may access through this network.

We focus on the structural dimension and evaluate the impact of social interaction through civic engagement at the regional level on the innovation performance of manufacturing enterprises. Associational activity, i.e. the tendency of citizens to become members in civil associations and other types of voluntary organizations, can be interpreted as interpersonal networks (Annen, 2001, 2003; Knack & Keefer, 1997) and it is their ability to initiate and preserve social relationships (Maennig & Ölschläger, 2011) which drives their relevance for economic growth and innovation. However, there is a controversy regarding the exact role of these associations. Knack (2003) pointed out that the impact of civil associations will likely vary with "the group's goals and activities, and with the diversity and inclusiveness of their memberships" (p.343). One of the most prominent distinctions between voluntary organizations is the one between Olson-groups and Putnam-groups (e.g. Knack & Keefer, 1997). On the one hand side, Olson (1982) puts an emphasis on group's propensity to lobby for special interests. Such "distributional coalitions" impose disproportional costs on the rest of the society, thus generating a negative impact on economic growth (Olson, 1982). Putnam (1993), on the other hand, states that a "strong tradition of civic engagement – voter turnout, newspaper readership, membership of choral societies and literacy circles, Lions Clubs, and soccer clubs – are the hallmark of a successful region" (p.6). For him, a membership in horizontal associations is a source of economic and social prosperity.

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[2] For overviews on definitions refer to Adler and Kwon (2002) or Woolcock and Narayan (2000).
[3] Measures comprising structural dimensions of networks and trust are predominantly the ones being used in the increasing number of research evaluating the impact of social capital on economic outcomes (Dakhli & De Clercq, 2004).

We adopt the distinction between the membership in horizontal and vertical, distributional associations, especially since their functioning can be linked to the prominent discussion regarding the bonding and bridging function of social networks. Whereas the first refers to closed networks and organizations that encompass people with the same or similar background and specific interests, the latter describes networks and organizations that bring people into contact with others from a very different, cross-sectional part of society (Putnam, 2000). As a result, the ability of a network to contribute to the generation of innovation depends on the type of network and the derived functioning.

At the same time, social capital can also be located at different levels such as the individual, the organization, the region or the nation (Portes, 1998). We focus on the regional level. Learning, the basis for any innovation, is an interactive, socially embedded and localized process (Asheim & Gertler, 2005; Lundvall, Johnson, Andersen, & Dalum, 2002): "[…] while not all types of social relations are subject to distance cost, the interdependencies of different types of social relations make dense combinations of them dependent upon geographic proximity" (Lorenzen, 2007, p. 805). Marshall (Marshall, 1965) already pointed to the positive influence of geographical proximity for innovation caused by knowledge spillovers. Furthermore, based on a case study in Wales, Morgan (2007) comes to the conclusion that "trust, and other forms of social capital may be best developed at the regional level" (p. 501). As a consequence, the regional locality is an appropriate level to study the influence of civic engagement on innovation performance. Additionally, substantial differences in social capital between regions (Akçomak & ter Weel, 2009; Beugelsdijk & Van Schaik, 2005; Florida, 2002; Iyer, Kitson, & Toh, 2005; Miguélez, Moreno, & Artís, 2011) and the fact that formal and most importantly informal institutions such as social capital become place-specific (Gertler, 1997) call for an analysis evaluating the impact of civic engagement at the regional level.

1.2. External information sources and innovation performance

The relational view (Dyer & Singh, 1998) posits that "firms' critical resources span firm boundaries and are embedded in interfirm resources and routines" (p.660). This is also true for information which forms the basis of innovative activity: based on the assumption that innovation opportunities exist because of information asymmetries, having access to a wider range of information sources provides firms opportunities to tap into new technological knowledge (K.-H. Tsai, 2009). As such, drawing onto information sources beyond the firm's boundaries puts these in a better position to innovate (Chesbrough, 2003; von Hippel, 1988).

Informal collaborations, that are "relationships developed between individuals independently of any formal structure (…) built over time and used as complementary knowledge sharing alternatives to an organization's formal strategy" (Jewels, Underwood, & de Pablos Heredero, 2003, pp. 5–6) are one form of interaction with external agents and form part of the interorganizational network. According to Adler and Kwon (2002), benefits of such interactions are the direct access to additional information sources and an improved information quality with regard to relevance and timeliness. Additionally, new skills and competencies maybe acquired (Powell, Koput, & Smith-Doerr, 1996), the learning ability can be leveraged (Shu, Wong, & Lee, 2005) and the costs for doing so maybe lowered (Westlund & Nilsson,

2005). Empirical research in different settings has found that the use of external information sources positively influences the firm's innovation performance (e.g. Bönte & Keilbach, 2005), where the variety of external information sources used is positively related to the innovation performance of firms (Chen, Chen, & Vanhaverbeke, 2011; Laursen & Salter, 2006). Due to the technological complexity and rising market competition, individual firms benefit from specific competencies and knowledge of these external information sources as they complement existing or substitute missing internal ones. We therefore posit a positive relationship between the use of external information sources and the likelihood of product innovation.

Hypothesis 1: The use of external information sources increases the likelihood for the introduction of a product innovation.

1.3.   Social interaction and innovation performance

Social capital has been proposed as an important driver of economic growth (Beugelsdijk & Smulders, 2003; Beugelsdijk & van Schaik, 2005). One mechanism through which social capital contributes to the process of economic growth is indirect; it derives from its presence in interactive learning as the basis of innovative processes (Falk & Kilpatrick, 2000; Lundvall et al., 2002). Innovation is a "process where the outcome is highly dependent upon interaction and communication between people" (Lundvall & Christensen, 2004, p. 5). Social relations, often maintained for other purposes, can provide the mechanism for such interaction (Adler & Kwon, 2002; Coleman, 1988) and as such contribute to the generation of innovation (Dahl & Pedersen, 2004); a notion brought forward by the concept of innovative milieu (Camagni, 1991, 1995)[4].

Based on regions such as the Silicon Valley, researchers argue that social interactions among individuals in a specific geographical area form a critical mechanism of information exchange (Ibarra, 1993). They also enable cooperation (Coleman, 1988), facilitate knowledge diffusion and generate collective learning processes (Bresnahan, 2001; Camagni, 1991; Sorenson & Stuart, 2001). Putnam (1993) argues that an active civil society, that is one with many civic associations, chamber of commerce and the likes, fosters shared norms within a region. Not only do these shared norms expedite the information exchange as they provide the basis for mutual understanding. Additionally, routines and conventions of interactions are established, lowering the costs of future interactions (Fromhold-Eisebith, 2004; Maskell, 2001). As a result of faster, preferential and less costly access to information and a higher quality of transferred knowledge the innovation potential of firms in regions with higher associational activity increases (Fromhold-Eisebith, 2004; Maskell, 2001) generating a competitive advantage for these firms (Koka & Prescott, 2002).

However, we posit that the effect of associational activity within a region on the innovation process of firms located in that region are far from being homogeneous across all

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[4] The approach of innovative or creative milieu has been developed mainly by researchers associated with the Groupe de Recherche Européen sur les Milieux Innovateurs (GREMI) (Fromhold-Eisebith, 2004).

types of civil associations; rather dependent upon the functioning of these civil organizations, positive or negative externalities could be generated (Adler & Kwon, 2002; Portes & Landolt, 1996; Portes, 1998; Woolcock & Narayan, 2000). We therefore distinguish – based on Putnam's (1993, 2000) and Olson's (1982) work – between two types of civil associations: horizontally organized like sports clubs or cultural associations and vertically organized special interest groups such as trade unions or political parties. Not only do these latter endeavor to achieve certain political aims (Knack, 2003) and as such are associated with characteristics of closed networks (Kallio, Harmaakorpi, & Pihkala, 2010). Additionally, it is also believed that they usually agglomerate homogenous members (e.g. Paxton, 2002; Stolle & Rochon, 1998) whereas horizontal associations such as sports clubs are characterized by more heterogeneous groups. Based on this differentiation, we can link the type of association with two types of socializing: bridging and bonding (Yamamura, 2011; Zmerli, 2003). Bridging associations are those which generate links between diverse social categories, whereas bonding associations fail to do so in most cases and rather tend to cement homogeneous groups (Putnam, 1993, 2000).

Based on the concept of structural holes which refers to unique ties between otherwise unconnected individuals, organizations or regions (Burt, 2009), horizontal organizations may exercise a bridging function between diverse social actors. This provides a broader source of information as it exposes social actors to novel communities, more diverse experiences and varying ideas (Burt, 2009)[5]. As a result, more varied and non-redundant information is generated and accessible at a faster rate (Brass, 1995; Ruef, 2002) and as such greater innovation opportunities can be obtained (Amara & Landry, 2005). Additionally, the resulting greater knowledge about who knows what (Lundvall, 2006) within a certain region will help to reduce search costs. As a result, firms who are located in regions with a high amount of bridging civil associations will have access to a richer set of communication and knowledge transfer channels (Sørensen, 2007). Since the basis of innovation is a large pool of diverse information and knowledge, innovation generation is likely to be increased. We therefore argue that bridging Putnam-type civil associations function as a communication channel for useful new information and knowledge and propose the following hypothesis

Hypothesis 2a: Firms in regions with a high level of memberships in Putnam-type civil associations will have a higher probability to introduce product innovations.

Bonding associations are networks of homogeneous individuals which tend to look inward and clearly identify the inside and outside of the association's boundary (Putnam, 2000). These networks commonly generate strong bonds leading to high levels of trust, reciprocity and commitment among their members (Coffe & Geys, 2007; Coleman, 1988; Krackhardt, 1992) The provision of this is likely to reduce transaction costs by limiting the uncertainty regarding the behavior of social actors and the generation of a control mechanism for opportunistic behavior (Adler & Kwon, 2002). It therefore allows for the exchange of more complex and

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[5] This argument can be linked to Granovetter's (1973) theory of weak ties as structural holes and weak ties are strongly correlated (Reagans & McEvily, 2003), or as Granovetter (1973) put it: "all bridges are weak ties" (p.1364).

proprietary information (Hansen, 1999; W. Tsai & Ghoshal, 1998). Additionally, the generation of trust facilitates the recognition of the value of new knowledge (Reagans & Zuckerman, 2001).

However, this positive effect may be counterbalanced by the network's potential closure. The network's members do not receive inputs outside their circle thus limiting the production of new ideas, often referred to as lock-in relationships caused by overembeddedness (Grabher, 1993; Uzzi, 1997). In other words, diffusion of varied information and knowledge may be hindered by bonding associations (Rodríguez-Pose & Storper, 2006). Additionally, these bonds potentially foment conformity and collective blindness and hinder acceptance of alternative ways of getting things done (Nahapiet & Ghoshal, 1998; Paxton, 2002; Tura & Harmaakorpi, 2005). One such example is the "not-invented-here" syndrome (Katz & Allen, 1982). These cohesive ties may also hinder co-operation beyond the boundaries of these bonding networks (Burt, 2009). As a result, we propose that the positive effects of bonding Olson-type civil associations are likely to be set off by the negative ones and therefore suggest:

Hypothesis 2b: Firms in regions with a high level of memberships in Olson-type civil associations will have a lower probability to introduce product innovations.

Even though it is now widely acknowledged that social capital "is fundamentally a multilevel theoretical perspective" (Payne & Moore, 2011), empirical studies have largely been limited to one single level of analysis (Adler & Kwon, 2002; Lazega, Jourda, Mounier, & Stofer, 2008; Payne & Moore, 2011), ignoring potential cross-level effects. However, Fromhold-Eisebith (2004) suggests that the advantage of socially embedded learning processes inherent in an innovative milieu are based among other factors on the "effective combination of personal professional and private relationships" (p. 750). Ceci and Iubatti (2012) showed through a content analysis of interviews undertaken in the Italian CISI consortium, comprised of subsidiaries of various automobile manufacturers that personal and professional relationships coexist in SMEs networks shaping the diffusion of innovation. Saxenian (1991, 1994) argues that it is this fusion which provides regions like Silicon Valley with its basis for success. Against this backdrop, we propose that the influence of regional social capital on a firm's innovation performance should be not be evaluated in an isolated matter. Rather, the influence of regional social capital based on the individual's participation in civil associations is contingent upon the firm's use of external information sources for the innovation process.

Apart from the potential complementarities between social capital at these two different levels, potential complementarities have theoretically been proposed between bridging and strong ties as well, especially with respect to their effect on the innovation process of firms (Tiwana, 2008). While bridging ties provide the firm with a wide array of non-redundant, heterogeneous information, resources and abilities (Burt, 2009), strong ties enable firms the transfer of more complex and tacit information as well as a greater efficiency at cooperation and coordination within the network (Coleman, 1988). From this argumentation follows that "strong ties provide mechanisms to integrate a diverse repertoire of skills and expertise that are made accessible by bridging ties, which span structural holes" (Tiwana, 2008). We argue that the presence of social capital at the regional level through associational activity should therefore be evaluated in combination with social capital derived from informal collaborations at the firm-level.

The generation of innovation requires first and foremost opportunities to access new and diverse information and knowledge (Moran & Ghoshal, 1996). This information may be obtained from the outside of the firm with external information sources being one and the network of regional associations being another information channel. The combination of external information sources with regional bridging Putnam-type associations can provide the firm with a wider knowledge base. However, social capital is no longer perceived as generating only positive outcomes; instead, risks and costs have to be taken into consideration (Adler & Kwon, 2002). As a result, empirical research supports for various measurements of the structural dimension of networks (network size, centrality and contact frequency) a u-shaped relationship with respect to knowledge creation (Leenders, Van Engelen, & Kratzer, 2007; McFadyen & Cannella, 2004; Uzzi & Spiro, 2005). The same is true for the usage of external information sources – scope and depth of external information sources is related to innovation performance in a curvilinear way (Laursen & Salter, 2006). It can therefore be expected that the positive effect derived from operating in a region with a high level or Putnam-type bridging civil associations is less for those firms which rely on external information sources. We therefore suggest that:

Hypothesis 3a: Firms which do not rely on external information sources will benefit to a greater extent from the positive impact on innovation performance of operating in regions with high levels of memberships in bridging Putnam-type civil associations.

Information and knowledge exchange relies on trust among the social actors (W. Tsai & Ghoshal, 1998). Partners who trust each other will be in a better position to understand each other, will be more open to each other and exchange more tacit information involving the exposure to higher risks (Nahapiet & Ghoshal, 1998). Furthermore, Coleman (1988) suggested that the closure of professional networks, which are among the Olson-type civil associations, make actors more willing to share tacit knowledge. This argumentation suggests a complementary relationship between bridging and bonding ties: whereas bridging ties provide the firm with a sufficient variety of new information and knowledge, bonding ties provide the necessary trust for the transfer of more complex and tacit information and a closer coordination among network actors. In light of existing external information sources, bonding Olson-type association may establish the necessary sense of trust as well as civic responsibility which leads to collective action and learning (Tura & Harmaakorpi, 2005). At the same time, the potential lock-in and overembeddedness effect which can be generated by bonding Olson-type civil associations may be limited for those firms which rely on external information sources as these firms rely on a firm-level network. We therefore suggest that:

Hypothesis 3b: The negative impact of operating in regions with high levels of memberships in bonding Olson-type civil associations on innovation performance will be higher for firms not relying on external information sources.

2. DATA DESCRIPTION AND METHODOLOGY

2.1. Data description

This research is based on firm- and region-level variables, using data derived from different sources. The firm-level data on innovation behavior and performance stems from the Colombian National Statistics Department (DANE), which collects data on Colombian manufacturing firms every two years. The "Survey on Development and Technological Innovation" (Encuesta de Desarrollo e Innovación Tecnológica - EDIT) follows the Bogota Manual (RICYT, OEA, & CYTED, 2001) and uses the data of the fourth wave carried out in 2009 covering the two-year period 2007 and 2008. It is a census of Colombian manufacturing firms which either have 10 or more employees or an annual production of $130.5 million Colombian Pesos in 2008. Empirical research employing this database is recent (Alvarado, 2000; Anlló & Suárez, 2009; Arbeláez & Torrado, 2011; Bogliacino & Naranjo Ramos, 2008; Crespi & Zuñiga, 2012; Juliao Rossi, Aguirre Barrios, Schmutzler, & Sánchez Manchola, 2013; Lambardi & Mora, 2014; Langebaek & Vásquez Escobar, 2007; Sánchez, Juliao Rossi, & Zuluaga Jiménez, 2013).

This dataset is combined with regional-level data containing information about social capital derived from the Social Capital Barometer (Barometro de Capital Social - BARCAS), a survey developed by John Sudarsky (2004, 2007) and carried out by the Fundación Restrepo Barco. The questionnaire, which has been adapted and extended from the World Value Survey to the Colombian context (Sudarsky, 2004, 2007), was applied to a representative sample of Colombian individuals for the second time in 2005. This dataset has not been used for empirical research. However, it follows the guidelines of the World Value Survey (2004-2010) which has been extensively used for empirical research (Beugelsdijk & Van Schaik, 2005; Beugelsdijk & van Schaik, 2005; Dakhli & De Clercq, 2004; Doh & Acs, 2010b; Estrin, Mickiewicz, & Stephan, 2013; Ghazinoory, Bitaab, & Lohrasbi, 2014; Johnson & Mislin, 2012). These two databases were merged, aggregating the firm-level data on the regional level for which the BARCAS is representative[6] and complemented by regional economic, human capital and infrastructure information derived from different official data sources. We excluded the case of the only firm whose headquarter is located in Casanare. Casanare in 2007 had a GDP per capita 2.5 times higher than that of the capital Bogotá; a result deriving from the very low population density which is coupled with one of the most active mining activities. As such, this case is an extreme outlier for the Orinoquía region and would distort our results.

2.2. Variable description

2.2.1. Dependent Variable

The dependent variable is a dummy variable that takes the value of 1 if the firm introduced a product innovation and 0 if it didn't. It is based on the responses to the following

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[6] Being a census, no limitations regarding the representativeness of the EDIT questionnaire exist.

question: "Please indicate whether your firm obtained during the period 2007-2008 any of the following innovations: Goods or services new or significantly improved for the firm, new or significantly improved for the national market or new or significantly improved to the international market." This variable is therefore the result of a very broad interpretation of product innovation following the Schumpeterian tradition (1934). As a result, the independent variable includes products that are new or improved for the firm, the national or the international market, thus representing both the diffusion as well as the generation of product innovation.

2.2.2. Independent variables

We employ a dummy variable for the use of external information sources (*fuenextnatpersd*), if any of potentially 18 information sources were used by the firm. The 18 items have a high degree of internal consistency (Cronbach's alpha coefficient equals to 0.8668). We relied exclusively on those information sources which involve personal interaction and which are restricted to the national borders. We argue that regional engagement in civil association will function as a communication channel facilitating the transfer of information and knowledge at the regional level. We therefore exclude information exchange with international actors. Additionally, our argumentation relies on interrelations between human actors. Clearly, information resources such as databases do not involve these kinds of interrelations and were therefore excluded as well.

The question of how to measure social capital is equally discussed (Portes & Landolt, 1996). To measure the structural dimension we utilize a question which has been used in other empirical research before: "Are you an active or passive member of [civil organization]?" (Beugelsdijk & Van Schaik, 2005; Dakhli & De Clercq, 2004; Doh & Acs, 2010a; Knack & Keefer, 1997). These authors used data from the World Value Survey (WVS). The BARCAS database follows the guidelines established by the WVS but is adapted for the Colombian context and thus includes a wider array of civil organizations, which we all used. We created two variables measuring active membership in various civil associations, differentiating between the Putnam-type and Olson-type relying on previous empirical work for this distinction (e.g. Knack, 2003). For this purpose, we created a dummy variable at the individual level if the person stated to be an active member of any of the civil association falling into either one of the two categories. We then aggregated the dummy variable at the individual level for the regional level by taking the weighted average for each region. Cronbach alpha's above 0.75 for both groups indicate a high internal consistency.

2.2.3. Control variables

Independent controlling covariates correspond to the theoretical perspective employed in this paper and we therefore include variables controlling for the firm's human capital and R&D activities as determinants of absorptive capacity (Schmidt, 2010). We control for investment in technological, scientific and innovation activities by including a categorical variable indicating the level of investments for innovative activities per employee (*investtotalcat*) and a continuous

variable which indicates the percentage of these investments targeted on R&D (*investrdpct*)[7], as well as people involved in innovation projects in percent of total employees (*persinvopct*) and the percentage of total employees working in R&D (*persrdpct*). We control for human capital by including the percentage of employees which count with a university degree (*persdegreepct*) and a concentration index (*indexconc*) reflecting the knowledge diversity in terms of academic formation of the firm's employees. This index takes values ranging from 0 to 1 with the upper limit representing the maximum level of concentration (or minimum level of diversity)[8]. We include a variable which represents an index for the lack of appropriability conditions as a barrier for innovation. Firms surveyed had to indicate on a 3-point Likert scale whether the following were two barriers for their innovation process: "ease of imitating third parties" and "insufficient capacity of the intellectual property system for the protection of innovations". We additionally included the percentage of investments in innovation activities financed by own resources over the total (*finownpct*), size in form of number of employees (*perstotal*), foreign ownership by including a dummy variable which takes the value of 1 on the case that 25% or more of the firm's capital is foreign-owned (*capi*) and a variable which controls for fixed sector effects (*pavitt*). The controlling covariates at the regional level again are incorporated based on the mainstream economics of innovation literature and thus include variables controlling for the regional level of human capital and absorptive capacities which we derived from official data published by the DANE. Regional control variables include the PIB per capita in million Colombian Pesos (*pibpercap*). Additionally, we controlled for the university graduates per 1000 habitants (*graduaprof*), the number of higher education institutes in the region (*institute*) as well as the number of researchers registered at Colciencias to control for human capital in that geographical area. These numbers were all taken for the year 2007.

2.3. Methodology

Our dependent variable – the introduction of product innovation in its widest sense – is a dummy variable, requesting the use of logistic regression. The structure of the variables in the proposed relationship is hierarchical: the firm-level data (level-1 units denoted with $i=1 \ldots m$) is embedded in the regional-level variables (level-2 units denoted with $j=1 \ldots n$). Y_{ij} is the value of our dichotomous outcome variable reflecting whether the firm produced or not a product innovation. When applying a traditional regression model based on partial least square method the assumption of independent observations would be violated (Hox, 2010; Snijders & Bsoker, 2012), leading to biased standard errors and inefficient coefficients (Raudenbusch & Bryk, 2002).

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[7] Different than most empirical research (e.g. Laursen et al., 2012) we are not able to include the firm-level R&D intensity, as the EDIT does not contain variables regarding sales figures.

[8] In the EDIT survey the potential academic formations are grouped into the following categories: a) Chemistry, Physics, Mathematics and Statistics; b) Health science; c) Engineering, Arquitecture and Urban Studies; d) Agronomy, Veterinary Studies and alike; e) Social Science; f) Human Science and Arts.

We apply multi-level logistic regression, also known as a hierarchical, random effects, or variance component model, thus taking into account the clustered data. In our case, we use a logistic regression predicting the probability that a firm will generate a product innovation as a function of variables at both the firm-level (*i*) and the regional-level (*j*). As such, we include a random intercepts which vary across regions *j*. We hereby avoid the ecological fallacy often present in innovation studies. This fallacy is present when the attributes at the regional level are assumed to be directly reflected in the firm's behavior (Robinson, 2009). At the same time, we also bypass the individual fallacy which is caused by incorrectly imputing firm-level innovative behavior to the regional or national level (Seligson, 2002). Furthermore, multilevel modeling, unlike other modeling techniques, allows us to properly evaluate the extent to which differences at the regional level are accountable for differences at the firm level (Srholec, 2011).

The structure of our basic random intercept model estimated in the paper is provided in equation (1):

$$Logit\{P(y_{ij} = 1| \quad)\} = \log\left(\frac{\pi_{ij}}{1 - \pi_{ij}}\right) = \beta_{0j} + \sum_{k=1}^{K} \beta_{kj} X_{ijk} + \varepsilon_{ij} \tag{1}$$

X_{ijk} are individual characteristics, β_{0j} and β_{kj} are the coefficients to be estimated and ε_{ij} is a random error term. Applying a multilevel regression allows β_{0j} and β_{kj} to be modeled as outcomes that depend on a number of contextual factors which pick-up information regarding the second level, i.e. regions; therefore, β_{0j} and β_{kj} are treated as random variables. Here we consider the simplest case, where the slopes β_{kj} are assumed to be fixed but the intercept β_{0j} is assumed to be determined by:

$$\beta_{0j} = \beta_0 + \sum_{q=1}^{Q} \gamma_{0q} Z_{jq} + u_{0j} \tag{2}$$

where γ_{00} is a fixed intercept, Z_{qj} a set of contextual factors that only vary at country level, γ_{0q} and γ_{k0} are a set of fixed parameters and u_{0j} are specific country random intercepts.

3. ECONOMETRIC ANALYSIS AND RESULTS

3.1. Descriptive analysis

Table 1 presents descriptive statistics and the correlation coefficients for the variables used in this study. The analysis of the correlation coefficients indicates a potential problem with multicollinearity due to very high correlation coefficients for the variables at the regional level. The Variance Inflation Factor shows a values well above 170, a problem that other authors have encountered as well (Laursen et al., 2012). Among other things, such multicollinearity may cause greatly inflated parameters. To circumvent this problem, we dropped the regional variables *graduaprof* and *institute* having extremely high individual VIF, reducing the VIF just below the typically recommended threshold of 10 (Belsley, 1991). When taking out *researcher* as well, the VIF drops to levels around 4 for all variables.

Figures 1 and 2 provide us with information at the regional level. The three regions Viejo Caldas, Nariño and Bogotá show the highest propensity for its inhabitants to be active members of Putnam-type civil organizations. One might argue that this – due to the vast geographic extension of the departments and regions in Colombia – may be caused by the high population density in these regions. And while Bogotá and the three departments of Viejo Caldas region are among the most densely populated regions, Nariño is not[9]. At the same time, Atlántico, Valle del Cauca and Antioquia, three departments which rank among the highest densely populated regions due to its capitals Barranquilla, Cali and Medellín, are among the regions ranking lowest with respect to active memberships in Putnam-type associations. Active membership in churches or religious groups is an outlier among the different civil association with a regional average of 23% of the population. The civil association which follows in terms of regional average is sports, social and recreational clubs with 8.4% of the population. For this reason, we included a map which shows the propensity of forming Putnam-type civil associations without including churches for each region. As one can observe comparing the two maps in Figure 1, the percentage drops considerably and additionally, some differences with regard to rankings arise, e.g. Norte de Santander where a very high active civil engagement seems to be driven mainly through memberships in churches and religious organizations. Comparing the participation in Putnam-type and Olson-type civil associations in Figure 2, we can observe that despite a high correlation, the same regions are not the top ranking for Olson- versus Putnam-type civil associations.

Figure 1. Regional average of active memberships in Putnam-type civil associations with and without churches.
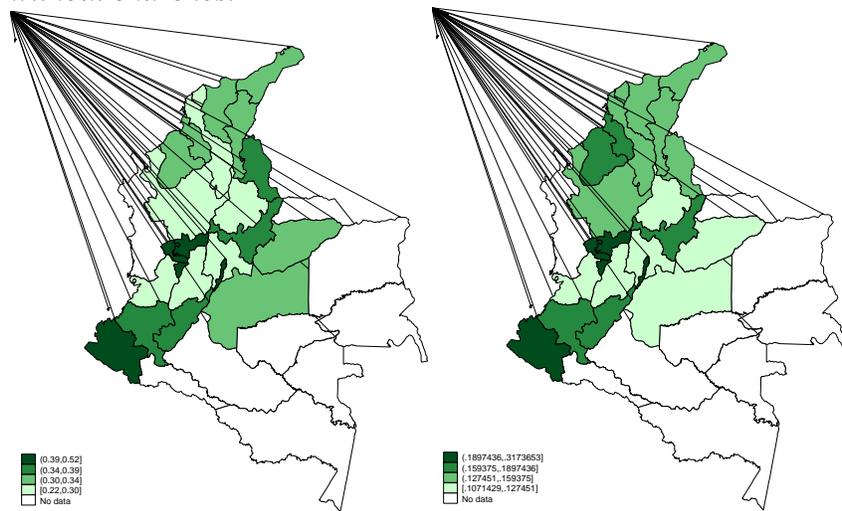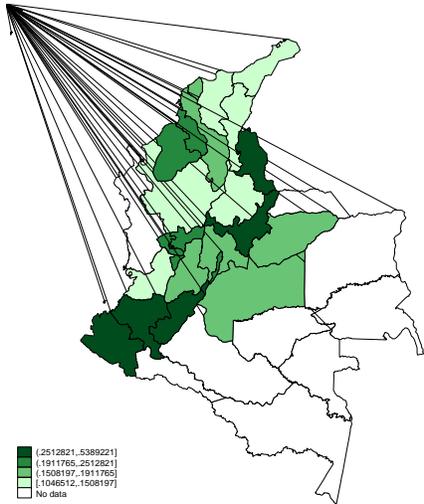

Figure 2. Regional average of active memberships in Olson-type civil associations.

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[9] This information was retrieved from
http://www.enciclopediacolombiana.com/enciclopediacolombiana/departamentos/departamentos.php

3.2. Regression analysis

In order to investigate the contingent effect of regional bridging and bonding social capital on the effectiveness of using external information for a firm's probability to generate a product innovation, we conduct two separate estimations for the two measures of the usage of external information sources. Our empirical results are presented in Table 2. The dependent variable for all models is product innovation in its widest definition. We report both regression coefficients and odds ratio in the multi-level logit regression for each explanatory variable. The 3 model specifications in each table are included in order to assess the robustness of the results. We first estimate a model that focuses only on the firm-level determinants. We then add the regional-level variables and in the third model we add the interaction terms. As we can observe, results for the individual-level control variables do not change across the three model specification, indicating the robustness of our results. Additionally, Figure 3 illustrates the differences between regions in the production of product innovation for model 3, with 95% confidence intervals. We can observe considerable heterogeneity across the different regions, with Norte de Santander being the region with the lowest average probability of achieving a product innovation and Antioquia being the region with the highest average probability.

For Model 1 and 2, we can evidence a statistically significant and positive correlation for the usage of at least one external information source, thus providing evidence for *hypothesis 1*. The odds of producing a product innovation for a firm is approximately 1.7 times higher for those firms using at least one external information source than for those who do not. Model 3 is consistent with this result in that there is a positive correlation between the reliance on external information sources and the generation of product innovation. Model 2 does not provide empirical evidence for *hypothesis 2a* and *2b*. The positive correlation of Putnam-type civil associations and the negative correlation of Olson-type civil association are statistically not

significant. This result is partially confirmed in Model 3; the negative correlation of bonding civil associations becomes significant, though only at the 10% level. At the same time, Model 3 provides us with partial empirical evidence for *hypothesis 3a* and *3b*. The coefficients for the interactions between bridging versus bonding civil associations and the use of external information sources are statistically significant at the 10% level. The positive effect of the regional propensity to actively participate in Putnam-type associations is 0.04 times lower for those firms which rely on external information sources. At the same time, the negative effect of the regional propensity to actively participate in Olson-type civil associations is 78 times greater for those firms which use external information sources.

In order to better assess these interactions, the two graphics in Figure 4 plot the predictive margins for product innovation separately for those firms which rely on external information sources and those which don't. We can observe for the latter group of firms that for higher values of Putnam-type of associations, the predictive margin for product innovation is higher. The slope for those firms which use external information sources is almost flat, thus providing evidence for our hypothesis. In the case of Olson-type of civil associations, we can observe that while again the slope for those firms using external information sources is almost flat, with very low levels of Olson-type civil associations this group of firms seems to benefit more than those firms which do not rely on external information sources. For both groups, however, a higher propensity to engage at Olson-type organizations at the regional level lowers their propensity to generate product innovation. This hints at a potential substitution effect between bridging networks at the regional and the firm-level; if the firm already maintains informal collaborations with external economic actors, the new knowledge which can obtained through personal networks in civil associations of its employees may be limited. Different from what we suggest, the negative effect of bonding civil associations is not smaller for firms which rely on external information sources. This may be due to extremely regionally focused, bonding firm-level network of external actors which then overlap with the personal networks through civil associations of the firm's employees, intensifying the problem of lock-in and over-embeddedness. These results call for further investigation, especially in light of recent findings of Kallio and colleagues (2010). These authors brought forward in their analysis of the Lahti region that regional bridging, organizational bonding and personal creative social capital are present in a regional innovation system.

Our results confirm earlier evidence that using at least one external information source increases the probability of firms to generate product innovations just as does the scope of external information sources (Chen et al., 2011; Laursen & Salter, 2006) for the case of a developing country. At the same time, the lack of evidence for a statistically significant correlation between the existence of civil association within a region and the innovation generation of firms of that region differs from earlier empirical research (Crescenzi, Gagliardi, & Percoco, 2013; Hauser, Tappeiner, & Walde, 2007; Kaasa, 2009; Laursen et al., 2012). These differences in empirical results may be attributed to the fact that most of these studies do not take into consideration that innovations are generated by firms located in different regions; instead, they evaluate the impact of regional social capital on regional innovativeness. Furthermore, the only study where the firm-embeddedness is taken into consideration does not apply a multi-level regression design (Laursen et al., 2012). Additionally, the lacking relationship may be caused by

the very broad categorization inherent in the data and a much more fine grained function of these civil associations (Knack & Keefer, 1997).

Above, we have observed that the propensity of active memberships in Putnam-type organizations is mainly driven by memberships in churches or religious organizations. We therefore reevaluated our results taking into consideration Putnam-type organizations excluding churches. Additionally, we also ran a regression analysis including only churches and Olson-type organizations. In both cases, our results were generally confirmed thus providing an indication of the robustness of our results.

Figure 3. Country effects in rank order with 95% confidence intervals for product innovation.
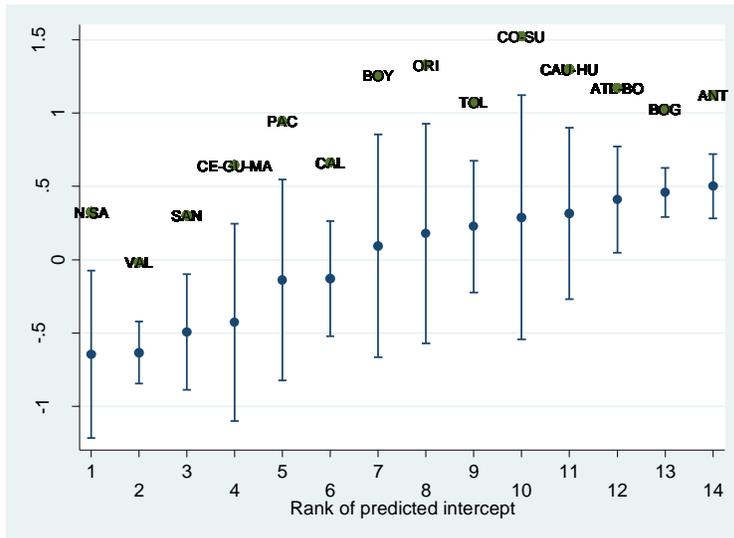
Table 1. Correlation matrix, descriptive statistics and Variation Inflation Factor (VIF) for firm-level and regional-level variables.

Variables	Mean	St. Dev.	VIF1	VIF2	1	2	3	4	5	6	7	8	9	10	11	12
1 productinov	0.30	0.46			1											
2 fuenextnatpersd [+]	0.35	0.48	1.62		0.5214*	1										
3 fuenextnatpersscope [+]	1.37	2.57		1.43	0.4643*	0.7257*	1									
4 investrdpct	0.03	0.14	1.12	1.12	0.2812*	0.2039*	0.1889*	1								
5 investtotald	0.40	0.49	4.09	3.80	0.7622*	0.5979*	0.4887*	0.2893*	1							
6 finownpct	0.30	0.44	3.34	3.34	0.6202*	0.4939*	0.4155*	0.2887*	0.8345*	1						
7 persdegreepct	0.13	0.13	1.22	1.22	0.0883*	0.0914*	0.0942*	0.0714*	0.0941*	0.1031*	1					
8 persrdpct	0.00	0.02	1.16	1.16	0.1517*	0.1568*	0.1690*	0.1289*	0.1544*	0.1367*	0.2415*	1				
9 persinvopct	0.02	0.04	1.34	1.34	0.2969*	0.2778*	0.2423*	0.1579*	0.3496*	0.2833*	0.2907*	0.3030*	1			
10 Indexconc	0.62	0.33	1.05	1.05	-0.0637*	-0.0451*	-0.0703*	-0.0388*	-0.0509*	-0.0440*	0.1357*	-0.0444*	0.0229	1		
11 perstotal	113.90	292.67	1.16	1.18	0.2112*	0.1875*	0.2583*	0.0798*	0.2206*	0.1811*	0.0593*	0.0708*	-0.0107	0.0939*	1	
12 approb_index	2.37	0.76	1.06	1.06	-0.1661*	-0.1978*	-0.2055*	-0.084*	-0.1566*	-0.1211*	-0.0161	-0.0623*	-0.1033*	-0.0118	0.0015	1
13 capi	0.07	0.26	1.15	1.15	0.0989*	0.0835*	0.0786*	0.0553*	0.1146*	0.1278*	0.2005*	0.0805*	-0.0192	-0.0781*	0.2639*	0.0483*
14 pavitt	2.13	0.99	1.01	1.01	0.0404*	0.0317*	0.0339*	0.0133	0.0526*	0.0507*	0.0210	0.0223	-0.0211	-0.0223	0.0135	0.0040
15 putnam_a	0.34	0.08	4.16	4.17	-0.014	-0.0188	0.0123	0.0126	-0.0730*	-0.0461*	0.0502*	-0.0018	-0.0010	0.0168	0.0267	0.0071
16 olsen_a	0.19	0.06	2.02	2.02	-0.0092	-0.0384*	-0.0275*	-0.0089	-0.0385*	-0.0122	0.0791*	-0.0004	0.0177	0.0047	-0.0190	0.0253
17 pibpercap	9,781,118	3,140,362	5.43	5.43	-0.0366*	0.0006	-0.0086	0.0035	-0.0600*	-0.0362*	0.0559*	-0.0215	-0.0050	0.0024	-0.0130	0.0204
18 educacionsup	783,357	489,951	134.20	134.31	-0.0079	-0.0045	-0.0078	0.0148	-0.0629*	-0.0406*	0.0756*	0.0288*	0.0027	0.0074	-0.0160	0.0195
19 researcher	2,770	2,174	166.70	166.82	-0.0112	-0.0037	-0.0031	0.0164	-0.0679*	-0.0425*	0.0695*	0.0284*	-0.0011	0.0067	-0.0101	0.0192

	13	14	15	16	17	18	19
13 capi	1						
14 pavitt	0.0201	1					
15 putnam_a	0.0340*	-0.0081	1				
16 olsen_a	0.0278*	0.0422*	0.6748*	1			
17 pibpercap	0.0455*	-0.0653*	0.4173*	0.1495*	1		
18 educacionsup	0.0838*	-0.0665*	0.4946*	0.2936*	0.8760*	1	
19 researcher	0.0807*	-0.0658*	0.5704*	0.3410*	0.8832*	0.9922*	1

*Note: [+] indicates that these two variables are alternative measures for the use of external information sources. * p < .10; ** p < .05; *** p < .01. Source: Authors' own elaboration based on data from EDIT IV.*

Table 2. Estimation results for product innovation. Multi-level random intercept logistic model.

productinov	Modell (1)		Modell (2)		Modell (3)	
	Coefficients	Odds Ratio	Coefficients	Odds Ratio	Coefficients	Odds Ratio
Firm-Level Variables						
fuenextnatpersd	0.528***	1.695***	0.524***	1.689***	0.810*	2.248***
	(0.109)	(0.184)	(0.109)	(0.1836)	(0.429)	(0.965)
investrdpct	0.925***	2.522***	0.925***	2.522***	0.929***	2.532***
	(0.301)	(0.758)	(0.301)	(0.758)	(0.301)	(0.761)
investpercapcat_	4.442***	84.967***	4.441***	84.871***	4.458***	86.297***
< 1,000 per employee	(0.224)	(19.033)	(0.224)	(19.010)	(0.225)	(19.434)
investpercapcat_	5.062***	157.974***	5.063***	157.986***	5.082***	161.174***
< 3,000 per employee	(0.225)	(35.508)	(0.225)	(35.513)	(0.226)	(36.465)
investpercapcat_	5.194***	180.104***	5.195***	180.384***	5.222***	185.280***
< 8,000 per employee	(0.221)	(39.7811)	(0.221)	(39.851)	(0.223)	(41.237)
investpercapcat_	5.324***	205.165***	5.325***	205.397***	5.335***	207.446***
< 20,000 per employee	(0.242)	(49.708)	(0.242)	(49.760)	(0.243)	(50.478)
investpercapcat_	5.404***	222.313***	5.410***	223.672***	5.427***	227.522***
< 35,000 per employee	(0.337)	(74.931)	(0.337)	(75.414)	(0.338)	(76.839)
investpercapcat_	5.225***	185.909***	5.221***	185.207***	5.230***	186.863***
< 150,000 per employee	(0.334)	(62.151)	(0.334)	(61.915)	(0.335)	(62.682)
investpercapcat_ >= 150,000 per employee	5.890***	361.469***	5.886***	360.058***	5.911***	368.909***
	(1.089)	(393.769)	(1.089)	(392.265)	(1.089)	(401.588)
finownpct	-0.0470	0.9541	-0.0453	0.9557	-0.0359	0.9648
	(0.146)	(0.139)	(0.146)	(0.139)	(0.146)	(0.141)
persdegreepct	-0.600	0.5488	-0.605	0.5460	-0.614	0.5413
	(0.479)	(0.2631)	(0.480)	(0.262)	(0.481)	(0.260)
persrdpct	1.170	3.2204	1.177	3.2432	1.229	3.4191
	(3.030)	(9.758)	(3.028)	(9.820)	(3.050)	(10.429)
persinvopct	1.317	3.7338	1.331	3.7849	1.321	3.7481
	(1.093)	(4.081)	(1.093)	(4.138)	(1.096)	(4.107)
Indexconc	-0.244	0.7838	-0.243	0.7844	-0.241	0.7860
	(0.171)	(0.134)	(0.171)	(0.134)	(0.171)	(0.134)
perstotal	0.000532***	1.000532***	0.000533***	1.000533***	0.000531***	1.000531***
	(0.000201)	(0.000201)	(0.000201)	(0.0002009)	(0.000201)	(0.0002015)
approb_index	-0.278***	0.757***	-0.278***	0.757***	-0.283***	0.754***
	(0.0681)	(0.052)	(0.0681)	(0.0516)	(0.0683)	(0.052)
capi	-0.271	0.7627	-0.270	0.7634	-0.270	0.7631
	(0.187)	(0.142)	(0.187)	(0.143)	(0.187)	(0.143)
pavitt_*science*	0.527***	1.694***	0.530***	1.699***	0.531***	1.701***
	(0.151)	(0.256)	(0.151)	(0.257)	(0.152)	(0.258)
pavitt_*scale*	-0.0444	0.9566	-0.0430	0.9579	-0.0381	0.9626
	(0.119)	(0.114)	(0.119)	(0.114)	(0.119)	(0.114)
pavitt_*special*	-0.0289	0.9715	-0.0283	0.9721	-0.0172	0.9830
	(0.204)	(0.199)	(0.204)	(0.199)	(0.205)	(0.201)
Constant	-3.713***	0.024***	-3.604***	0.027***	-3.760***	0.023***
	(0.308)	(0.008)	(1.003)	(0.027)	(1.034)	(0.024)

Regional-level variables						
putnam_a			1.723	5.599	3.769	43.355
			(2.375)	(13.298)	(2.604)	(112.876)
olsen_a			-1.909	0.148	-4.542*	0.011*
			(2.339)	(0.347)	(2.718)	(0.029)
pibpercap			-3.01e-08	1	-3.43e-08	1
			(5.55e-08)	(5.55e-08)	(5.54e-08)	(5.54e-08)
Interactions Firm-Regional-Level						
fuenextnatpersd#putnam_a					-3.292*	0.037*
					(1.761)	(0.066)
fuenextnatpersd#olson_a					4.362*	78.401*
					(2.280)	(178.756)
Random Intercept						
Constant	-0.641**	0.527**	-0.693***	0.500***	-0.697***	0.498***
	(0.256)	(0.135)	(0.265)	(0.132)	(0.266)	(0.132)
Observations	5,198	5,198	5,198	5,198	5,198	5,198
Number of groups	14	14	14	14	14	14
LR test vs logistic reg	77.51		56.16		55.3	
p-value LR test	0		0		0	
ll(model)	-1321.383		-1320.9893		-1318.854	

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure3. Predictive margins using an external information sources by the level of active memberships in Putnam (a) versus Olson (b)-type civil associations at the regional level.
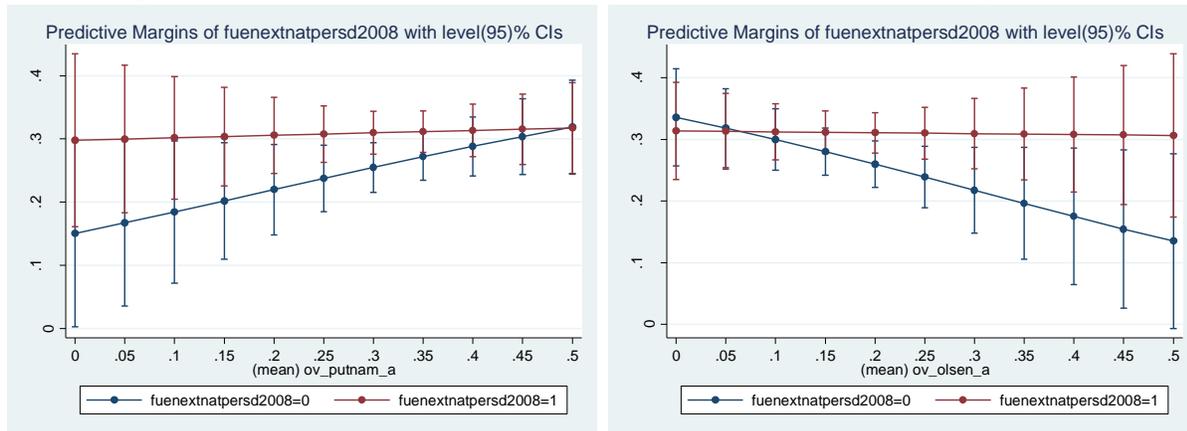
4. CONCLUSIONS

We base our research on the notion that innovation is a process, "a bridge-building process linking individuals" (Anderson & Jack, 2002, p. 207). As such, we argue that regional social capital in form of active memberships in civil associations play a crucial role in boosting innovation output at the firm level. We place this contention on the fact that memberships in civil associations are often local activities which put individuals into contact with others in their community, city, and region (Dakhli & De Clercq, 2004). Some authors argue that the scope and intensity of personal relationships within a regional innovation system function as local buzz (Storper & Venables, 2004), that is a process of information and knowledge exchange which based on face-to-face interactions between members of firms geographically concentrated taking place in local community organizations, bars or restaurants (Bathelt, Malmberg, & Maskell, 2004). We contest that the effect of actively participating in bonding and bridging civil associations constitutes a potential channel for the acquisition of new information and knowledge. However, this effect needs to be evaluated in light of the firm's network with external economic actors.

Our empirical research provides no statistical evidence for a direct effect of bridging or bonding regional social capital. However, we do find empirical evidence that the effectiveness of relying on external information sources for Colombian manufacturing firms depends on the regional civil activity. To the best of our knowledge, we provide first empirical evidence that associates civil engagement through memberships in voluntary organizations at the regional level with firm-level innovation output applying a multi-level model and therefore bypass the ecological and individual fallacy when not taking into account the hierarchical structure of firms being embedded in regions. Our results go in line with earlier research that positively associates civic participation at the regional level with the aggregated regional patenting activity in Italy (Crescenzi et al., 2013) and Europe (Hauser et al., 2007; Kaasa, 2009). Our research, however, goes further by differentiating between the two mentioned types of civil associations, making clear that not all civil associations serve the same cause. Laursen and colleagues (2012), on the other hand, provide empirical evidence at the firm-level that social interaction at the regional level positively moderates the effect of external R&D acquisition. We extend this finding providing evidence that not only externally acquired R&D activities but also the use of external information sources is moderated by social interaction at the regional level. Our results, however, differ from those from Hauser and colleagues (2007). For a sample of the 60 largest German cities, they found a statistically significant negative direct effect between voluntary associations and patent intensity, while at the same time a statistically significant positive direct correlation was found for expenditures of Chambers of Commerce. One possible explanation of these findings is that the authors relied on patent application, a measure for innovations which is much more restricted than the ones used in this empirical study, though it only represents inventions rather than innovations. As mentioned above, future research should evaluate the influence of bridging and bonding ties differentiating between the degrees of innovation. Furthermore, the authors relied on a very broad measure for voluntary associations: the registration of the association. This, however, does not say anything regarding the active participation. Additionally, it may distort the results as the same amount of people can be member in either many small organizations or one very large organization. Lastly, they evaluated these correlations at the aggregated regional level which might generate difference in results.

We acknowledge that our research is not free of caveats. However, most of these shortcomings offer interesting venues for future research. In particular, the datasets on which we relied can be subject to criticism. We have mentioned that the data on social capital is representative at the regional level, not at the department level. However, though it is likely that civil associations are of local rather than national character (Dakhli & De Clercq, 2004), we cannot derive from the data whether these associations generate personal interactions at the community, city, department or regional level. It would be very interesting for future research to evaluate the cross-effects between these regional levels of social capital generated through civil associations. Furthermore, the categories of groups in the BARCAS are overly broad, a shortcoming brought forward already by Knack (2003). It is therefore difficult to differentiate between Putnam- and Olson-type civil associations. Also, the empirical operationalization between those two types on which we relied (Knack, 2003), is far from clear cut and needs further empirical work (Coffe & Geys, 2007). Lastly, we are not able to infer about the depth of commitment regarding the active membership in civil organizations; relying on active memberships and excluding passive memberships is only a very broad distinction.

The problem of not being able to differentiate between the different geographical levels also applies for the case of external information sources: while we explicitly excluded international external resources, the classification of national external information sources is rather broad. The famous comparison of Silicon Valley and Route 128 shows that this is a shortcoming which in future research should be overcome. Saxenian (1994) provides evidence that the lacking success of Route 128 in comparison with Sillicon Valley were due to missing bridging links with outer-regional network actors. The possible negative effects of strong regional bonding ties such as overopportunism and lack of flexibility (Adler & Kwon, 2002; Tura & Harmaakorpi, 2005) were overly pronounced in that case. In summary, future research should take into consideration the joint influence of firm-level, regional-level and outer-regional level bridging and bonding social capital.

We have, taking into consideration the developing country context in which this study takes place, adopted a very broad definition to measure product innovation. That means that while from our empirical results we can infer that regional civic participation is a moderating contextual variable impacting the adoption and diffusion of product innovation, we are not able to differentiate between various degrees of novelty. Provided that the empirical studies mentioned earlier found evidence of regional civic participation on patenting activity, brings forward the necessity for further studies evaluating this differential impact arises. Furthermore, the generation of innovation is a process that takes place in different stages with stage-specific tasks; for example while during the innovation initiation the central tasks are concentrated on problem perception and idea formation, during the innovation implementation the implementation of plans and actions are at the center of attention (Damanpour, 1991). Based on the differentiated tasks involved, the moderating effects of regional civil participation may differ as well. While during the idea generation stage, bridging ties maybe of greater help and accelerate development speed by providing access to a wide information and knowledge pool bonding ties are required at later innovation stages with increasing complexity (Harrison and colleagues (2008). Future research may focus on the impact depending on the innovation stages.

An additional limitation lies in the lack of being able to control for possible problems of endogeneity. While we have bypassed – applying the multilevel design – the ecological and individual fallacy present in the cited empirical studies, our data inhibits the use of an adequate instrument variable as did Laursen et al. (2012) at the firm-level and Crescenzi (2013) at the regional level. Endogeneity problems arise when there is a third, unobservable or unobserved variable that would affect both the use of external knowledge sources and product innovation respectively social capital and product innovation. Unfortunately, EDIT IV does not contain any financial information which could be used as an instrument variable nor did we identify any regional-variable which could serve as an instrumental variable.

References:

Adler, P. S., & Kwon, S.-W. (2002). Social capital: Prospects for a new concept. *Academy of Management Review*, *27*(1), 17–40.

Akçomak, İ. S., & ter Weel, B. (2009). Social capital, innovation and growth: Evidence from Europe. *European Economic Review*, *53*(5), 544–567. doi:10.1016/j.euroecorev.2008.10.001

Alvarado, A. (2000). Dinámica de la estrategia de innovación: el caso de Colombia. *Coyuntura Económica, Fedesarrollo*, *30*(3), 61–119.

Amara, N., & Landry, R. (2005). Sources of information as determinants of novelty of innovation in manufacturing firms: evidence from the 1999 statistics Canada innovation survey. *Technovation*, *25*(3), 245–259. doi:10.1016/S0166-4972(03)00113-5

Anderson, A. R., & Jack, S. L. (2002). The articulation of social capital in entrepreneurial networks: A glue or a lubricant? *Entrepreneurship & Regional Development*, *14*(3), 193–210.

Anlló, G., & Suárez, Y. D. (2009). Innovación: algo más que I+D. Evidencias Iberoamericanas a partir de las encuestas de innovación: Construyendo las estrategias empresarias competitivas. In *El estado de la ciencia 2008* (pp. 73–103). RICYT.

Annen, K. (2001). Inclusive and exclusive social capital in the small-firm sector in developing countries. *Journal of Institutional and Theoretical Economics*, *157*(2), 319–339.

Annen, K. (2003). Social capital, inclusive networks, and economic performance. *Journal of Economic Behavior & Organization*, *50*(4), 449–463.

Arbeláez, M. A., & Torrado, M. P. (2011). *Innovation, R&D Investment and Productivity in Colombian Firms* (No. IDB-WP-251).

Asheim, B. T., & Gertler, M. S. (2005). The geography of innovation: Regional Innovation Systems. In J. Faberberg, D. C. Mowery, & R. R. Nelson (Eds.), *The Oxford Handbook of Innovation* (pp. 291–317). Oxford: Oxford University Press.

Asheim, B. T., & Isaksen, A. (1997). Location, agglomeration and innovation: Towards regional innovation systems in Norway? *European Planning Studies*, *5*(3), 299–330.

Barge-Gil, A. (2010). Cooperation-based innovators and peripheral cooperators: An empirical analysis of their characteristics and behavior. *Technovation*, *30*(3), 195–206. doi:10.1016/j.technovation.2009.11.004

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*(1), 31–56.

Becheikh, N., Landry, R., & Amara, N. (2006). Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993–2003. *Technovation*, *26*(5-6), 644–664. doi:10.1016/j.technovation.2005.06.016

Belderbos, R., Carree, M., & Lokshin, B. (2004). Cooperative R&D and firm performance. *Research Policy*, *33*(10), 1477–1492. doi:10.1016/j.respol.2004.07.003

Belsley, D. A. (1991). A Guide to using the collinearity diagnostics. *Computational Economics*, *4*(1), 33–50. doi:10.1007/BF00426854

Beugelsdijk, S., & Smulders, S. (2003). Bridging and bonding social capital: Which type is good for economic growth? *The Cultural Diversity of European Unity*, (October), 275–310.

Beugelsdijk, S., & Van Schaik, T. (2005). Differences in social capital between 54 Western European regions. *Regional Studies*, *39*(8), 1053–1064. doi:10.1080/00343400500328040

Beugelsdijk, S., & van Schaik, T. (2005). Social capital and growth in European regions: An empirical test. *European Journal of Political Economy*, *21*(2), 301–324. doi:10.1016/j.ejpoleco.2004.07.004

Bodas Freitas, M. I., Clausen, T. H., Fontana, R., & Verspagen, B. (2011). Formal and informal external linkages and firms' innovative strategies: A cross-country comparison. In A. Pyka & M. da Graca Derengowski Fonseca (Eds.), *Catching up, spillovers and innovation networks in a Schumpeterian perspective* (pp. 119–145). Berlin: Springer Verlag. doi:10.1007/978-3-642-15886-5

Bogliacino, F., & Naranjo Ramos, A. (2008). Optimal intellectual property rights protection: The case of Colombia. *Economics Bulletin*, *15*(20), 1–15.

Bönte, W. (2003). R&D and productivity: Internal vs. external R&D - evidence from West German manufacturing industries. *Economics of Innovation and New Technology*, *12*(4), 343–360.

Bönte, W., & Keilbach, M. (2005). Concubinage or marriage? Informal and formal cooperations for innovation. *International Journal of Industrial Organization*, *23*(04), 279–302. doi:10.1016/j.ijindorg.2005.01.007

Bourdieu, P. (1986). The forms of capital. In J. G. Richardson (Ed.), *Handbook of Theory and Research for the Sociology of Education* (Vol. 241, pp. 241–258). Greenwood Press. doi:10.1002/9780470755679.ch15

Brass, D. J. (1995). A social network perspective on human resources management. *Research in Personnel and Human Resources*, *13*(1), 39–79.

Bresnahan, T. (2001). "Old economy" inputs for "new economy" outcomes: Cluster formation in the new Silicon Valleys. *Industrial and Corporate Change*, *10*(4), 835–860.

Burt, R. S. (2009). *Structural Holes: The Social Structure of Competition*. Cambridge: Harvard Business Press.

Cainelli, G., Mancinelli, S., & Mazzanti, M. (2007). Social capital and innovation dynamics in district-based local systems. *The Journal of Socio-Economics*, *36*(6), 932–948. doi:10.1016/j.socec.2007.01.023

Caloghirou, Y., Kastelli, I., & Tsakanikas, A. (2004). Internal capabilities and external knowledge sources: complements or substitutes for innovative performance? *Technovation*, *24*(1), 29–39. doi:10.1016/S0166-4972(02)00051-2

Camagni, R. (1991). Local "Milieu", Uncertainty and Innovation Networks: Towards a New Dynamic Theory of Economic Space. In R. Camagni (Ed.), *Innovation Networks Spatial Perspectives* (pp. 121–142). Belhaven Press.

Camagni, R. (1995). The concept of innovative milieu and its relevance for public policies in European lagging regions. *Papers in Regional Science*, *74*(4), 317–340.

Cassiman, B., & Veugelers, R. (2006). In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition. *Management Science*, *52*(1), 68–82. doi:10.1287/mnsc.1050.0470

Ceci, F., & Iubatti, D. (2012). Personal relationships and innovation diffusion in SME networks: A content analysis approach. *Research Policy*, *41*(3), 565–579. doi:10.1016/j.respol.2011.10.003

Chen, J., Chen, Y., & Vanhaverbeke, W. (2011). The influence of scope, depth, and orientation of external technology sources on the innovative performance of Chinese firms. *Technovation*, *31*(8), 362–373. doi:10.1016/j.technovation.2011.03.002

Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston, MA: Harvard Business School Press.

Coffe, H., & Geys, B. (2007). Toward an empirical characterization of bridging and bonding social capital. *Nonprofit and Voluntary Sector Quarterly*, *36*(1), 121–139. doi:10.1177/0899764006293181

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, *94*(s1), S95. doi:10.1086/228943

Crescenzi, R., Gagliardi, L., & Percoco, M. (2013). Social capital and the innovative performance of Italian provinces. *Environment and Planning*, *45*(4), 908–929. doi:10.1068/a45221

Crespi, G., & Zuñiga, P. (2012). Innovation and Productivity: Evidence from Six Latin American Countries. *World Development*, *40*(2), 273–290. doi:10.1016/j.worlddev.2011.07.010

Dahl, M. S., & Pedersen, C. Ø. R. (2004). Knowledge flows through informal contacts in

industrial clusters: myth or reality? *Research Policy*, *33*(10), 1673–1686. doi:10.1016/j.respol.2004.10.004

Dakhli, M., & De Clercq, D. (2004). Human capital, social capital, and innovation: a multi-country study. *Entrepreneurship & Regional Development*, *16*(2), 107–128.

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, *34*(3), 555–590.

Doh, S., & Acs, Z. J. (2010a). *Innovation and social capital: A cross- country investigation* (No. 082). *Industry and Innovation* (Vol. 17). Jena.

Doh, S., & Acs, Z. J. (2010b). Innovation and social capital: a cross-country investigation. *Industry and Innovation*, *17*(3), 241–262.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, *23*(4), 660–679.

Edquist, C., & Johnson, B. (1997). Institutions and organizations in systems of innovation. In C. Edquist (Ed.), *Systems of Innovation: Technologies, Institutions and Organizations* (pp. 41–63). London: Pinter Publishers.

Estrin, S., Mickiewicz, T., & Stephan, U. (2013). Entrepreneurship, social capital, and institutions: Social and commercial entrepreneurship across nations. *Entrepreneurship Theory and Practice*, *37*(3), 479–504.

Falk, I., & Kilpatrick, S. (2000). What is social capital? A study of interaction in a rural community. *Sociologia Ruralis*, *40*(1), 87–110.

Florida, R. (2002). *The Rise of the Creative Class and How It's Transforming Work, Leisure, Community and Everyday Life*. New York, NY: Basic Books.

Fromhold-Eisebith, M. (2004). Innovative milieu and social capital—complementary or redundant concepts of collaboration-based regional development? *European Planning Studies*, *12*(6), 747–765. doi:10.1080/0965431042000251846

Gertler, M. S. (1997). The invention of regional culture. In R. Lee & J. Willis (Eds.), *Geographies of Economies* (pp. 47–58). London: Arnold.

Ghazinoory, S., Bitaab, A., & Lohrasbi, A. (2014). Social capital and national innovation system: a cross-country analysis. *Cross Cultural Management: An International Journal*, *21*(4), 453–475. doi:10.1108/CCM-10-2013-0154

Grabher, G. (1993). *The embedded firm: On the socio-economics of inter-firm networks*. Routledge.

Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology*, *78*(6), 1360–1380.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly*, *44*(1), 82–111.

Harryson, S. J., Dudkowsk, R., & Stern, A. (2008). Transformation networks in innovation alliances–the development of Volvo C70. *Journal of Management Studies*, *45*(4), 745–773.

Hauser, C., Tappeiner, G., & Walde, J. (2007). The Learning Region: The Impact of Social Capital and Weak Ties on Innovation. *Regional Studies*, *41*(1), 75–88. doi:10.1080/00343400600928368

Hean, S. (2002). Social capital and its measurement. *Canadian Journal of Policy Research*, *2*(1), 41–51.

Hox, J. (2010). *Multilevel analysis: Techniques and applications*. Routledge.

Ibarra, H. (1993). Network centrality, power, and innovation involvement: Determinants of technical and administrative roles. *Academy of Management Journal*, *36*(3), 471–501.

Isaksen, A., Asheim, B. T., & Isaksen, A. (2002). Regional innovation systems: The integration of local "sticky" and global "ubiquitous" knowledge. *Journal of Technology Transfer*, *27*(1), 77–86.

Iyer, S., Kitson, M., & Toh, B. (2005). Social capital, economic growth and regional development. *Regional Studies*, *39*(8), 1015–1040.

Jewels, T., Underwood, A., & de Pablos Heredero, C. (2003). The role of informal networks in knowledge sharing. In *ECIS 2003 Proceedings* (p. 56).

Johnson, N. D., & Mislin, A. (2012). How much should we trust the World Values Survey trust question? *Economics Letters*, *116*(2), 210–212. doi:10.1016/j.econlet.2012.02.010

Juliao Rossi, J., Aguirre Barrios, F., Schmutzler, J., & Sánchez Manchola, I. D. (2013). Relación entre la estrategia de innovación de la firma y su decisión de patentar: evidencia de empresas pertenecientes al sector manufacturero colombiano. *Estudios Gerenciales*, *29*(128), 313–321.

Kaasa, A. (2009). Effects of different dimensions of social capital on innovative activity: Evidence from Europe at the regional level. *Technovation*, *29*(3), 218–233. doi:10.1016/j.technovation.2008.01.003

Kallio, A., Harmaakorpi, V., & Pihkala, T. (2010). Absorptive capacity and social capital in Regional Innovation Systems: The case of the Lahti region in Finland. *Urban Studies*, *47*(2), 303–319. doi:10.1177/0042098009346373

Katz, R., & Allen, T. J. (1982). Investigating the not invented here (NIH) syndrome: A look at the performance, tenure, and communication patterns of 50 R&D project groups. *R&D Management*, *12*(1), 7–20.

Knack, S. (2003). Groups, Growth and Trust: Cross-Country Evidence on the Olson and Putnam Hypotheses. *Public Choice*, *117*(3), 341–355. doi:10.1023/B:PUCH.0000003736.82456.04

Knack, S., & Keefer, P. (1997). Does social capital have an economic payoff? A cross-country investigation. *Quarterly Journal of Economics*, *112*(4), 1251–1288.

Koka, B. R., & Prescott, J. E. (2002). Strategic alliances as social capital: A multidimensional view. *Strategic Management Journal*, *23*(9), 795–816.

Krackhardt, D. (1992). The strength of strong ties: The importance of philos in organizations. In N. Nohria & R. G. Eccles (Eds.), *Networks and Organizations: Structure, Form, and Action* (pp. 216–239). Cambridge, MA: Harvard Business School Press.

Lambardi, G., & Mora, J. (2014). Determinantes de la innovación en productos o procesos: el caso colombiano. *Revista de Economía Institucional*, *16*(31), 251–262.

Langebaek, A., & Vásquez Escobar, D. (2007). Determinantes de la actividad innovadora en la industria manufacturera colombiana. *Coyuntura Económica, Fedesarrollo*, *37*(1), 67–89.

Laursen, K., Masciarelli, F., & Prencipe, A. (2012). Regions matter: How localized social capital affects innovation and external knowledge acquisition. *Organization Science*, *23*(1), 177–193. doi:10.1287/orsc.1110.0650

Laursen, K., & Salter, A. J. (2006). Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, *27*(2), 131–150. doi:10.1002/smj.507

Lazega, E., Jourda, M., Mounier, L., & Stofer, R. (2008). Catching up with big fish in the big pond? Multi-level network analysis through linked design. *Social Networks*, *30*(2), 159–176.

Leenders, R. T. A., Van Engelen, J. M. L., & Kratzer, J. (2007). Systematic design methods and the creative performance of new product teams: do they contradict or complement each other? *Journal of Product Innovation Management*, *24*(2), 166–179.

Lorenzen, M. (2007). Social capital and localised learning: proximity and place in technological and institutional dynamics. *Urban Studies*, *44*(4), 799–817.

Lundvall, B.-Å. (1992). *National System of Innovation: Toward a Theory of Innovation and Interactive Learning*. London: Anthem Press.

Lundvall, B.-Å. (2006). *One knowledge base or many knowledge pools?* (No. 06-8). Aalborg.

Lundvall, B.-Å. (2007). National Innovation Systems—Analytical Concept and Development

Tool. *Industry & Innovation*, *14*(1), 95–119. doi:10.1080/13662710601130863

Lundvall, B.-Å. (2010). *National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning*. London and New York: Anthem Press.

Lundvall, B.-Å., & Christensen, J. (2004). Introduction: Product innovation-on why and how it matters for firms and the economy. In J. Christensen & B.-Å. Lundvall (Eds.), *Product Innovation, Interactive Learning and Economic Performance* (pp. 1–18). Amsterdam: Elsevier Ltd.

Lundvall, B.-Å., Johnson, B., Andersen, E. S., & Dalum, B. (2002). National systems of production, innovation and competence building. *Research Policy*, *31*(2), 213–231.

Maennig, W., & Ölschläger, M. (2011). Innovative Milieux and Regional Competitiveness: The Role of Associations and Chambers of Commerce and Industry in Germany. *Regional Studies*, *45*(4), 441–452. doi:10.1080/00343401003601917

Malerba, F. (2002). Sectoral systems of innovation and production. *Research Policy*, *31*(2), 247–264.

Marshall, A. (1965). *Principles of Economics*. (Maxmillan, Ed.). New York, NY: Macmillan Press.

Maskell, P. (2001). Towards a knowledge-based theory of geographical cluster. *Industrial and Corporate Change*, *10*(4), 921–943.

McCormick, D., & Atieno, R. (2002). Linkages between small and large firms in the Kenyan food processing sector. In M. P. van Dijk & H. Sandee (Eds.), *Innovation and small enterprises in the Third World* (pp. 223–248). Cheltenham (UK): Edward Elgar.

McFadyen, M. A., & Cannella, A. A. (2004). Social capital and knowledge creation: Diminishing returns of the number and strength of exchange relationships. *Academy of Management Journal*, *47*(5), 735–746.

Melo, A. (2001). *The innovation systems of Latin America and the Caribbean* (No. 460).

Meyer, K. E., Estrin, S., Bhaumik, S. K. S. K., & Peng, M. W. M. W. (2009). Institutions, resources, and entry strategies in emerging economies. *Strategic Management Journal*, *30*(1), 61–80.

Miguélez, E., Moreno, R., & Artís, M. (2011). Does Social Capital Reinforce Technological Inputs in the Creation of Knowledge? Evidence from the Spanish Regions. *Regional Studies*, *45*(8), 1019–1038. doi:10.1080/00343400903241543

Miotti, L., & Sachwald, F. (2003). Co-operative R&D: why and with whom? An integrated framework of analysis. *Research Policy*, *32*(8), 1481–1499. doi:10.1016/S0048-7333(02)00159-2

Moran, P., & Ghoshal, S. (1996). Value creation by firms. In *Academy of Management Proceedings, Volume 1* (pp. 1–46).

Morgan, K. (2007). The learning region: institutions, innovation and regional renewal. *Regional Studies*, *41*(S1), S147–S159.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital and the organizational advantage. *The Academy of Management Review*, *23*(2), 242–266.

Narayan-Parker, D. (1999). *Bonds and bridges: Social capital and poverty* (Vol. 2617.). World Bank Publications.

Nelson, R. R. (1993). *National innovation systems: a comparative analysis*. Oxford: Oxford University Press.

North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge: Cambridge University Press.

Olson, M. (1982). *The rise and decline of nations: Economic growth, stagnation, and social rigidities*. New Haven: Yale University Press.

Paxton, P. (2002). Social capital and democracy: An interdependent relationship. *American Behavioral Scientist*, *67*(2), 254–277. doi:10.1177/0002764297040005004

Payne, G. T., & Moore, C. (2011). Multilevel challenges and opportunities in social capital research. *Journal of Management*, *37*(2), 491–520.

Portes, A. (1998). Social capital: Its origins and applications in modern sociology. *Knowledge and Social Capital*, *24*(1), 43–67. doi:10.1146/annurev.soc.24.1.1

Portes, A., & Landolt, P. (1996). The Downside of Social Capital. *The American Prospect*, *26*(26), 18–21.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, *41*(1), 116–145.

Putnam, R. D. (1993). *Making democracy work: Civic traditions in modern Italy*. Princeton, NJ: Princeton University Press.

Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. New York, NY: Simon & Schuster.

Raudenbusch, S. W., & Bryk, A. S. (Eds.). (2002). *Hierarchical linear models in social and behavioral research: Applications and data analysis methods* (Second.). Thousand Oaks: Sage Publications Ltd.

Reagans, R., & McEvily, B. (2003). Network structure and knowledge transfer: The effects of cohesion and range. *Administrative Science Quarterly*, *48*(2), 240–267.

Reagans, R., & Zuckerman, E. W. (2001). Networks, diversity, and productivity: The social capital of corporate R&D teams. *Organization Science*, *12*(4), 502–517.

RICYT, OEA, & CYTED. (2001). *Manual de Bogotá: Innovación tecnológica en América Latina y el Caribe*.

Robinson, W. (2009). Ecological correlations and the behavior of individuals. *International Journal of Epidemiology*, *38*(2), 337–341.

Robison, L. J., Schmid, A. A., & Siles, M. E. (2002). Is social capital really capital? *Review of Social Economy*, *60*(1), 1–21.

Rodríguez-Pose, A., & Storper, M. (2006). Better rules or stronger communities? On the social foundations of institutional change and its economic effects. *Economic Geography*, *82*(1), 1–25.

Ruef, M. (2002). Strong ties, weak ties and islands: structural and cultural predictors of organizational innovation. *Industrial and Corporate Change*, *11*(3), 427–449. doi:10.1093/icc/11.3.427

Sánchez, I. D., Juliao Rossi, J., & Zuluaga Jiménez, J. (2013). La relación entre las redes externas de trabajo y el desempeño innovador de las pymes colombianas: un análisis del rol moderador del ambiente industrial. *Estudios Gerenciales*, *29*(128), 339–349.

Saxenian, A. (1991). The origins and dynamics of production networks in Silicon Valley. *Research Policy*, *20*(5), 423–437.

Saxenian, A. (1994). *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. (H. U. Press, Ed.) (Vol. Cambridge,). Harvard University Press.

Schmidt, T. (2010). Absorptive capacity—one size fits all? A firm-level analysis of absorptive capacity for different kinds of knowledge. *Managerial and Decision Economics*, *31*(1), 1–18.

Schumpeter, J. A. (1934). *The theory of economic development*. Cambridge: Harvard University Press.

Seligson, M. (2002). The renaissance of political culture or the renaissance of the ecological fallacy? *Comparative Politics*, *34*(3), 237–292.

Shu, S., Wong, V., & Lee, N. (2005). The effects of external linkages on new product innovativeness: an examination of moderating and mediating influences. *Journal of Strategic Marketing*, *13*(3), 199–218.

Snijders, T., & Bsoker, R. (Eds.). (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling* (Second.). Thousand Oaks: Sage Publications Ltd.

Sørensen, J. B. (2007). Closure and exposure: Mechanisms in the intergenerational transmission of self-employment. *Research in the Sociology of Organizations*, *25*(83), 83–124.

Sorenson, O., & Stuart, T. E. (2001). Syndication networks and the spatial distribution of venture capital investments. *American Journal of Sociology*, *106*(6), 1546–1588.

Srholec, M. (2010). A multilevel approach to geography of innovation. *Regional Studies*, *44*(9), 1207–1220. doi:10.1080/00343400903365094

Srholec, M. (2011). A multilevel analysis of innovation in developing countries. *Industrial and Corporate Change*, *20*(6), 1539–1569. doi:10.1093/icc/dtr024

Stolle, D., & Rochon, T. R. (1998). Are All Associations Alike? *American Behavioral Scientist*, *42*(1), 47–65.

Storper, M., & Venables, A. (2004). Buzz: Face-to-face contact and the urban economy. *Journal of Economic Geography*, *4*(4), 351–370.

Sudarsky, J. (2004). La medición del capital social de Colombia con el BARCAS. *Departamento Nacional de Planeación. Colombia*.

Sudarsky, J. (2007). *La evolución del capital social en Colombia, 1997-2005*. Fundación Antonio Restrepo Barco.

Tiwana, A. (2008). Do bridging ties complement strong ties? An empirical examination of alliance ambidexterity. *Strategic Management Journal*, *29*(3), 251–272.

Tsai, K.-H. (2009). Collaborative networks and product innovation performance: Toward a contingency perspective. *Research Policy*, *38*(5), 765–778. doi:10.1016/j.respol.2008.12.012

Tsai, W., & Ghoshal, S. (1998). Social capital and value creation: The role of intrafirm networks. *The Academy of Management Journal*, *41*(4), 464–476.

Tura, T., & Harmaakorpi, V. (2005). Social capital in building regional innovative capability. *Regional Studies*, *39*(8), 1111–1125. doi:10.1080/00343400500328255

Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly*, *42*(1), 35.67.

Uzzi, B., & Spiro, J. (2005). Collaboration and creativity: The small world problem. *American Journal of Sociology*, *111*(2), 447–504.

van Waarden, F. (2001). Institutions and innovation: The legal environment of innovating firms.

Organization Studies, 22(5), 765–795. doi:10.1177/0170840601225002

Vega-Jurado, J., Gutiérrez-Gracia, A., & Fernández de Lucio, I. (2009). Does external knowledge sourcing matter for innovation? Evidence from the Spanish manufacturing industry. *Industrial and Corporate Change*, 18(4), 637–670. doi:10.1093/icc/dtp023

von Hippel, E. (1988). *The sources of innovation*. Oxford: Oxford Handbooks Online.

Westlund, H., & Nilsson, E. (2005). Measuring enterprises' investments in social capital: A pilot study. *Regional Studies*, 39(8), 1079–1094.

Woolcock, M., & Narayan, D. (2000). Social capital: Implications for development theory, research, and policy. *The World Bank Research Observer*, 15(2), 225–249. doi:10.1093/wbro/15.2.225

Yamamura, E. (2011). *Groups and information disclosure: Olson and Putnam Hypotheses* (No. 34628). Munich.

Zmerli, S. (2003). Applying the Concepts of Bonding and Bridging Social Capital to Empirical Research. *European Political Science*, 2(3), 68–75.