Role of Context in Knowledge Flows: Host Country versus Headquarters as Sources of MNC Subsidiary Knowledge Inheritance

Mike Horia Mihail Teodorescu a Prithviraj Choudhury b, and Tarun Khanna b

a Carroll School of Management, Boston College, Chestnut Hill MA USA
b Harvard Business School, Harvard University, Boston MA USA

ABSTRACT

Research Summary

We respond to calls in the strategy and international business literature for elucidating how multinational subsidiaries develop contextual intelligence in host countries and how they use the local context as a source of valuable opportunities for learning. Applying the theoretical lens of subsidiary absorptive capacity and building on a gravity model, we propose an approach that can distinguish and compare the influences of the host country context and headquarters over the subsidiary knowledge production. Some subsidiaries may become global second headquarters and innovation hubs, as evidenced qualitatively in the paper with the case of Cisco. Essentially, subsidiaries, characterized by higher stocks of knowledge and greater number of locally hired employees are likely to absorb relatively more knowledge from the local host country context.

Managerial Summary

Managers at multinational companies have to carefully balance acquiring knowledge from the headquarters, vis-a-vis acquiring knowledge from the local context of countries where the firm has subsidiaries. In contrast to a ‘headquarter-centric’ approach where most of the knowledge management activities are centered around the MNC headquarters, we argue that larger subsidiaries, often characterized by a large presence of local R&D workers, might disproportionately draw knowledge from the local context, rather than from the headquarters. In addition to developing theoretical propositions along these lines, we provide an illustrative example of how Cisco opened a “second headquarters” in India, to learn from the rich local context.

KEYWORDS: MNC, Knowledge Flows, Innovation, Absorptive Capacity, Gravity model.
INTRODUCTION

Evidence shows that the geographic patterns of knowledge flows within multinationals are changing and in a recent editorial on international strategy in an “era of global flux”, Aguilera et al. (2019) report that multinational activity is retracting and becoming more regional, partly because of frictions between the MNC headquarters and larger subsidiaries. These authors also argue that while choices related to sourcing and developing technologies have been traditionally based on models of maximizing economic global efficiency, in an era of flux due to changes in geopolitical environments, there might be a greater role for local, national and regional considerations. In light of this assertion, we ask whether or not the host country context, rather than the headquarters, is gaining in importance as the main source of knowledge for the multinational subsidiary. It is important to study characteristics of subsidiaries that prompt them to absorb more knowledge from the host country context – develop contextual intelligence as it were (Khanna 2014, 2015) – rather than primarily from the headquarters. In doing so, we contribute to the literature on the changing geographic scope of the multinational firm (Zaheer and Hernandez 2011).

This paper attempts to make conceptual progress on studying characteristics of subsidiaries that prompt them to absorb more knowledge from the host country context, compared to the headquarters, in a relative sense. We build on the literature on subsidiary absorptive capacity (Cohen and Levinthal 1990; Zahra and George 2002; Minbaeva et al. 2003; Chang et al. 2012) and combine insights from that stream of work with insights from the gravity model in trade and international business, as illustrated by prior literature (Tinbergen 1962; Anderson 1979; Grosse and Trevino 1996; Feenstra et al. 2001; Hejazi and Ma 2011). Our theorizing leads to a main prediction: “larger” subsidiaries, i.e., subsidiaries with greater knowledge stock and greater number of local employees, are more likely to draw upon pools of knowledge available within the
context of the host country compared to knowledge available within the headquarters, in a relative sense. This is consistent with qualitative observations of multinationals employing a second headquarters, which builds R&D capacity from local resources, as is the case of Cisco. We include qualitative evidence from a mini-case study of Cisco India, which includes interview data as well as corporate records, which, together with our proposed gravity model, shed light on the phenomenon of a second headquarters which draws resources from the local context.

We contribute to several streams of the multinational literature including research on multinational subsidiary knowledge inheritance, changes in the subsidiary mandate, and the importance of the host country context. As multinationals extract more value out of the local context, they may move towards the ‘federative structure’ of the MNC where power is dispersed across the network of subsidiaries (Andersson et al. 2015), and even create a second headquarters abroad, as in the case of Cisco. For managers of multinational firms, we proposition that being tethered to the host country can provide subsidiaries with a lifeline of knowledge inheritance and an active role in circulating knowledge from the host country to the country in which the headquarters is located and through the entire network of the MNC, beyond the role of acquiring knowledge from the headquarters. The relative independence of subsidiaries can change dynamically, as the reason for starting a subsidiary may change over time. An example of a network model based on graphs is included in the appendix. The theoretical propositions in this paper, in particular the proposition that larger subsidiaries are likely to absorb relatively more knowledge from the host country context, can be used to analyze the dynamics of the interplay between the subsidiary and headquarters.
CONCEPTUAL ANTECEDENTS

The “internalization of intangible assets” argument initially conceived by Hymer (1960) has been widely adopted to justify the existence of the multinational corporation (Buckley and Casson 1976; Caves 1971; Caves, Christensen, and Diewert 1982; Ghoshal 1987; Ghoshal and Bartlett 1990; Gupta and Govindarajan 2000). Over the past several decades, this literature has also viewed the multinational subsidiary as being dependent mainly on the knowledge from the headquarters and to the broader MNC network. Knowledge “inflows” and “outflows” from the perspective of MNC subsidiaries are a rich topic of research in the empirical literature, which examines how MNC headquarters and other subsidiaries influence such knowledge flows (Feinberg & Gupta 2004; Gupta & Govindarajan 2000; Singh 2008; Berry 2013). Berry (2015) stresses the importance of “knowledge inheritance” from the MNC headquarters to the subsidiary. As Monteiro, Arvidsson and Birkinshaw (2008) argue, “knowledge transfers in MNCs typically occur between highly capable” members of the MNC network (the network comprising the headquarters and all subsidiaries). Acquisition of a foreign joint venture partner to become a subsidiary for obtaining technology and manufacturing capabilities was done in the automotive industry in the 1960s and 1970s (Doz and Prahalad 1981) – such ‘reverse’ knowledge flows from the subsidiary to the HQ are common (Frost and Zhou 2005). Knowledge flows are facilitated by technological similarity (Tallman and Phene 2007), strength of interpersonal relationships (Brenner and Ambos 2013), strength of intellectual property rights (Branstetter et al. 2011), and geographic mobility of knowledge workers between the headquarters and the subsidiary (Choudhury 2017). Work by Desai et al. (2009) shows that US firms that expand abroad and increase investment in operations abroad generally benefit domestic firm activity.
There has also been a tradition of studying the importance of host country contexts to MNC subsidiaries, and this stream of research dates back to the work of Prahalad, Doz and Bartlett in the 1970s and in the 1980s. This stream of research focused on the fact that subsidiaries face two sets of institutional, environmental and relational forces, one each from the headquarters and the local context, and this realization led to insights around the importance of “national differentiation” (Bartlett 1986) and “pressures for local responsiveness” (Prahalad and Doz 1987). Scholars have posited that MNC subsidiaries have to adapt to the local context (Birkinshaw and Hood 1998; Ghoshal and Nohria 1989; Kostova and Roth 2002; Nobel and Birkinshaw 1998; Nohria and Ghoshal 1994; Rugman and Verbeke 2001). Yet, even when scholars have examined the importance of the local context to the subsidiary, it has mostly been in relation to how the local context helps or hurts knowledge transfers from the headquarters to the subsidiary. As an example, while building on the institutional and relational duality faced by the subsidiary, Kostova and Roth (2002) study how the transfer of knowledge (of organizational practices) from the headquarters to the subsidiary is related to the host “country’s regulatory, cognitive, and normative institutional profiles”. In other words, prior scholarship has not theorized about whether and why knowledge inheritance to the subsidiary from the host country could be comparable or even exceed knowledge inheritance from the headquarters. Sourcing knowledge from a location outside the host country can be a source of competitive advantage (Cantwell 2009), as Rugman and Verbeke show that location-bound knowledge specific to the host country operations is a source of “competence building in the multinational” (Rugman and Verbeke 2001).

Multinationals have also been usefully conceptualized as a “network of relationships between headquarters” and subsidiaries, and between subsidiaries (Nohria and Ghoshal 1997). But it is also useful to think of multinational subsidiaries as embedded within the host country context, as
elements of a network within an external network of host country actors and institutions. Beckert (2003) offers a useful crystallization for our purposes of long-standing ideas of embeddedness (Polanyi 1944; Granovetter 1973). Thus, the embeddedness refers to “the indissoluble connection of the actor with his or her social surrounding” (Beckert 2003, p. 769). Of course, the multinational subsidiary has to choose the level of its embeddedness within the host country’s institutional fabric. Some scholars have suggested that a subsidiary’s emphasizing such external embeddedness, and perhaps de-emphasizing internal embeddedness, might generate competitive advantage (Teece 2006; Heidenreich 2012; Yamin and Andersson 2011). This may be because such actions allow the subsidiary to develop “weak ties” that leave to “more novel information flows” than do “strong” intra-subsidiary ties (Granovetter 2005). In this paper’s conceptualization, we recognize that social ties across individual innovators within a private corporation are often not observable. Yet, knowledge flows can proxy for the social ties and are visible externally through citations, patents, or publications. Thus, a component of our proposed theoretical approach involved knowledge flows and the literature surrounding their analysis. An early-stage empirical analysis illustrating these concepts was presented in the working paper Choudhury et al. (2018).

Empirical studies on knowledge flows within MNCs, such as Gupta and Govindarajan (2000) and Feinberg and Gupta (2004), focus on knowledge flows between the subsidiary and the headquarters or other subsidiaries and largely omit analysis of knowledge flows from the host country to the subsidiary. This gap exists even though recent literature has made a strong case for studying how the local context shapes the multinational subsidiary (Khanna et al. 2005; Khanna and Palepu 2010; Mudambi et al. 2014; Meyer and Estrin 2014; Santos and Williamson 2015; Hennart 2020). Within this nascent literature, Meyer and Estrin (2014) argue that host country resources such as local knowledge and local talent are critical for MNC subsidiaries. This stream
of research also argues that these host country resources evolve over time, growing in emerging markets. However, the literature lacks detailed studies comparing subsidiary knowledge flows from the two essential knowledge pools available to the subsidiary, i.e., the headquarters and the host country context, and the role of the local context, mainly the amount of knowledge generated from interacting with the host country culture, markets, and institutions. We also lack insights on what subsidiary level and local context factors might tilt the relative balance of subsidiary knowledge in-flows from predominantly inheriting knowledge from the headquarters to predominantly acquiring knowledge from the local context. MNCs may be initially interested to use the lower cost skills extant in a developing market, but during the evolution of the subsidiaries and the local skills and competences, MNCs may find it strategically sound to use the local subsidiaries as taps of locally developed knowledge.

**MOTIVATING CASE STUDY: CISCO INDIA**

We present a qualitative case study to exemplify our core proposition that larger subsidiaries, characterized by higher knowledge stocks are likely to absorb relatively more knowledge from the local host country context, compared to absorbing knowledge from the headquarters. In the year 2006, the multinational Cisco made an ambitious announcement of setting up a “second global headquarters” in Bangalore, India (Kapur 2006). At this point, Cisco already had a strong local presence in India and the Cisco Indian workforce comprised more than 1,800 Indian engineers working at its Bangalore R&D facility. The announcement also led to an ambitious innovation mandate awarded to Cisco India, its “largest global development center outside the US” to “develop disruptive business models for Cisco to create new go-to-market channels, markets, processes and technologies for emerging markets” (Cisco Company Overview 2018). Cisco India additionally increased the hiring of local talent dramatically beginning with 1,800 employees in
2006 (Kapur 2006), growing rapidly to 2,800 in 2007 (PTI 2017), and reaching 11,800 in FY’13 (Cisco 2013; we note that corporate documents on hiring figures are not available to the public for every year). Arguably, this illustrates our arguments about how an increase in hiring local talent could result in an increase in the ability of the firm to absorb local knowledge from the host country.

This development awarded the new Global Development Center in Bangalore significant autonomy to develop innovation. At this point Cisco India clearly had a choice of which knowledge pool to tap in order to develop this new innovation and prioritize whether to source knowledge from the headquarters or from local knowledge partners in India. To inductively build insights, we conducted field interviews with managers from Cisco India and quote a senior manager responsible for sourcing knowledge at the Bangalore R&D center:

“In 2005-2006 we decided to strategically invest in India which was based on the notion of a second headquarters in Bangalore and shifted how we look at India; that’s been going on for over twelve years. We have over 11,000 employees in India [today in 2019], 6,500 of them in R&D, 8,000 of them Engineers. Twenty five percent of our R&D is now based in India, mostly Bangalore, and we have gone through several maturity cycles at how we look at engineering, and we are now independently developing from India for the global market. We have one global strategy, and we all execute to that global strategy and ensure we build up the perspectives and insights of the R&D engineers in India for the global market.” (Cisco Bangalore Senior Executive, interviewed by authors in June 2019)

To achieve a rapid growth of capability, Cisco India decided to build capacity in India by partnering with local universities. They established a curriculum at colleges, including “Cisco
Labs” which would include sponsoring equipment, creating faculty positions, and taking back the top students as hires:

“In the early days we started with building CISCO labs in the major universities, especially at the reputed Indian Institutes of Technology and let the universities play around with what we offer in our labs and created exchange interaction opportunities where we hire from those colleges but also throwing back problems we struggle with back to those colleges and labs. […] We are creating a network of labs in those colleges, we guide the colleges on how to roll out technologies, we guide them to create value on top of the data they collect. We sponsor equipment, provide high level technical guidance on what are the possibilities of research, we sponsor a chair for cybersecurity, we have our technical experts go in and teach, take students through internships, and then hire them.” (CISCO Bangalore Senior Executive, interviewed by first two authors in June 2019).

Cisco invested resources in India strategically and purposefully, intending to leverage the computer science skills built by the top local universities, and to create a core of technical and managerial talent in India. To quote a senior Cisco manager interviewed by the authors:

“If you look at the context, most other companies were looking at cheaper scaling of labor in India. At that point of time we shifted some of the core leadership to India. Our #2 was headquartered in India with leadership operating from India and acting globally. We did that by forcefully having some of the heads of key functions run the strategy out of India, to show this isn’t about cheap labor or scaling of talent, but as a strategic investment because we believe growth would come from out of US. […] We make the investment profile based on what we need to do; over a period of time we are seeing an increase of the slice of the pie going to India.” (CISCO Bangalore Senior Executive, interviewed by authors in June 2019).
The qualitative data presented here from corporate documents, the interview with the senior executive, and news articles, in part motivates our proposition that firms build up capabilities abroad in order to absorb more from the local context and do so purposefully. We expect that with the advent of globalization firms strategically move towards Ghoshal and Bartlett’s 1990s view of the federative structure of the MNC, where the subsidiary can build strategic capital in the MNC, such as new capabilities rooted in the culture or location of the subsidiary, intellectual property that results from cross-border collaborations, skills that are more developed in the subsidiary employee force, or dynamic capabilities in response to local conditions that can be translated across the MNC (Riviere et al. 2021). We propose an empirical model to compare the influences of the headquarters and local context on each subsidiary which can be useful to both managers and researchers to illustrate this shift in the knowledge flows to the subsidiary.

THEORETICAL PROPOSITIONS

Theoretical Foundations – Role of the Headquarters in MNC Knowledge Flows

The MNC headquarters plays a multi-faceted, complex role in the knowledge acquisition and dissemination process within the overall multinational. The earliest models of the MNC view the organizational structure as a “centralized hub” (Bartlett 1986), where the headquarters directs resources, tasks, and relationships to the MNC subsidiaries. Reconceptualizing the description of the MNC, Ghoshal and Bartlett (1990) introduced the “interorganizational network” view of the MNC, where the organizational units of the MNC, which include its subsidiaries and its headquarters, are embedded in a “network” that consists of all the entities the MNC interacts with. Within this interorganizational network, the headquarters may assign different strategic roles to its MNC subsidiaries.
There is a rich subsequent literature establishing the pivotal role of the headquarters in the MNC organization (Ghoshal and Nohria 1989; Ghoshal and Bartlett 1990; Gupta and Govindarajan 1991; Dacin et al. 1999; Andersson et al. 2002; Björkman et al. 2004; Nell and Ambos 2013). Ghoshal and Bartlett (1990) see the MNC as “somewhere between […] unitary and federative structures” (Ghoshal and Bartlett 1990, p. 607); the theory is that in some MNCs the goals are set and the decisions are made with full authority by the headquarters, with the subsidiaries following directions from the headquarters, while in other MNCs, the subsidiaries are given the various degrees of choice of whether to ratify the decisions handed to them from the headquarters.

As Gupta and Govindarajan (1991) and Narula (2014) show, different subsidiaries may have very different types of inward knowledge flows and different levels of control exerted by the MNC, which, as argued first in Gupta and Govindarajan (1991), may be due to the different contexts where the subsidiaries operate. Among the control means that the headquarters may use to increase knowledge transfer to itself, Björkman et al. (2004) first identify “the specification of knowledge transfer as a criterion of subsidiary performance” (p. 446), which may push the subsidiary to transfer more knowledge to the headquarters and other subsidiaries – and to receive more knowledge from other subsidiaries. Gupta and Govindarajan (2000), O’Donnell (2000), Björkman et al. (2004), and Brenner and Ambos (2013) identify managerial socialization as an opportunity to bring the subsidiary closer to the headquarters vision, including through “international training programmes, by establishing international task forces and committees, and by encouraging visits across MNC units” (Björkman et al. 2004, p. 451). Bouquet and Birkinshaw (2008) find that subsidiaries attract the attention of headquarters using their structural position, and by taking initiative and building their profile. They also find that subsidiaries geographically further from
their headquarters show stronger initiative, which in turn yields positive attention from the headquarters. Branstetter et al. (2011) find that reforms that yield stronger intellectual property rights in a host country spur R&D investment by MNCs, including manufacturing of more advanced goods in the host country and increased licensing activity. Berry (2015) stresses the importance of knowledge inheritance from the MNC headquarters to the subsidiary. Berry uses U.S. Bureau of Economic Analysis data and subsidiary royalty payments to the parent to measure knowledge inflows from the headquarters to the subsidiary and finds that the transfer of knowledge from the headquarters to the subsidiary leads to greater return on asset generation at the subsidiary, especially when there are large clusters of innovation in the home country of the MNC and when the knowledge is transferred to subsidiaries based in host countries that are lagging behind in innovation compared to the headquarters. Thus, the MNC headquarters has multiple levers available to enhance innovation at the subsidiaries, but in applying these instruments, factors such as technology distance between the headquarters and subsidiary, degree of spontaneous initiative at the subsidiary, presence of knowledge clusters near the location, and strategic role the MNC assigns to the subsidiary. Details of the roles of the subsidiary are discussed further in the next section.

**Theoretical Foundations – The Subsidiary Role**

While the initial theorizing in the MNC literature was primarily focused on the central importance of the headquarters, subsequent research viewed the MNC subsidiary as being part of a triadic relationship involving the headquarters, the subsidiary, and the host country context. This literature also identified various pathways in which the MNC subsidiary could evolve. However, even in this literature development, the headquarters arguably did not lose its pre-eminence in either the theoretical or empirical streams of literature.
It has been shown that subsidiaries with higher knowledge output and more connections to their local context are more valuable to the MNC and its headquarters (Almeida and Phene 2004). Gupta and Govindarajan (1991), building on the transaction cost economics literature, define this type of subsidiary as playing a “global innovator role,” in which the subsidiary’s benefit to the MNC is driven by its unique knowledge-generating potential, knowledge that is used as currency in exchanges with other units within the MNC organization, as well as by the lower intra-organizational knowledge transfer transaction costs. Monteiro, Arvidsson, and Birkinshaw (2008) have argued that “some subsidiaries are isolated from knowledge transfer activities within the multinational” (p. 90) because they do not belong to the units “perceived to be highly capable” (p. 90), or because of the low “levels of communication and reciprocity” (p. 94). These “levels of communication” are directly connected to the high-capacity channels described by Narula (2014) and to the “richness of transmission channels” emphasized by Gupta and Govindarajan (2000).

Studying the product flow only, Birkinshaw and Morrison (1995) found in a study focused on configurations of the MNCs that the parent-subsidiary relationship differs substantially for “world mandate subsidiaries” and local subsidiaries, with the former experiencing a significantly larger strategic autonomy, which may positively influence the ability of the subsidiary to choose its knowledge sources (Birkinshaw and Morrison 1995, p. 744).

In fact, drawing on the theme of different pathways that MNC subsidiaries can undertake in their development and growth, Birkinshaw and Hood (1998) draw attention to the fact that there is an “enormous variety of subsidiaries in existence” (p. 773). The authors employ two theoretical lenses, that of network theory and that of decision processes in large organizations. They conclude that the subsidiaries are continuously evolving as elements of a network, sometimes going beyond a strict dyadic relationship with the headquarters, with the evolution being propelled by the
“underlying capabilities” of the subsidiaries (Birkinshaw and Hood 1998, p. 782), the social ties within the MNC network (Hansen 2002), and by the degree of autonomy they have to make decisions and take initiative as entities. This tension, between the mandate given to the subsidiary by its parent and the subsidiary’s evolving charter, is fueled by the subsidiary’s growing capabilities in its local network. Subsidiaries are no longer “resource seeking, market seeking, or efficiency seeking” entities (Birkinshaw and Hood 1998, p. 773); instead, they create their own dynamic capabilities (Nelson and Winter 1982) and become sources of competitive advantage for their parent organizations. In other words, while the subsidiary charter evolution literature still views the role of the headquarters with primacy, there is a gradual realization that the host country context can shape MNC subsidiary charter evolution as well. We propose that we can distinguish and compare these two influences – host country context and headquarters – over the subsidiary’s knowledge production.

**Theoretical Foundations – The Host Country Role**

The network model of Ghoshal and Bartlett (1990) and Rugman and Verbeke (1992) allows for ties between the subsidiary and the host country that are inherently valuable, external to the headquarters and costly for the headquarters to develop abroad. Subsequent scholars such as Dunning (1988), Anand and Delios (2002), and Cantwell and Mudambi (2005) have argued that the MNC has to integrate its firm-specific assets (the “ownership” advantages) with location-specific assets of host country contexts (the “location” advantages). Prior research has focused on the importance of factor endowments of the host country, such as the level of technological sophistication of the host country as a factor that influences the decision choice of MNCs to establish R&D centers in certain host countries (Kuemmerle 1999; Feinberg and Gupta 2004; Alcacer and Zhao 2012). In fact, Feinberg and Gupta (2004) argue that in addition to host country
factor endowments, the ability “to capture and utilize knowledge spillovers from competitors” located in the host country might drive the R&D location decisions of MNCs. We posit that small R&D subsidiaries are inefficient in tapping both the host country innovative knowledge and the knowledge created in the headquarters of the MNC and that the subsidiary ends up choosing an alignment based on the cost of acquiring knowledge. This brings us to the following related propositions:

**Proposition 1:** The MNC headquarters’ size of innovative output is positively associated with the subsidiary’s knowledge inheritance from the headquarters.

**Proposition 2:** The size of the subsidiary is positively associated with the subsidiary’s knowledge inheritance from the host country.

The first proposition illustrates the subsidiary-headquarters relationship in innovation activities; it is largely derived from the literature. The second proposition introduces an important moderator, i.e., subsidiary size, that drives knowledge inheritance by the subsidiaries from the local context. A graphical explanation of how these propositions materialize is given in Figures A1 and A2 in the Appendix.

The most recent studies of knowledge flows and innovation in MNCs build upon this growing role and influence of the host country for the subsidiary, and introduce the perspective that subsidiaries evolve and might turn to their host countries, as opposed to the headquarters, to define their charter and role. Meyer, Mudambi and Narula (2011) outline two mechanisms in which the local context can shape an MNC subsidiary – through the quality of its formal and informal institutions (Rodrik et al. 2004) and through resource endowment for MNC subsidiaries. Chacar, Newburry and Vissa (2010) show that the quality of formal institutions in the product, labor and financial markets is related to performance persistence of MNCs. Critical among these resources
is knowledge. One may think that the MNC would like more diversity, implanting subsidiaries in host country that have very different orientation of the innovative activity compared to its own, because that would provide higher knowledge flows. This line of thought is that new orientations in innovation would be followed with great efficacy. However, following the logic of lower transaction costs in transferring knowledge internally, it may also be that MNCs prefer a subsidiary more aligned with the host country’s innovation spectrum to reduce the cost of acquiring the host country’s innovative knowledge. This leads to our third proposition.

Proposition 3. An R&D subsidiary’s knowledge inheritance is positively associated with the degree of technology alignment with the source of that knowledge transfer.

In fact, the strategy and international business (IB) literature has long studied the importance of knowledge inheritance from the host country, in relation to studying why MNCs establish R&D centers in some host countries and not others. We propose that a theoretical model based on gravity may be fruitful in representing and studying these relationships. We note that Proposition 3 is related to and clarifies the innovation-integration dilemma posed by Mudambi (2011).

A Proposed Gravity Model for MNCs

Based on this exposition of the twin sources of knowledge inheritance for the subsidiary, it is tempting to study the relative influences of the headquarters and host country in subsidiary knowledge inheritance. To aid in doing so, we propose the use of a “gravity model” as a theoretical and future empirical tool to compare the relative influences of the headquarters and the host country on knowledge inflows to subsidiaries. The model usefully co-exists with a network conceptualization of the MNC, in a form that might lend itself to empirical analyses more easily. It simplifies the analysis as details of the individual nodes such as connectivity properties of pairs
of nodes can be analyzed in an aggregated form with an empirical model and measures which have been tried and tested in the international trade literature.

The gravity model in economics was introduced in the trade literature with Tinbergen’s (1962) work and was later formalized by Anderson (1979). Intuitively, this gravity model builds on the Newtonian mechanics, where the force of attraction between two bodies is proportional to the masses of the two bodies and inversely proportional to the square of the distance between those bodies. The equivalent form of the gravity equation in the trade literature substitutes the force of attraction as a dependent variable with a measure of trade, such as the dollar flow of traded goods between two countries (Anderson 1979) in relation to the masses of the two countries as measured in GDP (Mátyás 1997), and in relation to a distance variable, often specified as the geographic distance between the two trading regions (Anderson 1979). Bergstrand (1985) further expanded the theoretical foundations of the gravity model in the trade literature by deriving it from a general equilibrium model.

The gravity model is highly generalizable (see Appendix), as long as one has sensible measures of flow (force), mass (quantity), and distance (in a conceptual, space, not necessarily geographical distance). Consequently, it is now being applied in various fields beyond trade economics. Summary (1989) used measures of political factors between trading partners as additional independent variables to augment a regression model based on the gravity equation. Lewer and Van den Berg (2008) developed a gravity model of immigration where the masses were population sizes of pairs of countries, flow represented immigration, and distance was the traditional geographic distance measure. Zwinkels and Beugelsdijk (2010) employed cultural distance in a gravity model of trade. Waugh (2010) focused on determining trade flow asymmetries between countries based on differences in the standards of living of the trading countries. In another
example of the flexibility of the gravity model approach, the effect of cultural distance, legal system distance, and egalitarianism similarity were measured on foreign direct investments (Siegel et al. 2013). In this paper we propose that the gravity model can be applied to knowledge flows, specifically for the relationships between the headquarters and the subsidiary and, respectively, the subsidiary and its host country.

In the context of subsidiary knowledge inheritance, and using a gravity metaphor, we posit that an innovation produced by an MNC subsidiary is influenced by an “attraction force” generated by the MNC headquarters and acting upon the subsidiary and a competing “attraction force” generated by the subsidiary’s host country and acting upon the subsidiary.

Comparing knowledge inheritance of a multinational subsidiary from the headquarters and the host country using a gravity paradigm might identify subsidiary level factors that might tilt the balance of knowledge inheritance away from the headquarters, towards the host country context. We build on the literature of subsidiary absorptive capacity to theorize this proposition. Notice that the gravity model of knowledge exchange works at two levels: at the intrafirm level (i.e., subsidiary-headquarters) and at the company-country level (subsidiary-host country). Through the subsidiary, the headquarters also have a (subsidiary-mediated) knowledge exchange relationship with the host country. The distances between the headquarters and the subsidiary may vary during the evolution of the MNC, as new subsidiaries may be more distant geographically and culturally; this may facilitate and even trigger a faster and larger knowledge inheritance from the host country, while weakening the subsidiary-mediated knowledge exchange between the headquarters and the host country.

There is a rich literature focused on the construct of absorptive capacity in strategic management (Cohen and Levinthal 1990; Zahra and George 2002). In their seminal article, Cohen
and Levinthal (1990) define absorptive capacity of a firm as a function of its prior related knowledge. In other words, the ability of a firm to “evaluate and utilize” external “knowledge is largely a function of the level of prior related knowledge [of] the firm” (Cohen and Levinthal 1990). As the authors formalize, absorptive capacity refers to the acquisition and assimilation of external knowledge, which is followed by the exploitation of the external knowledge by the firm. Zahra and George (2002) added an intermediate step of transforming knowledge in between assimilation and exploitation.

Building on this literature, scholars of multinational firms evolved the concept of subsidiary absorptive capacity. In two related papers, Minbaeva et al. (2003) and Chang et al. (2012) showed the subsidiary absorptive capacity is related to facilitating transfer of knowledge from the headquarters and other parts of the MNC network to the subsidiary. Additionally, both papers posit that though subsidiary absorptive capacity is an organizational construct, such absorptive capacity resides within the employees of the subsidiary. Minbaeva et al. (2003) articulate that subsidiary absorptive capacity, contained in the prior knowledge stock and intensity of effort of subsidiary employees facilitates the transfer of knowledge from other parts of the MNC to the focal subsidiary. Similarly, Chang et al. (2012) hypothesize that subsidiary absorptive capacity springs from the knowledge bases and motivation of local employees. In fact, knowledge transfers from the headquarters to the subsidiary are facilitated by interactions between expatriates from the headquarters and local employees from the subsidiary and is only successful if local employees have the ability and motivation to utilize such knowledge.

The nature of innovation is that the complexity of knowledge necessary to create something novel and is useful is increasing over time, requiring more interdisciplinary collaboration and the ‘death of the renaissance man’, a phenomenon known as the ‘burden of knowledge’ (Jones 2009;
Jones et al. 2008). As individual degrees become more specialized, inventions require larger interdisciplinary teams (Jones 2009). This phenomenon holds also for scientific research, where journals appear to reward in-depth domain knowledge in individuals in a research team but who manage to combine that knowledge in a novel manner (Uzzi et al. 2013). Uzzi et al. show that the highest impact papers are not just the most novel, but the ones that manage to incorporate a degree of conventionality such as to ease the novel components into existing knowledge or familiar contextuality (Uzzi et al. give the example of eBooks with graphics made to resemble paper books). This concept of contextuality in scientific progress can be directly translated into the host country context for the MNC: a country could provide sources of innovation rooted in culture, labor force skills specific to the region, physical resources, institutional specifics of the region (including institutional voids which can themselves spur corporate innovation), and different educational systems, to name a few. It stands to reason that teams across subsidiaries of the MNC can produce novel combinations of knowledge that cannot be produced by teams within a single subsidiary and that such combinations are valuable and may become a source of competitive advantage.

In the case of U.S. headquartered MNCs, prior work has shown than ethnic innovators in teams of inventors are more “effective general managers at pursuing foreign opportunities, especially those of a technical nature”, have “language skills” and “cultural sensitivity” that make them more effective at spotting market demands in countries associated with the ethnicity, and help the MNC successfully commercialize a product in a foreign market (Foley and Kerr 2013: p. 1529). Different cultures have differing risk appetites and norms, as well as varying degrees of trust in institutions (Juma 2016) which lead to innovation if a cross-cultural team is employed. Khanna (2014, 2015) theorized some of these ideas into the idea of developing contextual intelligence. Phene and
Almeida (2008) add that while sourcing capabilities are important for subsidiary innovation, combinative capability by management of the subsidiary is key in developing a successful patent portfolio by the subsidiary. Given the increase in the burden of knowledge, and the potential of novelty rooted in combining subsidiary knowledge from local employees with that of the headquarters staff, that larger cross-cultural research and development across subsidiaries or mixed subsidiary – HQ teams are likely to produce more novel inventions than teams that are solely at one subsidiary. Thus, in terms of measures for mass, one could utilize knowledge stock at the subsidiary and headquarters, size of R&D staff, or other measures of R&D productivity, whereas distance in the gravity model could be represented as a measure of technological distance, based on – for instance – a cosine similarity based on technology categories of patents or publications, whereas flows could be represented with citations or novel combinations that yield new topics which could be measured using topic modeling.

We note that in terms of “mass” of subsidiary, the chosen unit of measurement may affect results of a model and knowing a baseline of R&D productivity in the host country of the subsidiary will be relevant, for instance in countries with high rates of advanced degrees in particular fields. For instance, a subsidiary may have high absorptive capacity for local knowledge even if it is a small subsidiary but has a high percentage of employees with PhD degrees or advanced technical expertise in a particular field. As an example, a small R&D subsidiary in electronics manufacturing in a country with a strong microprocessor design industry and related educational pipeline, such as Taiwan, Japan, or South Korea, may produce a larger quantity of R&D output such as patents, designs, or publications than a large subsidiary in terms of employee size but with a low percentage of advance degree engineers. Similarly, firms may choose to open small R&D subsidiaries in countries with an established track record of high-quality research
output in specific fields which may produce an outsized contribution compared to subsidiaries with an R&D component but also manufacturing, which while on an employee count level may be substantially larger may not produce a comparable knowledge output as the smaller subsidiaries in the MNC network. Empirically, this may be controlled using host country educational records data such as rate of advanced degrees per field per capita, or publication (including patent) counts in fields relevant to the industries the MNC is in. Unlike a trade gravity model where “mass” may be as simple a measure as GDP, a gravity model applied to knowledge may involve more nuanced measures based on other research productivity factors.

We build on this literature to posit that, over time, as the stock of subsidiary knowledge increases, there is relatively greater subsidiary absorptive capacity to acquire and assimilate knowledge from the host country knowledge context, rather than from the headquarters. We progress in two distinct steps. First, we build on the insight from prior literature (Chang et al. 2012; Choudhury 2015) that over time, employees transferred from the headquarters to the subsidiary become a relative minority of the employee base in the subsidiary, with the majority comprising local employees. In the second step, we return to the roots of the construct of absorptive capacity. As Cohen and Levinthal (1990) repeatedly stress, this construct is a function of prior related knowledge. As the authors argue, learning at an individual level is cumulative. We build on these insights and theorize that local employees, hired from the host country labor market, are more likely to be familiar with knowledge that is embedded in the host country, rather than knowledge that is embedded within the headquarters. As the number of local employees hired by the subsidiary increases over time, we expect to see two effects: the stock of subsidiary knowledge production is likely to increase, and local employees are likely to emerge as the dominant group
within larger subsidiaries. This leads to our final proposition, also directly related with the gravity model:

**Proposition 4: Subsidiaries characterized by larger sizes of knowledge stocks and stocks of locally hired employees, are likely to absorb relatively more knowledge from the local host country context, compared to absorbing knowledge from the headquarters.**

In terms of the gravity model, the smaller the distance to the host country leads to increased knowledge absorption from the host. Further, the larger the innovation activity (innovative “mass”) of the subsidiary and of the host are, their exchanges of knowledge are greater.

**CONCLUSIONS AND DISCUSSION**

This study contributes to several streams of the strategy and IB literature focused on multinational firms. We seek to understand how multinational subsidiaries evolve their capabilities over time, in particular how their relation to the host country context might result in their evolved contextual intelligence (Khanna 2014, 2015) as a source of advantage.

Recent protectionist policies naturally affect the operations of MNCs (Aguilera et al. 2019). The resulting intra-MNC changes can be conceptualized within our framework as a shift in the equivalent “distance” between the headquarters and the subsidiary. Prior work has shown that subsidiaries can become “centers of excellence” (Moore and Birkinshaw 1998) and generate “knowledge combinations that markets cannot” (Almeida et al. 2002, p. 149). The phenomenon of de-globalization has a deep historical precedence and extant research has established that MNC subsidiaries can flourish in these historical times by being more firmly tethered to the host country context (Choudhury and Khanna 2014; Choudhury et al. 2018). Our Cisco case study brings some qualitative context to this phenomenon.
We respond to the recent call in the international business literature for firms to develop contextual intelligence in host countries (Dhanaraj and Khanna 2011; Khanna 2015). Meyer, Mudambi, and Narula (2011) predict that host countries will play an increasingly large role in shaping MNC subsidiaries and thus MNCs overall. Santos and Williamson (2015) advise MNCs to cultivate a local presence that is not merely “adaptive” but fully intertwined with or even “made” in the local context. One way to establish a local presence is by learning from the host country context. Our gravity model conceptualization builds on existing conceptualizations of MNCs in a way that might lend itself to future large-sample empirical analyses of such attempts.

In conclusion, managers of innovative activities in MNCs should take notice that the knowledge inheritance at the subsidiary works in parallel over two planes, one within the organization (i.e., subsidiary-headquarters) and one external to the organization (i.e., firm-host country). These exchanges involve different dimensions of distances, with the shorter subsidiary-host country knowledge distance ineluctably favoring these exchanges. New subsidiaries established in geographically or culturally distant regions may develop a faster rate of, and larger share of knowledge inheritance from the host country, while weakening the subsidiary-mediated knowledge exchange between the headquarters and the host country. Furthermore, the ongoing trends of remote and distributed work affecting the locational choices of multinational employees (e.g., Bahar et al. 2022; Choudhury 2021) calls for greater scholarly and managerial attention to how multinational subsidiaries should manage their knowledge inheritance.
REFERENCES


APPENDIX

The network model of knowledge flows typically requires detailed information on the relationships between the constituents of the network, where the constituents are the nodes of the graphs, and the relations are represented by the edges. In case of knowledge flow between the headquarters and the subsidiary, on one side, and between the subsidiary and the local players, the network approach may need the information between connections between R&D workers in the three entities, as in Figure A1. Such detailed information is difficult to obtain empirically as it is often not public (internal to the organization). In contrast, the suggested gravity model aggregates the information while remaining compatible with the network model. In Figure A1 the graph vertices belong to three disjoint sets. By amassing the nodes in three entities and expressing the cumulated knowledge flows between individual knowledge workers in a flow between couples of MNC entities, a more interpretable picture emerges, see Figure A2. This perspective corresponds to the gravity model.

From the standpoint of network theory, the knowledge spillover increases with the number of connections of the knowledge workers, especially those employed in R&D. Their number is, however, on average determined by the total number of employees in the manufacturing field; while the average ratio of the R&D workers to the manufacturing workers differs from industry to industry and from state to state, the ratios are generally roughly constant over a period of a few years. This makes the total number of employees and ratios of R&D to manufacturing employees in host countries a reasonable proxy for the number of potential nodes in the graph of knowledge exchange. The last remark could be used in future empirical applications.
Figure A1. The tripartite graph of knowledge flow between HQ, subsidiary, and host country. The connections (representing knowledge flow) between the HQ and the host country are not depicted. However, this approach suffers empirically from the lack of public data on individual ties across R&D workers within organizations. With the approach of a gravity model, such ties can be aggregated to the subsidiary level, where data can be observed from public patent, design, or publication records.

Figure A2. Equivalent gravity model.
**Intuition for the Gravity Model**

The gravity model assumes that entities are characterized by a quantitative variable named “mass”, that in our case represents the amount of their innovative activity. We can quantify the mass by the count of patents, for instance. Couples of entities can be characterized by the “distance” between them, where the distance reflects the difficulty of collaboration or knowledge exchange between them. The distance may be represented by an aggregate of geographical distance, cultural dissimilarities, and differences between their technological level. For two entities, denoting by $m_1$ and $m_2$ the masses and by $d$ the distance, the influence one exerts on the other (the “force of interaction”) is expressed by the formula:

$$F_{12} = k \frac{m_1 m_2}{d^\alpha},$$

where $k$ is a constant depending on the process and $\alpha$ embodies the magnitude of the effect of the distance. Typically, $\alpha$ is close to the value 2. The interpretation is that the knowledge flow between the entities is proportional with the force of interaction. An application for headquarters and subsidiary interaction would look like:

$$F_{12} = k \frac{m_{HQ}^\gamma m_S^\lambda}{d_1^{\alpha}},$$

where $\gamma$ and $\lambda$ can be interpreted as efficiencies of the two entities. The distance between the HQ with mass $m_{HQ}$ and the subsidiary with mass $m_S$ is denoted by $d_1$. A similar relation can describe the knowledge and innovation flow between the subsidiary and the host country (HC), denoted in Figure A2 by $F_{23}$. Taking a logarithm of such an expression would then result in a linear form, which can be used in regression analyses, with the interpretation that the logarithm of the knowledge flow is expressed as a linear function increasing with the masses and decreasing with the distance, as expected intuitively. Aggregating in the distance geographical distance, cultural
dissimilarities, and dissimilarity of the activity domains of the entities. This latter point may provide nuanced empirical approaches depending on the types of entities and features of the flow being analyzed.