



EDITORIAL

Knowledge connectivity: An agenda for innovation research in international business

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Abstract

The innovation-driven multinational enterprise (MNE) has dominated international business (IB) research for several decades now. Beginning with the award-winning research of Dunning, there have been calls for IB researchers to rediscover the importance of locations. Recent work has emphasized that firms and locations co-evolve with one another, as knowledge is transferred and leveraged across space. Integrating insights from IB and economic geography, we propose a research agenda for IB scholarship on spatially dispersed yet connected innovation processes. This agenda is premised on the current reality of global value chains in which mobile (MNEs, people) and immobile (locations) factors interact. The research perspective suggested recognizes that locations are host to increasingly “fine-sliced” activities, whose nature and composition are continuously changed by MNE-driven innovation processes. As today’s specialized activities become tomorrow’s standardized ones, the shifting distribution of global value creation depends on the pattern of international knowledge connectivity.

Journal of International Business Studies (2016) 47, 255–262. doi:10.1057/jibs.2016.8

Keywords: innovation; economic geography; connectivity; global value chains; tacit knowledge; specialized activities

INTRODUCTION

Innovation is the key to value creation, and multinational enterprises (MNEs) have long been at the forefront of the pursuit of the knowledge-generating capabilities needed for technological development (Cantwell, 1989). As such, the analysis of cross-border innovation has become established as a key plank of international business (IB) research. Yet the IB environment has evolved dramatically over the past three decades, precipitating some fundamental changes in the nature of the global innovation process (Mudambi, 2008). This has created new opportunities for IB research. Through a convergent shift in technologies, organizations and geographies, we see a new underlying reality of IB: the rise of knowledge connectivity in innovation systems. In place of discussions of one-off knowledge transfer or absorption, the new agenda therefore entails continuous two-way interactions in knowledge development. In an integrative process, connections between global centers of excellence are gradually reducing the location boundedness of tacit knowledge (Amin & Cohendet, 2004). In so doing, firms and locations are co-evolving to form the fabric of the newly dispersed global innovation economy.

The nature of the resulting knowledge conduits, be they MNE–subsidiary linkages or diaspora-based relationships (Lorenzen & Mudambi, 2013; Thomas, 2016), impacts the full range of economic actors. The exploration of multidirectional knowledge connectivity across organizational subunits and across space is thus fertile ground for the *JIBS* community and beyond. It is the goal of this editorial to stimulate further research in this promising area by identifying constituent elements in a novel framework and to suggest paths along which future inquiry may proceed.

Firms and locations are symbiotic components of all innovation systems. In the classical economics view, locations attract homogenous firms that profit from agglomeration externalities (Marshall, 1920). In contrast, the bulk of the IB literature on innovation has typically used locations as the backdrop for the geographic dispersion in the activities of firms (e.g., Dunning, 1970; Vernon, 1966). Some early IB scholars focused on MNEs internalizing imperfect markets across national boundaries (Buckley & Casson, 1976). While location-bound factors were once thought to be the essence of location-specific or country-specific advantages, mobile firm-specific advantages were presented as the key reasons for the internalization of markets across borders (Rugman, 1980). In these early analyses, MNEs were the active agents, with locations taking a passive or recipient role.

These opposing perspectives represent a progression in IB research in historical context (Cantwell, 2015). The Marshallian approach focused on locations and clusters as the primary unit of agency forms the thesis, while the internalization analyses of MNEs as the central mode of governance across space that arose over half a century later forms the antithesis. Thus neoclassical international trade theory is based on the former approach, wherein firms are nationally embedded and all IB is carried out through exports and imports. The internalization revolution recognized the rise of MNEs that straddled international borders and conducted international, intra-firm activities. In reflecting on the potential synthesis of the above positions, we draw the attention of *JIBS* readers to the dramatic shifts in the way in which global innovation is now conducted: complex interactive systems are now evolving in real time across organizations and locations.

Co-Evolution: A Dialectic Perspective

Modern philosophy evolved in the late eighteenth century from the static dualistic contrast of

opposites (either A or B) typical of transcendental idealism (Kant, 1781), to the historical evolutionary sequence of thesis–antithesis–synthesis (Hegel, 1807), which introduces the notion of dialectic relationships in processes over time. Dialectics, as a method of thinking, overcomes the dualistic view of opposing states of the world or outcomes as mutually exclusive entities. In the dialectic view, separate entities or traits influence each other to the point that both are transformed as a result of the interaction. We propose dialectics as an overarching framework for developing a robust future research agenda that is firmly anchored in the major strands of the foundational IB literature. This newly emerging synthesis must comprise of an understanding of the *co-evolution* of mobile firms and immobile locations. Internalization theory has already provided us with the tools to analyze organizational connectivity, that is, MNEs coordinating resource use and integration from multiple locations across space. However, this very process of integration alters the characteristics of both the MNE and the associated locations.

The idea of co-evolution between firms and locations is not new to the literature. Dunning was an early proponent of such a holistic approach and it is implicit in his eclectic paradigm (Cantwell, 2015; Dunning, 1988). In a particularly seminal earlier paper, Dunning and Norman (1983) demonstrate that the roles of local MNE offices and the availability of local resources co-evolve over time. Cantwell, Dunning, and Lundan (2010) examine the interplay between the activities of MNEs and institutions, both external and internal to the firm. Organization theory has pointed to the co-evolutionary nature of firm–environment relationships (Koza & Lewin, 1998) and particularly in the patterns of entrepreneurial activity (Aldrich & Martinez, 2001). Through an economic geography lens, Storper and Walker (1989) have studied how regions and industries shape one another. However, as MNEs continue to drive global knowledge networks (Doz, Santos, & Williamson, 2001) and the pace of innovation in the global economy continues to accelerate, these research efforts have just begun to scratch the surface. Our foregoing discussion has highlighted a broad and fertile arena for future research. In this editorial, we will discuss three lines of potential inquiry in detail.

The first avenue of inquiry involves the role of locations in tacit knowledge transfer. IB scholars have developed substantive theories through the lens of the firm: the MNE is well established as the

superior form of organization to move tacit and codified knowledge across national borders (Cantwell & Santangelo, 1999). Outside of the IB field, scholars have begun to decouple the necessities of co-location and tacit knowledge transfer (Amin & Cohendet, 2004). However, the interwoven dynamics of place, space and organization continually generate new domains within which knowledge is leveraged in unique ways (Beugelsdijk, McCann, & Mudambi, 2010). Increasing connectivity between knowledge clusters may yield new relationship forms that enable knowledge co-creation, rather than mere transfer (Hannigan, Cano-Kollmann, & Mudambi, 2015). All told, these new complex systems demand that we re-evaluate the prior literature to account for shifting interdependencies in knowledge. The key research questions we put to *JIBS* readers include: How is knowledge *carried and interconnected* across space? How *effective* are these conduits? In particular, we encourage scholarly inquiry into *the processes* of connectivity itself, and not just the consequent outcomes for firms and places.

A second aspect driving knowledge connectivity and the co-evolution of firms and locations is the disaggregation of global value chains (GVCs): activities are “fine sliced” and placed in efficient locations around the world (Mudambi, 2008). MNEs combine the specialized resources available in locations with their ability to orchestrate activities to create complex knowledge networks. This process demands that both firms and locations take on particular roles that require both proximity and symbiosis (Bathelt, Malmberg, & Maskell, 2004). A particularly important aspect of this co-evolution is that it may be self-reinforcing in what becomes a process of cumulative causation. As MNEs undertake global searches, the innovation hotspots or “peaks” in the rugged knowledge landscape (Cantwell, 2013; Levinthal, 1997) become yet more attractive sites within which to locate activities. Over time, co-evolution is likely to ensure that (a) the fit between these locations and the MNEs improves; and (b) the “peaks” that attract MNEs rise higher in the knowledge landscape, making it even more rugged. This remains an under-researched area of inquiry for IB scholars, who may be uniquely positioned to trace the value chain activities and location decisions of multinationals. The strands of new research that flow from an evolving conception of knowledge search utilize the notion of what may be called “connections in complex systems.” How does the co-evolution of firms and locations impact knowledge connectivity in a *differential* sense by altering the role or the

effectiveness of existing connections, or creating new connections? How and why is knowledge shared or exchanged (or not shared or exchanged) across different parts of a GVC? Under what conditions do effective conduits *flourish* and nurture particular GVC nodes?

Finally, there is a need to further explore the nature of the connections that span geographic, organizational and technological space. For instance, the notion of formalized pipelines between locations is well established in the economic geography literature (Bathelt et al., 2004; Lorenzen & Mudambi, 2013). It is especially true in a knowledge-generating context that connections are ultimately about people (Song, 2014). Their activities as agents within organizations give rise to the micro-foundations that underpin knowledge-replicating routines (Abell, Felin, & Foss, 2008; Nelson & Winter, 1982), which tend to be “sticky” (Szulanski, 1996). In addition, people can act as individual agents operating in their personal networks that arise from rapidly growing phenomena like global diasporas (Saxenian, 2006) and dispersed worldwide professional communities that provide regular fora (Maskell, Bathelt, & Malmberg, 2006). Thus an exploration of how modern knowledge networks are *organized* in the context of co-evolving firms and locations – that are necessarily composed of individual actors – may be of great significance to the *JIBS* community. For instance, knowledge connectivity may require some degree of actor geographic mobility, implying periods of at least temporary co-location in venues such as trade fairs, conferences and conventions; indeed, these kinds of connection-creating events have been described as “temporary clusters” (Maskell et al., 2006). Similarly, MNEs play a valuable role in establishing connectivity, such that knowledge boundaries now exist beyond those of the firm itself (Adams, Brusoni, & Malerba, 2011).

The Dynamic Nature of Knowledge Connectivity in GVCs

A shift toward lateral knowledge connectivity is at the core of the co-evolution of firms and locations. Hierarchical relationships in innovation processes are increasingly being replaced by associations characterized by parity and reciprocity. Subsidiaries that in the past were subservient operating “arms” driven by the headquarters “brain” are now increasingly generating knowledge locally that is to be used throughout the global MNE network (Cantwell & Mudambi, 2005; Song & Shin, 2008). The level and sophistication of technology continues to rise at an

ever-increasing pace. In order to maintain competitive advantage, MNEs must stay at the leading edge of the rising extant knowledge base. This pushes them to stake out higher ground and pursue orchestrating competencies. They must retain systems knowledge of the full innovative process, while parceling out individual specialized activities to a range of outsourcers, alliance and joint venture partners, and other units within their innovation ecosystem (Brusoni, Prencipe, & Pavitt, 2001).

The foregoing discussion implies that the scale of global knowledge flows is rising and their nature is growing more complex over time. Further, as conventional hierarchical relationships give way to more balanced interactions, a subsidiary, a contractor or a supplier may coordinate innovation projects. As Figure 1 suggests, the process that brings about knowledge connectivity is interwoven, iterative and continuous. GVCs can be analyzed from two perspectives: in terms of firms and in terms of activities. Orchestrating flagship firms and specialized high-knowledge firms tend to occupy network positions that enable them to capture the bulk of all value created. Activities can be categorized into high knowledge (specialized and non-repetitive) and low knowledge (standardized and repetitive) that are each geographically dispersed to appropriate locations, with some degree of trial and error. Connections form between those locations to carry

knowledge, constructed by organizations (e.g., MNEs), arising from personal relationships (e.g., diasporas) or both. A globally networked innovation process must therefore be predicated on high bandwidth connections (Lorenzen & Mudambi, 2013) that carry both codified and tacit knowledge (Amin & Cohendet, 2004). Over time, technology evolution leads to specialized activities becoming more finely sliced and some of their constituent components become standardized. A key objective of MNE-driven innovation processes is to codify and systematize tacit knowledge, in the process turning today's specialized, non-repetitive activities into tomorrow's standardized, repetitive ones. Thus the process through which connectivity grows and becomes more horizontal is the main driver of the continuous iterative co-evolution between the firms and locations that is central to global business.

The generalized study of the co-evolutionary nature of the global innovation system is itself complex and requires a fundamental paradigmatic shift. As with all scientific advances, this requires carefully balancing incremental advances based on the enormous storehouse of extant IB knowledge with the incorporation of radical new insights that arise from the integrating knowledge from related fields of inquiry. It requires moving beyond the already complex notion of the MNE as a knowledge network based on subsidiaries (Andersson, Forsgren, & Holm,

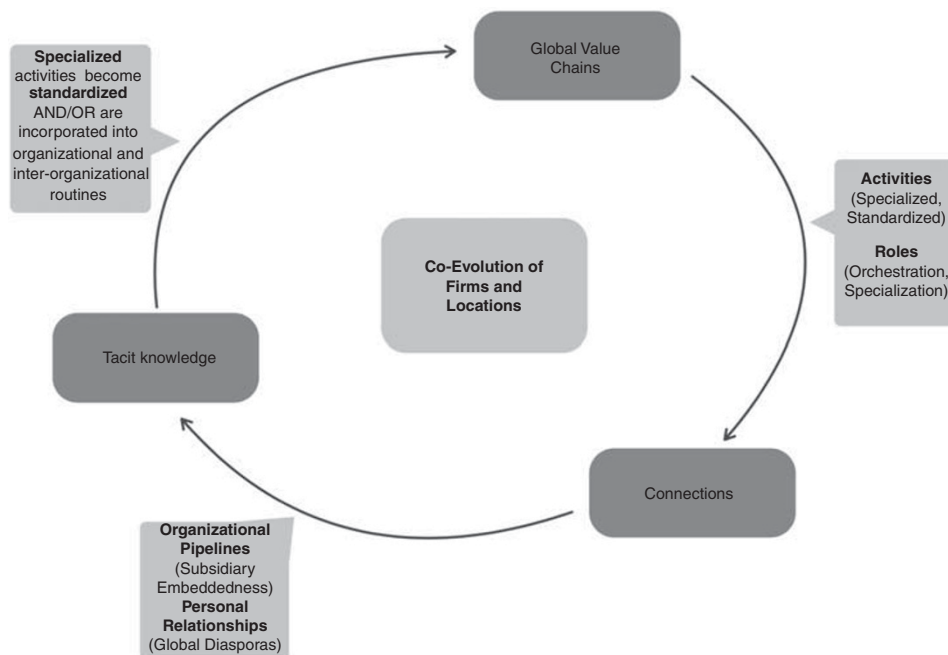


Figure 1 A model of co-evolution.



2002). Bridging the dualism of location- and firm-centric views requires both the synthesis of earlier theoretical approaches and the exploration of new methodological frontiers.

As a field, we need to know more about the knowledge connectivity associated with informal network connections, especially those made at the project level (Andersson, Buckley, & Dellestrand, 2015), and hence entail fluctuating network composition in moving from one project to another (Cantwell, 2014). Much of the extant research has focused on formal alliance structures of various kinds at a firm level (Baldwin & von Hippel, 2011). Our proposed research agenda calls for us to revisit and perhaps update the perspectives of those such as Ghoshal and Nohria (1989) or Kogut and Zander (1993) on the firm as an effective internal knowledge transfer device based on the existence of shared values among its members. Increasingly, knowledge may be shared in non-firm networks such as open source communities. Likewise, while conflicts of interest may emerge within MNEs (Mudambi & Navarra, 2004), project-based connections diffuse the accumulation of knowledge. Indeed, knowledge governance within a Williamsonian hierarchy can inhibit transfer, as it may stray from the collaborative norms that enable pipelines to form in the first place (Andersson et al., 2015).

At the center of the move toward lateral knowledge connectivity is the shifting boundary of the firm as a function of enhanced network relationships (Cantwell, 2013). This is a complex reality that the IB field must pursue, and the myriad threads that follow present enormous research opportunities. For instance, the nuances of sub-national and sub-regional locations suggest that the free flow of knowledge occurs as a function of the network complexities, rather than in spite of them. Firms develop knowledge networks, yet the attraction of these firms to locations is not necessarily exogenous. Addressing these challenges open up many robust avenues of inquiry for IB scholars.

Scholars have examined the points of contact of MNEs within host locations (Cantwell & Santangelo, 1999), as well as the motivations to pursue knowledge (Song & Shin, 2008). However, the conduits through which knowledge travels remain underexplored in the MNE context. To extend this area of inquiry further, the IB field must consider three crucial layers: the growth and complexity of the network connections, the types of knowledge that travel through these networks and the sub-national points of contact at which these interactions occur.

Global Innovation Networks

Innovation requires two processes: search (the discovery of new knowledge) and transfer (the movement of the knowledge to the point of use) (Amin & Cohendet, 2004). It is fair to say that mainstream IB research on innovation has focused much more attention to transfer processes. Borrowing the concept of weak ties from social network research helps to explain knowledge transfer across firm units; weak ties can speed up the transfer of simple knowledge, but complex knowledge requires stronger ties. Consistent with this, other scholars argue that knowledge accumulated in subsidiaries (both internally created or externally sourced) only gets transferred when there are high levels of interdependence between transferring and receiving units. There are numerous taxonomies of knowledge flows in MNEs. However, all share the perspective that the net balance of subsidiary's knowledge inflows and outflows matter in terms of its role in the MNE's innovation network (Cantwell & Mudambi, 2005). Subsidiary evolution and the changes in the subsidiary's charter are driven by the interaction of the relative capabilities of the subsidiary within the MNE network and the dynamism of the local business context where the subsidiary operates (Birkinshaw & Hood, 1998).

Firms can be understood as knowledge-creating entities; and the capabilities of the firm determine the knowledge conversion rate and the internal cost of knowledge creation, ultimately drawing the boundaries of the firm (Nonaka, Toyama, & Nagata, 2000). For MNEs, those boundaries will be related to the ability to integrate and recombine knowledge across borders, which is one of the key bases for MNE network advantage (Cantwell, 1989). The exact balance of host-country vs home-country knowledge sourcing ultimately depends on the technological capabilities of the headquarters *vis-à-vis* its overseas labs (Song & Shin, 2008) and the embeddedness of those labs in the scientific and technological communities of the host country. Home-country sourcing tends to be prevalent in subsidiaries that are adaptive, have no technical leadership and little technical presence of the parent firm in the host country (Cantwell & Mudambi, 2011; Frost, 2001). Technical embeddedness changes this sourcing pattern and has a positive impact on the expected performance of the subsidiary (Andersson et al., 2002).

Knowledge circulates through two types of networks. The first and most obvious for IB are organization-based linkages, also called pipelines

(Bathelt et al., 2004). The second are individual-based linkages, that is, personal relationships (Lorenzen & Mudambi, 2013). These networks of individuals can assume several forms. These include the so-called “epistemic communities” formed by networks of individuals employed in different organizations, but working on a “mutually recognized subset of knowledge issues, and who at the very least accept some commonly understood procedural authority as essential to the success of their collective knowledge-building activities” (Lissoni, 2001: 1482).

Innovation can be most effectively orchestrated across long distances when the MNE pipelines work in concert with personal relationships to form what have been called international networks of practice (Pinch, Henry, Jenkins, & Tallman, 2003). The concerted working of pipelines and personal relationships is seen in the mobility of skilled personnel, including such practices as the hiring of experts from other companies (Song, Almeida, & Wu, 2003), intra-company transfers and even networking events facilitated by MNEs. A second example includes inter-firm and intra-firm boundary spanners, individuals who can facilitate relationships across disparate organizational or cultural groups (Schotter & Beamish, 2011). A third example (and one of increasing importance) is the phenomenon of global diasporas, that is, individuals who live outside of their perceived homeland but maintain a psychic link with it (Saxenian, 2006). Diasporas of connected immigrants from a common ethnic or national origin are important vehicles for knowledge sharing and can affect innovation in their home countries (Lorenzen & Mudambi, 2013). These examples illustrate that the concerted working of MNE pipelines and individual-based personal relationships is a promising avenue along which we can advance our understanding of international innovation processes.

New Avenues for Innovation Research in IB

In sum, there is a growing recognition that as companies fine-slice their activities and disaggregate their value chains, subsidiaries and suppliers increase their contributions to knowledge creation and transfer, creating a world of increasing knowledge connectivity. The co-evolution of locations and firms increases the volume of horizontal knowledge flows and reduces the hierarchical distance between headquarters and subsidiaries, and between flagship orchestrating firms and GVC partners. This synthesis bridges the conceptual dualism that leads to the separation of analytical silos, and from which IB scholarship needs to emerge. It is true that firms are

attracted to locations, but locations and firms shape each other in the process. This generates complex, symbiotic networks of relationships. IB scholars have yet to fully exploit the nascent foundations of co-evolution that appear within the eclectic paradigm (Cantwell, 2009; Cantwell, 2015; Cantwell, Dunning, & Lundan, 2010; Dunning, 1988). In Hegelian terms, we have gone from a thesis based on location (a Marshallian view, where firms are local and so individual firms are merely one component of the generality of activity in a place), to an antithesis focused on the firm (MNEs that internalize transactions across multiple locations, which might be viewed as merely a special case of a general theory of the firm). We need to reach a synthesis, where (immobile) places and (mobile) firms may each be analogized, in an organic symbiosis, as flowers and bees. Flowers need bees to be pollinated, but bees need flowers' pollen to survive. Using that metaphor to illustrate our phenomenon of interest, places need border-crossing firms and firms need places, so that they co-evolve together (Cantwell & Zhang, 2009). For instance, if firms fine-slice their activities, locations are unlikely to remain thoroughly vertically integrated; as firms connect locations, these locations provide firms with specialized locally generated knowledge, and both change together.

The IB literature also needs to understand this interaction to develop a more nuanced view of location, both at the national and sub-national levels. In other words, we must proceed from “locational analysis” to “spatial analysis.” Location encompasses only one aspect of space, that is, geographic space. However, in general, space can also be technological, social, cognitive or institutional. We advocate for a holistic, interdependent and dynamic view that simultaneously integrates an analysis of place, space and organization (Beugelsdijk et al., 2010). From the specific point of view of MNEs, the key is to be able to increasingly orchestrate the integration of tacit knowledge over both geographical and technological space.

There are at least three factors underpinning these co-evolutionary processes. One is the importance of tacit knowledge flows as a generator of new ideas. Despite its initial context specificity, this tacit knowledge may flow both locally and across longer distances, although it may well be transformed in the process (Brannen, 2004). The flow (and adaptation) of tacit knowledge across geographic space requires high-bandwidth organization-based or individual-based networks. MNEs need to leverage the concerted hybrids of personal relationships working



within their organizational pipelines, in order to maximize the effectiveness of their knowledge management processes (Gibson & Zellmer-Bruhn, 2001). The second factor is the disaggregation of GVCs. This disaggregation implies that neither firms nor places can any longer maintain fully vertically integrated structures and they must instead focus on specific activities (greater internal specialization) to retain their competitiveness. Products and services are no longer associated with a particular geographic location, but rather are the result of the complex orchestration of knowledge and activities across organizations and locations. The third factor is the connectivity between places, firms and individuals across geographical space. This connectivity is the lifeblood of the system that allows these complex networks to thrive, succeed and expand.

The interplay between these three factors (tacit knowledge flows, disaggregation of GVCs and connectivity) poses new questions, which IB scholars have only recently started to explore. While these studies are steps in the right direction, we have only started to scratch the surface of this important area. Understanding the nuanced conditions that either facilitate or reduce the transfer of knowledge across innovation networks is critical in a context in which MNEs are at the same time orchestrating increasingly complex value networks, while trying to reduce potential leakages of critical or proprietary technology. Fine-grained explorations of these interactions will be crucial to improving our understanding of global innovation processes.

Reaching back to the beginnings of the IB field, and beyond that to its roots in the economics of location, this commentary has highlighted the limitations of a received theoretical dualism: firms need locations (beyond countries), locations compete for firms and they (together) are increasingly connected. We have proposed a dialectic framework that addresses the disjointed nature of these separate dualistic analyses. We seek to steer the conversation toward a synthesis that will enable a clearer understanding of the complex phenomena that our field must study in the next few years. We hope this piece motivates our cross-disciplinary field of scholarship to embrace a co-evolutionary view of the dynamic relationships between organizations, places, spaces and people.

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