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Strategic Entrepreneurship and Knowledge Spillovers: Spatial and Aspatial Perspectives

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Abstract: The literature in the Strategic Entrepreneurship (SE) is increasingly embracing the concept and implication of knowledge spillovers. In this paper, we add to the theoretical literature on SE and knowledge spillovers by investigating the different types of knowledge spillovers and what they imply for various dimensions of SE. On the one hand, we distinguish between spatial and aspatial knowledge spillovers. On the other hand, we distinguish between various dimensions of SE, i.e. inputs, resource orchestration, and output. Finally, we conceptually link the various types of knowledge spillovers and dimensions of SE and discuss the implications. Doing so, we argue that spatial knowledge spillovers (inter-firm) play the major role in increasing the amount of 'inputs' dimension of SE, while the aspatial knowledge (either inter-regional or intra-firm) play the major role not only for 'inputs', but also for 'resource orchestration' dimension. At the end, the paper provides suggestions for future research.

Keywords: Strategic entrepreneurship, knowledge spillovers, spatial, aspatial

JEL-codes: D23, D83, L10, L26, R10

1. Introduction

There is an emerging literature that analyses the role of knowledge spillovers for strategic entrepreneurship (SE) (Agarwal, Audretsch and Sarkar, 2007; 2010). A limitation with this literature is that it does not explicitly acknowledge that most of the knowledge spillovers are a spatial and geographical phenomenon, i.e. spatial inter-firm knowledge spillovers. This is because such knowledge spillovers occur between firms and other economic agents that have a specific location. This generates specific problems since the transfer of knowledge often is a slow and complicated process affected by the frictions of geographical space. Moreover, in knowledge spillover literate itself, less attention has been devoted to the aspatial knowledge spillovers, which could be intra-firm or inter-regional spillovers, let alone the implication of aspatial knowledge spillovers for SE.

In this paper, we add to the theoretical literature on knowledge spillovers and SE by investigating the anatomy of knowledge spillovers in terms of its geographical reach (spatial vs. aspatial) and what this implies for various dimensions of SE. We will pay particular attention to spatial knowledge spillover, as the most prominent type of knowledge spillovers in the literature, but we also discuss aspatial knowledge spillovers and its implication for SE, while highlighting the need for further attention to aspatial knowledge spillovers in the literature.

The rest of the paper is as follows. Section 2 provides an overview on state-of-the art on newly emerging literature on SE by discussing various dimensions of SE. Section 3 provides discussion on various aspects of knowledge spillovers, by distinguishing between spatial and aspatial types of knowledge spillovers. Section 4 links section 2 and 3 by providing a discussion on the role and implication of various types of knowledge spillovers on various dimensions of SE. Section 5 concludes and provide suggestions for further research.

2. Strategic Entrepreneurship

Strategic entrepreneurship (SE) focuses on the complementarities of strategic management and entrepreneurship (Ireland, Hitt and Sirmon, 2003). Both research disciplines are concerned with value creation (Bruyat & Julien, 2001). However, entrepreneurship research has been highlighting value creation through opportunity-seeking (e.g., Shane and Venkataraman, 2000) and strategic management research has stressed value creation through competitive advantage-seeking (e.g., Barney, 1991). Moreover, entrepreneurship has foremost been concerned with new venture creation and the growth of small firms and strategic management mostly with large established firms. The concept of SE is thus an attempt to merge the two views of value creation in order to explore "… how do firms create and sustain a competitive advantage while simultaneously identifying and exploiting new opportunities" (Hitt et al, 2011:57). While SE is not specifically about large or small firms there is an assumption that SE might learn more about how small firms could act

more strategically and how large established firms can become more entrepreneurial (Hitt et al, 2011).

SE is still a young and developing research field. Most research in the field emanate after the call for integrating the two research areas in a series of papers by Hitt and Ireland and associates (Hitt et al, 2001; Ireland et al, 2001). While the intersection of strategy and entrepreneurship had interested strategy and entrepreneurship researchers long before this, e.g., Mintzberg and Waters' (1982) entrepreneurial strategy; Meyer & Heppard (2000) entrepreneurship as strategy; and the whole field of corporate entrepreneurship (Burgelman, 1983); more systematic attention towards this field developed after 2001. Some of the more influential researchers in the field are Hitt and Ireland and their associates who have published several conceptual papers in the field mapping out the domain of SE. In their input-process-output model of SE (Hitt et al, 2011) they identify three dimensions of SE-research: resource/input factors, resource orchestration processes and outputs. Using these three dimensions as the basis, we will devote the remainder of this section to provide an overview of the recent research in the SE field.

2.1. Resources/inputs affecting SE

The external environment affects the firm's and the individual abilities to discover, create, and exploit opportunities in various ways. Ultimately, it affects long-term survival (Hannan & Freeman, 1989), firm performance (Keats and Hitt, 1988) and firms' development paths (Winter, 2005). From an SE perspective environmental munificence, dynamism and interconnectedness are the most important environmental factors (Hitt et al, 2011).

Environmental munificence makes resources relatively easy to acquire as well as identifying and exploiting opportunities. Firms seek for environmental munificence in order to facilitate survival and growth. SE researchers has paid attention to environmental munificence in the form of knowledge spillovers (Agarwal, Audretsch and Sarkar, 2010:271), defining it as "…the external benefits from creation of knowledge that accrue to parties other than the creator, occur at multiple levels of analysis, be it within or across organization and networks." The knowledge spillover view offers a lens to explain the causes and consequences why firms fail or succeed to create and appropriate value from knowledge investments (Agarwal, Audretsch and Sarkar, 2007). This is one of the dominant research areas within SE and we will highlight this research in section 4 of the paper.

Some environments are inherently dynamic and thereby uncertain. Environmental dynamism is associated with new venture creation (Aldrich, 2000). The ability to operate in dynamic environments, using dynamic capabilities (Eisenhardt & Martin, 2000) may be a source of competitive advantage (Teece, 2007). Some firms use collaborative strategies, and develop alliance capabilities (Larsson et al, 1998) to access resources from partners and bundle them in new combinations to exploit opportunities. SE research here includes Ketchen et al (2007) study of collaborative innovation where small and large firms share knowledge and expertise in order to exploit opportunities. On a cluster level there are

studies demonstrating increased firm performance for firms collaborating in local and external networks in the footwear (Boschma and Ter Wal 2007) and wine industry (Li et al, 2015).

Yang and Steensma (2014) explore the combination of knowledge spillovers and dynamism in a longitudinal study of the telecommunications-industry, where they find that knowledge originator firms are prone to look for guidance into new knowledge domains from knowledge recipient firms in dynamic and highly competitive environments. However, in high-growth environments firms are less prone to look for guidance from recipient firms and pursue more risky strategies, which are balanced by the munificence of the high-growth environment.

Another type of input to SE is organizational resources (Hitt et al, 2011) such as culture and leadership. Entrepreneurial leadership is to influence others to engage in a simultaneous opportunity-seeking and advantage-seeking behaviour (Covin and Slevin, 2002). Sheperd, Patzelt and Hayne (2009) have shown how leaders' entrepreneurial mindset and the organizational culture amplify each other in positive spirals. Top management teams' shared leadership has been demonstrated to benefit organizational ambidexterity, i.e., the simultaneous pursuit to explore and exploit (Mihalache et al, 2014).

Traditionally entrepreneurship research has focused on the individual and his/her resources (Shane & Venkataraman, 2000). Human capital in SE is the individual's knowledge, motivation, abilities and skills to perform in order to exploit an opportunity and achieve an advantage. In particular, the individuals' idiosyncratic capital is of interest as it might be a source of competitive advantage such as the entrepreneurial mindset (McGrath and MacMillan, 2000) and creativity (Ireland et al, 2003). Entrepreneurial leader with high self-efficacy has been associated with increased firm performance (Baum and Locke, 2004). A highly educated CEO is a relatively more valuable resource for a small firm than for a large firm as they might have more discretion in small firms and is a unique resource compared to other small firms (Miller, Xu and Mehrootra, 2015). An individual's social capital, such as reputation and extensive social networks within specific contexts, has been shown to have beneficial outcomes both for new ventures and established firms (Baron and Tang, 2009; Leinbaum and Tushman, 2007). There also studies which account for both human and social capital. Grichnik et al, (2014) show how nascent entrepreneurs with higher levels of social and human capital make them able to use more bootstrapping activities in order to acquire resources to their intended start-up. Moreover, social capital and social competence have been shown to overcome the gap between technical business ideas and market launch (Tocher, Oswald and Hall, 2015).

2.2. The resource orchestration processes

Controlling and gaining access to valuable, rare and inimitable resources is not enough to achieve competitive advantage, they also need to be efficiently organized and orchestrated (Barney, 1991, Helfat et al, 2007). Two such orchestration processes are bundling and lev-

eraging (Hitt et al, 2011). As resources and capabilities often are formed within functions such as manufacturing and IT, bundling means combining these resources and capabilities in order to identify and exploit new opportunities as well as seeking competitive advantages. Leveraging means actions to mobilize coordinate and deploy capabilities in order to achieve competitive advantages. In practice, these two processes are hard to differentiate as they both include the forming of more complex resource and capability combinations in order to create valuable, rare and hard-to-imitate capabilities as well as increased ability to act on opportunities. As an example Zhang, Wu and Henke (2015) found that a customer firm's boundary spanning capabilities combined with communication capabilities increased supplier firms' willingness to invest in the customer firm. However, all resources are not the same and sometimes may mix badly or require different management skills. It might be relatively easy for experienced managers when leveraging fungible resources such as cash and brands, but more difficult when it comes to more idiosyncratic resources with less fungibility such as talented film directors (Mannor, Shamsie, and Conlon, 2015). The capability to bundle and leverage might be thought of as a dynamic capability in the sense that it could be deployed in general to create bundles of resources and deploy them. For instance, Lu et al (2010) demonstrate how that the best-performing internationalizers among Chinese entrepreneurial firms are the ones that have these bundling capabilities in order to meet the requirements of the foreign markets.

2.3. Outputs of SE-processes

In general, the assumption in SE is that the final outcome will be a new stable venture or an established firm will experience competitive success by creating customer value (Hitt et al, 2011). These outcomes will be translated to financial wealth for the owners of the firm or venture but also other outcomes are discussed in the SE-literature. For the individual there is increased personal knowledge when starting a firm (Baron and Henry, 2010) as well as the enjoyment and pleasure of solving problems and creating something new (von Hippel, 2005). There are also societal benefits from strategic entrepreneurship such as running public services (McGahan, Zelner, and Barney, 2013). The social role of entrepreneurship includes connecting to societal aims such as quality of life, achieving progress, and enriching human existence as well as economic growth and technological advancement (Zahra and Wright, in press).

However, before reaching such outcomes more intermediate outcomes on the organizational level are likely to emerge, in particular new technology and innovation (Hitt et al, 2011). Creating innovations are vital for many new ventures as well as for established firms to maintain or increase competitiveness. To create novel innovations a firm needs to shift its attention from the present products; processes; organizational and marketing arrangements and/or business model to the future ones (cf. Sood & Tellis, 2005). Often firms, especially new and small firms, do not have all the required resources and capabilities to create innovations. They need to develop a network of partners and develop capabilities to manage innovation networks (Dodgson, Gann and Salter, 2006). Often new ventures, despite lack of resources, are more creative and entrepreneurial in creating more

radical innovations, while large and established firms are better at incremental innovations, adding new features to the products or trimming of processes. Thus, a solution to this is for large firms to team up with or acquire smaller and more entrepreneurial firms, balancing exploration and exploitation. Acquisitions of or investment in smaller entrepreneurial firms having developed promising new technologies are common in ICT and the pharmaceutical/biotech-sectors. Corporate investors seem to prefer smaller entrepreneurial firms with well-developed innovative capabilities pre-funding compared to private investors (Park and Steensma, 2013). However, it is not only about new technology, it could also concern new and better business models. In the electric power industry, some large utilities are now teaming up with small entrepreneurial solar energy firms (Ahlgren, Wadin and Bengtsson, 2015) mostly to learn about their new business models on the residential electric power markets.

Summarizing this section, SE has emerged as a new research field in the last two decades or so. The intent is to merge the strategic management's and entrepreneurship's view on value creation into an advantage- and opportunity-seeking view of the firm. We have described SE-research domain, in line with the input-output model proposed by Hitt et al (2011), as focusing on three dimensions: input/resources of SE, resource orchestration of SE and outputs of SE. One of the more dominant research streams in SE input/resources is knowledge spillovers and how new ventures and established firms succeed or fail to utilize knowledge spillovers in order to identify and exploit opportunities, developing new technologies and innovations, as well as developing competitive advantage. The next section will give an overview of important aspects of the research on the knowledge spillovers.

3. Knowledge Spillovers

In this section, we will portray the anatomy of knowledge spillovers by having a critical literature review on various aspects of knowledge spillovers. We will start by discussing various mechanisms through which knowledge spillovers are transmitted between economic agents (Section 3.1). Then we will discuss the sources and recipients of knowledge spillovers more in detail by paying particular attention to geographical reach of knowledge spillovers. This will be done by distinguishing between the spatial (inter-firm within a region) knowledge spillovers and aspatial (either intra-firm or inter-region) knowledge spillovers (Section 3.2 and 3.3 respectively). While the literature in knowledge spillovers is mostly dominated by spatial knowledge spillovers, we find it useful to have a discussion of aspatial knowledge spillovers as well. This is particularly helpful when it comes to the implications of knowledge spillovers for SE (will be elaborated in Section 4).

3.1 Mechanisms of knowledge spillovers

Breschi and Lissoni (2001) argue that the mechanisms conveying knowledge spillovers include (i) formal and informal interaction between firms and other economic agents, where the formal interaction is based on an explicit contract, while the informal interaction is based upon an implicit contract, (ii) active knowledge search of firms, and (iii) mobility

of firms and individuals, particularly in the form of entrepreneurial spin-offs. The formal and informal interaction between firms and other economic agents can take many forms ranging from transactions of goods and services (including R&D-services) to cooperation in the form of joint ventures and strategic alliances (including R&D-cooperation).

Informal networking tends mainly to take place at the regional level, and thus knowledge spillovers through this channel tend to be localised (Breschi and Lissoni, 2006). It includes the interaction of employees of different firms and other economic agents privately and in social, civic and professional organizations. Since much knowledge is embodied in people, it is natural to assume that knowledge spillovers are partly a function of the interaction between people with the relevant education, skills and experiences. Relations to suppliers and/or customers are also potential channels for knowledge spillovers, which is highlighted by Kline & Rosenberg (1986), who stress the importance of interdependence and dynamic learning across various firms and economic agents within a linkage and feedback model of innovation. Furthermore, trade with goods and services embodying knowledge is a further channel for knowledge spillovers and externalities (Grossman & Helpman, 1994; Verspagen, 1997).

Formal networking is the prominent mechanism for inter-regional aspatial knowledge spillovers and it is not mainly limited to the regional scale. For example, formal networking in the form of formal research collaboration tends to take place at both national and international scales (McKelvey et al, 2003; Ponds et al, 2007; Hoekman et al, 2009). Thus, knowledge spillovers from research collaboration that builds upon network formation through link investments can take place between firms in different regions.

Mobility of economic agents involves the mobility of labour as well as the mobility of firms, which are an important channel for knowledge spillovers (Boschma et al, 2008). One important form of mobility of firms is foreign direct investments (Braunerhjelm & Ekholm, 1998). An example of mobility of people is through the mechanism of international 'returnees'. Liu et al (2010) find that Chinese firms founded by Chinese overseas returnees are more innovative than their domestic counterparts founded by Chinese settled in the country are. These returnee firms also have a spillover effect on non-returnee firms. Moreover, there exist several more mechanisms, which support and facilitate the transfer and diffusion of tacit as well as codified knowledge (cf., Arrow, 1994) and technology: i) education, ii) seminars, conferences and trade fairs (Karlsson, 1988), iii) interactive communication channels (E-mail, the Internet, video conferences, etc.), iv) people specially designated to obtain and disseminate knowledge (e.g. gatekeepers) (cf. Allen 1977), v) knowledge management within and between firms and economic agents, and vi) imitation.

It is important to notice that even if each of these channels can be seen as partly independent of each other, they are often linked to each other in different ways. For instance, according to Archibugi and Coco (2004) international cooperation in both the private and the public sector play an important role for knowledge diffusion. An increasing number of partnerships among firms, universities and public research centres as well as between indi-

vidual researchers and inventors is a clear indication of the growing importance of collaboration (NSF, 2002). Collaboration permits the partners to share and acquire the expertise of each other, thus enriching their overall knowledge. It often functions as a positive sum game, where the advantages outweigh the disadvantages even if the advantages are not always equally shared among the partners (Archibugi & Lundvall, 2001).

The knowledge spillovers may occur vertically or horizontally. If we start with the former case, where firms interact directly, it is obvious that knowledge may spillover vertically between firms when goods or services are delivered between firms. The knowledge spillovers may occur due to geographical proximity and then they generate both localization and urbanization economies. Links between firms also facilitate knowledge spillovers. Knowledge may also spillover horizontally between competing firms in geographical proximity of each other. This may be referred to as a Porter externality and corresponds to localization economies (in a specialized cluster) (Porter, 1990). Considering the fact that knowledge spillovers to competing firms are unwanted effects for firms in a market economy, hence the clustering of competing firms tells us that there are advantages of agglomeration outweighing the negative effects of knowledge spillovers. Finally, Joint ventures and strategic alliances may give rise to vertical as well as horizontal knowledge spillovers depending upon what firms are involved.

Summarising this section, we can observe that firms may (i) acquire knowledge and support in its development activities by purchasing inputs from knowledge suppliers, (ii) form research, development and innovation links with other firms on a commercial basis, (iii) acquire knowledge as a spillover effect of the ordinary interaction on its transaction links, and/or (iv) get knowledge as a spillover effect when interacting directly or indirectly, intentionally and unintentionally with other firms and economic agents in the own region and in other regions.

3.2 Spatial knowledge spillovers

A critical issue in analysing the role of knowledge spillovers and thus knowledge externalities for regional economic development is the geographic or spatial reach of knowledge spillovers. We have many reasons to believe that knowledge is subject to spatial decay (cf. Henderson, 1996). Due to "the tyranny of distance", most human interaction takes place within the functional region and in particular the locality where firms are localized and where people live and often work. The claim that geographical proximity matters for knowledge spillovers between firms is largely supported by the empirical literature (Karlsson & Manduchi, 2001). Already Glaeser, et al. (1992, 1127) maintain that geographical proximity facilitates knowledge spillovers, because "intellectual breakthroughs must cross hallways and streets more easily than oceans and continents". This is followed up by Feldman & Audretsch (1999, 410) who argue, "knowledge spillovers not only generate externalities, but the evidence suggest that such knowledge spillovers tend to be geographically bounded".

In order to discuss the spatial knowledge spillovers one needs to consider the main activities of firms. Firms are characterised by two main types of activities. Firstly, we have the ordinary production activities, i.e. at each point in time a firm uses current and fixed inputs to produce output by means of given techniques (routines). Secondly, we distinguish development activities, i.e. the use by firms of part of the inputs to develop new types of outputs and/or new routines (including the development routines). It is essential to distinguish between these two types of activities, since knowledge spillovers have quite different effects in the two cases. Both ordinary production activities and development activities involve interaction with other firms and other economic agents – interactions that give rise to interaction costs, which increase with geographical distance between the actual firms and economic agents involved, and which are non-linear with regard to geographical distance (Johansson & Karlsson, 2001). Hence, geographical proximity to other firms and economic agents brings an advantage to firms in particular when the interaction with them involves knowledge.

When it comes to type of knowledge that is spillovers spatially, the prominent type is "technological knowledge", as supposed to scientific and entrepreneurial knowledge (which will be discussed in Section 3.3). This is mainly because technological knowledge is "tacit" in nature, and hence face-to-face interaction in the spatially bounded space is required for the spillover of knowledge to occur (Arrow, 1994). It should also be noted that the firm that developed new technological knowledge normally does not want to share it without compensation with competitors, so the knowledge-spillover in this case is unintentional.

When it comes to source of new knowledge, firms and other economic agents through deliberate search for new knowledge in the form of R&D-activities and through learning-by-doing generate it[1]. Inter-firm knowledge spillovers (and inter-economic agents in general) occur when the knowledge generated by one firm or economic agent is 'borrowed' by other firms and economic agents. Here, we must distinguish between spillovers between firms in the same sector (industry) and spillovers between firms in different sectors (Feldman & Audretsch, 1999). One critical question here concerns whether the specific mix of economic activities undertaken within different regions matter for the extent and direction of knowledge spillovers, i.e. do knowledge spillovers occur mainly within or between sectors? This question, which concerns the recipients of knowledge spillovers, is very relevant and a debate among researchers during the two last decades has focused precisely on how the knowledge externalities, generated by knowledge spillovers, are affected by the regional mix of economic activities. Despite a consensus that knowledge spillovers within a given region stimulate dynamic knowledge externalities, there is no agreement concerning who the recipients of these knowledge spillovers are.

[1] This search is directed towards different kinds of sources. The sources can be classified into two groups: i) sources containing embodied knowledge including individuals, firms, economic agents and products, and ii) sources containing disembodied knowledge, including books, articles, research, consultancy reports, patents, and web pages.

The seminal work in this literature is Glaeser et al. (1992), which analyses the factors that influence innovative activities in urban regions. The authors identify two relevant models in the economics literature. The first model is the so-called Marshall-Arrow-Romer (MAR) model, which formalises the insight that the concentration of a particular sector within a specific urban region (Lösch, 1954) promotes intra-regional knowledge spillovers across firms in that particular sector and therefore stimulates innovation in that particular industry. The basic assumption here is that knowledge spillovers, and thus knowledge externalities, mainly takes place across firms in the same sector.

The alternative view regards inter-sectoral knowledge spillovers as the most important channel to diffuse new economically relevant knowledge. Not least, Jacobs (1969 & 1984) argues that the agglomeration of firms from different sectors in urban regions fosters innovations due to the diversity of knowledge sources located in such regions. The recipients of knowledge spillovers from firms in one particular sector are here firms in other sectors. The assumption here is that the variety of industries within an urban region can be a powerful engine of growth for that region, and that the exchange of complementary knowledge across diverse firms leads to increasing returns to new knowledge. However, the degree of inter-industry spillovers seems to be determined by the technological proximity between industries (Goto & Suzuki, 1999; Verspagen, 1997). However, we only have limited and sometimes contradictory empirical evidences concerning the impact of diversity on knowledge spillovers (Audretsch & Feldman, 1999; van der Panne, 2004).

To sum up this stream of literature, agglomeration externalities implies that firms can benefit from mutual proximity but whether a more specialised or a more diversified region is most favourable for existence and size of localised knowledge spillovers is still an open question (Rosenthal & Strange, 2004). The empirical studies in the field give no clear answer to the question whether MAR or Jacobs's externalities are most important. While Henderson, Kunkoro & Turner (1995) reach the conclusion that MAR externalities are most important, Boix & Trullén (2007) reach the opposite conclusion.

At the end, it is worthy to note that the gains from knowledge spillovers do not apply uniformly across firms in a region due to the heterogeneity among firms. They differ in terms of their absorptive capacity, history, age, size, knowledge and other resources, location, networks, ownership structure, routines, strategies and behaviour even if they belong to the same industry (Cohen & Levinthal, 1990; Raspe & van Oort, 2011). However, whether or not every firm can benefit equally from knowledge spillovers have received limited attention in the literature (Saito & Gopinath, 2011).

3.3 *Aspatial knowledge spillovers*

As quoted earlier, Feldman & Audretsch (1999, 410) stated that knowledge spillovers 'tend to be' geographically bounded. Such statement indicates that knowledge spillovers also may occur between regions. In fact, the authors themselves only five years later argued "there is no reason that knowledge stop spilling over just because of borders, such as a city

limit, state limit or national boundary" (Audretsch & Feldman, 2004, 6). In this connection, it may be relevant to go back to Palander (1935), who observed that one of the most remarkable features of modern urban structures is the frequency and extension of the interactions between activities carried out in different cities. These interactions presuppose of course the possibility of communicating between cities. Possibilities that have multiplied many times since the 1930s due to, on the one hand, a telecommunications revolution that has lowered the marginal cost of information exchange between different locations to levels very close to zero, and, on the other hand, the evolution of highway and air travel networks that significantly has reduced the travel costs and the travel times. Thus, the inter-regional interaction costs have been reduced substantially in recent decades creating the necessary foundations for a global knowledge-intensive network economy (Karlsson, 1994). Against this background, we may ask to what extent it is actually true that knowledge spillovers are limited in scope and spatial reach.

Indeed Knowledge spillovers can be also aspatial, i.e. either intra-firm or inter-regional. The intra-firm knowledge spillovers imply that knowledge can spillover form one organizational unit to another within a firm (Oldroyd and Gulati, 2010; Ko and Liu, 2015) or through alliance (Shu et al, 2014). While it is often implicitly assumed that internal knowledge is uniformly available to all firm units and internal knowledge spillovers is costless in the knowledge spillover research (Agarwal, Audretsch and Sarkar, 2010), more fine-grained research reports problems arising from for instance knowledge stickiness (Szulanski, 1996) and costly transfer and interpretation processes (Oldroyd and Gulati, 2010). Most research in this field is labelled knowledge transfer or knowledge spill-in (Villasalero, 2013) as it often entails some conscious management offers to transfer knowledge from one organizational unit to another. One area with several studies concerns knowledge spill-ins in the form of learning effects experienced by one organizational unit which is then transferred to another organizational unit (Oldroyd and Gulati, 2010; Villasalero, 2013) in order to better interpret and respond to dynamic environments.

The aspatial knowledge spillovers can be also in the form of inter-regional. This can typically happen through the mechanism of formal networking, as noted in Section 3.1. An example of such formal networking is through formal research collaboration, which is usually not only inter-regional but also inter-national (Ponds et al, 2007; Hoekman et al, 2009). A prominent type of knowledge that spillover inter-regionally (and internationally) is "scientific knowledge". The inter-regional scientific knowledge spillovers are indeed both substantial and rapid between individuals with the relevant absorptive capacity. The reason for this is that the international scientific community is organised in big knowledge networks, relying, for example, on international scientific conferences and journals and that rapid publication of new scientific results are important for the prestige of the individual scientists. Moreover, "entrepreneurship knowledge" in the form of business ideas also can diffuse between regions without major problems, since it normally is not proprietary, even if trademarks and logotypes can be protected. Thus, it might be the case that the claims that geographical knowledge spillovers tend to be geographically bounded underestimates the geographical reach of knowledge spillovers.

4. The role of knowledge spillovers on strategic entrepreneurship

Knowledge spillovers are becoming one of the popular research streams in SE, as illustrated by the special issue in Strategic Entrepreneurship Journal (Agarwal, Audretsch and Sarkar, 2010). In this vein, issues regarding spatially bounded and inter-firm knowledge spillovers mostly in the area of technological knowledge spillover (Gambardella and Giarratana, 2010) are dominating the SE research. Examples of studies in this field include Kotha's (2010) longitudinal case study on Boeings ability to use technological knowledge spillovers, especially in certain technical domains in military industry, to outmanoeuvre the competitor and market leader Douglas Aircraft Company. Plummer and Gilbert (2015) have also investigated technological knowledge spillovers from defence industry into entrepreneurial start-ups.

As noted earlier, in general knowledge spillovers can be spatial, i.e. inter-firm knowledge spillovers within a same region, or it can be aspatial, i.e. either intra-firm or inter-region. Starting from spatial knowledge spillovers, we argue that this type of knowledge spillovers mostly play a role in the *resource/input* part of SE (Section 2.1). In particular, spatial knowledge spillovers can be manifested as a mechanism underlying the environmental munificence as one of the most important environmental factors (Audretsch and Feldman, 2004; Hitt et al, 2011). Such knowledge spillovers are the result of various types of interaction between the following categories of firms and other economic agents (von Hippel, 1988): (i) the developer and other firms in the same trade, (ii) the developer and firms that are (potential) input suppliers, (iii) the developer and firms that are (potential) customers, (iv) the developer and commercial as well as non-commercial knowledge suppliers (including universities and research institutes), and (v) the developer and other firms belong to the same multi-agent organization.

On the other hand, we argue that aspatial knowledge spillovers can play a role in both resources as well as resource orchestration dimensions, depending on the source of aspatial knowledge spillovers. As discussed in Section 3.1, aspatial knowledge spillovers can be either inter-regional or intra-firm. First, if it is inter-regional, its effect on the dimension of SE is similar to spatial knowledge spillovers in a sense that here, again, the knowledge spillovers act as the knowledge input and hence can increase the amount of *resource/input* dimension of SE. The only difference here is that this inter-regional knowledge spillovers comes through the inter-regional and perhaps international networks and it is mostly in the form of scientific and technological knowledge between few existing hot spot in a particular technology. Second, if the aspatial knowledge spillovers is intra-firm (e.g. between various units of a same firm located in various countries), it mostly play a role in the *resource orchestration processes* part of SE, in particular in the resource bundling processes (Section 2.2). In particular, intra-firm knowledge spillovers can contribute to a better bundling of resources in a sense of combining the resources and capabilities in order to identify and exploit new opportunities as well as seeking competitive advantages (Hitt et al, 2011).

While knowledge spillovers do not play a direct role in affecting the outcome part of SE, it definitely affects outcome part of SE indirectly, through its effect on *input* and *resource orchestration processes* parts. The higher inter- and intra-firm knowledge spillovers, the higher the *knowledge inputs* and the more efficient the *resource orchestration processes*, which eventually leads to higher intermediate outcomes (e.g. innovation) as well as final outcomes at the organizational level. For instance, if we consider product development and innovation activities, it is obvious that the information and knowledge that facilitate product development can be either generated within the firm (especially large firms with R&D labs), i.e. intra-knowledge spillovers, or it may be exchanged (unintentionally or commercially) between the developer and other firms and economic agents, i.e. inter-firm knowledge spillovers. Above discussion is schematically shown in Table 1.

Table 1-Sources of knowledge spillovers and dimensions of SE

		Dimensions of Strategic Entrepreneurship		
		Resources	*Resources orchestration*	*Output*
Knowledge Spillovers	*Spatial*	✓	NA	✓
	Aspatial	✓	✓	✓

Note: The sign "✓" indicates that a particular type of knowledge spillovers (e.g. Spatial) has positive effect to increase the level (or efficiency) of a particular dimensions of SE (e.g. Resources). "NA" indicates Not Applicable.

5. Conclusions

In this paper we have theoretically discussed various types of knowledge spillovers (by distinguishing it to be either spatial or aspatial) and then conceptually linked them to various dimensions of SE. We argued that spatial knowledge spillovers (inter-firm) play the major role in increasing the amount of *resources/inputs* dimension of SE. Moreover, we argued that aspatial knowledge (either inter-regional or intra-firm) play the major role not only for *resources/inputs* dimension, but also for *Resources orchestration* dimension. Considering such "double" implication of aspatial knowledge spillovers for SE, we found it striking the lack of theoretical framework and empirical evidence on aspatial knowledge spillovers already in knowledge spillovers literature, let alone the implication of it for SE. Hence, here we provide few suggestions for future research.

First, the research in knowledge spillovers needs to pay particular attention to aspatial knowledge spillovers (which can be either inter-regional or intra-firm). This will pave the way for a better understanding of the implication of this type of knowledge spillovers for SE. Moreover, future research is needed to investigate empirically the three elements of SE, i.e. resources, resources orchestration, and output. This can be done in various ways. First, each of the elements can be separately investigated in a case study setting with a firm or a region as a unit of analysis. The analysis can also go beyond a case study and uses a

large-scale data on firms and regions. Second, the interrelation between the three elements can be investigated, once again, both in a case study design or quantitative large-scale data driven studies. Finally, the relation between types of knowledge spillovers and dimensions of SE (Table 1) can be tested empirically in various regions and countries.

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