

# INNOVATION MANAGEMENT CAPABILITIES FOR START-UPS AND SPIN-OFFS: A LITERATURE REVIEW

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## ABSTRACT

A firm's ability to innovate is critical to retaining its competitiveness and even survival: in the long run it is the capability to generate a stream of product and process changes that matters. Consequently to secure their position into the future, firms need to be able to develop, maintain and renew their Innovation Management Capability (IMC). In order to improve their firm's IMC, managers need to know which 'levers' to pull. An extensive and diverse body of literature exists that has sought to identify these factors, and several attempts at synthesis have been made which imply that organisations successfully able to innovate exhibit a number of generic characteristics. The contingency perspective presents a challenge to these views and raises questions about their universal applicability, whether or not different contexts demand different IMCs and to what extent there is variation in generic factors across different contexts.

This paper presents a literature review on innovation management capability in relation to firms that are at the early stages of development, whether they are starting out or spinning-off from other organisations. Start-ups and spin-outs (SUSOs) constitute important motors for industrial change, and their IMCs are therefore important considerations. The aim of this review is to assess the pertinence of the IMC construct for organisations in the early stages of their development and uncover any contextual contingencies. The paper indicates that SUSOs are heavily reliant networks and connectivity. In the open innovation paradigm, where connectivity and links are essential, this is reinforced. This finding indicates an important area for further research: how SUSOs form their network connections, become part of established networks and/or transform them, and co-evolve and create new innovations with network parties.

**Keywords:** Capability; Innovation management; Network; Spin-off; Spin-out; Start-up

## INTRODUCTION

Innovation does not happen by accident and many firms realise that to retain their current position or grow in the future, they must innovate (Von Hippel, 1988). Occasionally organisations stumble on ideas and are able to harness them, but for most firms who demonstrate repeated successes, innovation represents a set pattern of activities (Tidd *et al.*, 2005). Companies invest heavily to create new ideas or acquire new knowledge externally to fuel the innovation activity (e.g., Story, Hart & O'Malley, 2009), but the process requires key competences and capabilities to make it happen (Adams *et al.*, 2006); competences that must be prevalent across the entire organisation (Akgün *et al.*, 2009) and/or reachable beyond company borders.

New firms are no different, whether they spin-out from another organisation or start-up, they too require a distinct set of competences to enable their innovation activity, and whilst these may be shared across a small number of staff as a company starts up, they nevertheless need to be present. This paper aims to explore within the literature, the prevalence of innovation management capability (derived from absorptive capacity research) to gain an understanding of how the innovation management capabilities might vary based on companies' relative newness.

Numerous scholars have noted how innovation covers a broad spectrum of activities, including product, process, management, technological, administrative, organisational, financial and marketing innovation. An extensive and diverse body of literature exists that has sought to identify important factors in the innovation process (e.g. Adams *et al.*, 2006; Crossan and Apaydin, 2010; Smith *et al.*, 2008; Wolfe, 1994) but, the multiple factors and their interrelationships render innovation management a complex phenomenon to the extent that a universal best-practice model probably is unlikely. Indeed, contingencies are evident, and it has been argued that the innovation process, and so necessarily requisite capabilities, will vary according to context (Burns and Stalker, 1961; Damanpour, 1991; Gallouj and Weinstein, 1997; Lawrence and Lorsch, 1967) and so the generic model may require contextual adaptation.

Start-ups and spin-outs (SUSOs) constitute important motors for industrial change. A start-up is a new organisation within the early years of lifecycle (Tidd and Bessant, 2009), whilst Phan *et al.* (2009) define spin-offs as new businesses created from an established organisation which may be a company or a university (cf. Clarysse *et al.*, 2011). The aims of both corporate and university spin-offs are to exploit knowledge created in the original organisation, though their modes of exploitation and also the kind of knowledge can differ between them. University spin-offs tend to be science-oriented and base their business on a broad scope of technology (Steffenson *et al.*, 1999), though they often lack customer and other business contacts (Löfsten and Lindelöf, 2002). Corporate spin-offs, which may be means for an organisation to encompass its product portfolio to fit its competences (Chesborough, 2003), would inherit customer contacts to larger extents from its parent organisation. They would be created round a proprietary competence or technology.

This paper considers the innovation management capabilities of SUSOs arising out of new intellectual property. It is based on a review of the literature to address the question 'what innovation management capabilities (IMCs), or configurations of IMCs, do SUSOs exhibit?' The purpose of the paper is to review literature to begin to identify contingent IMC characteristics in SUSO firms. A contribution of the review is to highlight the context-dependent nature of innovation management capabilities. Furthermore, it is to indicate areas

for further research where the importance of networks is highlighted in the review, and a network approach to SUSOs is suggested to capture these ideas (cf. e.g., Aaboen, Dubois & Lind, 2011).

The remainder of the paper is structured as follows: Next follows a description of the capabilities-based view of the firm from a core competence/resource based view perspective, which leads into a discussion of IMC and provides our theoretical framing. After briefly describing the research methodology findings are presented followed by their discussion.

## **THEORETICAL FRAMING**

### **The Capability Based View of the Firm**

The capability based view of the firm originates in the work of a number of scholars, drawing on the resource-based view of the firm (Barney, 1991; Penrose, 1959; Teece and Pisano, 1994; Teece *et al.*, 1997; Teece, 2007). This perspective on the firm conceptualises capabilities as the ability to assemble, allocate and apply resources within the firm to achieve competitive advantage and as such is somewhat internally-focused and emphasises firm processes.

Although, it has been criticised for having been left somewhat vague (Schreyögg and Kliesch-Eberl, 2007), at its most fundamental level the notion of organisational capabilities has come to be regarded as reflecting those activities that the organisation is capable of performing: capabilities are "...close to action. Conceptually they cannot be separated from acting or practicing" (Schreyögg and Kliesch-Eberl, 2007: 915). Amit and Schoemaker (1993: 35) define capabilities as the "capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end." To paraphrase Teece *et al.* (1997), it is not just about the assets that one has to play with but also about how one plays the game of resource deployment and redeployment: IMC is a characteristic of the firm's preparedness for and development of the 'muscles for innovation' (Börjesson and Elmquist, 2011: 1174).

In light of such conceptualisations, a range of types of organisational capability has been identified. Leonard-Barton (1992) describes a set of 'core capabilities', those that distinguish or differentiate the firm and are operationalized to deliver the firm's competitive advantage and include such things as employee knowledge and skills, technical systems, managerial systems and values and norms. However, if core capabilities are not refreshed they can become core rigidities and condemn a firm to a trajectory predicated on former (diminishingly relevant) capabilities. Teece and Pisano (1994) introduced the idea of 'dynamic capabilities' to reflect a firm's need and ability to integrate, build, and reconfigure competences as a response to rapidly changing environments. Consequently, the important insight that the capabilities perspective contributes is that it is not the ownership of resources that is important for competitive advantage, but also the way that they are used and the end to which they are directed.

### **Innovation Management Capability**

#### *Definition*

In the context of dynamic environments, arguably amongst the more important capabilities is the firm's innovation capability. As with the capabilities literature more generally, the term *innovation capability* suffers from a lack of consensus over its definition and so has been

subject to criticism (Börjesson and Elmquist, 2011; Kundt, 2011). According to Neely *et al.* (2001), an organization’s innovation capacity can be thought of as the potential to generate innovative outputs. Lawson and Samson (2001) define innovation capability in terms of the application of resources to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders. Romijn and Albaladejao (2002: 1054) define innovation capability as the skills and knowledge needed to effectively absorb, master, and improve existing technologies, and to create new ones. Alternatively, innovation capability is the ability routinely to achieve innovative outcomes (Wallin *et al.*, 2011) or, the underlying capacity to gain advantage by successfully exploiting and implementing more and better ideas than rivals (Francis and Bessant, 2005). Assink (2006: 219) defines innovation capability as “the internal driving energy to generate and explore radical, new ideas and concepts, to experiment with solutions for potential opportunity patterns detected in the market’s white space and to develop them into marketable and effective innovations”.

Branzei and Vertinsky (2006), adopting a product orientation, define product innovation capability as the ability to acquire and assimilate external knowledge, transform it into novel, unique competencies and ideas, and harvest these ideas by first generating and then effectively commercializing new or improved products. Nilsson *et al.* (2010) use the term innovation capability to imply the capacity of an organisation to create novel product feature concepts which are successfully incorporated in product development, (eventually) creating significant value for product stakeholders. For Rahab *et al.* (2011), innovation capability is the capability to develop and modify existing products or services or to create new products or services. Finally, Hogan *et al.* (2011: 1266) define innovation capability as “a firm’s ability, relative to its competitors, to apply the collective knowledge, skills, and resources to innovation activities relating to new products, processes, services, or management, marketing or work organization systems, in order to create added value for the firm or its stakeholders”.

### *Indicators*

This brief, but not exhaustive, review of definitions of innovation capability demonstrates something of an evolution in the conceptualisation of the term. Definitions are variously oriented toward outputs, products, processes and technologies and some also specify and incorporate particular types of resource – such as knowledge and skills – applied to the purpose of adding value. There is similar variety in how the constituent parts of innovation capability have been conceptualised, see table 1.

**Table 1: Dimensions of innovation capability**

Study	Dimensions of innovation capability
Freeman (1999)	<p><b>Internal Management Responsibilities:</b>  Collaborative Process  Performance Measures  Education &amp; Development  Distributed Learning Network  Intelligence Market Positioning</p> <p><b>External Organizational Interfaces:</b>  Knowledge Products and Services  Collaborative Market Penetration  Market Image Campaign  Leadership Competencies  Communication Technology</p>
Lawson and Samson (2001)	<p>Vision and strategy  Harnessing the competence base  Organisational intelligence</p>

	Creativity and idea management Organisational structure & systems Culture and climate Management of technology
Smith <i>et al.</i> (2008)	Management style and leadership Resources Organisational structure Corporate strategy Technology Knowledge management Employees Innovation process Organisational culture
Kalvaraskaya (2009)	<b>Financial capital innovation capabilities:</b> the economic efficiency of innovation activity <b>Human innovation capabilities:</b> the ability to motivate staff to innovate and to apply its innovation <b>Information innovation capabilities:</b> the ability to make use of different information sources <b>Innovation process capabilities:</b> effectiveness and speed of the innovation process <b>Strategic values innovation capabilities:</b> the ability to develop and maintain a shared vision <b>Cooperation capabilities:</b> the quality and effects of cooperation with external agents
Saunila and Ukko (2012)	<b>Innovation potential:</b> factors that reflect current potential to innovate (including, leadership and decision-making processes, organizational structures and communication, collaboration and external links, organizational culture and climate, and individual creativity and know-how) <b>Innovation processes:</b> the systems and activities that organizations utilize to realise current innovation potential. <b>Innovation output:</b> the results of innovation activities
Saunila <i>et al.</i> (2012)	<b>Exploitation of external knowledge:</b> Absorptive capacity, Social networks, Structural holes <b>Innovation structures:</b> Openness, Functionality, Tools, Feedback, Rewards <b>Culture:</b> Trust and respect, Tolerance of ambiguity, Learning from failures <b>Leadership:</b> Participation, Decentralised Decision making, Motivation <b>Individual Innovation capability:</b> Creative thinking, Readiness for change, Empowerment

If summarising the different indicators provided in Table 1, it could be suggested that they involve the *organizing* of innovation (e.g., culture, climate, structure, communication; organizational intelligence; systems); *strategy* (e.g., corporate strategy, vision, management style and leadership; performance measures); *processes* (e.g., internal collaborative processes, decision-making processes); *learning* (e.g., know-how, knowledge management; distributed learning networks; knowledge products and services); and *linkages or networks* (e.g., external links, collaborative market penetration). These summarising dimensions correspond to innovation management capability indicators as outlined by Tidd and Bessant (2009), and while different scholars emphasise or divide these dimensions further, they depict dimensions mentioned by several researchers. In this paper, we describe organization, strategy, processes, learning and linkages/networks as the generic indicators for innovation management capabilities.

#### *Universal or specific indicators?*

Studies have shown that different mixes or configurations of capabilities may be required to deliver different types of innovation. For example, market orientation and customer knowledge are important factors in the development of product innovations (Hernández-

Espallardo and Delgado-Ballester, 2009), process capabilities appear more important in new service development (Gryszkiewicz *et al.*, 2011), but there is only very limited evidence in this field of research. Some authors further distinguish between radical<sup>1</sup> and incremental<sup>2</sup> product innovation capability (e.g. Menguc and Auh, 2010). New skill acquisition and transformational and exploratory capabilities are important prerequisites for radical innovation (Herrmann *et al.*, 2007; Kundt, 2011; O'Connor, 2008) but competence exploitation is considered an important capability for incremental innovation (Subramaniam and Youndt, 2005) and the differences between the capabilities of incremental and radical innovation are based on the type of knowledge used (Martínez-Román *et al.*, 2011). For example, in a comparative study of capability development for competitiveness versus sustainable business management, Van Kleef and Rooome (2007) found significant overlap between capabilities which, in both contexts, are deployed through similar structures and processes of networking, coalition and relationship building, collaborating, systemic thinking, inventing unknown options, combining and integrating different innovations and problems, and learning. But, they found, too, nuanced differences between the contexts – such as the wider variety of actors with whom innovators for sustainability must engage.

It is clear, then, that the notion of innovation capability encompasses a broad range of activities directed toward the purpose of adding value and competitive advantage. It is clear, also, that innovation capability is not a unitary set of attributes and different innovations require distinctive approaches (Francis and Bessant, 2005). Innovation capability is, then, a multi-faceted phenomenon which includes a number of contextual and structural, internal and external factors, some of which are within the realm of managers to influence and control (Hauser *et al.*, 2006). Also important are the type of innovation and the properties of the domain in which the innovation is carried out (Nilsson *et al.*, 2010).

It is proposed that organisations that consciously and explicitly develop, invest in and manage their innovation capability have a higher likelihood of achieving sustainable innovation outcomes in the long run (Lawson and Samson, 2001). What is not well understood, however, is the nature and extent of the capability differential at a sectoral level and what the implications for innovation management might be. Roper *et al.*'s (2009) survey shows inter-sectoral variation in innovation capability. That is, between sectors a considerable gap in proficiency exists in terms of sectoral capability in accessing knowledge for innovation, building innovation and commercialising innovation. Other studies have also indicated inter-sectoral variance in configurations and proficiency in the profiles and deployment of IMCs (e.g. Griffin, 1997; Persaud, 2005). The importance of SUSOs for industrial change, makes it prominent to study what indicators or configurations are present to explain IMC of SUSOs.

## METHOD

To identify relevant papers, a two part search strategy was adopted. First, a keyword search of the database *Business Source Complete* was undertaken. Search strings were constructed reflecting our sector of interest (so, start-up, spin-out, spin-offs) and combined with keywords relating to IMC (so, capability, competence, innovation process, performance, activity and so forth). Second, to ensure we captured contemporary research and the most recent thinking,

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<sup>1</sup> The ability to engage in competence destroying product innovations that change the rules of competition and force existing competencies into obsolescence by pursuing variance seeking capabilities

<sup>2</sup> The ability to develop product innovations that exploit, leverage, reconfigure, and integrate existing technologies

we hand-searched the recent content (2010-2012) of innovation-related conferences (ISPIM, R&D Management Conference and EGOS) for relevant material.

In the analysis of the papers, each relevant source was summarized and the description of innovation management capabilities was extracted from the paper. These were then compared among the literature on SUSOs, and secondly so to descriptions on generic descriptions on innovation management capability (Lawson and Samson, 2001; Saunila and Ukko, 2012). This was done so as to be able to judge the particularity of SUSOs and their similarities with generic models. Lastly, the specific capabilities of SUSOs, and their consequences for how innovation processes are organized were addressed through returning to the reviewed literature and considering it in the light of descriptions on IMC.

### **FINDINGS: IMC IN START-UPS AND SPIN-OFFS**

The results of our search are presented in table 2. Relatively few studies specifically attend to the question of innovation activities in SUSO firms, and the innovation activities of spin-off firms, in particular, are under-studied. Of those that do, differences between the innovation activities of SUSOs and established firms are highlighted (e.g. Criscuolo *et al.*, 2012). Furthermore, differences are noted in spin-offs that originate in the corporate sector and those coming out of universities (Zahra *et al.*, 2007), and also between manufacturing and service firms (Criscuolo *et al.*, 2012). Contrasting services and manufacturing industries, Criscuolo *et al.* (2012) emphasise the impact of industry conditions under which new firms operate and so suggest different capability requirements. Amongst service industries, innovative SUSOs are facilitated by the intangibility of services, low capital intensity, and the intimate producer–user relationships that characterise the nature of the sector. Firms capable of operating within and exploiting these conditions enhance their performance opportunities. Both sectors benefit from having strong appropriability regimes, but this is particularly so in the case of manufacturing.

Zahra *et al.* (2007) argue that to transform new technologies into commercial products, spin-out firms require *Knowledge Conversion Capability* (KCC), which has three components: (i) *conceptualisation and visioning*: conceptualisation of applications of the knowledge and how the technologies satisfy consumer need; (ii) *configuration and design*: the conversion of technologies into products that meet customers' needs and create value; and (iii) *the embodiment and integration*: the integration of different bodies of knowledge, organizational functions and skills in order to commercialize their products quickly, efficiently and profitably. Whilst the results of their study underscore the importance of having systems to convert knowledge and transform discoveries into viable sources of competitive advantage, it appears that managers' capabilities vary according to whether they originate from the corporate or university domain: the former benefit from accrued commercial skills and prior commercial experiences which may be lacking in managers from universities (Zahra *et al.*, 2007). As a result, spin-off managers from corporate backgrounds should ensure they are able to cultivate and maintain their professional and business relationships with their parent organizations. Managers from universities should seek opportunities to develop their commercial and managerial skills outside the context of academia and research.

**Table 2: Innovation Management Capabilities for SUSOs**

Capability	Notes	Source
Knowledge conversion capability	Consisting of: Conceptualization and visioning; configuration and design; and embodiment and integration	Zahra <i>et al.</i> (2007) USA, 91 corporate and 78 university spin-offs
Relationships with service intermediaries	Ties with service intermediaries enable new ventures to search a broader range of firms, organizations, and industries.	Zhang and Li (2010) China, 202 firms ( $\leq 8$ years) in high technology cluster
Start-up legitimisation	New ventures that acquire legitimacy externally by forming alliances with established firms gain more from their new products than new ventures that do not form such alliances	Rao <i>et al.</i> (2008) USA, 93 product introductions from biotechnology new ventures
Management capabilities	Success in start-ups attributed to ability to ensure initiatives (i.e. the strategic paths) are coherent with the type of resources and competencies/capabilities within the firm	Nosella <i>et al.</i> (2006) Italy, biopharmaceutical start-ups (n=4)
Network and relationship capabilities	Emphasises the importance of establishing strong relationships in the earliest stages of network formation. Relatively informal relationships with members of early-formed networks are very supportive for the learning and knowledge behaviours needed to build innovation capacity.	Jørgensen and Ulhøi (2010) Danish case study of m-commerce (electronic-commerce transactions conducted through mobile devices) start-up
Network capabilities	Start-up organisations rarely have well developed networks at inception and so may need to rely on founders' ties and capabilities. Through these connections, start-ups can have access to important resources and commit themselves to organizational innovation	Huang <i>et al.</i> (2012) 222 start-ups from China-based Taiwanese SMEs
Entrepreneurial capabilities	Ability to mobilise resources and align incentives for start-up companies designed from the outset to be sold	Freeman and Engel (2007) ventures built around technology or business model innovations
Knowledge capabilities	Acquisition, development and integration of knowledge are important at all stages of the spinning –off process, including: opportunity recognition; raising risk capital, and building a sustainable new venture	Lockett <i>et al.</i> (2005) positioning paper
Opportunity recognition	Interactive process involving, founding entrepreneur's knowledge and experience within the firm and of technology	Park (2005) UK, case study, advanced engineering start-up
Opportunity refinement Leveraging Championing	A key distinction that emerges is the need to identify the different (internal and external) actors who can make the bridge between the academic and commercial environments.	Rasmussen <i>et al.</i> (2011) UK and Norway, 2x2 cases of university spin-offs
Appropriability management	Responsiveness to industry conditions impacts potential to harvest returns and innovation performance	Criscuolo <i>et al.</i> (2012) UK, start-up firms ( $\leq 5$ years) compared against established firms

In a case study in the Italian biopharmaceutical industry, Nosella *et al.* (2006) note a relative absence of academics and researchers as principals and directors of SUSO businesses. In an analysis of spin-offs from the previous 10 years, most were founded by managers coming from multinational firms, not universities or other public research centres – despite their having important patrimony of knowledge in the field. Nosella *et al.* (2006) attribute this paucity to academic and public researchers and engineers lacking the necessary capabilities, in particular managerial capabilities that they observe as critical for the creation of spin-offs.

Such a relative lack of skills and experience raises credibility questions for university-led spin-outs. Rasmussen *et al.* (2011) identified three capabilities crucially important to developing new venture credibility in the context of university spin-outs: (i) *opportunity refinement*: the discovery or enactment of an opportunity and the ability to further refine and develop the opportunity into a clearly articulated and commercially viable business concept; (ii) *leveraging*: the development and acquisition of resources to build and sustain the new venture; and (iii) *championing*: the personal commitment or the leadership role needed to sustain the venture start-up process

Much of the focus of the identified studies is on the capabilities of the new venture's founder(s). Amongst the more important capabilities in SUSOs are those that reside in the founder(s) on which the firm may be dependent for as long as between 5 to 10 years, after which time 'extreme dependence' begins to dissipate (Teece, 2012: 1396). However, Park (2005) argues that in high-tech start-ups, the presence of a driving entrepreneur is not, by itself, sufficient. Instead, innovation in this context requires a mix of technical, entrepreneurial and managerial experience to turn an embryonic new technology into a market success. A key part of this is matching the logical thinking processes of the scientific world with the ability to learn as you go: this capability he summarises as 'opportunity recognition'.

One of the biggest challenges SUSOs face is in overcoming what has been called 'the liability of newness' (Rao *et al.*, 2008) which manifests itself in a number of dimensions including limited resources, market uncertainty, knowledge deficiencies and unproven legitimacy. SUSOs can acquire external legitimacy through forming alliances with established firms in related industries and, those that do, gain more from their new products than new ventures that do not form such alliances. As Rao *et al.* (2008) note, to introduce products successfully new ventures must engage in active legitimizing strategies that provide credibility in the eyes of stakeholders.

Huang *et al.*'s (2012) study of founders' of China-based Taiwanese SMEs connects the 'founder capability' model with a 'network capability' model of innovation in start-ups. They investigate founders' use of their own network connections (interpersonal relationships and relationships with other firms) and human capital (personal capabilities in terms of expertise, management skills, and experience) and show their positive influence on founder's organization's innovation capability and performance. Developing and maintaining these networks, Huang *et al.* (2012) conclude, is critical for the long-term development and success of start-ups particularly because they can help lower transaction costs, as well as enhance and complement the strategic resources required by resource-constrained start-ups.

Other studies, too, emphasise the importance for innovative start-up businesses to develop, maintain and exploit network relationships early, particularly in order to support learning, knowledge sharing and innovation. Jørgensen and Ulhøi (2010) emphasise the importance of

establishing strong but relatively informal relationships in the earliest stages of network formation to support learning and knowledge behaviours needed to build innovation capacity.

These relationships can take a variety of forms with a range of different types of partner including universities and other public research institutes, established and credible businesses and, intermediaries. Researchers have argued that each offers a distinct type of benefit to the start-up firm. Zhang and Li (2010) specifically consider the role of service intermediaries (technology service firms, accounting and financial service firms, law firms, and talent search firms that sit at the intersection of many firms, organizations and industries) in new ventures' product innovation performance and find that the specialized network role of service intermediaries can contribute to product innovation by facilitating new ventures' external innovation search.

According to Garnsey and Heffernan (2005), the emergence of a science-based cluster of businesses around Cambridge did not derive from infrastructural advantages catalogued in other regions of the world (e.g. earlier industrial experience: Oxford; government spending on infrastructure: Sophia Antipolis; large company effects: Siemens in Munich, Ericsson in Stockholm; metropolitan influences: London, Paris; and, defence spending and procurement: Silicon Valley, Route 128). The absence of such influences, they argue, makes more evident the transformative potential of the knowledge networks that so characterised the Cambridge Phenomenon.

Clearly, such networks, and the opportunities they generate, require attention and careful management. But, they also have the potential to enhance SUSOs' innovation capacity through the sharing of knowledge and experiences – such as sharing learning relating to new technologies or types of market served.

## **DISCUSSION**

The purpose of this review of the literature has been to begin to identify contingent IMC characteristics in SUSO firms. The review has been motivated by the contingency perspective that suggests nuanced characteristics of the innovation process, and thus capability requirements, depending on context. Previous studies in other domains have shown such variety to exist. In this review, we too note qualitative differences in the content of the different generic categories of IMC reflecting differences in the type, scale and character of the specifics of each area of capability suggesting the need for contextual modifications for IMC.

To an extent that one might not anticipate finding in other types of organisation, our findings indicate the importance of the individual capabilities of founders and managers lending support to Teece's (2012) observation that the longer an organisation has been around and the larger it is, the less its capabilities depend on particular individuals. Similarly, and again in contrast to established firms, the capability to transform might be considered an antidote to the risk of today's competences becoming core rigidities (Leonard-Barton, 1992), it is the ability to create new competences that cater to tomorrow's needs, the preparedness to relinquish existing competencies and the capability to develop new competencies. However, Herrmann *et al.* (2007) note that amongst start-up businesses, the requirement for transformational capabilities that characterise more established firms is less apparent. Further research is needed to test the extent to which such differences are significant, however preliminary considerations could point to a reduced reliance on strategic requirements in

SUSOs, due to their low staff numbers and the dominant role that the lead entrepreneur might play on a day-to-day basis as well as strategically.

Our findings also reinforce the message of the open innovation movement and networks (Chesborough, 2003; Håkansson, Ford, Gadde, Snehota & Waluszewski, 2009; Lichtenthaler, 2011). Generally, our findings are in line with Chatenier *et al.* (2010) who find that the three main capabilities required of innovation professionals in the context of open innovation are: (i) managing the inter-organisational collaboration process; (ii) managing the overall innovation process; and (iii) creating new knowledge collaboratively: in other words, they continue, innovation professionals must be socially competent and able to broker solutions. This again reflects on the importance of linkages, process whilst also bringing into focus the importance of the organisational learning and particularly its ability to create or absorb new knowledge effectively. A critical innovation management capability is the ability to manage the ‘knowledge boundaries’ of the firm. Both collaborative capabilities such as trust-building, entrepreneurialism, negotiating and balancing skills and, influencing, visioning and motivating skills (Verhoeven and Maritz, 2012) are fundamental.

New relationships, network working, collaborative practices and open innovation are important practices for innovation which, in the context of SUSOs means interactions with established firms, intermediaries and service providers to enhance legitimacy and credibility, provide access to resources, skills and expertise and, provide reach into new knowledge and market arenas that would otherwise be unavailable. For SUSOs, the development and maintenance of networks, partnerships, relationships and cluster membership to leverage individually limited resources are critical to innovation success: this might be described as the innovation management capability of obtaining the benefits of being a large company whilst remaining small – further reinforcing the necessity for networks and connectivity. Previous research has suggested that network relationships and collaborative innovation impact innovation performance, but that further work is required to understand better the different configurations these relations take according to context (Pullen *et al.*, 2012; Pittaway *et al.*, 2004). The present study takes a step in the direction of addressing this call.

## CONCLUSIONS

The literature study has reinforced that SUSOs are firstly, heavily reliant on their networks and connectivity. In the open innovation paradigm, where connectivity and links are essential, this is reinforced. The literature also promotes the learning imperative for SUSOs as well as the importance of having a strong and reliable innovation process. This is interesting as, anecdotally, spin-outs often consider themselves to be particularly knowledge rich, especially when they spin-out from a university (or other research-based organisation), but this should not be taken as an excuse to stop seeking new knowledge.

Our findings do not emphasise the importance of an innovation strategy for SUSOs, nor do they stress an innovative culture (Tidd & Bessant, 2009). These findings are unanticipated and warrant explanation. One explanation could relate to the SUSO organisation’s proximity to venture capital and start-up funding, which in turn requires careful strategic planning/demonstration to gain capital investment. The reference to a SUSOs size might, in this context however, provide illumination on the relative lack of focus on organisational culture. Another explanation may lie in limitations of the existing body of research.

This study represents a preliminary step in better understanding the unique characteristics of IMCs for SUSOs which have previously been under-reported. To move our findings forward, more research is needed. In terms of the literature, this means a more systematic and targeted search for published studies relating to strategic and cultural IMCs in SUSOs. In terms of empirical work, our findings will need to be tested and validated in the field. However, and as pointed out by our findings, networks and SUSOs are interesting research combinations to explore further. The IMC idea has until present focused on the capabilities of individuals and firm levels, but need consideration also on network levels. This would potentially erode ideas on ownership of resources further, while a capability perspective in network studies help to explain resource ties, activity links and actor bonds (Håkansson & Snehota, 1995).

Without outlining a research agenda for SUSOs according to a network approach, some ideas are suggested:

- (i) How do SUSOs go about to establish and maintain network connections?
- (ii) What impact do those network connections have on the SUSOs and their IMCs?
- (iii) What changes of network configuration is regarded as the SUSO moves into more established structures and customer acceptance?, and
- (iv) How does the decoupling from research connections affect the SUSO and to what extent is it a required step for the SUSO and its development?

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