

State of the Art Review



Collaboration and Knowledge Transfer between SMEs and Universities



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Andrew Johnston

Sheffield Business School,
Sheffield Hallam University

a.johnston@shu.ac.uk

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Collaborative links between firms and universities are regarded as an important mechanism for the pursuit of R&D activities within an economy and encouraging innovation among firms. Due to their relative resource constraints, SMEs potentially stand to benefit from these collaborations as a means for leveraging new knowledge and expertise into the firm. This review examines the factors that underpin these collaborations, revealing it to be a socio-technical process reliant upon the ability of those involved to interact and understand one another. Thus, cognitive and relational similarities, i.e. sharing characteristics in terms of mutual networks and a common technical language, facilitate the formation and function of these collaborations.

Background

Collaboration with universities has been promoted as an important means by which resource constrained SMEs may procure external knowledge for innovation (Etzkowitz 2014; Ranga and Etzkowitz 2013; Fini et al. 2018). While SMEs may be less likely than larger firms to engage in such collaborations (Laursen and Salter 2004; Freel and Harrison 2006), they still occur. Indeed large scale surveys of firms have shown that for SMEs, university collaboration is subject to different dynamics in terms of the formality of their collaboration, their outcomes, perception of barriers, and reliance on local universities (for summary see **State of the Art Review - University-Industry Collaboration: Are SMEs different?**).

There exists a wealth of insights into the specifics of university collaborations from an SME perspective. A key feature of this literature is the use of in depth case studies, utilising what has been described as a 'micro level perspective' that focuses on activities within the firms through interviewing the individuals involved in the collaborations to capture the detail of these interactions (Bjerregaard 2009). Given this evidence, the aim of this review is to provide an insight into the collaboration process between SMEs and universities to highlight the factors that underpin their formation and function in order to better understand these collaborations as well as identifying knowledge gaps.

Summary of the evidence

The literature covers a range of factors in terms of university collaboration from the perspective of SMEs, including the formation of these links (Mäkimattila, Junell, and Rantala 2015; Johnston and Huggins 2018; Delfmann and Koster 2012), their governance and performance (Garcia-Perez-de-Lema, Madrid-Guijarro, and Martin 2017), the role of policy initiatives to support these collaborations (Caloffi, Rossi, and Russo 2015), and their outcomes and impact (De Zubieta, Jones, and Lester 2016; Rosli et al. 2018; Lauvås and Steinmo 2019; Dada and Fogg 2016).

First, in terms of partner selection, for Dutch SMEs seeking university partners, Delfmann and Koster (2012) found that the more 'applied' nature, i.e. a focus on problem solving, of practice orientated colleges were perceived to be more accessible than traditional universities with a pure research focus. Furthermore, they found that SMEs were typically involved in more localised collaborations with a greater emphasis on face-to-face interactions. In addition, small firms typically utilise 'realism' in their assessment of the credibility of their potential partners, basing their judgment on observing their academic titles (e.g. Professor of Astrophysics) and affiliations (e.g. working in a Department of Engineering) of the potential partner. Importantly, this assessment tends to focus on the individual rather than the institution (Johnston and Huggins 2018). Thus, SMEs place a premium on seeking a person with the appropriate knowledge and expertise (Mäkimattila, Junell, and Rantala 2015).

Examining the processes and practices underpinning collaborations between SMEs and universities highlights their socio-technical nature (Al-Tabbaa and Ankrah 2016); thus, the process is reliant upon the ability of those involved to interact and understand one another. As such, it is argued that cognitive and relational factors have a significant influence on their formation and function as shared understandings and expectations between the partners, referred to as 'short institutional distances', are regarded as the key to facilitating these collaborations (Bjerregaard 2009). These therefore act as boundary crossing mechanisms in university-SME collaborations (Rajalo and Vadi 2017), and are promoted by the closeness of the actors in terms of their social, technical or organisational background (Balland, Boschma, and Frenken 2015). The importance of these factors is also highlighted by the fact that previous collaborations between the parties have been identified as an important determinant of future links, suggesting that, for SMEs, once a collaborative link develops it becomes an enduring relationship (Caloffi, Rossi, and Russo 2015).

Rajalo and Vadi (2017) regard firms that were able to use their similarities in terms of social, technical or organisational background as 'excellent collaborators', as it meant their projects were characterised by effective communication and led to a successful outcome. Importantly, three out of the four firms identified as such were SMEs. Similarly, Steinmo and Rasmussen (2018) found that what they termed as 'cognitive social capital,' or the ability of actors to relate and understand one another, enabled the development of trusting relations and the development of a shared goal between firms and universities. Again, these results applied to SMEs as well as larger firms. Therefore, this evidence suggests that cognitive and relational factors allow SMEs to collaborate effectively with universities. Furthermore, the socio-technical nature of these relationships suggests that SME-university collaborations is typically embedded or emergent in character i.e. the relationships tend to develop in an organic manner rather than being arranged by a third party (Al-Tabbaa and Ankrah 2019).

Importantly, studies of SME-university collaboration also emphasise the dynamic nature of these cognitive and relational factors (Bjerregaard 2010; Steinmo and Rasmussen 2018). Thus, while boundaries between the firm and the university may exist at the outset of the project, these may blur as the collaboration continues and the proximities between the parties develop and evolve as they learn to work together effectively (Bjerregaard 2009; Balland, Boschma, and Frenken 2015). Consequently, the closeness of the actors identified as important for the formation and function of collaborative links with universities may continue to develop over the course of a project (Balland, Boschma, and Frenken 2015).

In addition, a strong relationship between the parties had a positive effect on the successful development of new business opportunities for SMEs from the collaboration (Rosli et al. 2018). Furthermore, the firm owner/managers' commitment to the project also had a positive effect on a successful outcome, while longer term opportunities were positively influenced by the presence of a suitable boundary spanner, i.e. an individual who was able to work effectively in the context of both the firm and the university, in the collaboration (ibid).

For SMEs, university collaboration also has a positive effect on their organisational learning, and also compliments the entrepreneurial orientation of the (Dada and Fogg 2016). Therefore, for SMEs university engagement may augment their entrepreneurial activities as well as promoting learning and innovation within the firm. This evidence backs up other work that suggests that the outcomes of SME-university collaboration are more likely to be focussed on increasing the absorptive capacity of the firms. i.e. their or ability to understand, rather than producing outputs (De Zubielqui, Jones, and Lester 2016).

While the SME-university collaboration process may be socio-technical in nature, further insights suggest that relational aspects complement the contractual. For example, a formal governance structure, based on contractual relations, has been found to have a positive effect on innovative outputs from SMEs' university collaborations (Garcia-Perez-de-Lema, Madrid-Guijarro, and Martin 2017). While relational governance structures, i.e. less formal connections, were not found to influence the innovative outputs directly, they had a positive influence on the formation of contractual governance; thus, the caveat is that relational factors may be important for the formation and function of collaborative links between SMEs and universities but are no substitute for contractual governance of the projects (ibid).

An important feature of the literature on SME-university collaboration is the absence of spatial proximity, or the physical distance between actors, as an important factor in their formation and function, a finding also highlighted in the broader innovation literature (Ben Letaifa and Goglio-Primard 2016). Thus, while the spatial proximity of partners has been highlighted as an important factor for the open innovation activities of SMEs (Lawson et al. 1998; Pickernell, Clifton, and Senyard 2009; Gertler 2003; Kapetaniou and Lee 2019) and the broader university-industry links literature (D'Este, Guy, and Iammarino 2013; Johnston and Huggins 2016; Crescenzi, Filippetti, and Iammarino 2017), evidence of its influence on SME-university collaborations is surprisingly scant. Indeed, the evidence is not only limited but mixed. For example, one study finds spatial proximity to be insignificant in the formation of SME-university collaborations (Caloffi, Rossi, and Russo 2015). On the contrary, Rosli et al (2018) found that spatial proximity had a significant and positive effect on short term business opportunities following the end of the collaboration but not longer-term opportunities. Thus, Davenport's (2005) recognition that contextual factors unique to individual firms, such as sector, or location, may determine the importance of spatial proximity.

Summary and evidence gaps

In summary, empirical studies of SME-university collaborations highlight the socio-technical processes that facilitate these, underpinned by similarities between the actors involved in terms of cognitive and relational factors. Thus, the collaborations are facilitated by the ability of actors to exploit shared connections in terms of networks and languages. In addition, these similarities are crucial in underpinning these collaborations. In this respect, these SME-university collaborations are similar to other R&D alliances, which have also been found to be underpinned by the ability of actors to communicate and understand one another (Eisenhardt and Schoonhoven 1996; Dyer and Singh 1998).

While the extant literature provides important insights into SME-university collaboration, there are still gaps to be addressed. First, processes of knowledge co-creation, absorption, understanding knowledge, and adoption, using knowledge, could be examined in more depth to produce a clearer understanding of the workings of these projects. Second, the question of why the influence of spatial proximity requires further investigation. Third, the literature does not examine the interaction of new start-ups and universities. Fourth, examining the extent of international collaborations involving SMEs and universities could be an interesting avenue. Fifth, are outcomes different for SME-university collaborations if they develop organically, i.e. they are embedded or emergent in nature, or are engineered by a third party? Finally, the lack of large-scale SME focussed survey data means insights are not generalisable. Therefore, a better understanding of the phenomenon would provide more evidence to enable the encouragement of greater levels of SME-university interaction, understand the process of knowledge exchange between the two, and allow universities to tailor their efforts to work together effectively.

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About the author



Andrew Johnston is currently a Reader in the Economics of Innovation and Entrepreneurship at Sheffield Business School, Sheffield Hallam University. His research interests focus on open innovation and networks, particularly collaborations between firms and universities. He can be contacted at a.johnston@shu.ac.uk

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