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# The nature of SME co-operation and innovation: A multi-scalar and multi-dimensional analysis

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## ABSTRACT

Recent work on SMEs and networks has emphasised the importance of external co-operative ties in enhancing firms' innovative performance. These external ties provide resource constrained SMEs with access to a wider set of technological opportunities through information sharing and resource pooling. Previous studies of the SME innovation–cooperation relationship have used categorical measures to capture tie existence which, while providing some useful insights, largely fail to capture the strength of co-operative relationships and/or the variety of relational directions in which co-operation occurs. This study aims to address this measurement deficiency and explore the SME innovation–cooperation relationship by designing and utilising measures that capture both the multi-scalar (strength) and multi-dimensional (variety) nature of co-operation and innovation. We then apply these measures to a survey of UK manufacturing SMEs. Data is obtained for 371 SMEs, and we then assess the innovation–cooperation relationship within a multivariate regression framework. We find that the strength of cooperative ties across a range of productive activities within the value chain are important facilitators for SME innovative capability; this is true for both product and process innovation. However, we find that SME co-operation with rivals (co-opetition) has no significant impact upon innovation. Our results have significant implications for both supply chain managers and policy-makers interested in enhancing innovation among SMEs. In particular, we argue that SME innovative activity benefits from good, close dyadic relations within the supply chain, while more generally policy should be geared towards nurturing and sustaining SME innovation networks.

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## 1. Introduction

There is now an extensive literature on the role of inter-firm networks and their impact upon firm performance (for a review, see Hoang and Antoncic, 2003) and especially an interest in the links between network ties and innovative performance, particularly among small and medium sized firms (SMEs).<sup>1</sup> Network ties offer internally resource constrained SMEs access to a wider set of technological opportunities (Chesbrough, 2003, 2007).<sup>2</sup> By establishing networks, SMEs can overcome their internal resource

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<sup>1</sup> In defining innovation, we closely adhere to the Oslo Manual (Organisation for Economic Co-operation and Development OECD, 2005; 46) definition: 'Innovation is the implementation of any new or significantly improved product (goods or services), operational processes (methods of production and service delivery), any new marketing methods (packaging, sales and distribution methods) or new organisational or managerial methods or processes in business practices, workplace organisation or external relations'.

<sup>2</sup> More generally, SMEs have been seen to benefit from various synergies arising through (developing) their business networks (see for instance, Cooke and Wills, 1999; Cooke et al., 2005).

constraints and obtain the advantages often associated with larger size (Nooteboom, 1994). Indeed, a plethora of earlier studies highlighted that SMEs were as innovative as larger firms despite employing less internal resources (see Rothwell and Zegveld, 1982; Pavitt et al., 1987; Oakley et al., 1988; Acs and Audretsch, 1990) and, in this regard, both Lipparini and Sobrero (1994) and De Propris (2002) have postulated this relatively superior performance might reflect the greater capacity of SMEs to (better) exploit their network relationships through information sharing and resource pooling. Additionally, Fountain (1998) has also noted an increasing tendency for large firms to subcontract innovation processes out to their (largely SME) supply chains, which often benefitted from good links with regulators and state funded bodies.

Over the last two decades, policy has followed these developments with numerous initiatives promoting greater inter-firm networking and collaboration being pursued. For instance, in the OECD, innovation policy has shifted from predominantly direct subsidies to individual firms towards funding projects that promote collaborative ties between firms (Bougain and Haudeville, 2002). In the UK, such an approach continues to influence innovation policy, as evident in recent government

directives concerned with the leadership, strategy and delivery of innovation (see Department for Innovation, Universities and Skills (DIUS), 2008). Innovation networking and collaboration, particularly among SMEs and along supply chains, are thus salient issues for both managers and policy-makers.

A key feature of networks is the degree of co-operation between partner firms and, in particular, the strength of such ties (Uzzi, 1996). Indeed, this is particularly the case in supply chain management (see for instance, Bessant, (2003)). Unfortunately, as we shall highlight, many previous empirical studies exploring innovation–co-operation relationships among SMEs do not explicitly measure the strength of co-operative ties and/or capture the range of relational directions over which co-operation occurs. Rather they tend to capture the existence of such ties through the use of categorical variables. While undoubtedly providing useful insights, such studies may thus omit important information.

The aim of this study is two-fold. First, we aim to overcome some of the measurement deficiencies in previous studies by utilising unique survey data of UK based SME's in manufacturing to explore the relationships between innovation (both product and process) and types of co-operation along the vertical supply chain and horizontally with competitor firms. In doing so, our approach seeks to capture both the scale and the various dimensions of collaboration between firms by using multivariate regression to assess whether the strength of co-operative ties, across a range of productive activities, furthers innovative capability among SMEs. Second, our analysis seeks to add to the literature on SMEs and innovation networks and draw conclusions for both practitioners and policy-makers.

The remainder of this paper is set out as follows. Section 2 provides a comprehensive review of the previous literature on SME networks, co-operation and innovation. The section ends with the formulation of three testable hypotheses. In Section 3, we carefully outline our methodological approach and provide details of the data used. Section 4 introduces the model specification, the estimation procedure and presents the main results. In Section 5, we consider the implications of our results for managers and policy-makers, while also deliberating on some wider issues relating to networks. Finally, Section 6 concludes with some caveats to our approach and suggestions for future research.

## 2. Network ties, co-operation and innovation

### 2.1. Networks and open innovation

It is now widely acknowledged that a firm's critical resources may extend beyond its traditional boundaries and will draw upon the resources and expertise of others. These external resources are typically accessed through a firm's business network, namely its suppliers, its main consumers and retail outlets and in some cases, collaborations with competitors (known as co-opetition (Brandenburger and Nalebuff, 1996)). In turn, it has been suggested that such resources may enhance a firm's innovative capability (Lundvall, 1992; Chesbrough, 2003, 2007).

The view that external resources play a role in the innovation process accrues from various angles. From a pure 'market failure' perspective, it is often purported that where firms make investments in specific technologies and/or assets whose value in alternative use is low, or where investments are under monopolistic ownership and for which there is heavy reliance (perhaps along the value chain), there lies a risk of opportunistic behaviour which can undermine innovative endeavour (Williamson, 1985). In this regard, strong and close co-operative ties act as a governance mechanism (between partner firms), which can negate such

behaviour. This is usually achieved through partner firms promoting social norms and legitimacy for (implicit) codes of conduct, which reduces inter-firm monitoring costs. In addition, the possibility of collective sanctions guards against opportunism, but reliability and good behaviour are rewarded through enhancing a partner's credibility and reputation amongst the network (see Granovetter, 1992; Parkhe, 1993; Aldrich and Fiol, 1994; Uzzi, 1996; Jessop, 1998; Dyer and Singh, 1998). Similarly, in supply chains where there are risks of knowledge diffusion and free riding in technological development, dulled incentives arise as firms are unwilling to invest due to their inability to appropriate the full return on their own innovative activities (Klein et al., 1978; Katz, 1986). However, where strong and close co-operative ties exist, firms are more likely to engage in resource pooling and joint action on technological development, thus collectively improving the appropriability of innovations along the supply chain (Harabi, 1998; Negassi, 2004).

Beyond correcting for 'market failures' there is also wide recognition that strong collaborative network ties between firms are an important source of innovative activity both through direct and indirect means. In the open innovation systems paradigm associated with Chesbrough (2003, 2007), network ties are a direct source of innovative activity because firms can purposively use inflows of knowledge from others to accelerate their own internal innovation and its subsequent market exploitation; similarly outflows of knowledge from a firm may be used (occasionally indirectly) by others in the network to do likewise. Chesbrough's work gained significant attention among scholars and practitioners, largely because it identified a significant aspect of the innovation process (namely the role of innovation networks) and provided it with a distinguishable label; open innovation (Huizingh, 2011).<sup>3,4</sup> Many of the ideas that Chesbrough espoused had their origins in the earlier 'network competency' frameworks of Richardson (1972), Von Hippel (1976, 1988) and Hakansson (1987). These authors emphasised technical advance was very much a product of network ties, particularly within vertical production chains where close relations and shared competences between client and supplier firms may exist. Kogut and Zander (1992) also argued that a firm's capacity to innovate was very much associated with their ability to combine and exchange knowledge resources through inter-firm networks.<sup>5</sup> Brusoni et al. (2001) found that firms invest in the creation of knowledge not only for their own direct use, but so that they may also more easily engage with others to create network ties. Indeed, collaborative ties between firms can lead to mutual or shared learning and the development of new or enhanced internal capabilities leading to technological growth, diversification and hence further innovative opportunities (Duanmu and Fai, 2007).

For innovation, network ties provide firms with opportunities for knowledge transfer and, in particular, the exchange of technical information between producers and users, thus allowing for

<sup>3</sup> According to Huizingh (2011, 2), the extent of Chesbrough's influence among scholars is demonstrated by the fact that 'his 2003 book gathered over 1800 citations in just seven years'.

<sup>4</sup> Open innovation is clearly distinguished from 'closed innovation', where firms generate and develop new products and processes almost entirely internally (Chesbrough, 2003). Open innovation comprises both inbound innovation, defined as the internal use of external knowledge and outbound innovation—the external exploitation of a firm's internal knowledge (through the market). Given the predominance of the former among firms, in this paper, we follow Lasagni (2012) in focusing upon inbound innovation. Finally, a comprehensive review of the literature and recent developments on open innovation systems is provided by Huizingh (2011).

<sup>5</sup> This 'network view' formed much of Lundvall's (1992) national innovation systems approach, which was highly influential in European innovation policy during the late 1990s and early 2000s (see, for instance Department for Innovation, Universities and Skills (DIUS), 2008).

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