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New insights on the role of location advantages in international innovation

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New Insights on the Role of Location Advantages in International Innovation

Rajneesh Narula [*] ***and Grazia D. Santangelo*** [**]

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Abstract: This paper takes a closer look at the role of location advantages in the spatial distribution of MNE R&D activity. In doing so, we have returned to first principles by revisiting our understanding of L and O advantages and their interaction. We revisit the *meaning* of L advantages, and offer a succinct differentiation of L advantages. We emphasise the importance of institutions, and flesh out the concept of *collocation L advantages*, which play an important role at the industry and firm levels of analysis. Just because a country possesses certain L advantages when viewed at a macro-level, does not imply that these are available to all industries or all firms in that location without differential cost. When these are linked to the distinction between location-bound and non location-bound O advantages, and we distinguish between MNEs and subsidiaries it allows for a clearer understanding of the MNE's spatially distributed activities. These are discussed here in the context of R&D, which – in addition to the usual uncertainties faced by firms – must deal with the uncertainties associated with innovation. Although prior literature has sometimes framed the centralisation/decentralisation, spatial separation/collocation debates as a paradox facing firms, when viewed within the context of the cognitive limits to resources, the complexities of institutions, and the slow pace of the evolving specialisation of locations, these are in actuality trade-offs firms must make.

JEL codes: F23, L52, O14, O19

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Introduction

Understanding the reasons why economic activity prefers to locate in certain physical spaces (and not in others) forms the basis of much enquiry since at least the enlightenment, and continues to remain so. Although the jargon in such enquiry has evolved through the centuries, the concern with national competitiveness has driven much of these efforts, and connected to this, the propensity to trade, and the ensuing issues of balance of payments and national debt. Nonetheless, location and agglomeration of economic activity – until about 50 years ago – worked on the assumption that both capital and labour were location-bound, because firms and individuals showed little propensity to mobility. Thus, competitiveness was primarily shaped by the attributes of the location, and as locations evolved in the nature of their inherent strengths and weaknesses, the kind of economic activity based there also fluctuated. This had obvious ramifications for the nature and extent of trade, and the conditions that permitted one region or country to be more successful than others.

The evolution of the modern MNE[i] changed this with the growing level and intensity of foreign direct investment (FDI), intra-firm trade and complex sets of linkages amongst and between spatially dispersed economic actors. Mostly, this has gradually decoupled – but only to an extent – the severely linear relationship between the competitiveness of firms in a given location with the competitiveness of the location itself. That is to say, where capital and firms were physically static; the competitiveness of countries explained the competitiveness of firms located there, but rarely ever vice-versa (Vernon 1966). The firm as understood in this context was 'generic' in that it was neither multinational, nor multi-plant, and was by itself

organisationally and geographically a singularity, no different from other firms (Beugelsdijk et al. 2010).

However, the MNE has become a complex organism, with an ability to spatially reorganise its activities (and across borders) – and with growing ease - to take advantage of differences in the quality, availability and price of location-bound assets, both within countries and across countries, and these multiple engagements are dynamic in the sense that they are continuously evolving (Dunning 1977; Dunning 1980). The more complex the MNE spatially and organisationally, the greater the need to interpret its interdependence with multiple locations and multiple contexts, each with differing degrees of embeddedness (Meyer et al. 2011). In short, locational characteristics (location (L) advantages) and the operations of the MNE (ownership (O) advantages) are concatenated, implying that they are inextricably linked together, yet are not the same object. The MNE has the potential to shape the characteristics of the location, as much as it is shaped by its milieu (Cantwell 1995).

This multi-level complexity means that the study of location is no mere academic exploration, to explain the success and failure of nations and its industries with the hindsight afforded to us by history, for its own sake. Firms must make locational choices, and 'wrong' choices can be costly because they also imply other opportunities forgone. Firms are resource-constrained and have cognitive boundaries that shape what they can and cannot do, and this makes location decisions strategic in nature, and insinuates a micro-aspect to the study and understanding of location. Similarly, governments are able to shape their policies to determine their locational attractiveness, as firms and individuals have a growing degree of flexibility in selecting where (and where not) to locate, and perhaps more importantly what aspects of their value-adding activities to concentrate in which particular locations. This brings out the macro-level significance of the study of location.

Engaging in high value adding activities implies higher competence levels (or in other words, greater O advantages) of MNE subsidiaries, which require L advantages that are non-generic in

nature and are often associated with agglomeration effects, clusters, and the presence of highly specialized skills (Lall and Pietrobelli 2002). Firms are constrained in their choice of location for high competence subsidiaries by the L advantages of the host location. For instance, R&D activities tend to be concentrated in few locations, because the appropriate specialized resources are associated with only few locations. The embeddedness of firms is often a function of the duration of the MNEs' presence, since firms tend to build incrementally (Håkanson and Nobel 2001; Rabbiosi and Santangelo 2011). MNEs most often rely on L advantages *that already exist* in the host economy, and deepening of embeddedness occurs generally in response to improvements of the domestic technological capacity. However, while the scope of activities undertaken by a subsidiary can be modified more or less instantly, developing competence levels takes time (Cantwell and Mudambi 2005; Nobel and Birkinshaw 1998). MNE investments in high value-added activities (often associated with high competence levels) have the tendency to be 'sticky'. Firms demonstrate greater inertia when it comes to relocating R&D activities. This reflects the high costs and considerable time required to develop linkages with the host country actors and institutions (Narula 2002).

The complex interdependence between O and L advantages presents the MNE with a number of trade-offs when taking strategic decisions regarding the location of R&D. Firstly, MNEs need to decide whether to centralize or decentralize, Secondly, MNEs need to decide whether to spatially separate from or collocate with their rivals. Neither of these trade-offs are either/or decisions, nor are they diametrically opposed to each other. However, as is often the case in the nature of trade-offs, the choice is shaped by constraints most often associated with cognitive limits to resources, the bounded rationality of firms, and the uncertainty inherent in innovation.

This chapter addresses this topic in 5 sections. The next section discusses L and O advantages, providing a classification of and provides some novel insights into the interaction between the two. Section 3 focuses on innovation and location and explain the relevance of the

concept of and relationships between L and O advantages for R&D activity. The last two sections are concerned with the trade-off between centralization and decentralization, and spatial separation and collocation of R&D activity, respectively.

Location and Ownership advantages – an updated set of definitions

The essence of locational behaviour of MNEs (as well as other economic actors) reflects the interaction between O and L advantages (Cantwell 1995; Dunning 2008)).

Ownership advantages are firm-specific in nature, and the competitiveness of firms is associated with the strength (or weakness) of their O advantages. In this instance, we use O advantages to refer to firm-specific assets that are essential in the generation of economic rent and/or market share retention/creation (Narula 2010). There are two primary types of O advantages (Dunning and Lundan 2008). The first are about assets in the sense of the ownership of physical equipment, intellectual property, or privileged access to tangible and intangible resources (which also include knowledge possessed by employees). Such assets include knowledge of how and where resources may be accessed in any give location, the costs of acquiring such assets in one location relative to alternative locations, the knowledge to organise multi-location operations, etc. These are asset-type O advantages (Oa). A second class of O advantages are transaction-type O advantages (Ot). These derive from 1) the knowledge to create efficient internal hierarchies (or internal markets) within the boundaries of the firm, and 2) being able to efficiently utilise external markets. Ot assets form a necessary and (sometimes) sufficient basis for a firm to remain competitive (Narula 2003). Ot advantages also include the knowledge of institutions, because familiarity of institutions plays an important part in reducing the coordination costs, shirking costs and other transaction costs (Narula 2010; Santangelo and Meyer 2011). However, they are rarely in themselves a source of rent generation. It is important to distinguish between the O advantages of the MNE at large, and those associated with individual establishments or subsidiaries (Rugman and Verbeke 2001). Much of the early

literature on O advantages took a macro perspective, and given the nature of the typical MNE and its centralised management structure, at that time it was a reasonable assumption that the O advantages of the MNE were in principle available to and accessible by all subsidiaries. This, however, is increasingly hard to justify. The O advantages of the parent are not necessarily available to all its subsidiaries, and to each individual operating unit, and vice versa.

L advantages are about the characteristics of specific locations, and are location-bound. Although it is increasingly popular to use country-specific assets as a synonym for L advantages (Rugman and Verbeke 1992), the term 'L advantages' allow us to clearly distinguish between the various units of analysis, such as the country, national sub-regional, or supra-national regions[ii]. It is well known that even within countries, regions compete for FDI by offering more attractive institutional frameworks (Hogenbirk 2002; Meyer and Nguyen 2005; Narula and Dunning 2010) . Supra-national regions also exist - such as the European Union (EU) – which provide an additional layer of policies, regulations, and laws. An MNE may engage with all three levels of L advantage. For instance, consider an MNE with a production site in Maastricht, in the Netherlands. The MNE will need to consider the L advantages of the Netherlands at large, the Limburg province, as well as that of the EU, in addition to the special status of Maastricht as part of the Meuse-Rhine Euregio, which addresses aspects peculiar to the contiguous multi-country border region of Germany, Belgium and the Netherlands.

L advantages are a set of characteristics associated with a location, and are in principle accessible and applicable to all firms equally that are physically or legally established in that location. We say 'in principle' for three reasons. First, full information about L advantages associated with a specific location may not be readily available. Second, even where information is available, there may be costs associated with accessing this knowledge. This knowledge may be available to incumbents (whether domestic or foreign), by virtue of their existing activities on that location, and acquired through experience. Third, these L advantages may be made available differentially by the actions of governments that seek to restrict (or encourage) the activities of a

particular group of actors by introducing barriers to their use of certain L advantages. These may be for commercial reasons, or for strategic reasons such as national defence, or reflect the influence of interest groups who are able to influence government policy. These represent a subset of the 'liability of foreignness', when L advantages are available to local and foreign firms at differential costs (Zaheer 1995).

Note that when location-bound assets are in the private domain (i.e., they are internalised by others), they are no longer L advantages but constitute O advantages, since they assist rent generation/market share retention by specific actors to the exclusion of other economic actors. Location advantages can be said to be 'public' because they are not private goods, but not always in the sense of being 'public goods' because they may not always be used without (some) detriment to their value to subsequent users. This aspect of L advantages will be discussed at length later.

A classification of L and O advantages

L advantages come in all shapes and sizes, and it is hard to make general statements and lists of all possible L advantages (although we try in Table 1!). This is because the L advantages relevant to a particular circumstance vary by a variety of MNE and affiliate-specific factors, such as the motive of the investment; the spatial, logistical and strategic relationships with other operations, both within the same MNE and outside the MNEs with other independent firms. It is important to understand that *L advantages are about relevant complementary assets outside the boundaries of the MNE (or other firm actors) that are location-bound*. We discuss this later, when we introduce the concept of collocation L advantages.

Table 1 classifies L advantages into 3 broad categories – at the country, industry and firm level. For each of this category, we identify specific type of L advantages and related sources and provide examples. As we discuss below, these categories have a certain degree of overlap.

TABLE 1 ABOUT HERE

Country-level L advantages are 'contextual' in nature, in the sense that they provide the broad background of a location. They reflect the socio-economic and political environment that is relevant to any location. They remain macro and 'generic' because they are public or quasi-public goods, and are relevant to all firms regardless of size, nationality, industry, or geographical unit of analysis. Some are exogenous, in the sense that they are independent of economic stage of development, and are the natural assets of the location, such as population, climate, accessibility, etc. Others are created assets but remain generic in the sense that they are expected to exist in all nation states although there are countries where the government is unable to provide these – basic infrastructure, legal and financial infrastructure, and regulation and policy frameworks. The last category represents knowledge infrastructure L advantages. 'Knowledge infrastructure' as used here is 'generic, multi-user and indivisible' and consisting of public research institutes, universities, organisations for standards, intellectual property protection, etc. that enables and promotes science and technology development (Smith 1997). For obvious reasons, this can also be categorised as an industry-level L advantage, since such assets may be specifically geared to a particular set of industries.

Industry-associated L advantages. In making an investment decision, MNEs seek specific, industry and market-related complementary assets. It is not enough, for instance, for an IT firm that is seeking to establish software design facilities that there is a large supply of low-wage university graduates, but that there is a large supply of IT graduates. Neither demand conditions nor market structure can be analysed using country-level L advantages. For a market-seeking investor, income distribution and the size of the specific market cannot be gauged from generic L advantages such as population. A luxury watch manufacturer will be interested in knowing the market for other luxury goods, and opportunities for distributing her goods through channels specific to luxury goods, and the competition within that specific sector. Industry policy may also be seen to be industry-specific, by definition. A location which is home to a cluster of firms in a similar industry is likely to have access to a number of suppliers in support and related

sectors. Governments may also provide specific incentives and policies to promote a specific sector, which may make a location more attractive for a specific industry, and not for others.

In this chapter we define an important sub category of L advantages: collocation L advantages. Where important competitors in the same industry are collocated, there is an opportunity to get appropriately skilled and experienced potential workers, and the possibility of knowledge spillovers through mobile employees. In short, these are *L advantages that derive from the presence of other actors in the same industry that are collocated* (see Table 1 for more details). These include the *essence* of other collocated firm's O advantages, which contribute to the competitiveness of the location.

Firm-associated L advantages. Although O advantages *per se* do not generate L advantages, the presence or absence of specific firms in a milieu can act as important inducements to collocate. The physical location of a lead-firm within a global production network acts as a powerful L advantage to its key suppliers. Others may seek specific L advantages to improve knowledge spillovers by being proximate to a market or industry leader. In this sense, L advantages overlap with O advantages, and differ from industry-associated L advantages.

Informal institutions deserve special mention as an L advantage. Informal institutions (which may or may not be linked to current formal institutions) are routines, habits and procedures that are in common use and that shape the manner in which economic actors in a given location interact *in practice*. Formal institutions may prescribe one set of actions, but economic actors may utilise other institutions that are *de facto*, and not *de jure*. Knowledge of such institutions is also in principle available to all firms that seek to acquire this, but because informal institutions are largely tacit, physical proximity is crucial in their acquisition. In other words, they require some degree of embeddedness to acquire. Embeddedness in a location provides membership to a 'club' of complex relationships with suppliers, customers and knowledge infrastructure through formal and informal institutions that have taken years to evolve a stock of knowledge that is only

available to members by virtue of their constant interaction (Forsgren et al. 2005). There are 'goods' associated with these networks that are only available to those that are collocated, because they have evolved under the same informal institutions. Thus they are quasi-public goods, for which firms located there have invested in to acquire knowledge of these institutions (Narula and Santangelo 2009). Knowledge of institutions can indeed represent O advantages, but only where markets are closed. This is why some authors (e.g. Dunning and Lundan 2008) have classified them as O advantages, while others regard them to be L advantages (Narula 2010).

It is worth highlighting the difference between location-bound O advantages and those that are *non* location-bound (Rugman and Verbeke 2001). Location bound O advantages allow the firm to be able to generate profits from these assets but only in a specific location. This may be due to government-induced incentives, such as privileged access to specific natural resources, to capital, or specific infrastructure. In other cases, market entry may be restricted providing the firm with a monopoly or a pseudo-monopoly, and consequent opportunities to generate rent (e.g., telecoms licenses, petroleum drilling rights). Location-bound O advantages may also derive from specific (non-government) L advantages which the firm is able to access only in the given location, the use of which requires physical presence in that specific location. Many MNEs are amongst the largest in their home markets, and are themselves part of large industrial groups (sometimes with cross-holdings and common ownership) with interests in several industries, and also derive location-bound O advantages from privileged access to intra-group transactions and intermediate goods within the same family of firms, but these advantages are not necessarily available when they move abroad (Narula and Nguyen 2011). These may also derive from knowledge of institutions, and by being an 'insider'. By virtue of their size and importance in the home economy, they may have close relationships with state-owned organisations, ministries and policy makers, and are able to influence domestic policy, as well as the associated knowledge infrastructure to their own needs, and in many cases, these have evolved around and with their own domestic activities, often over a long period of time. Such linkages confer the basis to

generate economic rent for incumbents, and are a cost to new entrants or those less entrenched in the domestic milieu (Cantwell and Mudambi 2011). These advantages are not transferable to foreign markets, and establishing 'membership' in business and innovation networks in new locations is not costless (Narula 2002).

Non location-bound O advantages derive from skills, technology or other knowledge which the firm possesses to the exclusion of other economic actors operating in the same location. Such O advantages also tend to be a function of the home country. Firms typically build their original resource endowments in their home country and this original resource endowment drives their international growth (Narula and Nguyen 2011; Tan and Meyer 2010).

Interaction between L and O advantages

There are circumstances where the differentiation between O and L advantages can be challenging, partly because of the interaction and concatenation of O and L advantages. Initial O advantages of any MNE derive from the L advantages of the home country, and as the work pioneered by Rugman and Verbeke (2003) has shown, many MNEs continue to show a strong bias towards their home regions. For firms that are beginning to internationalise, the dependence on the home country is especially strong (Narula 1996; Narula and Nguyen 2011). However, there is a certain degree of obfuscation that derives from taking an MNE-level perspective on L and O advantages, which requires the aggregation of individual operations. The O advantages of MNEs – once they become embedded in new locations abroad - are influenced by multiple sets of L advantages, and create the challenge of multiple embeddedness (Meyer et al. 2011).

The MNE in any given location has to interact frequently with other actors in each host country, and additionally when it has multiple establishments, with multiple locations within the host country. Each interaction has the potential to change the knowledge base of all the participants, and by extension, the O advantages of the various participants. Where the domestic actors are locationally bound, this implies changes in the L advantages of the host country as

well. Such interactions vary in intensity, depending upon a variety of factors. In general, the greater the scope and competence of an MNE subsidiary in a given location, the greater the degree of embeddedness in the host location, and the greater the interaction with other actors in that location (Holm and Pedersen 2000). This implies managing a portfolio of subsidiary level activities in multiple, heterogeneous, local contexts and plays an important role in defining its O advantages (Figueiredo 2011). Figure 1 illustrates the complexities of this concept.

FIGURE 1 ABOUT HERE

In particular, the O advantages of any given subsidiary ('subsidiary A' in Figure 1) are shaped by:

1. The parent firm. Since the O advantages of the parent firm are a function of the home country L advantages, by extension, the O advantages of subsidiary A are also greatly influenced by these L advantages;
2. The extent to which the parent and the particular subsidiary are integrated. At the one extreme, a free-standing MNE may function as a completely autonomous set of subsidiaries with little or no intra-MNE interaction, and the O advantages of the subsidiary and the parent are independent sets. At the other extreme, the MNE may be completely integrated such that the O advantages of subsidiary A are a complete subset of the parent MNE;
3. The extent to which subsidiary A is embedded in the host country. This reflects a variety of factors. The quality of the linkages are associated with the scope and competence level of the subsidiary (Santangelo 2009), and these in turn are co-determined by a variety of factors (for an extensive discussion see Narula and Bellak 2009). These include MNE internal factors such as their internationalization strategy, the role of the location in their global portfolio of subsidiaries, and the motivation of the investment, in addition to the available location-specific resources which can be used for that purpose (Benito et al. 2003).

4. The relative strength of the association with other subsidiaries. Specific subsidiaries may function within a regional structure, along functional lines, or within a specific integrated product or supply chain. In such instances, the relationship with subsidiary B may be much more intensive than within the parent firm. As such, the O advantages of subsidiary A may be influenced to a greater extent by the O advantages of subsidiary B, and the L advantages associated with location B.

The subsidiary has to balance the forces that require local responsiveness to its host milieu, with those that emanate from the parent MNE which may require the subsidiaries' integration within the MNE's overall structure. Given that many larger MNEs are a complex aggregation of a large number constituent subsidiaries, such multiple embeddedness generates trade-offs between external and internal embeddedness, since each subsidiary must reconcile the interests of its parent with those of its local business interests.

This implies – from the perspective of the interaction of the more global MNE – that its portfolio of O advantages are a complex blend of those derived from multiple contexts (Meyer et al. 2011), and therefore a complex set of L advantages of different locations. In each location, it absorbs and adapts its O advantages in response both to the L advantages available, and through linkages with collocated firms adapts as well to the O advantages of these unaffiliated firms. Note that by joining an agglomeration, the MNE itself become part of an agglomeration, and *therefore enhances the L advantages of the host location for other firms.*

Innovation and location

The literature on motivation of R&D activities is reasonably well developed, and we will not seek to revisit it, focusing instead on the broad dichotomy of asset-augmenting and asset-exploiting R&D motivations (Dunning and Narula 1995, Kuemmerle 1999), and its relationship with motivation of more general FDI activities of MNEs (Dunning 1993). It is important in this context to note that in certain industries and sectors, R&D performs a subordinate and supportive

role to ‘mainstream’ activities such as production and sales, while in others, R&D is a primary input to these activities (Figure 2a,b). For instance, in sectors such as software and pharmaceuticals, R&D is a primary input to the firm’s primary function, while in sectors such as paper products, R&D is a supportive. In addition, increasingly firms are engaged in rationalising their activities globally, so as to maximise the link with specific value adding activities and locations which have specific competitive and comparative advantages. This has led to a tendency amongst MNEs to ‘break-up’ their value chains and locate specific aspects in particular locations for purposes of maximum efficiency (Mudambi 2008). As such, few locations host all parts of the value chain of one product for any given MNE, leading to an agglomeration of specific types of activities in particular locations. Prior to economic liberalization, MNEs responded to investment opportunities primarily by establishing truncated miniature replicas of their facilities at home, although the extent to which they are truncated varied considerably between countries (Papanastassiou and Pearce 1999). The extent of truncation was determined by a number of factors, but by far the most important determinant of truncation - and thereby the scope of activities and competence level of the subsidiary - were associated with market size, and capacity and capability of domestic industry (Dunning and Narula 2004).

FIGURE 2 ABOUT HERE

MNEs may seek to engage in R&D in response to specific L advantages because R&D is more demand oriented. This may reflect, for instance, large markets, or scarce natural resources that are location-bound. These promote the outwards spread of production, sales and other value adding activities where MNEs attempt to *exploit their existing assets* and competences in conjunction with these L advantages. In such cases, innovation is undertaken in order to adapt existing products and services to local stimuli. Such R&D facilities tend to be relatively low knowledge-intensive, and remain somewhat footloose, requiring greater integration with the

parent firm as well as the market, rather than a focus on the knowledge asset L advantages of the host country (Table 1). Such asset-exploiting activities is subordinate to the MNE's market-seeking FDI activities, in that R&D follows (perhaps reluctantly) the location of other aspects the value chain. In such instances, the MNE's R&D activities are primarily determined by the same L advantages that shape their other activities, although not at the same intensity or timing.

An important set of L advantages for R&D activity are associated with the interaction between the knowledge infrastructure-related L advantages of locations, and the L advantages that derive from the O advantages of firms already based in these locations (e.g., collocation L advantages). These in turn are strongly associated with L advantages that derive from knowledge of institutions. Note that the institutions themselves are L advantages, while the knowledge of these institutions is an O advantage. These particular L advantages play a preeminent role in shaping the location of innovation in three sets of circumstances. First, where MNE R&D is asset-augmenting in motivation and essentially represent supply-driven R&D. Second, in market-seeking MNE activity where R&D is central (rather than subordinate) to the primary value adding activities of firms. Third, where the MNE's activity are tightly linked and interdependent with other collocated firms' activities, as in the case with supply chains, production networks and keiretsu. All three share another common feature: the importance of the role of institutions, and the knowledge of these institutions.

The systems of innovation literature can be useful to understand this dynamic (Lundvall 1992). In particular, this stream of research builds on the principle that innovation is a collective process, which involves firms as well as other actors such as policy makers, universities, public research centres, investment banks, etc.[iii]. These actors are bound together through rules, routines, habits and procedures which may be formal or informally defined, but that shape the nature and extent of interaction between the various parties. This ties into the idea propagated by Marshall (1920) about successful agglomerations - something that is 'in the air', a stock of

knowledge that is only available to members with a particular location-specific absorptive capacity by virtue of their constant interaction.

Whatever the geographical unit of analysis, a systems view builds around the important principle that knowledge diffusion between actors in geographical proximity foster innovation. Where knowledge is being exchanged, and this knowledge has a strong tacit nature, "physical" or geographical proximity eases knowledge transmission (e.g. Blanc and Sierra 1999). Knowledge spillovers tend indeed to be more intense between parties that are located close to each other in space (e.g. Jaffe and Trajtenberg 1996; Jaffe and Trajtenberg 1998; Jaffe et al. 1993; Maurseth and Verspagen 2002). Thus, MNEs are typically located in a particular location because of such L advantages, which often include quasi-public goods provided though universities and public research institutes (Asheim and Gertler 2006). The point here is that proximity, linkages and institutions are inextricably tied together, and that especially where innovation (which has a tacit aspect) is concerned, firms share an inertia in seeking alternative locations.

MNEs and the trade-off between centralization and decentralization

The innovation activities of MNEs follow the same general logic as other value adding activities, in that they require access to specific L advantages. However, the nature of innovation and its strategic significance to the long-term well-being of the MNE means that MNEs have been more reluctant to internationalize R&D then other aspects of the value chain (Narula and Zanfei 2004) Nonetheless, there is compelling evidence that this is changing as well, albeit much more cautiously, and with a time lag relative to other aspects of the value chain.

The issue of location in the innovatory activities of MNEs is a complex one. At the most elementary level, MNEs face the dual and (sometimes) opposing challenges of centralization and

decentralization (Sanna-Randaccio and Veugelers 2007), although the contradictions between the two are not necessarily always as stark – firms seek to do both simultaneously, depending upon the motivation of the R&D, and the centrality of R&D to the primary value adding activities of the MNE. The willingness or reluctance to internationalize is due to a number of factors. First, the strategic importance of R&D means that firms may wish to exert as much control over the process by keeping R&D close to headquarters which can assure an optimal level of monitoring and control over its activities. Second, there is a minimum efficient scale associated with R&D activities. Given the relatively high costs of R&D, MNEs prefer to maintain a single (or as few) R&D facilities to reduce costs. Small firms are constrained by their limited resources – the expansion of R&D activities- both at home and in overseas locations requires considerable resources both in terms of capital investment, and managerial resources which these firms simply do not have. *Ceteris paribus*, large firms have more money and resources to use on overseas activity. Third, a dispersion of R&D activities across the globe also requires extensive coordination between them – and particularly with headquarters- if they are to function in an efficient manner with regards to the collection and dissemination of information. *Internal* proximity between R&D and the rest of the MNE is an important issue (Blanc and Sierra 1999).Spatially distributed R&D requires the establishment and management of networks internal to the firm, in addition to those between external networks and internal networks, and require complex coordination if they are to provide optimal benefits (Narula and Zanfei 2004). Such networks are not only difficult to manage, but also require considerable resources (both managerial and financial). Managing spatially dispersed R&D – even within the same organisation – is suboptimal, due to knowledge internal stickiness (Szulanski 1996). Thus firms' default option is to maintain R&D in as few locations as possible, and to maintain strategic control by concentrating it close to headquarters.

Fourth, there are industry-specific reasons that may encourage or discourage centralization. The maturity of the core technology and its characteristics, determines the extent

to which the innovation process can be internalised (Narula 2003; Teece 1986) and geographically dispersed (Cantwell and Santangelo 1999; Cantwell and Santangelo 2000). Most mature technologies evolve slowly and demonstrate minor but consistent innovations over time. The technology is to a great extent codifiable, widely disseminated, and the property rights well-defined. Intra-industry competition emphasises price and therefore economies of scale. In the extreme – as in many resource-extractive industries - downstream activities add most value with the natural resource being priced as a commodity. These sectors do not require outputs to be tailored to customers to the same extent, or as quickly. This means that constant and close interaction between customers is not an important determinant of R&D. Profits of firms are highly dependent on the costs of inputs, and proximity to the source of these inputs is often more significant than that of customers. On the other extreme, rapidity of technological change in 'newer' technologies require a closer interaction between production and R&D. Technologies has a higher tacit, uncodifiable element, and this requires a closer coordination between users and producers of innovation.

In addition, though, supply-side considerations are especially important in asset-augmenting innovation. To engage in more intensive activities such as research (as opposed to development), complementary assets are necessary. These assets can be best described as non-generic, knowledge-intensive L advantages, which the firm cannot have access (or as cheaply) to in its home base (or other locations). Thus, MNEs need to access 'unique' or scarce L advantages to do with the knowledge infrastructure and specialized sources of knowledge that may be either firm-specific and location-bound, or location-specific and available to all. In the case of asset-augmenting activity, MNEs may situate (or seek to establish) themselves in particular locations to (and in some cases only to) undertake innovation because of specific location-bound assets provided through the innovation system. Such innovation activities are more of the nature of stand-alone R&D facilities which are considerably knowledge intensive, and imply a considerably greater dependence on domestic knowledge sources and infrastructure.

MNEs and the trade-off between spatial separation and collocation

Most theoretical perspectives (such as the innovation systems literature) provide arguments in favour of firms locating in close spatial proximity, particularly for R&D. However, recent research has provided a number of arguments challenging this view.

First, while all firms in principle seek to have positive inflows of knowledge, few firms wish to be the source of (unintended) knowledge outflows (Alcácer 2006; Santangelo 2011). Although in the case of R&D (compared to sales or manufacturing) there is a greater active interest in seeking spillovers, this tendency reflects the capabilities of the firm. R&D tends to be more concentrated relative to manufacturing and sales, but more-capable firms collocate less than less-capable firms, regardless of the activity. In other words, firms may seek to *avoid* collocation of R&D to minimise leakages of value assets. Even where spillovers are the objective, being co-located is not always necessary. Of course, this varies considerably by industry, particularly in sectors where the tacit aspect is considerable. Tacit knowledge is much more difficult to exchange or trade, and, as a result, tends to be sticky and geographically less mobile. In industries where the tacit aspect is considerable, *ceteris paribus*, the propensity to geographically concentrate is higher (Iammarino and McCann 2006) than in sectors where the knowledge being exchanged is codifiable. This is especially so in oligopolistic industries (as opposed to industries with a competitive market structure) where loss to rivals is perceived as costly, and the private good aspect of knowledge is more important than the public good aspect (Iammarino and McCann 2006; McCann and Mudambi 2005). Empirical evidence has shown that the involvement of firms in clusters is extremely sensitive to the nature of the industry structure in which the firm operates (Cantwell and Kosmopoulou 2002). That is, firms operating in the same R&D-intensive oligopolistic industry tend to spatially separate their core innovative activity (Cantwell and Santangelo 2002). Unintended knowledge outflows from a firm can be quite valuable to its direct competitors and can therefore be important not to locate close to rivals

(Cantwell and Santangelo 2002), or it may result in an adverse selection of collocated firms (Shaver and Flyer 2000). Thus, for oligopolistic industries, although the choice of R&D location is important in determining the capabilities of firms and their access to 'members only' public goods, collocating with rivals is not always the preferred option. Technically advanced firms prefer being proximate to universities, and are disinterested in locating close to other firms in the same industry, whereas less competitive firms prefer to locate close to rivals (Alcácer and Chung 2007).

Second, firms do not always collocate because they wish to benefit from knowledge transfers (intended or unintended), but simply to have access to the same location-specific assets (such as skilled labour), which may be achieved by staying broadly in the same regional vicinity (Cantwell and Iammarino 2003). When, however, the local system provides a combination of factors that contributes to innovation (such as skills, finance, production, user-producer linkages), the fear of knowledge spillovers to competitors may be counterbalanced by location-bound (i.e., associated with firm specific advantages) or location-specific factors, and intra-industry spatial concentration then takes place. Firms – whether they are technological leaders or followers – often have little choice in their location, and may in fact be collocated in a cluster by virtue of their history, or because of the presence of an important university or public research establishment. In particular, firms often locate their R&D to take advantage of a specific scientific specialization of a university or public research establishment. The number of specialized universities and institutes in a given scientific field are finite, so even where a technological leader would prefer to avoid spatial proximity with its less-able rivals, it cannot prevent these firms from collocating in order to establish embedded relationships with these institutions. Thus, once competitors collocate, the decision to embed locally in order to access local complementary knowledge depends on entry motivations and firms capabilities since such a decision may bring about risks of unintended knowledge spillovers (Perri et al. 2011; Santangelo 2011). In particular, when domestic actors are valuable in terms of knowledge, rivals

entering the market with a competence-creating motivation (as opposed to a non-competence-creating motivation) embed in the host economy as their expected payoffs of embeddedness exceed those of isolation (Santangelo 2011). Moreover, empirical evidence documents that highly capable firms invest more on the relationships with local partners under conditions of low competition, but they also reduce their commitment more to such relationships when the perceived pressure from the competitive environment exceeds a certain threshold as a result of potential loss from outward spillovers (Perri et al. 2011).

Third, few technological leaders have superior capabilities in all sub-sectors, and may require complementary resources from their rivals. Alliances allow firms to effectively engage in knowledge exchange without the hazard of unintended knowledge spillovers (Narula and Santangelo 2009). Firms are unable to properly protect their technological assets which they intentionally or unintentionally share with their neighbours, even though formal property rights have been obtained. This is particularly the case when they are geographically close since, while the marginal cost of transmitting *codified* knowledge across geographic space does not depend on distance, the marginal cost of transmitting *tacit* knowledge increases with distance (Criscuolo and Verspagen 2008). The co-location of innovation activities therefore implies potential threat to competitive advantage of co-located rivals. This argument applies especially to alliances between firms operating in the same industry and core technological fields. In such cases, the need for closely monitoring knowledge transmission is greater, the higher the degree of competition, since co-located rival firms with technologically similar profiles compete both in the output market and the technological realm (Narula and Santangelo 2009). Therefore, in these cases partnerships enable firms to directly monitor their co-located market and technological rivals as well as to access possible complementary capabilities.

Implications and avenues for future research

We have sought here to examine certain current issues in the role of location advantages in the spatial distribution of MNE R&D activity. In doing so, we have returned to first principles by revisiting our understanding of L and O advantages and their interaction. This interaction lies at the heart of innovation studies, economic geography and the economics of innovation (which takes a policy view of the competitiveness of locations), as well as innovation and strategic management (which take a firm-level perspective on the competitiveness of firms).

Returning to key insights from these related disciplines, we have revisited the *meaning* of L and O advantages, as opposed to their definitions. This has required us to return to the oft-cited (but underutilised) differentiation between country, industry and firm-level issues, and offer a succinct differentiation of L advantages. Taking a systems view has allowed us to emphasise the importance of institutions, and flesh out the concept of *collocation L advantages*, which play an important role at the industry and firm levels of analysis. Just because a country possesses certain L advantages when viewed at a macro-level, does not imply that these are available to all industries or all firms in that country without differential cost. When these are linked to the distinction between location-bound and non location-bound O advantages, and when we distinguish between the portfolio of assets available by MNEs and its individual subsidiaries and establishments, it allows for a clearer understanding of the challenges the modern MNE faces in managing its spatially distributed activities.

These have been discussed in the context of R&D, which – in addition to the usual uncertainties faced by firms – must deal with the uncertainties associated with innovation. These have to do with the nature of knowledge, and how these inherent characteristics determine effective knowledge flows within the MNE, as well as with other actors that make up the host location. Although prior literature has sometimes framed the centralisation/decentralisation, spatial separation/collocation debates as a paradox facing firms, we feel that when viewed within the context of the cognitive limits to resources, the complexities of institutions, and the glacial pace of the evolving specialisation of locations, these are in actuality trade-offs firms must make.

It has not been our intention to provide a complete synopsis of the literature in this area, nor is it possible to raise all aspects of the conceptual and empirical lacunae that arise, but we shall offer a few suggestions.

First, neither the IB nor the innovation studies literature has as yet come to terms with the growing use of non-equity modes in cooperative R&D, and the role of location. Social network theory remains on the fringes of this research, and relatively little effort has been made to marry the seeming contradictions between the global nature of R&D cooperation and the stickiness of locations (Narula and Santangelo 2009). The overlapping of complex supply chains, production networks and MNEs within and across locations presents a tapestry of establishments that is not as yet fully understood. Where are the boundaries of the firm where non-equity suggests legal separation and separate ownership, but where control suggests a de facto single organisation?

This raises an interesting second line of future enquiry. This fuzziness of boundaries of the firm has implications for the fuzziness of boundaries of countries. Policy makers have fewer tools at their disposal in building up the competitive advantage of individual nations where MNEs operate with alacrity across borders. Regulation, industrial policy and investment promotion no longer function as effectively (Narula 2003, Narula and Dunning 2010).

Third, the study of motives for MNE activity – while useful in providing texture to the discussion – is poorly understood conceptually, and the broad motivational arguments from Dunning (1993) are in need of revision. To cite a simple example, asset-exploiting and asset-augmenting activity are rarely done exclusively, and this is increasingly so.

Fourth, the last two decades has seen a vigorous discussion of the benefits of clustering. How does spatial separation matter to firms in other aspects of the value chain? Does the propensity to collocate vary by size of firm, and industry? Under what circumstances is collocation more important, and when does spatial separation represent a superior option?

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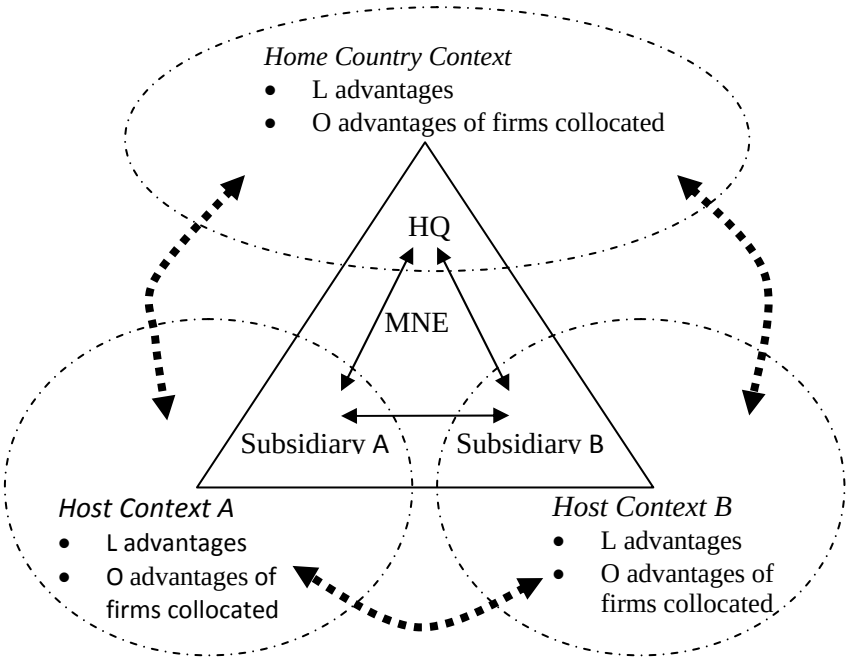
Table 1 A classification of L advantages

	TYPE OF L ADVANTAGES	SOURCES OF L ADVANTAGES	EXAMPLE OF L ADVANTAGES
Macro-region/country level L advantages	**Exogenous L advantages**	These derive from natural assets (independent of development stage)	Sociological/anthropological - Culture, norms, religion, political stability. - Land availability, rainfall, climate, extractive resources, basic population - Proximity and accessibility to other markets
Macro-region/country level L advantages	**Fundamental L advantages**	Basic infrastructure	- Primary schools - Health care - Transport (roads, railways) - Utilities (electricity, water) - Telecoms - Ports - Efficient bureaucracy - Public transport
Macro-region/country level L advantages	**Fundamental L advantages**	Legal infrastructure	- Legal system - Security and police - Tariff system - Property rights - Tax and excise
Macro-region/country level L advantages	**Fundamental L advantages**	Regulation and policy	- Incentives - Subsidies - Tax holidays - Regulatory agencies - Industrial policy - Competition policy - Capacity to enforce regulation
Macro-region/country level L advantages	**Fundamental L advantages**	Financial infrastructure	- Banking, insurance, stock exchange
Macro-region/country level L advantages	**Knowledge asset L-advantages**	Knowledge infrastructure	- Tertiary education, universities - Public research institutes
Industry-level L advantages	**Structural L advantages**	Market and demand structure	- Income distribution - Size of potential market - Wage rates - Skilled employee mobility/scarcity
Firm-associated L advantages	**Collocation L advantages**	L advantages that derive from the presence of other actors in the same location	- Agglomeration economies - Networks of suppliers - Networks of customers - Level of intra-industry competition - Concentration ratio - Market size and potential - Presence of support industries (inter-industry)
Firm-associated L advantages		Industrial policy	- Specific policies associated with given industry
Firm-associated L advantages		L advantages that derive from location-bound O advantages of other actors	- Presence of significant customer - Presence of significant supplier

Figure 1 Multinational Enterprises and Local Context



Source: Meyer et al (2011)

Figure 2a: a value chain where R&D is subordinate to the primary value adding function

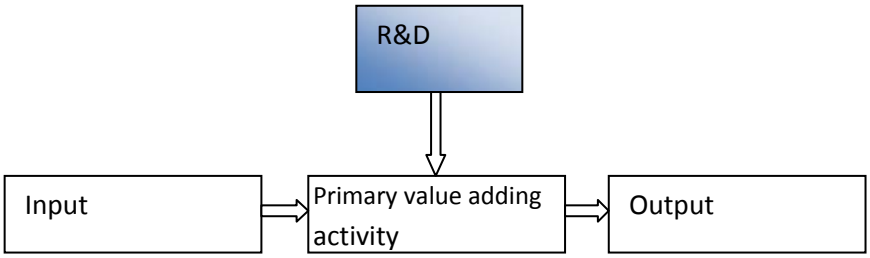
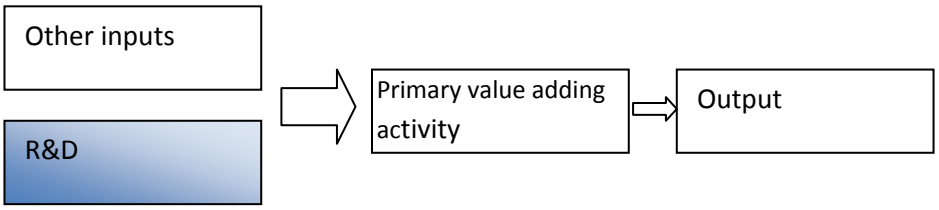


Figure 2b: a value chain where R&D is central to the primary value adding function



[i] In this chapter we intentionally exclude the free-standing international company.

[ii] The use of the term 'advantage' is also troublesome, and reflects the path dependency of the eclectic paradigm and its provenance as an extension of trade theory (Dunning 1977). It implies – in the same sense as comparative and absolute advantage – the relative strength or weakness of economic activity within a specific industry within a specific location (rather than between or relative to other locations). The term advantage also implies a subjective assessment, and as such we think it preferable to use the term 'characteristics'. In this chapter we shall use location advantage and locational characteristics as synonyms.

[iii] Although the concept of cluster *à la* Porter takes a broadly similar view (Porter 1980; Porter 1986, 1990), it has been criticised for being too general. The concept of clusters in innovation has been fleshed out by Iammarino and McCann (2006) classify three types of clusters depending on the nature of innovation processes and structural conditions under which technical change occurs across space.

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