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Recruitment, knowledge integration and modes of innovation

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ABSTRACT

This paper investigates how the strength and intrinsic characteristics of firms' knowledge bases and processing routines have evolved with the past inflow of employees. The empirical analysis is based on linked public register and innovation survey data for Norway. It finds that recruitment from universities, research institutes and higher education institutions has increased the capacity of firms to generate technical inventions. Yet, the organizational knowledge bases and processing routines on which commercial innovation output depends have been strengthened only by the recruitment that has occurred from related industries. Implications for research, management and policy are drawn.

1. Introduction

Commodity trade, innovation collaboration and labor mobility are considered the primary channels through which knowledge diffuses between actors, intuitional spheres and economies (Görg and Strobl, 2005; Hauknes and Knell, 2009; Henderson, 2007). As the commitment of industry to global production and innovation networks grows (Herstad et al., 2014), it is becoming increasingly important to understand how knowledge spillovers stemming from geographically localized flows of skilled labor influences the innovativeness of firms and the growth of regions and countries (Eriksson, 2011).

The dominant proportion of mobility occurs outside the realms of top management and R&D. In recent years, major advances have been made in the understanding of how these aggregate flows relate to productivity growth (Balsvik, 2011; Eriksson and Lindgren, 2009; Maliranta et al., 2009; Møen, 2005; Timmermans and Boschma, 2013), new firm formation (Andersson and Klepper, 2013) and structural change (Frenken et al., 2007; Neffke et al., 2011). Still, prior studies of implications for technological development at the firm level have primarily focused on the labor market movements of specific occupational groups, such as top executives (e.g. Rao and Drazin, 2002), researchers recruited from universities (e.g. Ejsing et al., 2012; Herrera et al., 2010) and inventors (Agrawal et al., 2006; Oettl and Agrawal, 2008; Singh and Agrawal, 2011; Tzabbar, 2009), This entails that the question of whether mobility flows more broadly defined influences different aspects of firms' capacities to innovate is left open in the literature.

In the following, we seek to address this question. Conceptually, we link the concepts of cognitive distance (Wuyts et al., 2005) and industry relatedness (Frenken et al., 2007) to the distinction between STI (science–technology–innovation) and DUI (doing–using–interacting) modes of knowledge development and use (Jensen et al., 2007). This is done in order to understand the conditions under which novelty value from aggregate mobility inflows can be expected, link the new human resources to the organizational processes that determine what forms of knowledge that tend to be integrated into development work; and, ultimately, to capture how the intrinsic characteristics of this work evolve with inflows in a manner that is reflected in the composition of innovation output.

The empirical analysis is based on Norwegian innovation survey data gathered in 2008, supplemented by public registers that provide basic information on all employer organizations and individuals above age 16 in the years 2001–2006. The 'linked employer–employee' (LEED) registers are maintained by governmental agencies, updated continuously and available for research purposes as annual sets. These allow us to characterize labor

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inflow into manufacturing and knowledge intensive business services firms by relative size; to isolate recruitment from the public research system and to differentiate recruitment by the dispatching and receiving firms' degree of industry relatedness (Boschma et al., 2009). Innovation survey data are gathered by Statistics Norway in accordance with EUROSTAT guidelines (Eurostat, 2010), and contain information on different aspects of innovation activity and output in a representative sample of firms.

2. Knowledge integration and modes of innovation

Innovations are created at the intersection between established and emerging technologies, specialized capabilities available in and around the innovating firm, and market demand (Dougherty, 1992; Katila, 2002; Zahra and Nielsen, 2002). Due to the complexity of modern products and production processes, not all relevant knowledge can be contained within R&D departments or project groups (Grant, 1996). Much is either generated through the ongoing practices of various organizational communities or accessed through the different external contact points that these communities maintain (Ebersberger and Herstad, 2011; Kessler et al., 2000; Østergaard et al., 2011). Development work therefore involves efforts aimed at knowledge identification, mobilization and integration (Grant, 1996; Hoopes and Postrel, 1999).

As innovation projects evolve, R&D departments or project groups serve as points of gravitation for the many types of input needed and for the many issues arising during the course of the work. This allows them to influence and implement standards for judging what issues are of legitimate concern, define the efforts that are required to tackle them, and where, in the organization or amongst partners, knowledge subsequently is to be integrated from (Nonaka, 1994). These choices are intimately interlinked with the attention paid by top management to specific aspects of innovation, and the resource allocation decisions that this attention is reflected in (Ocasio, 1997).

Over time, preferences for projects of a given type, size, and risk level are formed and become institutionalized as routines. These favor certain key resources, success factors, stages of the product life cycle, or product-market positions (Lane and Lubatkin, 1998). Because management attention, organizational routines and the knowledge assets that are mobilized into development work reflect past problem-solving activities (Ahuja and Katila, 2004), they are inherently specific to individual firms and heterogeneous between them (Birkinshaw et al., 2002; Pennings and Wezel, 2007; Wernerfelt, 1984). Yet, as a way of dealing with this heterogeneity, we suggest that they can be captured in terms of the two basic modes of innovation that have been identified and applied in much recent literature (Jensen et al., 2007).

The two modes referred to as 'science–technology–innovation' (STI) and 'doing–using–interacting' (DUI) respectively can be thought of as representing a hierarchy of knowledge integration (Grant, 1996), and thus of organizational complexity. This complexity is lowest for STI, i.e. when innovation is the responsibility of experts engaged in the systematic search for global technological opportunities and scientific solutions to local problems (Jensen et al., 2007). From the perspective of management, STI offers transparency and accountability. The primary strength of this mode is the ability to transcend the path-dependencies inherent in more broadly distributed organizational processes, enable technological repositioning through expert recruitment (Tzabbar, 2009) and generate radically new knowledge and technology (Fitjar and Rodríguez-Pose, 2012; Herstad and Brekke, 2012).

The contrasting DUI mode involves the mobilization and integration of diverse competences and organizational capabilities. Therefore, it comes with far less transparency and accountability than STI. Due to the many interfaces, contradictions, negotiations and trade-offs that such distributed processes involve; they are complex and dependent on established organizational routines, local codes for communication and firm- or industry-specific principles for justification; i.e. the criteria that define the form and content of knowledge to be integrated or discarded (Nonaka, 1994; von Krogh and Grand, 2000). Thus, the strength of the DUI mode derives from broad-based development and exploitation of specialized, often 'tacit', knowledge with a distinctively local nature (Jensen et al., 2007).

Typically, strong STI-type capacity is signaled by inventive output in need of patent protection (Jensen et al., 2007). Prior to commercial exploitation, STI firms may have to invest substantial effort in adapting this output to actual products, production processes and commercial demands. Such broad-based integration is the primary strength of the DUI mode; which also comes with a much higher risk of lock-in stemming from its focus on what is contextual, distributed and tacit (Herstad and Brekke, 2012).

Previous research has found pure STI-type development work to be rare, and the most innovative firms to be those that operate 'combined and complex' innovation processes wherein the two modes co-exists and complement each other (Herstad and Brekke, 2012; Isaksen and Karlsen, 2011; Jensen et al., 2007). The two modes can therefore be thought of as aspects of firms' knowledge development processes that may be more or less pronounced, and partly so due to the human resources that have entered into them in the past.

3. Recruitment

New employees enter various parts of the organization with categories of cognition, i.e. of perception, sense-making, inference and enactment (Nooteboom et al., 2007), that reflect their prior work-life experiences. This means, first, that they provide their new employer with access to specialized knowledge, experiences and insights gained at prior places of employment (Song et al., 2003). This knowledge is, second, expressed in ways which reflect work processes, organizational routines and codes for communication prevalent at their prior workplaces (Aime et al., 2010; Dokko et al., 2009; Madsen et al., 2003; Wezel et al., 2006).

Individuals are also embedded in interpersonal networks that reflect the geographical and cognitive domains covered by their career paths (Agrawal et al., 2006; Corredoira and Rosenkopf, 2010; Oettl and Agrawal, 2008). It is well established that these networks may continue to convey valuable information between past and present places of employment long after the mobility event itself (Agrawal et al., 2006; Bouty, 2000; Dahl and Pedersen, 2004). As a result of this, new employees may, third, broaden the firm's search for new technology and market opportunities, reorient the search process in the direction of specific cognitive domains or reinforce the tendency to search domains already known (Laursen, 2012; Laursen and Salter, 2006; Rosenkopf and Almeida, 2003).

The exploitation of new employees' competences and networks is enabled or constrained by how they relate to the recruiting firm's pre-existing knowledge bases and routines. For instance, the experiences of technical personnel entering the production floor from adjacent industrial firms are more likely to be assimilated into DUI-type organizational processes, than into those with a strong element of STI. In the latter cases, they may not be identified, due to lack of internal communication channels that link the production floor to R&D, or may not be understood, due to unfamiliarity. They might even be considered irrelevant, due to the criteria for justification prevalent in and around the R&D department. Individual researchers entering into organizations dominated by broadly distributed organizational learning processes may