

Knowledge effects on competitiveness: from firms to regional advantage

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Abstract In this article we integrate concepts of strategic management with economic policy to explain knowledge effects on firms' and regions' competitive advantage. A literature review allows us to create a framework that portrays the current state of research and future development. Through an evaluation of the ample literature we aim to rationalize the effects knowledge and entrepreneurship have on regional competitive advantage.

Keywords Knowledge · Firms' competitive advantage · Entrepreneurship · Regional advantage

JEL Classification M000 · O300

1 Introduction

The literature considers knowledge as main driver of firms' competitive advantage, entrepreneurship and regional advantage. We conducted a literature review aimed to demonstrate the effects of knowledge on both firms and regions and the role of entrepreneurship in affecting their interaction.

The design of the literature review is realized considering the scope of Journal of Technology Transfer. A bibliographic selection of articles covers a period from 1962 to 2015. We explore the state-of-the-art research on knowledge effects using ABI Inform, EBSCO, PubMed, Google Scholar and other online services. To discuss articles concerning knowledge and its effects on local competitiveness, we searched for 'knowledge and firms competitive advantage', 'knowledge and entrepreneurship', and 'knowledge and regional development' in the abstract of papers. Through a qualitative approach, we closely

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examined 116 papers, which allowed us to create a more detailed statement on the current state of the research and the interaction between these topics.

The remainder of the paper proceeds as follows. The next section presents a review of articles on knowledge effects on firms' competitive advantage. Section 3 presents papers focused on knowledge effects on firms' entrepreneurship. Section 4 discusses papers on knowledge effects on regions competitiveness. Finally, Sect. 5 presents some conclusions and discussions.

2 Existing firms' advantage

In globalized world, firms compete with each other, for everything, everywhere. A well-developed strand of literature in strategic management has emphasized the role of resources as main drivers of firms' competitive advantage. Specifically, resource-based view scholars have argued that the unique position developed by firms in relation to their competitors is based on complex, embedded and firm-specific resources (Barney 1986a, b, c; Wernerfelt 1984). Among these resources, knowledge has the greatest potential to serve as source of sustainable advantage generating economic rents that enhance firms' position on their competitors. Knowledge generates causal ambiguity between actions and results that affects firm's competitive strategies aimed at altering its position in the industry, defending existing market share or seeking new markets (Barney 1991; Henderson and Cockburn 1994; Liebeskind 1996). Thus, better performance of firms over their competitors arises from their capabilities in creating, transferring and combining knowledge in a way that can't be imitated by other organizations (Kogut and Zander 1992; Rumelt 2005; Dierickx and Cool 1989).

Firms may choose to seek competitive advantage through *internal investment in research and development* (R&D) aimed to improve knowledge (Arrow 1962; Ahuja and Katila 2004; Peters 2009). At this aim they need innovative capabilities to select R&D investment, to coordinate internal activities and to modify strategies when external conditions change (Aldridge et al. 2014).

Firms may also choose to seek competitive advantage through *formal inter-organizational linkages*, such as alliances or networks, aimed at facilitating knowledge sharing and interactive learning processes among participating firms (Inkpen and Tsang 2005; Aristei et al. 2015; Carayannis and Alexander 1999). These collaborations generate relational rents for single firm and the whole network (Azagra-Caro and Consoli 2014; Dyer and Singh 1998; Georghiou 1999; Ramlogan and Consoli 2014). In this way, the locus of competitiveness shifts from individual firms to networks and firms that are unable to be part of these networks are unable to maintain a competitive advantage (Huang and Yu 2011; Powell et al. 1996; Boehm and Hogan 2014). At this aim, firms need collaborative, relational and absorptive capabilities to create a network and absorb knowledge created by other firms of such network (Di Guardo and Harrigan 2015; Carmeli et al. 2011; Franza et al. 2012; Carmeli and Waldman 2010). Collaborative and relational capabilities are firms' abilities to create R&D alliances and manage inter-organizational network (Morandi 2013; Bojanowski et al. 2012; Nielsen 2015; Perko and Narin 1997; Rodríguez Díaz 2012). Absorptive capabilities are firms' abilities to exploit outside sources of knowledge, recognize the value of new knowledge, assimilate and apply it to commercial ends (Cohen and Levinthal 1990).

Although there is consensus among management scholars about the importance of innovative, collaborative, relational and absorptive capabilities in creation and absorption of knowledge (Cozza and Zanfei 2015; Nelson and Winter 1982), economists increasingly emphasize the role of *proximity* in transmission of knowledge (Audretsch and Stephan 1996). Firms absorb external knowledge not only collaborating with other organizations but also accessing to external spillovers (Audretsch and Lehmann 2005; Audretsch 1995). Thus, while strategic management scholars focus on investments in competences as a mechanism to facilitate the absorption of external knowledge (Teece et al. 1997), Audretsch and Stephan (1996) find that firms' proximity is a prerequisite to board members accessing external knowledge.

The un-codified knowledge that is embedded in the experience of an innovator who operates in a specific country, industry and technological domain (Feldman and Audretsch 1999) makes knowledge difficult to transfer across these domains (Kogut and Zander 1993; De Fuentes and Dutrénit 2014). Researchers have analyzed the effects of geographical, technological and industrial proximity to the knowledge domain of innovators and adopters and the consequent spillovers (Arellano and Bover 1995; Blanchflower and Burgess 1998).

According to these studies, spatial proximity between innovators and adopters is a crucial issue in the knowledge diffusion process (Audretsch and Vivarelli 1996; Audretsch and Thurik 2001). Proximity is particularly important when un-codified knowledge is involved in the production of new knowledge and knowledge transfer relies on learning-by-doing (Audretsch and Feldman 1996; Breschi 1999; Klepper 1996). Direct interactions of innovators with other firms located in the same geographical area led adopters to increase their stock of knowledge, which in turn, affect firms' competitiveness (Lindelöf and Löfsten 2004; Díez-Vial and Fernández-Olmos 2014). Moreover, geographical proximity may reduce the cost of accessing knowledge spillovers. This explains the extent to which knowledge flows bounded within geographic limits receive particular attention in the literature (Padmore and Gibson 1998). Assuming that direct interactions lead firms in a region to adopt ideas from their neighbours more frequently (Jaffe et al. 1993), several studies on geographical clusters, local innovation systems, and industrial districts focus on the local nature of the knowledge diffusion process (Audretsch and Feldman 1996; Acs et al. 2002; Braczyk et al. 1998). Thus the idea that proximity can support firms and regions' competitive advantage has become central in the literature of economic geography and strategy, and emphasizes the importance of knowledge that is external to the firm but internal to the location (Fukugawa 2013; Patton et al. 2009). Other researchers provide evidence that firms are most able to absorb knowledge that is technologically close to their own knowledge (Jaffe 1986). Jaffe (1989) finds that firms that are active in research-intensive technology groups enjoy higher competitive performance, suggesting that technological proximity accentuates knowledge diffusion (Woerter 2012; Goto and Suzuki 1989). Consequently, according to these studies, firms are expected to develop an innovation trajectory closely aligned with other firms with more similar technologies (Teece et al. 1997; Baskerville and Pries-Heje 2003).

Also industrial proximity makes knowledge easier to be diffused and adopted for innovative products and processes (Fier and Pyka 2014; Drivas and Economidou 2014). Knowledge moves more within the industry as on going practice creates both shared knowledge about how the sector works and understanding of the meaning and context of such knowledge (Fernández-Ribas and Shapira 2009; Brown and Duguid 2001). Innovators are most easily able to recognize and absorb knowledge developed from other actors within the same industry (Cohen and Levinthal 1990). Thus, even when they seek to incorporate new external knowledge in their process of creation of new knowledge, the resultant search

processes restrict external knowledge utilized to familiar and proximate industries (Lindelöf and Löfsten 2004; Lee and Miozzo 2015). Consequently, adopters are expected to develop knowledge closely aligned with other firms of the same industry (Ponds 2009).

However external knowledge has to be combined with internal one for becoming a unique source of competitive advantage. At this aim, firms need combinative capabilities to integrate knowledge that resides both inside and outside their boundaries (Lorenzoni and Lipparini 1999). Moreover, adoption, integration, and reconfiguration of endogenous and exogenous knowledge have to meet environmental change (Oehler et al. 2015; Núñez-Sánchez et al. 2012). Thus, for achieving new forms of competitive advantage firms need dynamic capabilities to be flexible and innovative when external change demand highly responsive decisions and when future competition and market structures are difficult to forecast. Thus, only firms with dynamic capabilities are able to create, absorb and combine internal and external knowledge and can achieve a sustainable competitive advantage over their competitors (Porter 1990; Saxenian 1994).

3 New firms' advantage

Knowledge further supports the competitive advantage of established organizations, as it serves as a source of entrepreneurship (Gartner and Carter 2003). Knowledge created in a firm serves as source of entrepreneurial opportunities for the same firm that supports R&D investment, for its formal partners and for other emerging organizations. It extends the range of possible opportunities to engage in entrepreneurial activity (Companys and McMullen 2007). However, the uncertainty inherent in these opportunities leads to a gap between the latent and emergent entrepreneurship. In some cases the uncertainty of such opportunities can lead them to remain undeveloped in a latent stage while in other cases they can be turned into an emergent form (Fig. 1). Consequently we distinguish latent entrepreneurship from emergent in that the former refers to all the possible options to create a new firm, while the latter refers to a concretization of a single option to form a new business (van Stel et al. 2007).

If latent entrepreneurship is created by the production of new knowledge, how is it turned in emergent entrepreneurship? One way in which people exploit latent entrepreneurship is through entrepreneurial capability. Entrepreneurial capability is the ability to identify and manage potential opportunities coming from internal and external

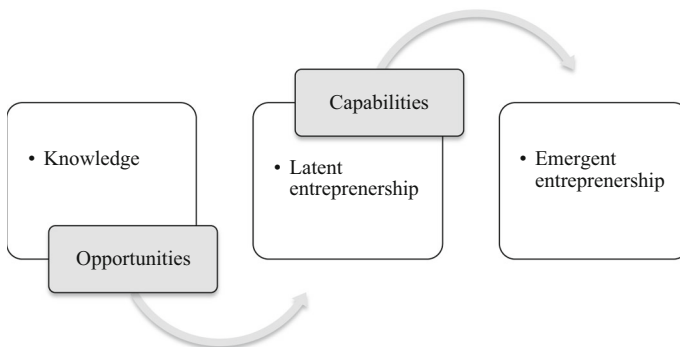


Fig. 1 From latent to emergent entrepreneurship

knowledge at the aim to create new firms. It is the ability to discover entrepreneurial opportunities and then to act upon them through undertaking entrepreneurial activity. It turns entrepreneurial opportunities into new firms, filling the gap between the latent form of entrepreneurship and the emergent one. Thus, latent entrepreneurship comes from entrepreneurial opportunities and becomes emergent through entrepreneurial capabilities (Liao and Phan 2015).

Specifically, knowledge created through internal investment generates potential opportunities to create spin-offs in order to commercialize that knowledge. Corporate spin-offs are means to exploit such opportunities through the entrepreneurship capability developed inside the parent organization. They represent the emergent entrepreneurship that comes from some latent possibilities that parent firms' exploit through entrepreneurial capabilities (Xue and Naser 1996).

Knowledge can also be acquired through alliances that offer to the involved firms several entrepreneurial opportunities to create an *equity joint venture*. In this case, knowledge shared in the alliance lead to latent entrepreneurship that the involved firms turn into a new company to commercialize their ideas. The act of founding an equity joint venture to commercialize knowledge generated through alliance serves as the mechanism for latent entrepreneurship to assume a real form.

However, it can happen that firms able to create entrepreneurial opportunities can be incapable of exploiting them into an entrepreneurial activity (Hitt et al. 2001). Furthermore, firms unable to create entrepreneurial opportunities can have the lack the ability to identify and implement them into a concrete activity (Ireland et al. 2003; Roland 1982). Thus, another way in which people exploit entrepreneurial opportunities is through knowledge spillover.

In fact, because of knowledge spill-overs, opportunities created in a firm but left in a latent stage can be exploited by another actors (Audretsch et al. 2006). The discrepancy between organizations creating opportunities of latent entrepreneurship and the emergent entrepreneurship exploited from others has been discussed by Audretsch (1995) through the *knowledge spillover theory of entrepreneurship*. According to this theory entrepreneurial opportunities created in a firm, but left in a latent form as a result of the uncertainty in knowledge, serve as a source of latent entrepreneurship that others can turn into an emergent form (Acs and Armington 2006; Acs et al. 2004; Audretsch et al. 2006). The entrepreneurial capability leads to the concretization of emergent entrepreneurship from latent opportunities developed by other firms (Acs et al. 2009; Acs and Armington 2006; Acs et al. 2004; Audretsch et al. 2006). It involves exploration and exploitation of new opportunities created but not appropriated by other firms, absorption of knowledge spillovers and creation of new organizations (Acs et al. 2004). Thus, the entrepreneurial capability of founding a new firm to commercialize knowledge generated in another organizations serve as a conduit of knowledge spillovers and provides the missing link between knowledge investments and economic development (Audretsch et al. 2009; Audretsch and Keilbach 2007).

4 Regions' advantage

Globalization has shifted the regional advantage away from being based on traditional input of production toward knowledge (Audretsch 2009; Audretsch and Thurik 2001). A great deal of evidence shows that creation and diffusion of knowledge influencing

competitiveness of existing firms and creation of new one affect economic growth of regions in which they operate (Baumol 2002; Di Cagno et al. 2014). However, despite of it is generally accepted that knowledge leads to growth, it is not well evidenced why some regions of the world are more able to turn knowledge into economic development and become more competitive than others. Some American regions (i.e. Silicon Valley or Route 128) are thought to commercialize new knowledge more effectively than European regions (i.e. Sophia Antinopolis) giving rise to the so-called European paradox (Audretsch et al. 2015; Audretsch 2007; Barajas et al. 2012; Bonardo et al. 2010; Mukherji and Silberman 2011; Murakami 2014).

Literature has tried to explain this phenomenon identifying *knowledge filters* that act as barriers to knowledge diffusion and its commercialization in some regions rather than in others. The components of these barriers are both formal and informal institutional filters. Formal institutional filters influence the rules and structures of social behaviour such as regulatory frameworks and industrial structure (Scott 2001). Informal institutional filters, instead, influence culture and social capabilities (Kalapouti and Varsakelis 2014; Coyne 2008). These filters reduce firms' propensity to invest in R&D and create inter-organizational relationships with private and public organizations to develop knowledge (Kochenkova et al. 2015; Grimm and Jaenicke 2012). They also affect creation of entrepreneurial opportunities that lead latent entrepreneurship to assume an emergent form. Finally, they affect the diffusion of knowledge among firms and its economic use (Kolb and Wagner 2015; Baumol 2002). Thus, regions that aim to achieve a competitive advantage have to implement policies able to reduce knowledge filters that affect both firms competitiveness and entrepreneurship (Mustar and Wright 2010; Jeong et al. 2013). Policy-makers can focus their attention on economic and legal aspects adopting macro-economic measures such as financial incentives to firms that invest in knowledge creation and diffusion (Protogerou et al. 2013; Carayannis and Grigoroudis 2014; Burnett et al. 1997). They can realize structural measures aimed toward integrating various regulatory authorities and support creation of centres able to promote knowledge diffusion (Qian and Haynes 2014; Goldstein and Glaser 2012; Hameri 1997). Finally, policy makers can act on informal institutions through a series of measures aimed toward facilitating inter-firm collaboration by sharing information and achieving economies of scale and strengthening on-going business and technological development relationships (Grimpe and Fier 2010; Guerrero et al. 2014; Ponomariov 2013; Jaffe 1998; Dits and Berkhout 1999).

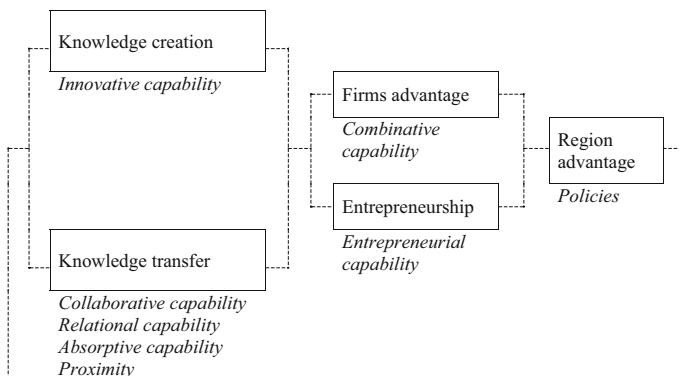


Fig. 2 Knowledge effects on firms and regions

In sum, regional policies aimed toward reducing filters of knowledge creation and transfer increase firms competitiveness and entrepreneurship that in turn improve regions competitiveness. This virtuous circle involves both firms and regions' competitiveness demonstrating the central role of knowledge in this process (Fig. 2). Consequently, the fact that different regions may have different levels of competitiveness depend on both their investment in knowledge and their political support of knowledge diffusion and exploitation in firms' competitiveness and entrepreneurial activity (Agarwal and Hoetker 2007; Agarwal et al. 2010; Levie and Autio 2011).

5 Conclusions and discussion

In this article we have integrated concepts from strategic management with those of economics to evidence knowledge effects on firms' and regions' competitive advantage. On one side we indicate that firms' competitiveness and entrepreneurship depends on both the creation of knowledge through their internal investment and adoption of external knowledge created by other organizations. On the other side we illustrate that regional competitiveness depends on the knowledge effects on firms' competitiveness and entrepreneurship. However, a region's competitiveness is not an end in itself, but a means for reinforcing competitive advantage of localized firms and for creating of new firm. In this way, we provide an explanation for differences in regions and firms' competitiveness within a region revealing the interaction between the firms and the central role of knowledge. For researchers, our model synthesizes concepts that can be useful in future studies on management, strategy, entrepreneurship, and economics. For managers, our model suggests that knowledge creation and diffusion is essential for sustaining firms' strategic development. Finally, our model suggests that policy-makers should create formal and informal infrastructures aimed at supporting knowledge creation and diffusion between economic actors.

Conflict of interest The authors declare that they have no conflict of interest.

References

- Acs, Z. J., Anselin, L., & Varga, A. (2002). Patents and innovation counts as measures of regional production of new knowledge. *Research Policy*, 31(7), 1069–1085.
- Acs, Z. J., & Armington, C. (2006). *Entrepreneurship, geography, and American economic growth*. Cambridge University Press.
- Acs, Z. J., Audretsch, D. B., Braunerhjelm, P., & Carlsson, B. (2004). *The missing link: The knowledge filter and entrepreneurship in endogenous growth*. London: Center for Economic Policy Research.
- Acs, Z. J., Braunerhjelm, P., Audretsch, D. B., & Carlsson, B. (2009). The knowledge spillover theory of entrepreneurship. *Small Business Economics*, 32(1), 15–30.
- Agarwal, R., Audretsch, D., & Sarkar, M. B. (2010). Knowledge spillovers and strategic entrepreneurship. *Strategic Entrepreneurship Journal*, 4(4), 271–283.
- Agarwal, R., & Hoetker, G. (2007). A Faustian bargain? The growth of management and its relationship with related disciplines. *Academy of Management Journal*, 50(6), 1304–1322.
- Ahuja, G., & Katila, R. (2004). Where do resources come from? The role of idiosyncratic situations. *Strategic Management Journal*, 25(8–9), 887–907.
- Aldridge, T. T., Audretsch, D., Desai, S., & Nadella, V. (2014). Scientist entrepreneurship across scientific fields. *Journal of Technology Transfer*, 39(6), 819–835.
- Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29–51.

- Aristei, D., Vecchi, M., & Venturini, F. (2015). University and inter-firm R&D collaborations: Propensity and intensity of cooperation in Europe. *Journal of Technology Transfer*. doi:10.1007/s10961-015-9403-1.
- Arrow, K. J. (1962). The economic implications of learning by doing. *Review of Economic Studies*, 29, 155–173.
- Audretsch, D. B. (1995). Innovation, growth and survival. *International Journal of Industrial Organization*, 13(4), 441–457.
- Audretsch, D. B. (2007). Entrepreneurship capital and economic growth. *Oxford Review of Economic Policy*, 23(1), 63–78.
- Audretsch, D. B. (2009). The entrepreneurial society. *Journal of Technology Transfer*, 34(3), 245–254.
- Audretsch, D. B., Bönte, W., & Keilbach, M. (2009). Knowledge based entrepreneurship and regional economic performance. In *Sustaining entrepreneurship and economic growth*. International Studies in Entrepreneurship (Vol. 19, pp. 65–75). New York: Springer.
- Audretsch, D. B., & Feldman, M. P. (1996). R&D spillovers and the geography of innovation and production. *American Economic Review*, 86(3), 630–640.
- Audretsch, D. B., & Keilbach, M. (2007). The theory of knowledge spillover entrepreneurship*. *Journal of Management Studies*, 44(7), 1242–1254.
- Audretsch, D. B., Keilbach, M. C., & Lehmann, E. E. (2006). *Entrepreneurship and economic growth*. Oxford University Press.
- Audretsch, D. B., & Lehmann, E. E. (2005). Does the knowledge spillover theory of entrepreneurship hold for regions? *Research Policy*, 34(8), 1191–1202.
- Audretsch, D. B., Lehmann, E. E., & Paleari, S. (2015). Academic policy and entrepreneurship: A European perspective. *Journal of Technology Transfer*, 40(3), 363–368.
- Audretsch, D. B., & Stephan, P. E. (1996). Company-scientist locational links: The case of biotechnology. *The American Economic Review*, 86, 641–652.
- Audretsch, D. B., & Thurik, A. R. (2001). What's new about the new economy? Sources of growth in the managed and entrepreneurial economies. *Journal of Industrial and Corporate Change*, 10(1), 267–315.
- Audretsch, D. B., & Vivarelli, M. (1996). Firms size and R&D spillovers: Evidence from Italy. *Small Business Economics*, 8(3), 249–258.
- Azagra-Caro, J. M., & Consoli, D. (2014). Knowledge flows, the influence of national R&D structure and the moderating role of public–private cooperation. *Journal of Technology Transfer*, 39(6), 898–914.
- Barajas, A., Huelgo, E., & Moreno, L. (2012). Measuring the economic impact of research joint ventures supported by the EU framework programme. *Journal of Technology Transfer*, 37(6), 917–942.
- Barney, J. B. (1986a). Organizational culture: Can it be a source of sustained competitive advantage? *Academy of Management Review*, 11(3), 656–665.
- Barney, J. B. (1986b). Strategic factor markets: Expectations, luck, and business strategy. *Management Science*, 32(10), 1231–1241.
- Barney, J. B. (1986c). Types of competition and the theory of strategy: Toward an integrative framework. *Academy of Management Review*, 11(4), 791–800.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
- Baskerville, R., & Pries-Heje, J. (2003). Diversity in modeling diffusion of information technology. *Journal of Technology Transfer*, 28(3–4), 251–264.
- Baumol, W. J. (2002). Entrepreneurship, innovation and growth: The David–Goliath symbiosis. *The Journal of Entrepreneurial Finance*, 7(2), 1–10.
- Blanchflower, D. G., & Burgess, S. M. (1998). New technology and jobs: Comparative evidence from a two country study‡. *Economics of Innovation and New Technology*, 5(2–4), 109–138.
- Boehm, D. N., & Hogan, T. (2014). 'A jack of all trades': The role of PIs in the establishment and management of collaborative networks in scientific knowledge commercialisation. *Journal of Technology Transfer*, 39(1), 134–149.
- Bojanowski, M., Corten, R., & Westbrook, B. (2012). The structure and dynamics of the global network of inter-firm R&D partnerships 1989–2002. *Journal of Technology Transfer*, 37(6), 967–987.
- Bonardo, D., Paleari, S., & Vismara, S. (2010). The M&A dynamics of European science-based entrepreneurial firms. *Journal of Technology Transfer*, 35(1), 141–180.
- Braczyk, H. J., Cooke, P. N., & Heidenreich, M. (1998). *Regional innovation systems: The role of governments in a globalized world*. Psychology Press.
- Breschi, S. (1999). Spatial patterns of innovation: Evidence from patent data. *The Organization of Economic Innovation in Europe, 1999*, 71–102.
- Brown, J. S., & Duguid, P. (2001). Knowledge and organization: A social-practice perspective. *Organization Science*, 12(2), 198–213.

- Burnett, L. M., Massari, G. B., & LaScala, R. D. (1997). Transforming academic research findings into economically profitable technologies. *Journal of Technology Transfer*, 22(3), 17–23.
- Carayannis, E. G., & Alexander, J. (1999). Winning by co-opting in strategic government–university–industry R&D partnerships: The power of complex, dynamic knowledge networks. *Journal of Technology Transfer*, 24(2–3), 197–210.
- Carayannis, E., & Grigoroudis, E. (2014). Linking innovation, productivity, and competitiveness: Implications for policy and practice. *Journal of Technology Transfer*, 39(2), 199–218.
- Carmeli, A., Atwater, L., & Levi, A. (2011). How leadership enhances employees' knowledge sharing: The intervening roles of relational and organizational identification. *Journal of Technology Transfer*, 36(3), 257–274.
- Carmeli, A., & Waldman, D. A. (2010). Leadership, behavioral context, and the performance of work groups in a knowledge-intensive setting. *Journal of Technology Transfer*, 35(4), 384–400.
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35, 128–152.
- Companys, Y. E., & McMullen, J. S. (2007). Strategic entrepreneurs at work: The nature, discovery, and exploitation of entrepreneurial opportunities. *Small Business Economics*, 28(4), 301–322.
- Coyne, C. J. (2008). The politics of bureaucracy and the failure of post-war reconstruction. *Public Choice*, 135(1–2), 11–22.
- Cozza, C., & Zanfei, A. (2015). Firm heterogeneity, absorptive capacity and technical linkages with external parties in Italy. *Journal of Technology Transfer*. doi:10.1007/s10961-015-9404-0.
- De Fuentes, C., & Dutrénil, G. (2014). Geographic proximity and university–industry interaction: The case of Mexico. *Journal of Technology Transfer*. doi:10.1007/s10961-014-9364-9.
- Di Cagno, D., Fabrizi, A., & Meliciani, V. (2014). The impact of participation in European joint research projects on knowledge creation and economic growth. *Journal of Technology Transfer*, 39(6), 836–858.
- Di Guardo, M. C., & Harrigan, K. R. (2015). Shaping the path to inventive activity: The role of past experience in R&D alliances. *Journal of Technology Transfer*, 20.
- Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 35(12), 1504–1511.
- Díez-Vial, I., & Fernández-Olmos, M. (2014). Knowledge spillovers in science and technology parks: How can firms benefit most? *Journal of Technology Transfer*, 40(1), 70–84.
- Dits, H., & Berkhout, G. (1999). Towards a policy framework for the use of knowledge in innovation systems. *Journal of Technology Transfer*, 24(2–3), 211–221.
- Drivas, K., & Economidou, C. (2014). Is geographic nearness important for trading ideas? Evidence from the US. *Journal of Technology Transfer*, 40(4), 629–662.
- Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660–679.
- Feldman, M. P., & Audretsch, D. B. (1999). Innovation in cities: Science-based diversity, specialization and localized competition. *European Economic Review*, 43(2), 409–429.
- Fernández-Ribas, A. A., & Shapira, P. (2009). Technological diversity, scientific excellence and the location of inventive activities abroad: The case of nanotechnology. *Journal of Technology Transfer*, 34(3), 286–303.
- Fier, H., & Pyka, A. (2014). Against the one-way-street: Analyzing knowledge transfer from industry to science. *Journal of Technology Transfer*, 39(2), 219–246.
- Franza, R. M., Grant, K. P., & Spivey, W. A. (2012). Technology transfer contracts between R&D labs and commercial partners: Choose your words wisely. *Journal of Technology Transfer*, 37(4), 577–587.
- Fukugawa, N. (2013). University spillovers into small technology-based firms: Channel, mechanism, and geography. *Journal of Technology Transfer*, 38(4), 415–431.
- Gartner, W. B., & Carter, N. M. (2003). Entrepreneurial behavior and firm organizing processes. In *Handbook of entrepreneurship research*. International Handbook Series on Entrepreneurship (Vol. 1, pp. 195–221). New York: Springer.
- Georghiou, L. (1999). Socio-economic effects of collaborative R&D—European experiences. *Journal of Technology Transfer*, 24(1), 69–79.
- Goldstein, H. A., & Glaser, K. (2012). Research universities as actors in the governance of local and regional development. *Journal of Technology Transfer*, 37(2), 158–174.
- Goto, A., & Suzuki, K. (1989). R&D capital, rate of return on R&D investment and spillover of R&D in Japanese manufacturing industries. *The Review of Economics and Statistics*, 71(4), 555–564.
- Grimm, H. M., & Jaenicke, J. (2012). What drives patenting and commercialisation activity at East German universities? The role of new public policy, institutional environment and individual prior knowledge. *Journal of Technology Transfer*, 37(4), 454–477.

- Grimpe, C., & Fier, H. (2010). Informal university technology transfer: A comparison between the United States and Germany. *Journal of Technology Transfer*, 35(6), 637–650. **Antonelli, C.,**
- Guerrero, M., Urbano, D., & Fayolle, A. (2014). Entrepreneurial activity and regional competitiveness: Evidence from European entrepreneurial universities. *Journal of Technology Transfer*. doi:[10.1007/s10961-014-9377-4](https://doi.org/10.1007/s10961-014-9377-4).
- Hameri, A.-P. (1997). Innovating from big science research. *Journal of Technology Transfer*, 22(3), 27–36.
- Henderson, R., & Cockburn, I. (1994). Measuring competence? Exploring firm effects in pharmaceutical research. *Strategic Management Journal*, 15, 63–84.
- Hitt, M. A., Ireland, R. D., Camp, S. M., & Sexton, D. L. (2001). Strategic entrepreneurship: Entrepreneurial strategies for wealth creation. *Strategic Management Journal*, 22, 479–491.
- Huang, K., & Yu, C. J. (2011). The effect of competitive and non-competitive R&D collaboration on firm innovation. *Journal of Technology Transfer*, 36(4), 383–403.
- Inkpen, A. C., & Tsang, E. W. (2005). Social capital, networks, and knowledge transfer. *Academy of Management Review*, 30(1), 146–165.
- Ireland, R. D., Hitt, M. A., & Sirmon, D. G. (2003). A model of strategic entrepreneurship: The construct and its dimensions. *Journal of Management*, 29(6), 963–989.
- Jaffe, A. B. (1986). Technological opportunity and spillovers of R&D: Evidence from firms' patents, profits, and market value. *The American Economic Review*, 76, 984–1001.
- Jaffe, A. B. (1989). Real effects of academic research. *The American Economic Review*, 79(5), 957–970.
- Jaffe, A. B. (1998). The importance of “spillovers” in the policy mission of the advanced technology program. *Journal of Technology Transfer*, 23(2), 11–19.
- Jaffe, A. B., Trajtenberg, M., & Henderson, R. (1993). Geographic localization of knowledge spillovers as evidenced by patent citations. *Quarterly Journal of Economics*, 63(3), 577–598.
- Jeong, S., Lee, S., & Kim, Y. (2013). Licensing versus selling in transactions for exploiting patented technological knowledge assets in the markets for technology. *Journal of Technology Transfer*, 38(3), 251–272.
- Kalapouti, K., & Varsakelis, N. C. (2014). Intra and inter: Regional knowledge spillovers in European Union. *Journal of Technology Transfer*. doi:[10.1007/s10961-014-9356-9](https://doi.org/10.1007/s10961-014-9356-9).
- Klepper, S. (1996). Entry, exit, growth, and innovation over the product life cycle. *The American Economic Review*, 86, 562–583.
- Kochenkova, A., Grimaldi, R., & Munari, F. (2015). Public policy measures in support of knowledge transfer activities: A review of academic literature. *Journal of Technology Transfer*, 29(1), 19–40.
- Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3), 383–397.
- Kogut, B., & Zander, U. (1993). Knowledge of the firm and the evolutionary theory of the multinational corporation. *Journal of International Business Studies*, 24(4), 625–645.
- Kolb, C., & Wagner, M. (2015). Crowding in or crowding out: The link between academic entrepreneurship and entrepreneurial traits. *Journal of Technology Transfer*, 40(3), 387–408.
- Lee, H.-F., & Miozzo, M. (2015). How does working on university–industry collaborative projects affect science and engineering doctorates' careers? Evidence from a UK research-based university. *Journal of Technology Transfer*, 40(2), 293–317.
- Levie, J., & Autio, E. (2011). Regulatory burden, rule of law, and entry of strategic entrepreneurs: An international panel study. *Journal of Management Studies*, 48(6), 1392–1419.
- Liao, Y. C., & Phan, P. H. (2015). Internal capabilities, external structural holes network positions, and knowledge creation. *Journal of Technology Transfer*. doi:[10.1007/s10961-015-9415-x](https://doi.org/10.1007/s10961-015-9415-x).
- Liebeskind, J. P. (1996). Knowledge, strategy, and the theory of the firm. *Strategic Management Journal*, 17(S2), 93–107.
- Lindelöf, P., & Löfsten, H. (2004). Proximity as a resource base for competitive advantage: University–industry links for technology transfer. *Journal of Technology Transfer*, 29(3–4), 311–326.
- Lorenzoni, G., & Lipparini, A. (1999). The leveraging of interfirm relationships as a distinctive organizational capability: A longitudinal study. *Strategic Management Journal*, 20(4), 317–338.
- Morandi, V. (2013). The management of industry–university joint research projects: How do partners coordinate and control R&D activities? *Journal of Technology Transfer*, 38(2), 69–92.
- Mukherji, N., & Silberman, J. (2011). Idea generation: The performance of US States 1997–2007. *Journal of Technology Transfer*, 36(4), 417–447.
- Murakami, Y. (2014). Influences of return migration on international collaborative research networks: Cases of Japanese scientists returning from the US. *Journal of Technology Transfer*, 39(4), 616–634.
- Mustar, P., & Wright, M. (2010). Convergence or path dependency in policies to foster the creation of university spin-off firms? A comparison of France and the United Kingdom. *Journal of Technology Transfer*, 35(1), 42–65.

- Nelson, R. R., & Winter, S. G. (1982). The Schumpeterian tradeoff revisited. *The American Economic Review*, 72(1), 114–132.
- Nielsen, K. (2015). Human capital and new venture performance: The industry choice and performance of academic entrepreneurs. *Journal of Technology Transfer*, 40(3), 453–474.
- Núñez-Sánchez, R., Barge-Gil, A., & Modrego-Rico, A. (2012). Performance of knowledge interactions between public research centres and industrial firms in Spain: A project-level analysis. *Journal of Technology Transfer*, 37(3), 330–354.
- Oehler, A., Höfer, A., & Schalkowski, H. (2015). Entrepreneurial education and knowledge: Empirical evidence on a sample of German undergraduate students. *Journal of Technology Transfer*, 40(3), 536–557.
- Padmore, T., & Gibson, H. (1998). Modelling systems of innovation: II. A framework for industrial cluster analysis in regions. *Research Policy*, 26(6), 625–641.
- Patton, D., Warren, L., & Bream, D. (2009). Elements that underpin high-tech business incubation processes. *Journal of Technology Transfer*, 34(6), 621–636.
- Perko, J. S., & Narin, F. (1997). The transfer of public science to patented technology: A case study in agricultural science. *Journal of Technology Transfer*, 22(3), 65–72.
- Peters, B. (2009). Persistence of innovation: Stylised facts and panel data evidence. *Journal of Technology Transfer*, 34(2), 226–243.
- Ponds, R. (2009). The limits to internationalization of scientific research collaboration. *Journal of Technology Transfer*, 34(1), 76–94.
- Ponomariov, B. (2013). Government-sponsored university–industry collaboration and the production of nanotechnology patents in US universities. *Journal of Technology Transfer*, 38(6), 749–767.
- Porter, M. E. (1990). The competitive advantage of nations. *Harvard Business Review*, 68(2), 73–93.
- Powell, W., Machray, G. C., & Provan, J. (1996). Polymorphism revealed by simple sequence repeats. *Trends in Plant Science*, 1(7), 215–222.
- Protogerou, A., Caloghirou, Y., & Siokas, E. (2013). Twenty-five years of science–industry collaboration: The emergence and evolution of policy-driven research networks across Europe. *Journal of Technology Transfer*, 38(6), 873–895.
- Qian, H., & Haynes, K. E. (2014). Beyond innovation: The Small Business Innovation Research program as entrepreneurship policy. *Journal of Technology Transfer*, 39(4), 524–543.
- Ramlogan, R., & Consoli, D. (2014). Dynamics of collaborative research medicine: The case of glaucoma. *Journal of Technology Transfer*, 39(4), 544–566.
- Rodríguez Díaz, A. J. (2012). Transferring knowledge in Quebec–Mexico partnerships: The case of the dairy industry. *Journal of Technology Transfer*, 37(5), 631–647.
- Roland, R. J. (1982). A decision support system model for technology transfer. *Journal of Technology Transfer*, 7(1), 73–93.
- Rumelt, R. P. (2005). Theory, strategy, and entrepreneurship. In *International handbook series on entrepreneurship* (Vol. 2, pp. 11–32). Springer.
- Saxenian, A. (1994). *Regional advantage: Culture and competition in Silicon Valley and Route 128*. Cambridge: Harvard University Press.
- Scott, A. J. (Ed.). (2001). *Global city-regions: Trends, theory, policy: Trends, theory, policy*. Oxford University Press.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509–533.
- Van Stel, A., Storey, D. J., & Thurik, A. R. (2007). The effect of business regulations on nascent and young business entrepreneurship. *Small Business Economics*, 28(2–3), 171–186.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180.
- Woerter, M. (2012). Technology proximity between firms and universities and technology transfer. *Journal of Technology Transfer*, 37(6), 828–866.
- Xue, L., & Naser, K. (1996). Knowledge-based spinoff in technology transfer: The case of autodoc, Inc. *Journal of Technology Transfer*, 21(1–2), 70–76.

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