A Balancing Act: Managing the global-local dimensions of industrial clusters through the mechanism of 'lead' organisations

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Abstract

The purpose of this paper is to investigate 'leading' organisations in a region to understand how the balance between the global and local dimensions can be managed by clusters. Two cases of industrial clusters are employed to examine how certain organisations can occupy a 'lead' position and how – if at all – such organisations generate an agglomerative effect in a cluster, given that firms engage in extra-local inter-organisational linkages in order to remain competitive. The study shows that when large firms enact a leading role by influencing the technology trajectory of the region and stimulating the local dynamic they can generate agglomerative effects thereby enhancing the relevance and sustainability of clusters. Most significantly, it shows how leading organisations act as an important facilitator in connecting the global and local dimensions of clusters even in the absence of extensive formal local linkages. While the study substantiates previous research on the significance of temporary and organised forms of proximity it also shows the value of permanent geographical proximity, thereby contesting recent research that downplays the relevance of the clustering institution (e.g. Wickham and Vecchi 2008, Lorentzen 2007).

Keywords: Regional industrial clusters, 'leading' organisations, permanent geographical proximity, Medical Technology sector, Software sector.

1 Introduction

Traditionally, theoretical and empirical research on industrial clusters has focused on the internal mechanisms at work in a cluster. It has been argued that geographical proximity facilitates transactional and non-transactional interaction among the cluster members resulting in knowledge flows that enhance the innovativeness of the firms and cluster alike (e.g. Porter 1990, Keeble and Wilkinson 1999, Maskell 2001). However, more recently the role of permanent geographical proximity or co-location has been scrutinised (e.g. Lorentzen 2007, Wickham and Vecchi 2008) as it is acknowledged that in an increasingly globalised environment, firms engage in inter-organisational networks on a global rather than solely local scale in order to remain competitive. While some authors argue that the use of global networks reduces the significance of the local milieu (Nachum and Keeble 2003a, Lorentzen 2007), other scholars propose that the local and global aspects of clusters may reinforce one another (Bathelt et al. 2004).

Against this debate, the recognition of 'leading' or 'anchor' organisations in industrial clusters is significant in the literature as the presence of such organisations has been conceptualised both to promote industrial clustering and to affect the degree to which firms connect with global networks. For example, the presence of 'anchor' firms is argued to enhance the availability of skilled labour, specialised suppliers and knowledge spillovers among firms in a cluster (Feldman 2003, Agrawal and Cockburn 2003). It is also maintained that the embeddedness of a 'focal' firm in a region can connect the locality to a global production network (Henderson et al. 2002) or that the presence of leading firms in industrial districts can theoretically feed the district with external knowledge by acting as 'gatekeepers' (Morrison 2008) or 'pollinators' (Lazarson and Lorenzoni 1999).

By explicitly examining 'leading' organisations in a region this paper contributes to our understanding of how the balance between the global and local dimensions can be managed by clusters. More specifically, the paper addresses the questions of how certain organisations can occupy a 'lead' position and how – if at all – such organisations generate an agglomerative effect in a cluster, given that firms engage in extra-local inter-organisational linkages in order to remain competitive. Two cases of high-technology clusters within a small, open economy are investigated. The choice of the two clusters allows for a cross-case analysis as both clusters are located in the same region and are similarly structured. The cases are that of the software and medical technology clusters in Galway on the west coast of

Ireland. Given that both foreign trade and foreign investment are relatively important in a small, open economy the high-technology firms in both clusters can be expected to engage in extra-local inter-organisational linkages. In addition, the clusters are similarly structured in that they both comprise of a few large foreign-owned leading MNCs (multinational corporations) that create most of the employment in the clusters and are surrounded by many small and medium-sized enterprises. Therefore, the cases are ideal for examining the influence of leading organisations in a cluster.

Following this introduction, the second section of the paper reviews the literature on industrial clusters, particularly focusing on the global and local dimensions of clusters, the issue of proximity and the significance of 'leading' organisations in clusters. Subsequently, the methodology employed to investigate the research questions is outlined in section three, while the findings are discussed in the fourth section. Finally, the implications of the findings for cluster theory as well as the conclusions are discussed in the fifth and sixth sections consecutively.

2 The global-local dichotomy of industrial clusters

The tension between the globalisation and localisation of economic activity has received great interest in the literature over the past couple of decades (e.g. Ohmae 1990, Porter 1990, Amin and Thrift 1994). While the forces of globalisation can intuitively be seen to diminish the importance of regional or even national economies evidence exists that firms within common industries tend to spatially agglomerate in particular regions. Following the conceptualisation of such agglomeration concepts as industrial districts, regional innovation systems and in particular Porter's (1990) concept of industrial clusters, extensive research has been undertaken on transactional and non-transactional inter-organisational linkages in regions. Clusters have been conventionally defined as "geographic concentrations of interconnected companies,...and associated institutions....in particular fields that compete but also co-operate" (Porter 1998b p. 197-198). The fundamental elements of clusters therefore have been geographical proximity and local linkages. However, empirical investigations of clusters reveal a significant prevalence of firms accessing global linkages and emphasise the importance of such linkages and the circumstances under which they are most likely to occur. For example, Nachum and Keeble (2003a), in their investigation of the media cluster in Central London, find global linkages more important for intangible factors, such as knowledge and learning while local linkages are important in the provision of services and

accessing labour. Furthermore, Tödtling et al (2006) observes from various Austrian industries that high-technology firms rely more on international networks and knowledge flows than medium-technology firms and De Martino et al. (2006) empirically discover that as firms internationalise, local linkages become weaker.

Bathelt et al. (2004) have conceptually combined the global and local dimensions of clusters in their 'local-buzz, global-pipeline' concept, arguing that they reinforce one another. The authors contend that as firms in a cluster develop structured and formal pipelines with partners globally, market and technological knowledge flows into the cluster. This stimulates the local 'buzz' as the knowledge is disseminated in intentional and unintentional meetings among the cluster members. Thus, extensive global pipelines by firms in a cluster can produce 'agglomerative' effects. However, this argument has been criticised for being static (Onsager et al. 2007) and, in particular, for a lack of evidence of extensive local knowledge exchange through informal networks as it has been found that firms create quite distinct and specialised linkages on mostly a global scale (Lagendijik and Lorentzen 2007, Lorentzen 2007, Wickham and Vecchi 2008).

In an effort to examine local and non-local linkages more thoroughly the notion of proximity, its deconstruction and its role in the development of these linkages has gained more attention recently (e.g. Torre 2008, Carrincazeaux et al. 2008, Lagendijk and Lorentzen 2007, Torre and Rallet 2005, Lorentzen 2007). Proximity can be differentiated into various forms, such as institutional, social, cognitive as well as geographical (Boschma 2005). In this line of thought a primary distinction is made between the relational aspects of proximity and the spatial aspects (Lagendijk and Lorentzen 2007). The relational aspects constitute institutional, social and cognitive forms of proximity, as they refer to closeness in the sense of sharing, belonging and similarity (Torre 2008, Lagendijk and Lorentzen 2007). These in turn explain "the ability of an organization to make its members interact" (Torre 2008, p.877, Torre and Rallet 2005, p. 49), which is termed 'organized proximity', and therefore captures and subsumes the other relational forms (Torre 2008, Lagendijk and Lorentzen 2007). On the other hand, geographic proximity refers to the closeness of actors in terms of space. Typically, the literature on clusters, innovation systems, industrial districts and innovative milieu has focused on permanent geographic proximity or the co-location of various actors in a particular region that produces external economies and enhances their innovative capacity and competitiveness. However, more recently the significance of temporary proximity in the

form of conferences, trade fairs and project meetings has been acknowledged in the literature for knowledge transfer and innovation (Bathelt and Schuldt 2008, Wickham and Vecchi 2008, Ramirez-Pasillas 2008). It is argued that geographic proximity does not necessarily have to be in place in order for organised proximity to occur. As Lagendijik and Lorentzen (2007) purport strong organised proximity and weak geographic proximity results in "non-localized interaction" (p.461). Conversely, it is contended that for the "success of clusters that work" in the conventional sense both permanent geographical proximity and organised proximity need to be in place (Torre 2008).

In general, empirical research has showed the importance of relational forms of proximity (Onsager et al. 2007, Lorentzen 2007) or temporary geographical proximity (Wickham and Vecchi 2008, Bathelt and Schuldt 2008) for knowledge transfer and innovation. However, the significance of permanent geographical proximity has, to a degree, been lessened in some of these research studies (Wickham and Vecchi 2008, Lorentzen 2007, Onsager et al. 2007). While some research suggests that temporary proximity can benefit the local cluster (Bathelt and Schuldt 2008, Ramierz-Pasillas 2008) and perhaps stabilise it as external knowledge is transferred to the milieu, other research contends that firms extensively access important global linkages and they do so without the assistance of local clustering institutions (Wickham and Vecchi 2008, Lorentzen 2007). Indeed, within this latter line of argument the importance of the local milieu is shown to centre on the supply of labour and general business support services (Lorentzen 2007, Nachum and Keeble 2003a) rather than as an important source of knowledge and innovation. Torre (2008) argues that while permanent geographical proximity is not necessary for knowledge transfer, neither is it the case that innovation can always occur through distant interaction. Certain stages of the innovation process require actors to meet for the effective transfer of knowledge and, therefore, geographical proximity in a temporary form "remains essential" (Torre 2008, p. 870).

Does this mean, however, that clusters are no longer sustainable? As organised proximity and temporary geographical proximity are shown to be important for innovation, are clusters at risk of 'hollowing-out' altogether? While the existence of clusters in the form of a regional agglomeration of industry-related firms is still prevalent across economies, the relegation of the significance of permanent geographical proximity makes them appear vulnerable. The limited advantages of co-location as purported by recent research that relate to general urbanisation economies or relatively restricted localisation economies in the form of

specialised labour, calls to question the sustainability of clusters. It implies that the balance between global and local linkages of regional clusters appears to swing in favour of the former and therefore it may mean that regions are less 'sticky'. Overall, therefore, can the balance between the global and local dimensions be managed by clusters to enhance their sustainability?

2.1 'Leading' organisations in industrial clusters

Coinciding with the theoretical developments in the literature on the nature and characteristics of industry clusters in the modern economy there has also been increased scholarly interest in the presence of 'lead' or dominant organisations. Generally, in examining the development and dynamics of industry clusters a number of authors have found the presence of 'leading' organisations in their studies (e.g. Wolfe and Gertler 2004, Niosi and Zhegu 2005). It has been argued that such organisations, commonly defined in terms of their large size and capability (see table 1), can affect the development and dynamics of a cluster (e.g. Albino et al. 1999, Carbonara 2002, Harrison et al. 2004) and can influence the extent to which actors of a cluster engage in extra-local linkages (e.g. Yeung et al. 2006, Mariotti et al. 2008).

Focusing on the role played by leading firms in enhancing a clustering process, the anchor tenant hypothesis approach emphasises their influence in generating external economies such as the availability of skilled labour, specialised suppliers and knowledge spillovers among firms and between firms and institutions in the cluster (Feldman 2003, Agrawal and Cockburn 2003). By using the analogy of a shopping mall system, the anchor tenant hypothesis approach postulates that the reputation effects of a large renowned firm may produce stronger influential effects than having a group of small firms. Recent empirical-based research shows that the co-location of firms – both early and established - with dominant firms is found to occur at a significantly high rate (Hatfield et al. 2007), which suggests that there are benefits from locating close to leading organisations. Indeed, the presence of dominant firms in a cluster is found to play an important role in attracting high skilled workers (Harrison et al. 2004), increasing the skill base of a region (Harrison et al. 2004) and drawing suppliers (Niosi and Zhegu 2005).

Table 1: Defining lead organisations in industries from a sample of the literature

	Term	Definition	Theoretical underpinning
Feldman (2003)	Anchor firm	"A large firm that provides both stability and traffic in ideas" (p.325).	Anchor tenant hypothesis
Hatfield et al. (2007)	Dominant firm	"Large, economically and technologically powerful firms that enter emerging markets from related markets" (p. 445).	Theory of entrepreneurship and theory of agglomerative economies
Mariotti et al. (2008)	Leader firms	"...the prerogative of leaders is not deterministically associable with size but they are likely to have gained such a position because of their greater capacity to grow" (p.726).	Industrial district
Harrison et al. (2004)	Magnet organisation	"...high reputation technically oriented organisations, offering positions in a range of functional areas" (p. 1066).	Theory of entrepreneurship and industry cluster theory
Lazarson and Lorenzoni (1999)	Leading firms/focal firms	"...those firms that occupy strategically central position because of the greater number and intensity of relationships that they have with both customers and suppliers (Aldrich, 1979). This position is usually reinforced by both their technological and organisational skills and their greater access to capital...These tasks...position focal firms to build bridges beyond the narrow confines of the district" (p. 362).	Industrial districts
Morrison (2008)	Leader firms as 'knowledge gatekeepers'	Measurement: "The selected firms account for almost 80% of the district's turnover and contribute to a widespread network of subcontractors....These leaders have played a key role in the take-off of the district and, more importantly, it has been argued that they greatly contributed to the local learning dynamism" (p.822).	Industrial district
Rugman and D'Cruz (1997)	Flagship firm	"...a multinational enterprise which has taken on the strategic leadership of a business network consisting of four other partners: key suppliers, key customers, selected competitors and the non-business infrastructure". (p.403).	Business partner networks
Ernst and Kim (2002)	Global 'flagship' corporation	"The flagship is at the heart of a network: it provides strategic and organisational leadership..." (Ernst and Kim 2002, p.1420-1422).	Global production networks

However, it is also argued that the presence of leading organisations can influence the extent to which firms in the cluster engage in global linkages. Empirical work has shown that the presence of dominant firms in a cluster increases the likelihood that other firms in the cluster will internationalise through outward FDI (Mariotti et al. 2008). Their presence has also been found to result in the creation of 'non-cluster economies' such as facilitating access to external customers (Yeung et al. 2006). Additionally, authors have focused on leading organisations enacting the role of 'knowledge gatekeeper' in a cluster as they capture external knowledge and then transcode and disseminate it to other cluster members (e.g. Morrison 2008). In this way, such firms can 'pollinate' the local district with information about changing tastes, technologies and products (Lazarson and Lorenzoni 1999). In an empirical investigation of an Italian furniture district, Morrison (2008) found that leader firms have many connections to knowledge sources and they systematically search for information and knowledge, which is not limited to the local area but rather extends well beyond the district. However, the author also found that local informal linkages are quite restricted and knowledge sharing is quite limited "suggesting that knowledge from leaders does not circulate pervasively among all district members" (Morrison 2008, p. 831).

Therefore, the literature on leading organisations within clusters contends that such organisations can impact the extent to which the cluster engages in extra-local linkages, networks and knowledge flows but can also promote a clustering process. As a result, can leading organisations balance the global and local dimensions of clusters? The purpose of this paper is to examine 'leading' firms in clusters and investigate how such firms occupy a focal position and how they can generate an agglomerative effect in a region of a small, open economy as firms engage in extra-local linkages in order to remain competitive. In this way the paper contributes to our understanding of how, if at all, the balance between the global and local dimensions can be managed by clusters through the mechanism of leading organisations. The following section outlines the research method employed to investigate this issue.

3 Research methodology

The research methodology employed is that of a multiple case study approach. As the aim of the study is to investigate the phenomenon of industry clusters and, more specifically, to understand the agglomerative effect of leading firms within the particular setting of a region in a small, open economy, it lends itself most appropriately to a case study strategy (Yin

1984, Eisenhardt 1989). The intention is not to seek generalisability through representativeness, but rather to build and advance on theory in line with Eisenhardt's (1989) and Eisenhardt and Graebner's (2007) design of case studies. Two cases of industry clusters were chosen for investigation, that is, the software and medical technology clusters located in Galway on the west coast of Ireland. Both clusters are similarly structured in that they contain a small number of large foreign-owned MNCs that create most of the employment and they are surrounded by small and medium-sized companies. In line with the literature that commonly defines leading firms as being large in size, the two clusters can be considered to potentially contain leading organisations in the form of the foreign-owned MNCs. The rationale for choosing two cases is to allow for cross-case analysis and search for patterns (Eisenhardt 1989) by comparing and contrasting the dynamics of the clusters.

The study incorporated the collection of both quantitative and qualitative data. Quantitative data, collected using a postal questionnaire survey of firms in both clusters (see table 2 for response rates), was used to provide context by profiling the clusters and gauging the extent to which firms have linkages with other organisations on a local, national and international level. Forming the core of the empirical research, qualitative data was collected from personal semi-structured interviews with senior level managers in a sample of companies from both clusters (see table 2). The analysis of this data was used to address the research questions posed. The interview schedule used has seven principal sections as the main topics of discussion. These are: background of the company; technological and industrial knowledge; relations with customers, suppliers and/or partners; relations with competitors and other companies in the same line of business; relations with industry associations, universities and research centres; industrial atmosphere; and finally, perception of the region. The term 'leading' firms was not explicitly used in the interviews nor was the role of the large MNCs specifically addressed. Instead, the issue of the influence of large-sized firms was allowed to emerge from the discussion. The following section details the findings from the two case studies.

Table 2: Details of empirical research

Cluster	**Questionnaire survey: response rates**	**Interviews**
Software	44.26% (27 responses)	Indigenous firms: 3 small firms 1 medium firm Foreign-owned firms:

		1 medium firm 2 large firms
Medical Technology	50% (15 responses)	Indigenous firms: 2 small firms 2 medium firms Foreign-owned firms: 1 small firm 1 medium firm 2 large firms

4 The dynamics of the software and medical technology clusters in Galway

4.1 Software cluster

The software sector in Ireland employs approximately 32,000 people in 800 foreign-owned and indigenous enterprises (IDA Ireland 2008). The sector is characterised by a strong presence of foreign-owned multinational corporations that has generally evolved from manufacturing packaged software to more sophisticated software product development (White 2004). As a result, Ireland has been described as a "key software centre" (White 2004 p.247). Over time a software indigenous base has developed and is now primarily characterised by innovative software design and development companies serving a global market. While the software sector is heavily concentrated in Dublin (Barry 2006), smaller concentrations of the industry have been identified in Cork (south of the country) and Galway (west) as well as the Limerick/Clare area (mid-west region) (Green et al. 2001, Barry 2006).

The Galway software cluster has its origins in the closure of a hardware manufacturing facility operated by a foreign-owned MNC, the Digital Equipment Corporation (Digital) (Green et al. 2001). The establishment of Digital in 1971 was the first investment in Information Technology in the region. By 1993, it had 1100 full-time employees and links with twenty local supplier companies (Needham 1999, Dunne 1993, Shanahan 1993). Therefore, the closure of the hardware manufacturing facility in that year, with a loss of 760 people, was a huge setback to the Galway region. However, the European Software Centre of the subsidiary remained open in Galway and was taken over by Compaq and subsequently Hewlett Packard. In addition, initiatives by the Government, local business groups and the company itself led to the establishment of numerous start-up enterprises in the region (Needham 1999). Many ex-Digital staff used their acquired managerial skills to form businesses in various areas including, electronics, software, manufacturing and services

(Needham 1999). The Galway Technology Centre housed many of the software companies and it was the high profile success of particularly the indigenous software company, Toucan Technology that provided the impetus for the development of the software cluster in Galway.

Today, the cluster is characterised by numerous small-sized indigenous companies and a smaller number of large- and medium-sized foreign-owned subsidiaries, two of which employ a relatively large number of employees. The geographic scope of the marketplace for the cluster firms extends well beyond the region. The majority of the firms are exporting, with two thirds (18 respondents) stating that they sell some proportion of their output abroad, primarily North America and Europe. The firms establish an array of formal partnership-type linkages with other sales offices, system integrators, distributors and technology partners that can provide a means of reaching the end-user. Many of the organisations that firms create partnerships with are based at the national (primarily Dublin) and global level.

Collaborating with technology partners, which provide the tools for software development, was the most frequently cited means of accessing technical knowledge and keeping up-to-date with technological developments by the companies interviewed. In addition, the indigenous companies, in particular, identified attendance at conferences and tradeshows primarily abroad or membership of international industrial bodies as ways of keeping abreast of industrial developments. These events or bodies are not necessarily software-oriented but rather they are specific to the industry that the company supplies software to, e.g. the telecommunications, financial services, and insurance sectors. The conferences and tradeshows allow the companies to learn about new developments in the sector to which they supply software to, to promote the company internationally and to meet potential investors and end-users.

In terms of local knowledge spillovers and flows there was limited evidence of such processes occurring in the cluster. While the Digital era had resulted in the founding of many start-up firms in the past there was limited evidence of start-up firms establishing in the region presently, as the following quotations reveal:

> "A lot of them happened from the Digital days…but I'm not sure if there is a lot of, for example, ex-[MNC B - Software]…." (Indigenous A – Software)

> [Asked if the manager has knowledge of many software start-ups in the region] "Not that I know of. Now I know there's the old story of DEC, where they had a lot of spin-offs". (MNC C - Software)

Furthermore, while there were contacts between the local firms on a social level which are viewed as useful for general business information, the interviewed mangers asserted that there is limited exchange of knowledge or experiences between companies on technical issues because most are not in the same business domain in that they produce software for different types of markets. Therefore, there is also limited possibility of companies formally aligning or partnering with each other in the region. Generally, the managers interviewed pointed to networks abroad or in Dublin as more relevant for the companies' business activities, for sharing ideas or experiences and for aligning with other companies. This is evidenced in the following statements in which the interviewees were asked of the extent to which local contacts result in technical knowledge flows:

> "We just haven't had the time to pursue them. Having relationships with other people here is not going to help me sell" (Indigenous B – Software)

> "What is the technical information that you share?....The specifics of how to design [the activity of MNC B - Software] isn't of interest to people in the region". (MNC B - Software)

However, there is evidence of knowledge flow processes taking place on a more formal level. For example, a computer engineering research institute DERI, which is based at the local university, has expanded its partner companies to include working with a number of software firms in Galway. In addition, many of the companies interviewed reported their participation in a collaborative training scheme organised by the local industry association, ITAG. The Association is industry-led and its purpose is "about promoting the industry in Galway and doing things for themselves as opposed to looking externally for assistance...ITAG wants to promote Galway as a location for the IT industry..." (Indigenous D - Software). Through the collective bargaining power of the software firms, ITAG organises training courses that are supplied by external providers at a reduced rate. In addition, the members get a certain percentage of the course cost refunded by the Government. The organisation of the training scheme requires the companies to collaborate as they agree on training needs to be fulfilled, the timeframe and the hosting of the training sessions.

In general, having more software companies in the region would be advantageous for both the MNCs and indigenous firms for a number of reasons declared by the companies including, the attraction of labour, the opportunities for hiring, the prospects for interacting and so that the region would be viewed as a high-technology district for software. In discussing the advantages of having a concentration of firms in an area two of the indigenous companies pinpointed the influence of MNCs for building clusters of activity and promoting the success of a region. However, one of these indigenous firms referred to this as the advantage of Dublin and something which is lacking in Galway. As the managing director of this company remarked;

> "I would fully endorse the need for – to try and build up a cluster... I think in the long-run it is better off that you have a large cluster in the area, - so you can attract people in. So I think success breeds success, I think that's the advantage of Dublin…..I think these large US multinationals are the big employer, Dell in Limerick, Ericsson in Athlone, - there's no Iona for example in the West". (Indigenous A - Software)

The other company spoke of the important role MNCs play in the region in terms of building the skills-base of people and as a means for local indigenous firms to reach the international marketplace. But the company specifically referred to the experience of Digital Corporation in the past and two MNCs in the medical technology field as playing such a role, without referring to any current MNC in the Galway software industry. This is evidenced in the following statement by a managing director of the company;

> "So as you bring in employers who have a certain scale, a certain expertise and require certain skills then the local skill base is increased and...work experience with these companies enables them to see that the international marketplace is within our reach...So it's hugely beneficial. I think it has been hugely beneficial for Galway that we have had companies like Digital here and [MNC A - Medical Technology] and [MNC B – Medical Technology], definitely". (Indigenous D Software)

Therefore, the influence of large MNCs was pinpointed by companies as being important for building clusters of activity and promoting the success of a region, however, this influence was viewed as something that is perhaps missing in the Galway software cluster but was present during the Digital era.

4.2 Medical Technology cluster

Similar to that of the software industry, the medical technology sector in Ireland is dominated by world-leading MNCs, such as Boston Scientific, Medtronic, Johnson & Johnson, Stryker, Vistakon and Tyco Healthcare. There are over 140 medical technology firms in Ireland, employing approximately 24,000 people (IBEC/IMDA 2008). Due to the presence of such organisations as Boston Scientific, Medtronic and Merit Medical, Galway has been recognised as a "focal point for many device firms" (Stommen 2005, p.1) and "one of Europe's leading industrial clusters" (Brown 2005, p.11). In particular, the region has built a specialisation in the area of cardiovascular devices as two large MNCs produce drug-eluting stents[1] from their sites in Galway. These MNCs also create most of the employment in the cluster, employing over 4500 people between them. A smaller indigenous base of firms has developed in recent years and other foreign-owned companies have been attracted to the region. The cluster produces cardiology-related products (e.g. hypotubes, balloon catheters, filters, guidewires) as well as other products in the areas of muscle and nerve stimulators, soft tissue implants and pulmonary drug delivery systems.

The firms are largely export-oriented (all of the survey respondents sell output internationally) and as a result they engage in networks with specialised suppliers, strategic partners, distributors and internal sales offices on a global level. The end-users for many of the medical devices produced by firms in the cluster are physicians, surgeons or cardiologists and they are identified as important sources of knowledge. Such end-users can provide feedback on a device in terms of its usability, any changes that are needed and the type of instrumentation required for the latest procedures or medical issues. Therefore, accessing such end-users and particularly internationally leading end-users was reported as important for the firms. As a senior manager from one MNC states "we use people in Ireland but the way the industry works is, the way the sector works, is that there are a number of physicians that are well-respected internationally and we would work with those internationally-respected ones as well as the local ones" (MNC B – Medical Technology).

Conferences, tradeshows and/or clinical congresses were reported by all the interviewees as important events for various reasons, such as learning about market developments, networking with potential as well as existing suppliers and partners, marketing and promoting

[1] A drug eluting stent is a device placed in a blood vessel to alleviate a blockage and to prevent its reoccurrence by slowly releasing medication.

the company, and most significantly, accessing end-users. Many of the conventions that the firms attend are renowned events within the sector and are based across the US and Europe. Furthermore, three of the companies interviewed, two large MNCs and one indigenous firm, collaboratively align with universities abroad. These universities have research centres of expertise in the medical technology field and leading end-users associated with them and are therefore important knowledge sources for the firms. In addition, however, all of the interviewees reported having formal and/or informal linkages with the local university, through the science and engineering departments as well as the National Centre for Biomedical Engineering Science based at the university. These collaborations take many forms, including the sponsorship of PhD and Masters students by firms, the analysis and testing of materials and products, the use of equipment and labs within the colleges and involvement in joint research projects.

In addition to the local industry-university linkages, there is evidence of local knowledge flows occurring through supplier contracts and labour mobility, while local knowledge spillovers are manifested in the form of start-up enterprises. The use of local suppliers by the large MNCs is viewed by the neighbouring companies as being particularly beneficial as the MNCs demand high international quality standards from their suppliers. This is achieved through close interaction and learning between the MNCs and local suppliers. As a result the neighbouring companies can avail of high quality supplies without the need for much further investment on their part. As a manager from one indigenous firm purported;

> "...some of the bigger companies, you know [MNC A, MNC B], they force these...supplier companies..., to comply with the standards and....they can drive the standards that these suppliers need and a quality system within in [MNC B] is not going to allow a supplier to slip and we would benefit from that....So they [suppliers] can come in here and in a very short period of time be quite productive" (Indigenous C – Medical Technology].

The influence of the MNCs in the region is also evidenced by a local indigenous supplier reporting that it repositioned itself from the electronics and metal-work industry solely into the production of components for medical devices as a result of the interaction with the large MNCs in the region. This firm now produces medical device components for companies internationally as well as locally. Furthermore, three of the small and medium-sized companies investigated were established by managers who had in the past worked in the large MNCs in the region and another indigenous firm appointed a chairman who had previously

worked in an MNC in the region because, as the CEO of the company explained, “he came in with that level of experience and he’s also familiar with the local surroundings” (Indigenous C –Medical Technology). Also, the interviewees asserted that the presence of the large MNCs has been important for developing labour skills and attracting workers to the region. A number of the managers commented that the resulting movement of staff within the cluster is often positive as knowledge is shared and opportunities arise.

All the interviewees reported that they know people in other medical technology companies in the region and generally for the smaller indigenous company such informal contacts can be useful for garnering information about regulatory conditions or finding suppliers. However, the interviewees from the large MNCs stated that while they share information regarding the general business environment, such as the supply of graduates and government funding for R&D, they do not informally collaborate with regards to specific business, technical or market information. This is because they aggressively compete with each other in the global marketplace.

When asked about the advantages of being located in the region the managers interviewed from indigenous companies referred to the significance of a concentration of activity for attracting labour, enhancing the quality of suppliers, stimulating knowledge and building contacts. One of the interviewees describes the cluster as a ‘hub’ of activity and ‘one of the centres of the world really for the medical device industry’ (Indigenous A), which arises from the presence of the world-leading MNCs. Their presence attracts international attention, which makes it easier for the neighbouring firms to build international networks. For example, one interviewee from an indigenous company reported that because of the hub of activity due to the presence of the large MNCs, suppliers from abroad would visit the region and this allows them to arrange a meeting and have personal, face-to-face contact. Furthermore, a leading tradeshow, MEDTEC, has been organised in Galway over the past number of years as a regional event called MEDTEC Ireland. MEDTEC events are also held in Stuttgart (Germany), Besançon (France), Birmingham (UK), Yokohama (Japan) and Shanghai (China). Many of the interviewees reported the value of having such an event in Galway for meeting with customers or suppliers from around the world, as revealed in the following quotations from the interviews;

> "Even just from the perspective of not necessarily your suppliers but our customers and trying to get somebody to Galway if they are not coming here for another reason – we find a lot of the time we use events like the local trade conference...." (Indigenous B – Medical Technology).

> "One of the leading ones [conferences] in Europe now in the sector is MEDTEC...that used not be in Ireland but because of the concentration of the industry here in Ireland it's actually attracting companies to come in here" (MNC B – Medical Technology).

Therefore, the presence of the large MNCs in the region is creating a 'hub' of activity that neighbouring firms can benefit from. The next discussion combines these findings with the literature on industry clusters to add to the body of knowledge.

5 Discussion: Balancing the global and local dimensions of clusters – the role of lead firms

In the literature on industry clusters, the significance of permanent geographical proximity or co-location has been questioned (e.g. Wickham and Vecchi 2008, Lorentzen 2007). Empirical evidence shows that firms extensively engage in extra-local linkages in order to remain competitive (e.g. Nachum and Keeble 2003a, Tödtling et al 2006) and organised proximity as well as temporary geographical proximity is shown to be important for knowledge flows (Onsager et al. 2007, Lorentzen 2007, Wickham and Vecchi 2008, Bathelt and Schuldt 2008). The findings of the two clusters investigated substantiate this research. The clusters are largely export-oriented with end-users being predominantly based globally. As a result, many of the firms were found to align with other organisations abroad in the form of strategic partnerships, technology partnerships and/or distributor relationships in order to access end-users. In effect, the firms concentrate on establishing structured, formal partnerships corresponding with the concept of global pipelines (Bathelt 2004). Furthermore, temporary proximity in the form of conferences, tradeshows and congresses were found to be important for firms in both clusters for networking and establishing various linkages. Again, the interviewed companies attend many of these events abroad.

However, with firms extensively creating linkages abroad this calls attention to the value of the locality and clustering. The literature on leading organisations within clusters contends that such organisations can further impact the extent to which the cluster engages in extra-local linkages, networks and knowledge flows but can also promote a clustering process.

Therefore, can leading organisations balance the global and local dimensions of clusters? This paper puts forth the following specific research questions:

a. How can certain organisations in a regional cluster of a small, open economy occupy a 'lead' position?
b. How – if at all – can such organisations generate an agglomerative effect in a regional cluster of a small, open economy as firms engage in extra-local linkages in order to remain competitive?

In addressing the first research question, the study shows that the presence of a large organisation in an industry cluster does not automatically result in them enacting a significant lead role beyond providing employment. The case studies of the software and medical technology clusters in Galway reveal that even though there are two large foreign-owned MNCs in both clusters, the MNCs are more influential in the former cluster. In medical technology the two large MNCs are acting as lead organisations because they are influencing the technological trajectory of the region and they are stimulating the local dynamic. Knowledge flows into the local environment and is manifested in the establishment of start-up enterprises, a pool of specialised labour and the development of supplier firms. Hence, the technological path of the cluster emerges. This substantiates previous studies that show the important role of leading firms in attracting labour (Harrison et al. 2004), increasing the skill base (Harrison et al. 2004) and drawing suppliers (Niosi and Zhegu 2005). In this way the leading firms shape the development of the cluster. Moreover, the presence of the two world-leading MNCs means that global actors are drawn to the region and the cluster develops an international reputation. This is shown in the study to facilitate local neighbouring firms in establishing international linkages and accessing networks. Firms perceive themselves as being part of 'hub of activity', which stimulates the local dynamic. In effect, as the MNCs influence the technological trajectory of the region and stimulate the local dynamic by attracting international attention on the cluster, the agglomerative effect in this cluster is relatively strong. Firms derive benefits from being located in close proximity to the leading organisations.

In contrast, the software cluster in Galway shows a case in which such leading organisations are lacking and the agglomerative effect is relatively weak. While the presence of the Digital Corporation resulted in knowledge spillovers in the form of start-up firms, there was limited evidence of such spillovers occurring presently. Many of the companies in the cluster,

including the two large MNCs, are involved in unrelated markets in that they provide software services or products to different industries, including financial services, telecommunications, entertainment, travel and insurance industries. As a result, while the MNCs are globally well-connected these pipelines are mostly irrelevant for many of the other firms in the clusters. Furthermore, as the large MNCs are involved in diverse software activities a distinct technological path within software has not developed that builds an international reputation for the region's industry. In effect, the software firms view themselves as being part of a concentration of activity outside the greater Dublin area and it would be advantageous if a stronger cluster developed to attract labour and promote the region internationally.

Therefore, in answering the second research question, when firms occupy a 'lead' position in a cluster by influencing the technological path of the cluster and stimulating the local dynamic they generate an agglomerative effect. Other firms in close permanent proximity benefit from knowledge flows through labour mobility, increased quality standards of suppliers, ease of attracting labour to the region and, most significantly, the facilitation in establishing global linkages as illustrated in Figure 1.

6 Conclusions

The purpose of this paper is to examine 'leading' firms in clusters and investigate how such firms occupy a focal position and how they can generate an agglomerative effect as firms engage in extra-local linkages in order to remain competitive. Significantly, the research contributes to our understanding of how, if at all, the balance between the global and local dimensions can be managed by clusters through the mechanism of leading organisations.

A number of important points arise from the case studies conducted. First, when large firms enact a leading role by influencing the technology trajectory and stimulating the local dynamic they can generate agglomerative effects thereby enhancing the relevance and sustainability of clusters. This substantiates previous research which shows that leading organisations can influence the development and dynamics of clusters and the clustering process (e.g. Albino et al. 1999, Carbonara 2002, Feldman 2003, Harrison et al. 2004, Wolfe and Gertler 2004, Niosi and Zhegu 2005). However, it also more specifically shows how leading organisations act as an important facilitator in connecting the global and local dimensions of clusters even in the absence of extensive formal and informal local linkages.

Therefore, it contests recent research that downplays the relevance of the clustering institution (Wickham and Vecchi 2008, Lorentzen 2007). Akin to the work of Bathelt et al. (2004) the study points to the way in which the local and global dimensions of clusters can reinforce one another. Even though it was found that the local 'buzz' defined by the transfer of knowledge in informal linkages between firms may be limited locally, the two cases revealed that the extent of the local dynamic generated by 'lead' organisations is important for neighbouring firms in terms of establishing global networks. In order to undertake the role of 'lead' organisations, the defining characteristics of the firms include having an international reputation within a particular market or research area, being involved in extensive global linkages and networks and, most significantly, having built a specialist area of activity within the region so that the cluster becomes recognised internationally. This latter characteristic differentiated the two clusters under investigation.

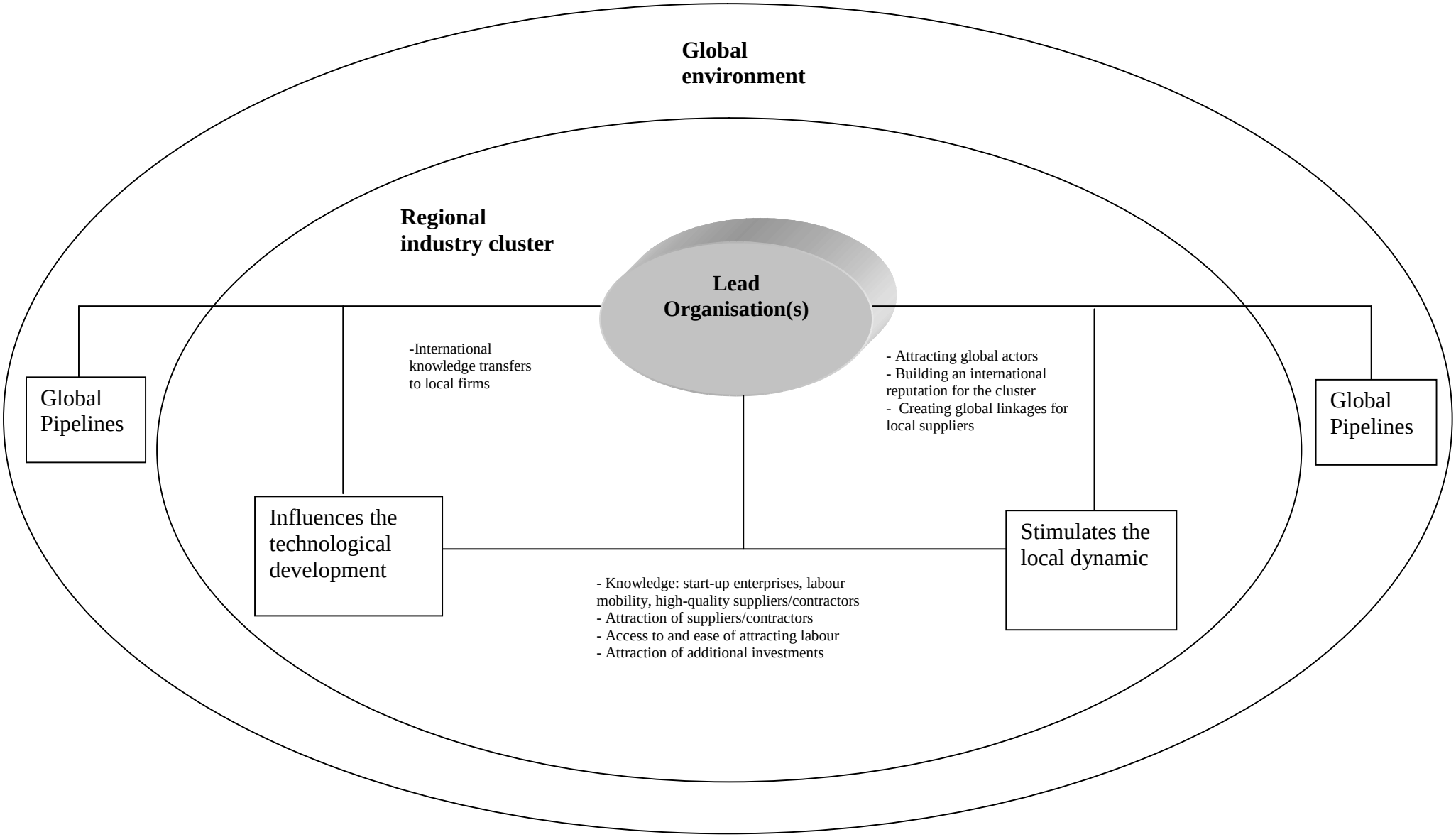
Secondly, and arising from the latter point, the presence of large-sized organisations alone in clusters does not automatically result in them enacting a significant 'lead' role. When large firms do not exert an influential effect as 'lead' organisations, there can remain a relatively hollow cluster with a quiet local dynamic and a comparatively weak agglomerative effect, as can be seen in the case of the software cluster investigated.

Thirdly, in this study, the leading firms are foreign-owned MNCs, and while they are shown to generate agglomerative effects in the medical technology cluster, the long-term stability of the cluster can be questioned. When foreign-owned firms are relied upon to create agglomerative effects, the dynamics of a cluster may change relatively quickly with economic challenges that may cause capital to move. If the lead position within a cluster is held by an indigenous organisation, such as a university or an internationally successful indigenous firm then the cluster may be more stable. However, as there are limitations on the extent to which conclusions can be made based on this study, future research should investigate the potential and characteristics of indigenous organisations enacting a 'lead' role in different types of industry clusters.

In conclusion, regional clusters described by extensive formal and informal local linkages are most likely not a prevalent feature in modern economics as firms engage in extra-local networks in order to remain competitive. Nonetheless, this research shows that permanent geographical proximity does matter for firms. In particular, through the mechanism of leading

organisations, industry clusters can facilitate firms in establishing necessary international linkages and thereby manage the balance between the global and local dimensions of clusters.

Figure 1: A framework characterising the global-local nexus of regional industry clusters in a small, open economy



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