Track 9: Headquarters-Subsidiary Relations,

Knowledge Transfer and Inter-Firm Spillovers

Competitive

The role of local partner heterogeneity in MNE subsidiaries' knowledge creation and protection: the case of Galway medical technology cluster

ABSTRACT

MNE subsidiaries commonly face trade-offs between the willingness to source knowledge that is embedded in the host location and the need to protect their own knowledge-based assets from external appropriation. These objectives are often contrasting because the local interaction that is required to gain access to the local knowledge endowment also acts as a channel for subsidiary knowledge leakage. We explore how subsidiaries orchestrate their local linkages with vertical and non-vertical partners to the aim of managing knowledge sourcing and knowledge protection. Our results show that subsidiaries that are assigned different mandates by the headquarters are likely to establish heterogeneous patterns of interaction with different agents in the host location' as their perception regarding the role these agents may play in their knowledge management varies. In presence of fierce competition, when higher spillover risks should drive to refrain from local interaction, competence-creating subsidiaries shy away from competitors, but simultaneously pursue their knowledge creation objectives by linking to agents that minimize spillover risks while still offering learning opportunities, such as universities. This leads us to conclude that spillover risks, by themselves, do not automatically drive the choice to avoid interaction, as subsidiaries are able to differentiate between various types of partners.

The role of local partner heterogeneity in MNE subsidiaries' knowledge creation and protection: the case of Galway medical technology cluster

INTRODUCTION

The complex management of knowledge-based activities in foreign locations has recently gained renewed attention in International Business literature (Hallin & Hollmstrom Lind, 2012; Perri et al., 2013; Perri & Andersson, 2014). Scholars have highlighted that MNE subsidiaries are likely to face a trade-off between the willingness to source knowledge that is embedded in the host location and the need to protect their own knowledge-based assets from external appropriation. These objectives are often contrasting because the local interaction that is required to gain access to the local knowledge endowment also acts as a channel for subsidiary knowledge leakage (Arikan, 2009). In other words, because knowledge tends to flow more easily through proximate and interactive channels, local linkages are critical conduits to manage, if knowledge inflows and outflows have to be kept under control.

Empirical research has demonstrated that subsidiaries actively seek to manage this trade-off, for instance by adjusting the extent of resources invested in local linkages to competitive conditions in the environment (Perri et al., 2013). Subsidiary heterogeneity also matters in this realm. In fact, more knowlegeable subsidiaries tend to deploy a greater degree of control over their assets, given the relatively higher competitive loss they would suffer in case of spillover (Perri et al. 2013; Perri & Andersson, 2014).

While this research stream has contributed to highlight that, besides parent companies, also subsidiaries may actively engage in the complex management of MNC knowledge sourcing and protection, the analysis of local partners has mainly been confined to subsidiaries' customers and suppliers. This approach overlooks non value chain partners, thus

neglecting that they may also contribute to determine the outcomes of subsidiaries' knowledge-based activities in host-locations. Accounting for the role of non value chain partners is particularly relevant when the nature of the industry in which MNEs operate lessens the importance of local customers and suppliers, as it happens when the subsidiary's most strategic value-chain partners are global – rather than local - organizations, or when its vertical relationships mainly occur within the MNE boundaries, involving other firm units at different stages of the value chain.

In this paper, we aim to fill this gap by exploring how subsidiaries orchestrate their local linkages with both vertical and non-vertical partners to the aim of managing the knowledge imperatives to which they are exposed, namely knowledge sourcing and knowledge protection. In doing so, we deepen the role of subsidiary heterogeneity by exploring the difference between competence-creating and competence-exploiting subsidiaries. Our results show that subsidiaries that are assigned different mandates by the headquarters are likely to establish heterogeneous patterns of interaction with different agents in the host location, as their perception regarding the role these agents may play in their knowledge management varies. More specifically, in presence of fierce competition, when higher spillover risks should drive to refrain from local interaction, competence-creating subsidiaries do shy away from competitors, but simultaneously pursue their knowledge creation objectives by linking to agents that minimize spillover risks while still offering learning opportunities, such as universities and research institutes. This leads us to conclude that spillover risks, by themselves, do not automatically drive the choice to avoid interaction, as subsidiaries are able to differentiate between various types of partners. Furthermore, an in-depth analysis reveals a more complex picture of the relationships between subsidiaries and competitors. Competence-creating subsidiaries avoid collaborating with competitors on technological domains that are closely related to the MNE's traditional strenghts, while being

more open to interaction on unrelated innovative activities. Similarly, subsidiaries refrain from collaborating with competitors with regard to business matters, but they simultaneously recognize the importance of interacting on indirect business issues on which they have converging objectives. In other words, competence-creating subsidiaries' interaction with competitors is confined to the pursuit of common goals that either do not involve knowledge sharing or refer to technological domains that are not well developed yet, thus falling outside their current areas of direct rivalry.

Our study offers both theoretical and empirical contributions. First, we add to the literature on the strategic management of subsidiary local linkages (Hallin and Hollmstrom Lind, 2012; Santangelo, 2012; Perri et al., 2013) by widening our lens beyond vertical relationships to cover a wider array of local linkages including non value chain partners, such as universities and competitors. This approach allows to gain a more comprehensive assessment of how MNE subsidiaries manage their linkage portfolio in the host-location. More specifically, it points to subsidiary managers' capability to detect opportunities and threats that emerge from heterogenous local partners, even when these operate outside the boundaries of the value chain in which they are involved, thus confirming the increasingly active role subsidiaries play in the local management of MNE knowledge (Perri and Andersson, 2014). Second, our findings contribute to the debate on MNEs' approach to foreign knowledge-based clusters, which is currently animated by two contrasting views. The strategic deterrence thesis emphasizes spillover risks arising from the contact with the host-location, and suggests that MNEs that are endowed with a technological leadership avoid co-locating in foreign clusters where they could be affected by adverse selection problems in the form of local knowledge leakage (Shaver and Flyer, 2000; Alcacer, 2006; Alcacer and Chung, 2007). Conversely, the physical attraction logic focuses mainly on knowledge sourcing opportunities, and proposes that leading MNEs are attracted into areas of high

industrial concentration because their dominant position eases the acquisitions of an insider status, thus enabling extensive local interaction and facilitated access to knowledge inflows (Cantwell and Mudambi, 2011). Clearly, the two approaches depict entirely different situations: a total interaction avoidance at one extreme (strategic deterrence view), and a deep and wide-ranging embeddedness at the other extreme (physical attraction view). Our results seem to reconcile these opposing logics by showing that intermediate solutions are possibile, as competence-creating subsidiaries are able to adapt their interaction behavior to account for the heterogeneity of local partners, as well as for the subject of the potential interaction. Finally, we offer an contribution in that we analyse the issue of the simultaneous management of knowledge creation and knowledge protection objectives by adopting a multi-case collective study methodology. While previous literature has used synthetic data such as patents in order to infer subsidiaries knowledge strategies, we answer to the extensive call for the use of qualitative data that enables the exploration of this issue in a more detailed and informative way (Perri and Peruffo, 2015). This data allows to elicit the perceptions of subsidiary managers (Davis and Meyer, 2004), thus offering a closer look into the factors that enter subsidiary-level strategic decision making.

LITERATURE REVIEW

Establishing a subsidiary abroad encompasses both opportunities and risks. From a knowledge-base perspective, opportunities arise from the potential access to a pool of resources and expertise rooted in the locality and that are usually new to the firm. However, the mere presence in the host-location does not secure the exploitation of such knowledge sourcing opportunities. As suggested by the so-called *physical attraction* perspective (Cantwell and Mudambi, 2011), to realize such opportunities, subsidiaries need to interact with the local business network, as this allows to develop the trust that facilitates the

exchange of information and resources. This is not an easy task, because at least in the very first stages of their foreign investment, MNEs are plagued by an "outsider" status, which prevents the access to local knowledge inflows.

For this reason, subsidiaries seek to develop ties with local actors, with the aim of becoming part of a network where knowledge circulates more easily. Yet, the way network ties work implies that resources flow bi-directionally within them. As a consequence, while subsidiaries develop channels for accessing local resources in order to reinforce their knowledge endowment, they simultaneously expose their proprietary knowledge to the risk of external leakage, as emphasized by the *strategic deterrence* logic (Shaver and Flyer, 2000; Alcacer and Chung, 2007).

Both the strategic deterrence view and the physical attraction perspective have recently prompted the discussion on how MNEs relate to foreign knowledge-based clusters, pointing to two very different scenarios. The strategic deterrence logic suggests that leading MNEs tend to avoid co-locating in areas with a high concentration of industrial activity: given their superior technological assets, they have more to lose than to gain from local knowledge networks (Shaver and Flyer, 2000; Alcacer and Chung, 2007). The physical attraction view proposes that dominant MNEs may gain a privileged positions in knowledge-based clusters: their technological leadership enables them to overcome the "closure" of the local innovation system, thus granting them the opportunity to establish wide-ranging connections with local partners and to access to relevant knowledge inflows (Cantwell and Mudambi, 2011).

This vivid debate confirms that managing spillover risks and knowledge access opportunities in the host-location is a very complex task, and a primary objective for contemporary MNEs. While previous literature attributed this responsibility mainly to headquarters (Chung & Alcacer, 2002; Alcacer & Chung, 2007), more recent studies

demonstrated that subsidiaries play a critical role in finding a balance between knowledge access and knowledge protection imperatives (Perri et al. 2013; Perri and Andersson, 2014). In fact, since local interaction is a crucial channel through which both knowledge access and knowledge leakage occur, it is exactly through the careful management of local linkages that subsidiaries may actively contribute to the objective of ensuring control over local knowledge inflows and outflows.

In this regard, previous literature has demonstrated that subsidiaries increase their investment in vertical linkages to respond to increasing levels of competition, in order to gain access to knowledge that is useful for adapting to the foreign business environment. However, when competition becomes too sharp, the fear of losing control over their proprietary assets leads subsidiaries to lower their commitment to the linkages with vertical partners (Perri et al., 2013). This confirms that, when embedding in domestic networks, foreign firms account for both incoming spillovers from the host environment and outgoing spillover of their private knowledge that could be assimilated by competitors (Alcacer, 2006; Alcacer and Chung, 2007).

A critical finding that this literature has documented is that the management of local linkages is also affected by the subsidiary heterogeneity, as different subsidiaries may have different incentives to establish linkages with local partners. Santangelo (2012) suggests that there exists an information sharing tension between the ‘pressure to innovate’ and ‘unintended private knowledge spillover’. This tension between the countervailing forces of competition and embeddedness can be mediated if the subsidiary has a competence-creating (CC) entry motive to avail of the local supply side’s innovation potential despite the threat of knowledge spillover to competitors. This is the case when the expected payoffs of embeddedness exceed those of isolation. Similarly, Perri et al. (2013) demonstrate that subsidiary capabilities influence the extent of commitment to local linkages, such that more

competent subsidiaries tend to protect their knowledge more extensively in the presence of higher spillover risks.

Hallin and Holmstrom Lind (2012) distinguish between unintentional spillovers with horizontal competitors and intentional spillovers with vertical suppliers and customers. In a highly competitive local environment a limited amount of knowledge can be intentionally shared with suppliers and customers. The existence of any cooperative relationship in embedded networks among locally proximate firms can result in knowledge spillover to competitors even if unintentional and injurious to the disseminator. While this study extends the analysis of local linkages partners to competitors, most of existing literature has focused on vertical counterparts. Yet, these are not the only agents that can assist or endanger a subsidiary's knowledge in the host location. To gain a more comprehensive understanding of how subsidiaries orchestrate the whole set of local linkages to manage their knowledge objectives, greater attention should be paid to other types of potential partners that may encompass different degrees of learning opportunities and spillover risks. For instance, scholars have already pointed to the importance of the host-locations' scientific infrastructure for technology-oriented FDI (Grandstrand, 1999), thus suggesting the critical role that local universities and research centers may play as potential collaborating actors.

In addition, it should be noted that in some industries local value chain partners might not be so critical to the subsidiary business eco-system. This may happen, for instance, when the subsidiary's most strategic suppliers and customers are global – rather than local - organizations, or when its vertical relationships mainly occur inside the MNE boundaries, involving other sister units at different stages of the value chain. In these contexts, the most relevant local connections MNE subsidiaries develop are likely to involve non value chain partners, which may entail varying degrees of spillover risks and knowledge access

opportunities that need to be carefully managed to optimize subsidiaries' knowledge objectives.

Hence, the foregoing discussion suggests that the strategic orchestration of local linkages can be fully understood only if both local partners' heterogeneity and subsidiaries' heterogeneity are accounted for.

METHODOLOGY

Research design

There has been a historic bias towards quantitative research in assessing knowledge sourcing and receiving by subsidiaries (Michailova and Mustaffa, 2012) and in particular the use of patent data to indicate knowledge creation (Almeida and Phene, 2004; Phene and Almeida, 2008). The deployment of qualitative methods and protocols can potentially produce rich interpretations of knowledge flows and the processes involved (Michailova and Mustaffa, 2012). Our objective was to use the explanatory case study approach to contribute to theory building (Eisenhardt, 1989; Yin, 1989; 1994). This research is exploratory and adheres to well-established practice in design of case studies (Yin, 1990; Eisenhardt, 1989). The approach is one of theory building and is inductive in nature, rather than seeking generalisability through representativeness.

Study setting

Context is critical to valid qualitative studies (Welch et al., 2011). Michailova and Mustaffa (2012) advocate the careful selection of idiosyncratic settings in which knowledge flows from and to subsidiaries take place in order to more accurately explicate factors involved in innovation. Some factors can be more important in one setting than in others.

Ireland is one of the most FDI dependent economies in the world (Giblin and Ryan, 2012). The medical devices sector (now commonly termed medical technology) employs approximately 25,000 people in foreign-owned companies (IDA, 2014; Forfas, 2014). Activity in the medical technology sector is concentrated quite heavily in the West of Ireland with Galway city as the economic centre (Giblin and Ryan, 2012; IMDA, 2014). The origins of the Galway medical technology cluster lie in the attraction of pioneer foreign MNEs to an unexplored region of Europe, by offering regional grant incentives, a low corporation tax rate and a young, educated and English-speaking workforce. Inward investor firms into Galway are predominantly involved in the production of drug-eluting stents (DES) in the area of cardiology. While they have expanded into other areas in more recent years, such as related-technology endovascular activity, their primary focus in the region has been the production of products in a single element of the wider MNE corporation's portfolio, that is, cardiovascular devices. They supply an international market place; delivering such medical devices to clinicians internationally through their respective corporations' distribution chains worldwide. Ireland's small economy means that there are limited local customers or users (e.g. clinicians) which these MNEs supply or with whom they can cooperate for product development. When they originally established in the region, pioneer subsidiaries were mainly involved in low-value added manufacturing and assembly line operations.

The local university, National University of Ireland, Galway (NUIG), responded positively to the arrival of foreign firms into its local environment. The university began to engage in specialist teaching and research activities as a consequence of the presence and growth of MNE subsidiaries in the region, as well as technological developments taking place internationally. The university has established four teaching and training programmes specific to the sector since the late 1990s and, more significantly, has established three prominent research centres all of which are set up and operate around academic-industry

partnerships. The National Centre for Biomedical Engineering Science (NCBES) was established to conduct research on the related branch area of medical devices. Subsequently, the Regenerative Medicine Institute (REMEDI) was established and its advent expanded the local network's knowledge base into both related cardiovascular areas and unrelated branch activities of stem cell biology and manufacturing, gene therapy, orthobiologies and immunology (REMEDI, 2014). The most recent research commitment by the university is the establishment of the research centre, CURAM in 2014, which aims to research and develop implantable 'smart' medical devices and both MNE subsidiaries are involved as partners.

NUIG now not only supplies graduates specialised in biomedical engineering but also has significantly research activity across diverse areas within medical technology including directly related technology areas of cardiovascular devices, related variety in minimally-invasive areas of surgical activity such as endoscopy and gastroscopy and unrelated variety technology areas of activity such as immunology, gene therapy, orthobiologies, stem cell biology and medical software technology. Such activity serves to both deepen and broaden the local knowledge base around medical technology in the region.

We created a database of all companies in the Galway medical technology cluster from the first inward greenfield investment in 1973 which we constantly updated. We used non-probability sampling in selecting the study cases. The four subsidiaries in this study are all involved in the production and development of the DES for minimally-invasive coronary surgical procedures and are designated 'centres of excellence' within their respective MNEs. The development of subsidiaries' activities from low value added manufacturing and assembly activity to engaging in R&D makes them ideal cases for exploring how partners for innovation were selected and which kinds of interactions with network members are most appropriate for MNEs to engage in knowledge creation and protection. We purposively selected exemplar cases of two competence-creating and two

competence-exploiting subsidiaries. Support for our competence-creating and competence-exploiting separation is evidenced in recent HQ investments in case subsidiaries. CORONA announced a 91 million euro investment in R&D for the Galway facility in 2009 to allow for early stage innovative activity to take place in a designated CoE for Cardiovascular and Cardiac Rhythm Diseases treatments. In 2013, CARDIO opened a 7.7 million euro Customer Innovation Centre in Galway that brings together physicians and engineers to develop innovative therapies. Both were elevated to global innovator roles within their respective MNEs. On the other hand, DIAGNO and VASCA were designated CoEs for world class manufacturing, production and operations as part of an integrated internal MNE network.

Data collection

Access was negotiated through the industry association, the Irish Medical Devices Association (IMDA). This study takes the perspective of the subsidiary manager involved in knowledge creation (Davis and Meyer, 2004). These managers possess critical first-hand knowledge of *phenomena* under investigation). Data collection in each case was primarily through semi-structured interviews and was supplemented by extensive documentary analysis. Such documentary analysis focused on corporate websites, newspaper reports, industry websites and magazines and internal company documentation provided by interviewees (such as corporate policies, magazines, annual reports etc).

Interviewees included a cross section of key informants within each subsidiary (See Table 1). Interviews lasted in the region of ninety minutes, were tape recorded and transcribed.

INSERT TABLE 1 HERE

Data analysis

The qualitative data analysis software package NVivo was used to organise the data. Data organisation consisted of coding sections of the transcriptions according to the main discussion topic and within these sections sub-sections were further coded accordingly. A master document with the coded sections and sub-sections was then produced for each MNE case study. By choosing cases within the same technology cluster it was possible to conduct cross-case analysis and pattern-searching. Within-case analysis and cross-case analyses were thus conducted for, and across all subsidiaries. This entailed defining the similarities and differences between the cases and identifying emerging patterns and deviating occurrences. We also employed narrative analysis (Miles and Huberman, 1994) and chose apt quotes to illustrate critical discoveries and particularly apposite evidence. Successive iterations between theory and data structured the analysis into relevant categories of relationships. As per good case study research protocol (Yin, 1989) the collected interview data was triangulated and cross-referenced with secondary sources such as company documentation, corporate websites and media reports of critical events in the technology cluster. This enhanced validity of the findings (Eisenhardt, 1989; Yin 1989). The next section presents the main findings from these interviews and illustrative interviewee quotations are used as evidence throughout the narrative.

FINDINGS

In order to gain deeper insight into the set of interactions for knowledge creation and protection between the MNE subsidiary and local actors within the local network we segment relationships into horizontal and vertical as advocated by Michailova and Mustaffa, (2012).

Horizontal Relations with Academia and Competitors

The most attractive partner for innovation for the study subsidiaries in the host network is overwhelmingly the local university, NUIG. NUIG became very active in diverse research areas within the medical technology field (see Table 1). The two anchor subsidiaries were particularly positive about their collaborations with the local university. Both CARDIO and CORONA saw the university as a critical competence base for resources and knowledge within the region:

> *"You can get a lot of knowledge from the local academics here…. they really have a lot we can and do learn from"*. (Senior R&D Engineer, CARDIO)
>
> *"….we can see how university-led R&D can really help and complement our site's efforts"*. (R&D Manager, CORONA)
>
> *"Using the unique knowledge we gain from the university in combination with our own expertise is critical in creating our distinctive worth as a site. The research carried out at NUIG is what we need to stay ahead, and our own unique insight into the more commercial side of the business complements the university's efforts. We have had many innovations as a result of this. The result of this is…we have created an MNC dependence on our locally- generated knowledge. Hence, we are seen as indispensable when it comes to the execution of certain critical corporate R&D projects"*. (R&D Director, CARDIO)

In terms of the type and quality of relations both subsidiaries developed strategic partnerships with the local university. This suggests that while subsidiaries clearly detected the knowledge access opportunities embedded in such local partner, they were overall not concerned about spillover risks, given that the type of partner involved could not initiate competitive relationships with them (Alcacer and Chung, 2007). Their connections evolved in terms of commitment and mutual understanding. This was manifest in joint problem-solving on technical difficulties in the early stages of the relationship. Over time, and not without communication complexities, this morphed into combined efforts that lead to the development of commercialisable innovation.

The positive attitude to the role played by the local university in knowledge creation within the cluster was not unequivocal. The two competence-exploiting subsidiaries were less effusive about their experiences with the local university. DIAGNO and VASCA have simple problem-solving relationships with the university. For these two study firms, the university is there merely to be used on an ad-hoc, needs-only basis:

> *"In a lot of ways, our relationship with them was from a service point of view. I'm not sure if we ever leveraged their expertise in a certain area, I don't think we did, because if we did I would know about it. It really was for once-off minor stuff"*
>
> (Managing Director, VASCA).

> *"Any time we have used them there has always been a specific practical reason for doing so. It would never be for innovative (NPD) reasons, or for pure basic research needs. So they are basically a problem solver rather than a source of innovation or inspiration for us. We'd never ask them to come up with new ideas for us".*
>
> (R&D engineer, DIAGNO)

The differences between the linkages that competence-creating and competence-exploiting subsidiaries have established with the local university is consistent with previous literature that has emphasized the critical role of subsidary heterogeneity in the development of vertical linkages (Perri et al. 2013). Competence-exploiting subsidaries can be thought to be less sensitive to the high-quality and sophisticated scientific knowledge that universities can offer, for at least two reasons. First, they might not be endowed with sufficient absorptive capacity to detect the usefulness of such knowledge, integrate it within the subsidiary technology base and make a productive use of it (Frost, 2001). Second, because their tasks are confined to the exploitation of technology developed elsewhere, they are less interested in advanced scientific knowledge that is unlikely to be useful for their short-term objectives (Kuemmerle, 1999).

Based on these data, we can posit that:

Proposition 1: In a highly competitive knowledge-based cluster, competence-creating subsidiaries are more likely to develop quality linkages with local universities than competence-exploiting subsidiaries.

Moving to the horizontal relations with competitors, there was no evidence of direct, formal collaboration on knowledge creation between the study firms in this local network. This was unsurprising given the fact that the case firms are rivalrous competitors in the same product category and technological space internationally. They were therefore unwilling to cooperate on new product development (NPD) due to the threat of unintentional knowledge spillover, or even worse, intellectual property theft. Zero, even negative trust was in evidence verging on a communal state of mutual suspicion, mistrust and even paranoia. One respondent when queried about the extent of collaboration on R&D with adjacent competitors in the Galway technology network bluntly asserts:

> "*Collaborate with them? You must be joking. We're making extremely competitive products. This is such a litigious industry. No!"* (Senior R&D Manager, CORONA).

The defining principle for the foreign competitors within the local network is 'zero tolerance' of knowledge spillover to direct rivals.

> *"The local industry is as dynamic as anywhere in the world, but is so competitive and litigious that it is inconceivable to think that we would collaborate with our local competitors. Intellectual capital is extremely precious to all companies in this industry in Galway and to jeopardize that would do untold damage to our competitiveness here and to our strategic standing within the MNC. So really, every effort is made to control any such instance"*. (R&D Manager, CARDIO)

> *"We would never dream of calling them up if we had a specific problem with our work or products or technologies; nor would they. The boundaries are quite clear in that sense"*. (R&D Manager, CORONA)

> *"We are not required to collaborate with [competitors] locally. HQ does this with [competitors] in the U.S., but it would actually be discouraged at a subsidiary level to be collaborating with another medical technology 'competitor' based locally"*. (R&D director, DIAGNO)

However, there was a clear realisation amongst the local network competitors that collective action had merits. The very presence of local competition was found to attract more expertise and government funding, useful for subsidiaries to be innovative. Direct competitors collaborate by collectively lobbying government for medical technology-related investment and the encouragement of establishing competence centres relevant to the industry.

> *"Collaborating on certain issues and activities works greatly in our favour. All of us [local competitors] know we have to push the boat out together if we are to reap more industry benefits from government and other bodies. So in a very ironic way we actually work good as a team, if you could call it that".* (R&D Manager, CARDIO).

There is nonetheless an appreciation amongst competitors in the local network that there are definite limits to collective action amongst intensely rivalrous competitors and that cooperation only goes so far.

> *"We work well with competitors when it comes to lobbying for certain things at a higher level, when we need the collective voice. On the other hand, even though a lot of us here know a lot of guys, or have worked in the past with guys up in CORONA, or VASCA, or wherever else, we would never dream of calling them up if we had a problem with something specific in relation to our work or products or technologies. Nor would they. The boundaries are quite clear in that sense"*
>
> (Senior R&D Manager, CARDIO)

> *"It's pretty healthy that we come together, there are enough common issues that we can work on together to improve it for everybody, like a rising tide raising all the boats. We would never, ever discuss products and technologies or anything competitive. However, if it comes to the supply of graduates to the industry.... to government support for R&D....putting money into Life Sciences, all of these things are good for everybody (in the cluster).... There's a lot of personal contacts, a good bit of networking and we all meet"*
>
> (Director of Product & Technology Development, CARDIO).

> *"Even though we are in competition there is a sense that we need to get certain things right so it's not self-destructive competition"* (R&D Manager, VASCA).

The foregoing discussion suggests that while subsidiaries are reluctant to interact with competitors on aspects that could generate detrimental knowledge outflows, they do not

refrain from collaborating with them when competitive knowledge is not involved. Moreover, in this case there not seem to exist dramatic differences between competence-creating and competence-exploiting subsidiaries. Both types of subsidiaries are able to separate those levels of activity in which interaction may be dangerous from those where cooperation is desirable as it can generate diffuse benefits. In other words, there seem to be intermediate solutions between the two opposite extremes of complete interaction avoidance and full-ranging cooperation.

Looking at this phenomenon from a different yet consistent theoretical perspective, it is possible to detect a logic of coopetition among competing subsidiaries in the cluster (Luo, 2007). Subsidiaries avoid interacting with peers when direct business matters are concerned for fear of deteriorating their own competitive position, but simultaneously recognize the importance of joining their efforts to reach mutually beneficial objectives, especially when dealing with outside stakeholders.

Overall, these data suggests that:

Proposition 2: In a highly competitive knowledge-based cluster, both competence-creating and competence-exploting subsidiaries refrain from interacting with competitors on direct business matters, but are likely to develop connections on indirect business matters.

Coopetition is also likely to be driven by the awareness of the fact that, within a cluster, some knowledge is always going to spill over. While it is critical to take serious actions to secure their own proprietary assets, an excessive emphasis on knowledge protection would nullify subsidiaries' establishment in a cluster. Absolute security of IP is beyond the scope of the network competitor firms no matter how high it builds dams to knowledge leakage. It is not feasible to impose restrictions on the mobility of knowledge workers between firms within the network. Despite the MNEs best efforts to preclude knowledge loss some leakage occurs, principally due to employee mobility within the cluster.

> *"Protection of IP limits the potential for capturing knowledge or ideas from our neighbouring competitors here. However, preventing IP leakage is always going to be imperfect, despite our efforts. We are located too close for nothing to be spilt out. As well as that, the fact that the industry"s pool of skilled expertise have moved around from company to company over the years is one way to definitely indirectly learn from each other"*
>
> (Managing Director, DIAGNO).

Nor is it necessarily desirable or feasible to expect perfect insulation of proprietary knowledge. Employee mobility cannot be officially regulated and some seepage will inevitably occur. But seldom does one person have complete knowledge and the process evolves and is dynamic rather that being static knowledge.

> *"Collaborations with these local guys (Galway Hospital Clinicians) aren't enough. We are not keeping our finger on the pulse by doing that. The Irish market is too small relative to our global market"*
>
> (R&D Manager, DIAGNO)

There was however an interesting difference in the relationships and extent of cooperation between the two competence-creating subsidiaries in the study. CARDIO engaged in joint efforts on related technology branch development in coronary stent development whereas CORONA went further into both related and unrelated technological domains, for instance stem cell research.

While subsidiaries were unwilling to establish linkages with competitors on direct business matters regardless of their competence-creating vs. competence-exploiting role, a critical pattern involving only creative subsidiaries emerged regarding linkages with competitors that also included another type of local actor, namely the university. In fact, on technological domains that were related to the current areas of direct rivalry, the two competence-creating subsidiaries assiduously avoided interaction and never joined the same research programme at the local university. However, on unrelated areas such as 'smart implantable devices', the two competence-creating subsidiaries were willing to join the same

research consortium to broaden knowledge created in the local network.

As already highlighted in the discussion leading to *Proposition 2*, this suggests that the choices of competence-creating subsidiaries in terms of local linkages development are not only driven by considerations regarding the type of partner. These choices also seem to depend on the subject of the linkage, and specifically on the areas of knowledge that are potentially involved, as this critically affects the comparison between knowledge access opportunities and spillover risks. In our data, competence-creating subsidiaries did not demonstrate an absolute aversion to *any* type of linkage that could involve competitors in addition to the local university. Rather, they actively selected the linkages in which to engage based on the subject that had to be developed within the linkage and, accordingly, on the careful evaluation of the potential knowledge opportunities and threats associated with it. In particular, they refrained from connections that could entail knowledge sharing in technological areas in which they were currently competing, but decided to participate to linkages whose objective was the development of technological domains that are unrelated from their actual fields of direct rivalry. Clearly, the first type of linkage encompasses a higher potential cost in terms of spillovers compared to the benefits of knowledge sourcing: it refers to areas of knowledge in which both subsidiaries already possess technological capabilities that they are willing to preserve as they could be the source of performance differentials. Conversely, the second type of linkages is characterized by a higher potential gain from knowledge sourcing compared to the spillover risks, as the cooperation is limited to a field of knowledge on which subsidiaries do not directly compete yet. It represents an option for future technology development, but it cannot hurt subsidiaries' current relative competitive position. Again, the dynamics between subsidiaries in the cluster are consistent with the predictions of the coopetition paradigm, as subsidiaries compete on specific technologies that drive their current relative competitive position, but simultaneously realize

the importance of collaborating on areas of technological innovation that are in extremely embrional stages. This leads them to share the risks and the costs associated with a common but uncertain investment process (Luo, 2007), such as the development of new technological trajectories that could sustain subsidiaries' long-term survival by granting them strategic importance within the respective MNE networks.

Overall, this suggests that:

Proposition 3: In a highly competitive knowledge-based cluster, competence-creating subsidiaries are more likely to develop linkages with competitors on technological domains that are unrelated to areas of direct rivalry.

Vertical Relationships with Customers and Suppliers

Since manufacture was overwhelmingly for export to a global marketplace, vertical relationships with customers within the local network, for knowledge creation were, for the most part, negligible. Customers, in this context, would be clinicians as the users of the medical device who are often the source and drivers of innovation in this field. It is through interactions with these users that companies learn about the problems or inefficiencies of current devices, what improvements could be made, what new devices should be developed and how well new-to-market devices are being received. Accessing the leading clinicians internationally in a particular area, for example, cardiology is important for a company because the opinions of and feedback from these clinicians hold significant weight within the sector. This is generally achieved by all companies through international congresses, conferences or direct contact with international hospitals, particularly in the US and Japan. Internationally, there tends to be strong linkages between the clinical community and the universities, whereby the latter can offer a link to the clinician for a company. Therefore, accessing clinicians internationally is important and this is demonstrated in the following

quotations from interviewees in the MNE subsidiaries:

> *"We do have good contacts with one or two Irish cardiologists but, you know, in terms of a global market the Irish market isn't at all significant and Ireland is…..you know we use them because we are close to them and they are friendly and because of lots of reasons like that but….there is not the research-type cardiologist in our hospitals….In a lot of European or US hospitals there are full-time funded research fellows, who are cardiologists, who are not treating patients, who are doing research and they are the sort of people that tend to have the new ideas".*
>
> (Senior R&D Manager, CARDIO)

As far as suppliers are concerned, the majority of local suppliers were simple raw material, assembly or packaging service providers since most beyond basic components were sourced from sister subsidiaries in the internal MNE network and global value chain. Therefore, often the highly specialised materials and components are sourced from abroad and more lower-value added activities are accessed locally. Relations with these lower value-added suppliers locally are arms' length with contract-based trust as a minimum in evidence and competence-based trust as a maximum. At the same time, however, some learning and transfer of knowledge from the MNE subsidiary to the local supplier takes place as the latter learns about the products of the subsidiary and becomes more familiar with the sector, particularly the regulatory environment and gaining an understanding of international standards required in the supply of materials and services.

> *"…because this business is built on I.P., we are very selective about what we want to expose externally"* (Managing Director, CARDIO).

> *"We do not see our suppliers as being in a position to help us with anything on the R&D front, so no we would not really see them as a source of innovation"*
> (R&D Engineer, DIAGNO).

There was a joint R&D effort by one MNE subsidiary, CARDIO, with one local supplier for new product innovation. It proved highly successful and that supplier became globally competitive and evolved into a 'homegrown' MNE. For this particular supplier its

interaction with the competence-creating subsidiary is strategic and in such a case a more partnership-based relationship developed. This is evidenced in the following quotation from one of the R&D managers in CARDIO:

> *"They (one supplier) are good from a product development point of view and innovation. We bounce ideas off them and they do the same. They are committed to providing us with innovative new ways of developing our products, and they are realistic as to what both of us can and cannot achieve vis-à-vis our local competitors. Plus with the close proximity, we get to execute the overall programme faster"*. (R&D Manager, CARDIO).

In spite of the isolated experience of CARDIO, the nature of the industry and the characteristics of the host-location make local suppliers and customers very unlikely to become major strategic partners. These are not critical to the subsidiaries' knowledge objectives, as they are likely to have limited knowledge to share with them, but also limited absorptive capacity to intercept subsidiary knowledge thus potentially convey it to the subsidiary competitors (Perri et al. 2013). In other words, linkages with local suppliers and customers do not encompass neither knowledge access opportunities, nor relevant spillover risks. Hence, we suggest:

Proposition 4: In a highly competitive knowledge-based cluster, both competence-creating and competence-exploiting subsidiaries that are strongly embedded in global value chains are likely to develop limited (arms' length) linkages with local vertical partners.

There is an empirical clarity from the overall picture of relations for knowledge creation by the competence-creating case subsidiaries in this idiosyncratic local network. Very few partners were considered attractive for knowledge sourcing and creation. In fact only the local university mattered, and to varying extents for the two competence-creating subsidiaries. Customers and competitors were not partners in the knowledge creation process. As the network is principally oriented to a global marketplace, local interaction with a customer base for input to R&D was deemed irrelevant by all case firms. Due to the high cost

of knowledge loss to local competitor subsidiaries in the same product category, direct collaboration on new product development was considered unfeasible and even negligent. Suppliers in this local network were foremostly contractors for the manufacture and provision of simple components and relations were distinctly arms' length. Exceptionally, there was one supplier that was part of the knowledge creation process. This one local supplier was selected by one of the case subsidiaries as a strategic partner in its R&D effort. Interestingly, that supplier upgraded its own internal R&D systems and became a homegrown MNE in its own right again deepening the knowledge in the local network. The final section of the paper discusses the implications of the findings for international business theory and addresses managerial implications of the research from a subsidiary's perspective.

CONCLUSION AND DISCUSSION

This study reveals how subsidiaries that are precariously situated in a highly competitive market manage the tension between the imperative to source and create knowledge and the vulnerability to loss of critical private knowledge. We *explicitly* account for the subsidiaries' motives and concerns in terms of knowledge creation and knowledge protection. We show that, in order to protect critical knowledge, subsidiaries may not collaborate on knowledge creation directly with competitors or even with their mutual supply base for fear of unintentional knowledge spillover. Cooperation for knowledge creation with direct rivals in the local network was considered unviable, even ludicrous or absurd. Also, as production in the local network was foremostly for overseas customers, knowledge creation through interaction with a local client base for input to R&D was deemed irrelevant by all case firms.

This paper contributes to the recent stream of literature on the strategic management of subsidiary local linkages (Santangelo, 2009; Hallin and Holmstrom Lind, 2012; Perri et al., 2013) by extending the focus of the analysis to a wide-range of local actors, beyond value-chain partners, and by accounting for differences between competence-creating and

competence-exploting subsidiaries. In other words, our analysis simultaneously covers both local partner and subsidiary heterogeneity. More in general, this study also adds to the theory on the embeddedness of the MNE in an external local knowledge network (Andersson et al, 2002; 2005; 2007) and the scope and quality of relations with partners within the network (Giroud and Scott-Kennel, 2009; Perri et al, 2014). Those subsidiaries that are more embedded in the locale develop 'strategic partner' collaborations, particularly with the local third level institutes, and through such absorption of knowledge from the local network become competence-creators. Mudambi and Navarra (2004) contend that achieving a competence-creating status depends on cost-benefit analysis of inward versus outward knowledge spillovers. Thus competence-creating subsidiaries flourish when they gain more from inward knowledge spillovers in relations with domestic actors than they lose from outward spillovers to competition. However, we show that the competitive logic not simply outweighs the cooperative logic but can complement it even in a highly competitive market.

Competence-exploiting subsidiaries pursue specialisation in related technology areas with a clear focus on process and product development whereas competence-creating subsidiaries pursue both specialisation and supplementary adaptation through knowledge creation in both related and unrelated technology domains. Whilst knowledge protection can never be absolute since some seepage will inevitably apply due to employee mobility within the local network but can at least be maximised through selective choice of partners for knowledge creation. Ultimately, interaction with competitors, suppliers, even universities on knowledge creation in related technology fields was inexistent as it was fraught with danger and even liable to catastrophic loss of valuable IP. Whether competence-creating subsidiaries or competence-exploiting subsidiaries, all four case firms sought to influence knowledge trajectory and density in the local network and saw the benefit in lobbying industrial development agencies and involvement in the industry association. Collective action occurred

with direct competitors to lobby for advanced factor conditions that enhance the knowledge base of the local network and enrich the infrastructure for knowledge creation to the ultimate benefit of all members. These findings reconcile the debate between the strategic deterrence paradigm (Shaver and Flyer, 2000; Alcacer, 2006; Alcacer and Chung, 2007) and the physical attraction logic (Cantwell and Mudambi, 2011), by illustrating a nuanced theory of coopetition (Luo, 2007; Bengtsson and Kock, 2000) in a highly competitive market wherein the benefits of the physical attraction thesis (Cantwell and Mudambi , 20011) are complemented by the security of the strategic deterrence theory (Shaver and Flyer, 2000). Far from adopting one out of the two potential extreme approaches to interaction in knowledge-based foreign clusters (interaction avoidance vs. full-ranging embeddedness), the subsidiaries included in this study selectively manage a diversified portfolio of linkages with heterogeneous local partners involving heterogeneous subjects, based on a careful evaluation of knowledge access opportunities and spillover threats associated with each linkage.

As with all empirical studies, this study has its limitations. Whilst acknowledging the call for more qualitative research on subsidiary knowledge flows in specific contexts and settings (Michailova and Mustaffa, 2012), these are very much sector-specific results from a highly idiosyncratic, competitive local knowledge network. The critical, exploratory multi-case study can reveal the underlying processes of complex phenomena (Yin, 1994). Nevertheless the conclusions and generalisations are confined. This local knowledge network evolved around a set of subsidiary firms in a very distinct product category and within a very narrow technology bandwidth. There are particular local factors such as the global customer base, the sourcing of supplies from sister subsidiaries abroad rather than from local suppliers, with one notable exception, and the evident necessity for IP protection from local competitor subsidiaries. For greater external validity and wider generalisability, future quantitative research would be beneficial as would further case studies in other idiosyncratic settings.

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TABLE 1: Interviewees’ Positions

	CORONA	CARDIO	VASCA	DIAGNO	TOTAL
CEO/MD	x	x	x	x	4
VP	x	x			2
R&D Director		x	x	x	3
Senior R&D Mgr	xx	xx	x	x	6
NPD Mgr	x	x	x	x	4
R&D Engineer	x	x	x	x	4
Total	6	7	5	5	**23**