

Crone, Mike; Roper, Stephen

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Knowledge Transfers from Multi-national Plants in Northern Ireland

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Knowledge Transfers from Multinational Plants in Northern Ireland

Mike Crone and Stephen Roper

Northern Ireland Economic Research Centre
46-48 University Road, Belfast, BT7 1NJ

Abstract

Using Northern Ireland as a case study, this paper focuses on the issue of knowledge transfers from the plants of multinational enterprises to their local suppliers. This is important both because the potential for knowledge transfers to indigenous firms has often been used as a justification for public support of inward investment and because of the centrality of “knowledge” and “learning” in recent debates about economic development. Using quantitative data obtained from structured interviews with senior managers at 33 of the largest multinational plants in Northern Ireland, the paper addresses three main issues. First, for a range of “best practice” manufacturing techniques it examines the *potential* for knowledge transfers by measuring “knowledge gaps” between each multinational plant and (a) best practice within its parent group, and (b) its best local suppliers. Secondly, the paper examines the incidence of various *activities* through which knowledge might be transferred from multinational plants to their suppliers. Thirdly, the paper considers the *impact* of knowledge transfers on the competitiveness of local supplier companies.

The research shows that multinational plants in Northern Ireland are broadly on a par with international best practice in terms of their stock of “knowledge”. However, their best local suppliers generally lag behind with notable “knowledge gaps” for some key manufacturing techniques. Substantial numbers of multinational plants in Northern Ireland are found to engage in various “knowledge transfer activities” with their suppliers. However, weak local supply linkages at these multinational plants undermine the “natural” level of knowledge transfer to the local economy. This suggests a need both to strengthen local supply chains and to develop other means for smaller local firms to benefit from the knowledge base of locally-based multinational plants. Such measures, which are designed to develop networks and intensify “local learning”, are consistent with the concept of the “learning region” and with the recent DTI White Paper on the “knowledge driven economy”. At present, however, Northern Ireland’s policy framework in this area is less well developed than that in some competitor regions such as Wales and the Republic of Ireland.

Knowledge Transfers From Multinational Plants in Northern Ireland¹

‘Contemporary capitalism has arrived at a point where knowledge is the most strategic resource and learning the most important process’. (Kevin Morgan, 1998, p. 493).

‘...inter-firm linkages [and] collaboration as part of normal trading relationships between firms may prove the most important means of technology transfer.’ (Phelps, 1996, p. 395).

4. Introduction

Reflecting its importance in the northern and peripheral regions of the UK, foreign direct investment has been the subject of a considerable amount of research over the last decade (e.g. Hill and Munday, 1991; Collis and Roberts, 1992; Turok, 1993; Phelps, 1997; Crone, 1999a). Attention has also focused on the potential contribution of multinational enterprises to regional growth and competitiveness (e.g. Young, Hood and Peters, 1994). One particularly interesting theme in this growing literature concerns the potential development of dynamic clusters of firms based around leading multinational plants. This model envisages networks of local suppliers surrounding multinational plants and suggests that these localised clusters will benefit from technology and knowledge transfers among their member firms (e.g. Morris, 1992; Wong, 1992; Botham, 1997; Morgan, 1997).

Recent years have also seen the emergence of various regional policy initiatives that seek to maximise the positive spin-offs from inward investment by increasing linkages with local suppliers and by promoting the transfer of technology and best practice to indigenous firms (e.g. the Welsh Development Agency’s “Source Wales” initiative and the Irish “National Linkages Programme”). In Northern Ireland, responsibility for encouraging local sourcing by inward investors was for many years the responsibility of the Industrial Development Board (IDB). More recently, in line with the development of the Regional Supply Network throughout Great Britain, the IDB has supported the establishment of a “Regional Supply Office” within the Engineering Cluster of the Northern Ireland Growth Challenge. The IDB has also experimented with some “supplier development” projects in association with major inward investors, largely on an *ad hoc* basis. However, to date, Northern Ireland’s policy infrastructure in this area has lacked both the strategic coherence and the financial backing of its Welsh and Irish equivalents.

Despite the longstanding importance of inward investment promotion within Northern Ireland’s economic policy framework, and the potential contribution of MNE plants to the local economy, there has been relatively little detailed research on the externally-

¹ This paper summarises the key findings of a much larger research report by the authors: ‘Knowledge Transfers from Multinational Plants in Northern Ireland – Local Learning in the Supply Chain’, NIERC Report Series No 15. Copies are available from NIERC, price £30.00.

owned manufacturing sector in Northern Ireland. Certainly, information about local sourcing and knowledge transfers by Northern Ireland-based multinational plants is currently very limited. This report aims, at least partially, to redress this shortcoming and, in doing so, to contribute to the debate about inward investment policy in Northern Ireland, and other regions.

The main objectives of the paper are as follows: Firstly, it seeks to examine the potential for knowledge transfers from Northern Ireland-based multinational plants by measuring “knowledge gaps” between each multinational plant and its local suppliers. Secondly, it seeks to establish the extent and nature of “knowledge transfer” and “supplier development” activities undertaken by Northern Ireland-based multinational plants with their suppliers. Thirdly, it seeks to establish the impact of these knowledge transfer and supplier development activities on the competitiveness of supplier firms in Northern Ireland. This leads ultimately to an assessment of the scope and suitability of various supply chain policies for Northern Ireland, and to a number of suggestions for other policy initiatives to strengthen the beneficial local impacts of multinational plants.

The paper is organised as follows: Section 2 briefly reviews previous conceptual and empirical studies of knowledge transfers from multinational plants. Section 3 discusses some conceptual issues and explains the methodology employed in the study. Section 4 highlights the importance of multinational plants in the Northern Ireland economy and introduces a typology of plants, based on their corporate context and functional role. Section 5 identifies and quantifies knowledge gaps between Northern Ireland-based multinational plants and their best local suppliers. Section 6 describes the incidence and intensity of knowledge transfer activities at multinational plants and Section 7 considers the impact of these knowledge transfers on the competitiveness of local suppliers. Finally, Section 8 considers the implications of this new evidence for policy and for wider debates about regional development.

5. Existing Literature on Knowledge Transfers From Multinationals

‘To the extent that technology transfer occurs within the region, foreign direct investment certainly has the potential to stimulate growth through its impact on the competitiveness of domestic firms.’ (B. Morgan, 1995, p. 1-2).

Multinational plants have the potential to exert a positive influence on their host region because of they are often technologically superior to local firms. In this section we review previous research on the technology and knowledge-related impacts of multinationals on their host economies, focusing firstly on conceptual perspectives and secondly on existing empirical evidence on this issue.

Young, Hood and Hamill (1988) present a useful conceptual discussion of the main costs and benefits offered by multinational plants to their host economies in the field of technology and innovation. First, they observe that the establishment of an multinational plant necessarily involves the physical relocation of technologies embodied in capital goods (e.g. machinery) and a number of forms of disembodied technology, including industrial property rights, unpatented know-how, and managerial

and organisational expertise. They also suggest three other ways in which an multinational plant may contribute to local technological development: (1) by undertaking local research and development; (2) through supply-chain linkages or supplier development activities; and (3) through a “demonstration effect” on local firms.

Emphasising the particular importance of the latter two effects for regional development, Dicken (1992) suggests that the critical question is:

‘...the extent to which the technology (possessed by the multinational plant) is made available to potential users outside the firm either directly, through linkages with indigenous firms, or indirectly via the “demonstration effect”’ (Dicken, 1992, p. 392).

In this study, we focus particularly on direct trading linkages between firms. This focus is based on our belief that inter-firm linkages, such as those between multinational plants and their suppliers, may be a particularly important conduit for the transfer of technology in peripheral regions. This rationale is supported by Phelps’ assertion that:

‘...in the absence of a highly developed institutional and producer service infrastructure, collaboration as part of normal trading relationships between firms may prove the most important means of technology transfer.’ (Phelps, 1996, p. 395).

An important conceptual point to emphasise in this regard is that the simple presence of a multinational plant within a region does not guarantee technology/knowledge spill-overs to the wider economy. Dicken (1992) observes that beneficial spin-off effects will only occur if multinational plants become linked to local firms (p. 395). In the absence of such linkages, multinational plants will remain as enclaves within the host economy. And even where multinational plants do become linked to local firms, it is by no means certain that knowledge transfers will take place. Technology and know-how are crucial to the success of most multinationals and, as such, they are not lightly handed over to other firms. When technology is transferred, the terms are dictated primarily by the multinational, in the light of its own overall interests (Dicken, 1992, p. 392). Hence, deliberate knowledge transfers (i.e. “supplier development” efforts) are only likely to occur where multinational plants perceive there to be a benefit, such as improved quality, reduced costs, or improved service:

‘Where the improvement of local supply capability is critical to the competitiveness of the purchasing company ... then it may pay the company to invest resources in upgrading the efficiency of its suppliers’ (Dunning, 1993, p. 456).

From the local supplier’s point of view, knowledge transfers may contribute to the development of their relationship with their multinational customer, and they may also contribute to longer-term improvements in competitiveness (i.e. there may be a positive externality effect). This can have a positive developmental effect because:

'The experience gained in new technologies by local firms may enable them to compete more effectively in broader markets, provided, of course, that they are not tied exclusively to a specific customer.' (Dicken, 1992, p. 395)

These long-term benefits will be excluded from the cost-benefit analysis of the multinational plant when it makes decisions about the extent of its supplier development efforts. This will lead to a divergence between the private and social returns from knowledge transfers and a socially sub-optimal level of local knowledge transfer or supplier development activity. In theory, this "market failure" provides a potential justification for public intervention to increase the level of local knowledge transfers.

Therefore, we conclude from our review of conceptual literature that multinational plants have the potential through knowledge transfers to exert a developmental impact on their host region and that supply chain linkages may be a particularly important mechanism for such knowledge transfers, especially in peripheral regions. However, we should not assume that knowledge transfer benefits would automatically accrue. Where such transfers occur they are likely to be on the multinational plant's own terms, and in its own interests. These interests will not necessarily be consistent with those of the host region so policy intervention may have a role to play in increasing the knowledge-related benefits from multinational activity.

In 1988, Young, Hood and Hamill stated that there had been little empirical research on the technology and innovation-related impacts of multinationals on their host economies. In the following decade, only three empirical studies have specifically investigated the issue of knowledge transfers from multinational plants. Two of these studies focused on knowledge transfers from electronics original equipment manufacturers (OEMs) in Singapore to their local suppliers and one sought to examine the wider impacts of foreign investment on the UK economy. Tan (1989) focused on the whether the relationships between OEMs and their local suppliers were conducive to supplier development. Using a postal survey, Tan found that the majority of OEMs were engaged in efforts to develop their suppliers including monitoring supplier performance and providing suppliers with technical support.

The second Singapore study, by Wong (1992), focused on the contribution of Singapore-based multinational plants to the technological development of local suppliers. Wong found that the dominant type of knowledge transferred to suppliers was process-related - associated especially with quality assurance. Wong also found evidence of 'significant learning of generalised management know-how in the form of good manufacturing practice', including operations management, systems and procedures, good housekeeping practices, organisational and management control methods and corporate cultures. Interestingly, however, he found very little evidence of the transfer of product design know-how to suppliers. Importantly, Wong concluded that multinational plants that are committed to long-term subcontracting relationships with their suppliers are the most likely to induce technological developments among those suppliers.

The third study, by PACEC (1995), set out to assess the wider impacts of manufacturing inward investment on the UK economy, especially the impact on

management and operational practices, using a survey of 30 large foreign-owned plants². PACEC found that because of the competitive strengths of the inward investors, there was substantial potential for knowledge transfers to suppliers. PACEC also found that most firms took a positive stance on the transmission of their practices to suppliers, because this helped them to ensure that their specifications were met at the right cost and within the desired time-scale. In fact, 60 per cent had explicit strategies for developing their UK supply base. The key mechanisms used by inward investors for the transmission of such operating practices were contractual arrangements, visits to suppliers, and quality audits. The majority of inward investors also provided technical assistance to their suppliers, whilst a smaller proportion passed on knowledge of market trends and gave advice on management and organisational issues. Inward investors felt their major impacts on suppliers were related to production processes (especially quality assurance), delivery methods and product development.

We conclude this review of conceptual and empirical literature by emphasising four key points, which have determined the specific nature of the research questions we investigated and the methodological approach we adopted:

1. *There is substantial potential for knowledge transfers from multinational plants to other firms in their host region.* This potential is based on the apparent technological superiority of many multinationals (and, by implication, the existence of a “knowledge gap” between multinational plants and other local firms).
2. *The supply chain is the main route by which knowledge is likely to be transferred* from multinational plants to other companies in their host region. However, the terms under which knowledge is transferred are dictated primarily by the multinational, in the light of its own interests.
3. *Knowledge transfers to suppliers can take place through a wide variety of activities.* These knowledge transfer activities range from formal agreements to informal and unstructured learning resulting from social contacts.
4. *Knowledge transfers through the supply can lead to important improvements in supplier performance.* In the short-run, the multinational plant itself will be the major beneficiary of these improvements. In the longer run, there may also be benefits for suppliers; in theory, performance improvements should enable suppliers to compete more effectively in broader markets.

6. Conceptual And Methodological Issues

(a) Key Terms

² Only one of these 30 plants was located in Northern Ireland.

The first point of clarification concerns the target population for the study, namely externally-owned multinational plants in Northern Ireland (or “MNE plants”). We classify a plant as multinational-owned if its ultimate parent company owns manufacturing plants in more than one country (although Republic of Ireland-owned firms whose operations are limited to the island of Ireland are excluded). The rationale for focusing on these plants is that multinationals tend to be “leaders” in technology and manufacturing best practice and may therefore be well placed to introduce new technologies and best practice into Northern Ireland. We also focus our analysis on those MNE plants with more than 200 employees because we believe these larger plants are likely to have the greatest influence on the regional economy.

The second point of clarification concerns use of the term “knowledge” (as in knowledge gaps and knowledge transfers). By “knowledge” we mean the whole bundle of competencies, know-how and technological expertise that manufacturing firms use in the development, production, marketing and delivery of their products. We employ the term “knowledge” in preference to “technology” because it has a broader meaning that includes “tacit” forms of understanding and “ways of doing things” as well as more tangible and embodied forms of technology.

(b) Source Of Data

The evidence presented in this paper comes from an interview-based survey of large MNE plants in Northern Ireland, conducted in spring and summer 1998. The survey was designed to be broadly representative of the population of MNE plants with 200 or more employees and thus targeted both UK-owned and foreign-owned MNE plants from all manufacturing sectors. A sampling frame was compiled from a variety of sources including Kompass and local business directories. All 52 identified MNE plants in the target sizeband were invited to participate in the study and 33 agreed (a response rate of 63 per cent). Chi-squared goodness of fit tests confirm that the respondent group is broadly representative of the target populations by nationality of ownership and industrial sector.

(c) Measuring Knowledge Gaps

We theorise that the potential and motivation for knowledge transfers from MNE plants depends on the existence of “knowledge gaps” (Young and Lan, 1997) or “lags” (Mansfield and Romeo, 1980) between MNE plants and their suppliers³. Any transfer of knowledge between the firms will therefore “close” the knowledge gap. We seek to identify the existence of “knowledge gaps” by comparing the “stock of knowledge” in each MNE plant or supplier. Two alternative methodological approaches have been adopted in the literature for the conceptualisation and measurement of the “stock of knowledge” in a plant. The first approach, which stems from an original paper by Mansfield (1975), seeks to develop a taxonomy that distinguishes between different forms of knowledge. The alternative approach, which we adopt here, measures the

³ Such knowledge gaps, however, are a necessary but not sufficient condition for knowledge transfers to take place. In cost-benefit terms, for example, it may simply not pay the MNE to engage in intentional knowledge transfer activities where the “capability” of suppliers to absorb or utilise any knowledge transferred is limited. Finding an alternative supplier or tolerating poor service or quality may be more cost-effective.

stock of knowledge in a plant by examining its utilisation of various advanced production, managerial or organisational methods and stems from the economic literature on technological diffusion (e.g. Roper and Hewitt-Dundas, 1998). Using this approach, “knowledge gaps” between plants can be quantified by measuring differences in the level of utilisation of various best practice methods⁴.

In this study, we focus our investigation on 11 best practice techniques - covering a range of production, managerial or organisational issues (Table 2). We measure the extent of knowledge gaps by considering the following questions: Firstly, how widespread is the utilisation of these best practice manufacturing techniques by MNE plants in Northern Ireland? Secondly, how does the level of utilisation of these best practice techniques by Northern Ireland MNE plants compare to (a) that by the best plant within their parent groups and (b) that by their best local suppliers? It is important to recognise that there will not be a single knowledge gap between any two plants; rather, there will be a specific knowledge gap relating to each of the eleven best practice techniques we have selected.

The data on knowledge gaps was ascertained by asking the managers of MNE plants to compare the level of utilisation of a particular technique in their own MNE plant with that in (a) their best sister plant and (b) their best local supplier. The managers were asked to consider how many *years* it would be (a) before the level of utilisation of the particular technique in their MNE plant was on a par with current group best practice (represented by the best sister plant) and (b) before the level of utilisation of the particular technique in the best local supplier was on a par with the current level of utilisation in their MNE plant. In essence, the manager was being asked to estimate how many years “ahead” or “behind” the best sister plant and the best local supplier were, relative to their MNE plant, in the utilisation of each best practice technique. This rather complex exercise was aided by the use of a diagram, which showed a “timeline” ranging from “five years behind” through to “five years ahead” for each best practice technique. Thus, for example, if the manager of an MNE plant thought that it would take its best local supplier two years to match its own current level of utilisation of Total Quality Management, this would amount to a two year “lag” or “knowledge gap”.

(d) Measuring Knowledge Transfers

Following previous studies of knowledge transfers and supplier development (e.g. Tan, 1989; Wong, 1992; PACEC, 1995) we focus our investigation on the “activities” (or “mechanisms”) that are likely to facilitate knowledge transfers. Thus we do not actually measure knowledge flows *per se*. More specifically, we focus on a list of twelve “knowledge transfer activities” ranging from discussions of technical issues and visits to suppliers’ premises to the evaluation of supplier performance and direct provision of advice and assistance (see Table 6). Some of the activities that we investigate are undertaken with the specific *intention* of transferring knowledge to suppliers, so as to enable the supplier to improve its competencies and capabilities (e.g.

⁴ One shortcoming of this approach is that it measures only certain types of knowledge and does not take account of product-embodied knowledge or “tacit” knowledge. However, these other forms of knowledge are more problematic to measure from a methodological point of view.

advice on equipment selection, introduction to new managerial/organisational techniques). In other instances, however, knowledge may be *incidentally* transferred as a necessary by-product of efforts to improve the quality of product, delivery performance, and level of service provided by the supplier (e.g. discussion of technical issues, notification of production forecasts). Another important point to observe is that specific knowledge transfer activities can be associated, at least primarily, with the transfer of specific types of knowledge. The four main types of knowledge we consider are those related to product and process innovation and those related to organisational and strategic change (see Crone and Roper, 1999, p. 63-64).

(e) Measuring Impact On Suppliers

We asked managers at MNE plants to assess the significance of their impact on local suppliers using a five-point rating scale (ranging from “no impact” to “very significant impact”). This enquiry covered the perceived impact on eight aspects of the business performance and competitiveness of local suppliers (see Table 8). The shortcoming of this approach is that it relies on the perceptions of managers at the MNE plants, who may tend to over-emphasise the scale of their impact on suppliers. However, in the absence of an extensive survey of suppliers to MNE plants, it was not possible to arrive at a more objective assessment of the impact on local suppliers.

7. Multinational Enterprises In Northern Ireland⁵

(a) Significance Of Multinationals In The UK And Northern Ireland

It is generally accepted that the significance of multinational enterprises (MNEs) within the manufacturing sector of the UK economy has increased in recent years (e.g. OECD, 1992; Crone, 1999a). However, it is difficult to say precisely how significant multinationals currently are because research by Stone and Peck (1996) shows that official data sources (i.e. *Business Monitor PA1002*) have consistently *underestimated* the importance of foreign enterprises and because official data sources do not measure the significance of UK-owned multinationals.

Setting aside its limitations, we can use the *Business Monitor PA1002* to give a rough indication of the significance of foreign multinationals. In 1995, for example, foreign multinationals employed a significant proportion of all manufacturing employees in the UK regions (highest in Wales at 24 per cent). Also, because of their above average productivity, foreign enterprises account for a significant proportion of net output in all UK regions (highest in Scotland at 34 per cent). In Northern Ireland, foreign-owned enterprises employed 20 per cent of all manufacturing employees in Northern Ireland in 1993 (21,100 persons). However, Stone and Peck (1996) estimate that foreign-owned plants employed 27,900 persons at this time (28 per cent of all manufacturing employees) – 6,800 more than the *Business Monitor* figure. Other data from the *Business Monitor* show that between 1990 and 1996, foreign enterprises accounted for

⁵ For a more detailed discussion of the significance and characteristics of the MNE-owned manufacturing sector in Northern Ireland see Crone and Roper (1998), Chapters 3 and 4.

an average of 31 per cent of net output and roughly 32 per cent of aggregate net capital expenditure in Northern Ireland.

It is more difficult to assess the significance of UK-owned multinationals in the Northern Ireland economy. Some indication can be gleaned using data on GB-owned manufacturing plants, although not all of the British firms operating in Northern Ireland are multinationals. In 1990, GB-owned plants accounted for 22 per cent of all manufacturing employees in Northern Ireland - roughly 23,000 persons (NIEC, 1992). Despite foreign acquisitions in recent years, it seems reasonable to suggest that the UK multinationals may still account for more than ten per cent of manufacturing employment in Northern Ireland. Thus, in aggregate, multinationals may account for perhaps 40 per cent of manufacturing employees and half of net output in Northern Ireland.

(b) Multinational Plants With 200 Or More Employees In Northern Ireland

The target group for this study is MNE plants with 200 or more employees. Of 95 manufacturing plants with 200 or more employees at the time of the study, 52 were owned by multinationals (54 per cent). Foreign multinationals were the dominant sub-group, accounting for 60 per cent of MNE plants with UK/Republic of Ireland multinationals accounting for the remainder. US multinationals are dominant within the foreign-owned sub-group, accounting for 60 per cent of these plants. In terms of industrial sector, the four largest sectors, which together account for nearly 70 per cent of all large MNE plants in Northern Ireland, are: the textile and clothing industries; electrical and electronic engineering; food, drink and tobacco; and mechanical engineering. Thus, Northern Ireland's large MNE sector is dominated by mature industries and characterised by a lack of diversity, although recent foreign investments in data processing equipment and vehicle components have partially alleviated this dependence.

(c) Typology Of Large MNE Plants In Northern Ireland

Young *et al* (1988) utilise a "corporate strategy-based approach" to develop a typology of foreign MNE subsidiaries in Scotland. This typology is then proposed as a framework for understanding the economic impact of MNE subsidiaries on the Scottish economy. They base their investigation around three generic types of MNE subsidiary: the miniature replica, rationalised manufacturer and product specialist. Primarily, these different plant types can be distinguished from one another by virtue of the fact that they play different roles within their parent company's overall strategy. This can be established by looking at the scope of their markets, whether or not they are unique within their parent group, and the range of functions they undertake. Using these criteria, a typology of large MNE plants in Northern Ireland was developed (Table 1). This comprises three categories that correspond to Young *et al's* (1988) generic types plus a fourth new type (the "macro-region replica"). Their chief characteristics are as follows:

- *Miniature replica.* Here the plant/subsidiary operates as a small-scale replica of the parent company. It produces, markets and sells one, or a range of, the parent

company's product lines in the local market (usually a national market). Typically, these plants conduct little or no research and development.

- *Rationalised manufacturer.* A production-only unit that is integrated within a wider multinational system and tends to lack higher functions. Typically, it produces a particular set of component parts or products, usually for supply to other sites in the parent group and is often reliant on its ability to manufacture at low costs. Can be described as a “true branch plant”.
- *Product specialist.* This plant/subsidiary develops, produces and markets a limited product line for a multi-country or global market. It has substantial strategic control over its product range and is largely self-sufficient. It may have freedom to develop new lines of business and the parent company is generally restricted to the role of a passive investor.
- *Macro-region replica.* Similar to the “miniature replica” type but serves a much larger geographical market, typically covering at least the whole of the European Union (hence “macro-region”), as part of its parent company's “triadisation” strategy for the global market. It tends to have more autonomy and greater product design and development capabilities than the miniature replica.

We argue that this typology of MNE plants provides a useful framework for understanding the nature of MNE activity in Northern Ireland and we use it later in the paper as part of our analysis of knowledge gaps and knowledge transfer activities.

8. Empirical Results

(a) Use of Best Practice Techniques

Among Northern Ireland MNE plants the most common of the best practice techniques considered was the use of computerised Management Information Systems, which were being used by 88 per cent of MNE plants (Table 2). Slightly lower levels of utilisation were identified for Computer Aided Design, Statistical Process Control, ISO9000 quality certification and teamworking. The least common techniques were more recent developments such as Computer Integrated Manufacturing and Electronic Data Interchange, which are currently used by 44 per cent and 53 per cent of MNE plants respectively, and currently being introduced by a further 16 per cent and 9 per cent respectively (Table 2). The utilisation of best practice techniques was more common among foreign-owned MNE plants than among their UK/Irish-owned counterparts, most notably for Computer Aided Design and Computer Integrated Manufacturing (Table 2). Engineering plants were also more likely to use each of the best practice techniques were than non-engineering plants. The difference was particularly notable for Computer Aided Design, Computer Integrated Manufacturing, Electronic Data Interchange, Just-In-Time Sourcing and ISO9000 (Table 2). In terms of the subsidiary typology, the most distinctive category is the rationalised manufacturer. The level of utilisation among these plants is below the overall level of

utilisation for nine of the eleven best practice techniques (Table 2). Rationalised manufacturers are particularly weak in the utilisation of Computer Integrated Manufacturing, Electronic Data Interchange and Just-In-Time Sourcing but had average levels of utilisation in Computer Aided Manufacturing, Statistical Process Control, Automated Shopfloor Data Collection and Total Quality Management⁶.

Despite these variations within the MNE population, best practice manufacturing techniques are found to be more common among MNE plants than other manufacturing plants in Northern Ireland (Table 3). Our sample of large MNE plants generally displays greater levels of utilisation than both smaller indigenously-owned companies and, more importantly, locally-owned plants of comparable size (i.e. with 200 or more employees). This finding confirms our hypothesis that MNE plants represent a “reservoir” of knowledge within the Northern Ireland economy.

(b) Knowledge Gaps and the Potential For Local Learning

Knowledge gaps were measured to highlight differences in utilisation of best practice techniques between MNE plants and their suppliers. It will be recalled that knowledge gaps indicate the time, in years, that it would take one plant to match the current level of utilisation of a best practice technique in another plant. Comparing each Northern Ireland MNE plant to best practice within its parent group and to its best local supplier defines two distinct knowledge gaps. Table 4 shows the mean values of these two knowledge gaps, for each of the 11 best practice techniques. Negative numbers indicate a “lag”, while positive numbers indicate a “lead”. In terms of the utilisation of ISO9000, for example, the mean knowledge gap between Northern Ireland MNE plants and their best local suppliers is –0.9 years. That is, on average, the best local suppliers of Northern Ireland MNE plants lag one year behind their MNE customers in the utilisation of ISO9000.

In terms of assessing the potential for local learning in the supply chain, the most important knowledge gaps are those between the MNE plants and their best local suppliers. However, it is useful to establish first whether, and by how far, Northern Ireland MNE plants lag behind best practice elsewhere within their wider parent groups. In fact, the average knowledge gaps between the MNE plants and best practice within their parent groups were relatively small, with mean lags of less than one year being observed for all best practice techniques (Table 4). Figure 2 illustrates the combined distribution of these knowledge gaps for all eleven best practice techniques and suggests a strong modal tendency around zero.

Larger mean knowledge gaps exist, however, between Northern Ireland MNE plants and their best local suppliers (Table 4). In terms of the utilisation of Electronic Data Interchange, for example, best local suppliers lagged behind their MNE customers by an average of 20 months. Lags of 12-18 months were evident for Automated Shopfloor Data Collection, Computer Integrated Manufacturing, MIS, and teamworking with smaller knowledge gaps of 6-12 months for Computer Aided Design, Statistical Process Control, Just-In-Time Sourcing, ISO9000, Total Quality

⁶ Essentially similar results were evident in terms of the average number of best practice techniques being used by different types of MNE plant (Crone and Roper, 1999, Table 6.4, p.52).

Management. The exception to the general rule that best local suppliers lagged their MNE customers occurred for Computer Aided Manufacturing, where best local suppliers had a comparable level of utilisation to their MNE customers. A more visual impression of these knowledge gaps is given by Figure 3, which is a combined frequency distribution of the knowledge gaps for all of the best practice techniques. The modal knowledge gap is a lag of one year (i.e. Northern Ireland MNE plants are one year ahead of their best local suppliers) but there is considerable variance in the distribution.

While it is clearly disappointing to find that sizeable mean knowledge gaps exist between Northern Ireland based MNE plants and their best local suppliers, a number of qualifications are important. First, the knowledge gaps are not the result of objective measurement. Rather, they reflect the views of the staff of Northern Ireland MNE plants about their position relative to other group plants and their local suppliers. Thus, there may be a tendency for MNE plants to overstate their own position, minimising the size of the knowledge gap relative to best practice within their group and exaggerating the knowledge gap relative to their best local supplier. Secondly, the knowledge gaps reported relate to the best local suppliers of Northern Ireland MNE plants, which are likely to be better than Northern Ireland suppliers in general. Thus, the reported knowledge gaps are likely to *underestimate* the knowledge gap between the best practice frontier and the “average” Northern Ireland supplier. Thirdly, it should be noted that the data in Table 4 are mean values for the knowledge gaps and, as Figures 1 and 2 suggest, there was relatively wide variation in the knowledge gaps reported. Thus, despite the average lags reported for all 11 techniques, there were some cases where the best local supplier actually led its MNE customer in the utilisation of certain techniques.

(c) Knowledge Transfer Activities

The percentage of MNE plants in Northern Ireland engaging in each type of knowledge transfer activity (with either local or non-local suppliers) is summarised in Table 5. The most commonly occurring activities were giving suppliers at least three months notice of their production plans and undertaking ongoing quality audits of their suppliers’ products – these activities being undertaken by nearly two-thirds of MNE plants in Northern Ireland. Much less common were advising suppliers on strategic or financial aspects of their business and introducing suppliers to new managerial or organisational techniques – these activities were undertaken by only a quarter of MNE plants in Northern Ireland.

In general terms, the incidence of various knowledge transfer activities among MNE plants in Northern Ireland is somewhat lower than that found in previous studies of other areas. For example, PACEC (1995) found that 60 per cent of large foreign investors in the UK visited their suppliers to audit their premises and 60 per cent provided technical assistance to suppliers on quality assurance, compared to only 47 per cent and 48 per cent respectively in the case of Northern Ireland MNE plants (Table 5). The incidence of knowledge transfer activities among Northern Ireland MNE plants is also generally lower than that observed among Singapore-based electronics original equipment manufacturers (OEMs) by Tan (1989). For example, 62 per cent of Singapore electronics OEMs conducted regular visits to suppliers’ premises

compared to only 39 per cent of Northern Ireland MNE plants. Also 93 per cent of Singapore OEMs regularly reviewed supplier performance compared to only 34 per cent of Northern Ireland MNE plants.

The evidence in Table 5 can also be examined in terms of the type of knowledge that each activity is likely to transfer (product-related, process-related, organisational, and strategic). Previous studies, notably that of Wong (1992), have suggested that knowledge transfers from MNE plants were most likely to be associated with “softer” forms of process and managerial/organisational know-how rather than “harder” forms of product-embodied and process-embodied technology. However, this does not seem to be the case in Northern Ireland, where the average value under each of the four knowledge types is between 40 and 50 per cent (Table 5)⁷.

Reflecting differences noted earlier in the knowledge gaps it is also clear that knowledge transfer activities differ by plant type (Table 5). For example, more engineering plants than non-engineering plants are engaged in knowledge transfer activities with their suppliers⁸, however, only very small differences between the UK/Irish-owned and foreign-owned MNE plants. The clearest differences in the incidence of knowledge transfer activities are observed between various plant types. In particular, rationalised manufacturers (i.e. true branch plants) participate less intensively than other plant types across the whole range of possible transfer activities⁹.

Two further lines of enquiry were also pursued in attempting to explain inter-plant variations in the incidence of knowledge transfers; these concern supplier partnerships and supplier development policies (Crone and Roper, 1999, p. 76-80). Phelps (1996), for example, has suggested that these forms of supplier relationship may be more conducive to knowledge transfers from major manufacturers to their supply chains¹⁰. In general, we find that MNE plants favouring a partnership approach are no more likely to be engaged in “indirect” or “incidental” knowledge transfer activities (e.g. contacts to discuss technical issues, ongoing quality audits) than plants with an adversarial attitude to supplier relations. However, MNE plants favouring a partnership approach are significantly more likely to be engaged in a range of more

⁷ It should be noted, however, that the product-related knowledge transfer activities investigated here are primarily concerned with “soft” forms of product knowledge (e.g. product specifications and feedback on supplier performance) and not “hard” product technologies. Hence, the comparison with Wong’s findings is not an exact one.

⁸ Note, however, that the difference between the use of knowledge transfer activities by engineering and other plants is only statistically significant for visits to audit suppliers (ANOVA, $p < 0.10$).

⁹ A similar picture is suggested if we look at the *number* of knowledge transfer activities being engaged in by individual MNE plants (a measure of the *intensity* of knowledge transfer activities at each plant). Engineering plants again tend to be involved in more knowledge transfer activities than non-engineering plants; there was again little difference between the UK/Irish-owned and foreign-owned sub-groups; and, the most notable differences were again observed between different plant types.

¹⁰ 55 per cent of Northern Ireland MNE plants explicitly stated that they used or favoured a “collaborative” or “partnership” approach with at least some of their key suppliers. A further 23 per cent of plants displayed some of the characteristics normally associated with the collaborative/partnership approach but did not specifically refer to this approach in discussions. The remainder of plants (22 per cent) made no mention of “collaboration” or “partnerships” and tended to adopt what might be described as an “adversarial” approach to supplier relations and supplier management.

direct knowledge transfer activities. Essentially similar results were identified for those firms involved with formal supplier development policies (Crone and Roper, 1999, p. 76-80).

In Table 6 (columns 1 and 2), we compare the proportion of *all* MNE plants in Northern Ireland engaging in various transfer activities with suppliers in Northern Ireland and with non-local suppliers. This distinction was only made for seven of the twelve knowledge transfer activities. For the remaining five activities, MNE plants made no distinction between local and non-local suppliers – if they engaged in the activity, they would do so with all suppliers, regardless of location¹¹. The data in Table 6 (columns 1 and 2) show that for all but one activity, a higher percentage of MNE plants was engaged with non-local suppliers than with local suppliers. For example, 41 per cent of MNE plants were collaborating with non-local suppliers on product development compared to 31 per cent who were collaborating with local suppliers. These differences may partially reflect variations in the propensity of different MNE plants to collaborate with their local *vis a vis* non-local suppliers but, more importantly, they reflect the fact that ten of the 33 Northern Ireland MNE plants in our sample had no significant local suppliers – hence they could not engage in knowledge transfer activities with local suppliers.

By adjusting for this factor, we can derive a more realistic indication of the propensity for the group of MNE plants that do have *local* suppliers to undertake knowledge transfer activities with these local suppliers (Table 6, column 4). The adjusted figures show that where MNE plants have local suppliers they are, for some activities, slightly *more* likely to interact with those local suppliers than with non-local suppliers. For other knowledge transfer activities MNE plants with local suppliers display a broadly similar propensity to interact with local suppliers as with non-local suppliers¹². Thus, we can confidently state that our findings in earlier sections about the incidence of knowledge transfer activities are applicable to knowledge transfers between Northern Ireland MNE plants and their local suppliers.

Perhaps the most important point to note here is that the extent of knowledge transfer activities undertaken by Northern Ireland MNE plants with their local suppliers depends not only on the characteristics of the MNE plants but also on the availability of appropriate suppliers in the host region. From a regional development perspective, this emphasises the point that inward investment *per se* will not necessarily bring knowledge transfer benefits to the local economy. Rather, certain types of inward investment are likely to be much more advantageous in this respect than others – notably those that form linkages with local firms. Our evidence suggests that the ideal scenario for Northern Ireland is probably a foreign-owned engineering plant that plays the role of a product specialist or macro-region replica within its group and, crucially, for which there are substantial local sourcing possibilities. In this scenario, the high

¹¹ Interestingly, these five activities were mainly concerned with giving formal or informal supplier development assistance.

¹² These results are broadly similar to those of PACEC (1995) who found little difference between the proportion of inward investors in the UK using each mechanism with their local and more distant suppliers. A “local” supplier in the PACEC study was one located within 25 miles of the inward investor.

knowledge transfer potential is likely to be realised in the form of beneficial local spill-overs through local supply chain linkages.

(d) Impact of Knowledge Transfers on Local Suppliers

It will be recalled that our interest in knowledge transfers from MNE plants stems from the idea that these transfers may have beneficial impacts on the host economy. Specifically, it is thought that MNE plants may, through various knowledge transfer activities, help their local suppliers to improve aspects of their competitiveness – i.e. they may stimulate localised learning in the supply chain. This learning process may help local suppliers retain or expand their business with established local MNE customers, and it may also help local suppliers to secure new business elsewhere. To address this issue we asked the MNE plants to assess their impact on their local suppliers, using a rating scale (ranging from “no impact” to “very significant impact”).

As a useful benchmark, the impact of Northern Ireland MNE plants on their local suppliers can be compared with similar evidence from PACEC’s (1995) study of foreign investors in the UK. PACEC asked large foreign investors if they had had an impact on the business performance of their UK suppliers in a number of different areas. The percentage of plants claiming to have had an impact in each of these areas is shown in Table 7. The comparable figures from our Northern Ireland study shown in Table 7 indicate the percentage of plants with local suppliers who claimed to have had a moderate, significant or very significant impact on those local suppliers (based on the rating scale). The two sets of data are in fact surprisingly similar, with almost the same proportion of MNE plants claiming to have influenced their local suppliers in each case. Thus, it seems that where Northern Ireland-based MNE plants have local suppliers they are at least as likely as major foreign investors in the UK to have had a positive impact on the business performance and competitiveness of suppliers in the host economy.

Following the example of the previous sections, we conducted further analysis to see if certain types of MNE plant have had a greater impact on their local suppliers than other types of plant. On average, foreign-owned plants claim to have a slightly greater impact on supplier performance and competitiveness than UK/Irish-owned plants in all areas except quality, where UK/Irish-owned plants have a greater impact, and sales, where the mean score is equal in both sub-groups (although none of the differences is statistically significant). Engineering plants claim to have a greater impact on supplier performance than non-engineering plants in all areas except sales and the size of the workforce. Rationalised manufacturers claim to have less impact on their local suppliers than other plant types in all areas except sales (where they are close to the average). On average, MNE plants that operate a formal supplier development policy claim to have a greater impact on all eight areas of supplier performance and competitiveness than MNE plants that do not operate such a policy¹³.

¹³ The PACEC (1995) study of foreign investors in the UK also found that plants operating a formal supplier development policy had a greater impact on the business performance of their suppliers.

9. Conclusions

The main empirical findings from this study of MNE plants in Northern Ireland are three-fold. First, the level of utilisation of best practice techniques among MNE plants in Northern Ireland is greater than that among indigenously-owned companies, and is broadly in line with best practice within the plants' wider groups. Secondly, sizeable knowledge gaps exist between many Northern Ireland MNE plants and their best local suppliers. Most notable are average gaps of 18-24 months in the utilisation of Automated Shopfloor Data Collection, Electronic Data Interchange and Computer Integrated Manufacturing and gaps of 12-18 months in the utilisation of Computer Aided Design, Statistical Process Control and teamworking. Thirdly, a significant proportion of MNE plants in Northern Ireland are currently engaged in a range of knowledge transfer activities with their suppliers. However, due to the low level of local sourcing in Northern Ireland, the proportion of MNE plants engaging in these knowledge transfer activities with local suppliers is apparently lower in Northern Ireland than in the UK as a whole (PACEC, 1995).

This evidence suggests that there remains an, as yet, unexploited potential for *local learning* from MNE plants within Northern Ireland. Or, put more formally, that the current, privately determined, level of knowledge transfer in Northern Ireland is lower than the socially optimal level. This implied market failure might be addressed by two main forms of policy initiative: (1) supply chain measures, designed either to extend or strengthen local linkages and knowledge transfers within the local supply chain; and (2) non-supply chain measures, intended to promote knowledge transfers from MNE plants to other local firms¹⁴.

Existing supply-chain initiatives in Northern Ireland are essentially similar to those implemented in the English regions through the Regional Supply Network (Crone and Roper, 1999, p. 87-90). These are brokerage services intended primarily to overcome a perceived lack of awareness of local sourcing opportunities among MNE plants (DTI, 1994)¹⁵. Given the limitations of the Northern Ireland supply base (Crone and Roper, 1999, p. 40-45), it seems unlikely that this type of initiative will have any very significant effect on the aggregate level of local sourcing or knowledge transfer by MNE plants. Measures to strengthen existing local linkages along the lines of either the Irish National Linkages Programme (Tomaney, 1995) or the Source Wales Initiative (Morgan, 1997) may, arguably, be more successful in increasing knowledge transfers in Northern Ireland. By encouraging the development of long-term "partnerships" between MNE plants and their suppliers these initiatives aim to increase "interactive learning" and knowledge transfers. No initiatives of this type currently exist in Northern Ireland.

¹⁴ Both types of policy initiative aim to deal with a specific form of market failure. Supply chain initiatives are essentially an attempt to "price" some activities currently occurring as externalities of firms' usual commercial activities. Non-supply chain measures are an attempt to solve a "missing-markets" problem.

¹⁵ The importance of this type of market failure caused by incomplete information is, however, questionable. Crone (1999a) shows that most MNE plants have specialised purchasing departments and use sophisticated procedures for supplier selection. In these circumstances it seems unlikely that the lack of local supply linkages at MNE plants is caused by a lack of awareness of local sourcing opportunities.

The limited ability of supply chain measures to increase knowledge transfers in small regions such as Northern Ireland suggests the potential importance of non-supply chain measures, intended to induce “learning” from MNE plants by non-supplier companies. The choice of policy instrument depends on the source of the knowledge whose transfer it is intended to promote. Knowledge embodied in the capital or equipment of MNE plants may, for example, be transferred (in disembodied form) through demonstration events (e.g. the DTI Advanced Control Technology Transfer Scheme). Alternatively, transferring person-embodied knowledge may involve staff secondments or exchanges or mentoring schemes for managerial or technical staff (e.g. the Biotechnology Mentoring and Incubator (BMI) Challenge run by the DTI or the business mentoring initiative run by the London Borough of Sutton). In either case, the success of any non-supply chain initiative of this type will depend on the willingness of MNE plants to participate. This willingness may be limited, for as Dicken (1992) notes:

‘Possession and exploitation of technology are a diagnostic feature of the TNC. Such technology - the essential life-blood of the TNC - is not lightly handed over to other firms. Control over its use is jealously guarded: the terms under which the technology is transferred are dictated primarily by the TNC itself in the light of its own overall interests.’ (Dicken, 1992, p. 392).

However, one possibility for encouraging MNEs to share their knowledge with other firms in the host region might be to make such co-operation a condition attached government grant assistance to inward investors. Radical innovations in public policy will certainly be required if the full social benefits of inward investment are to be harnessed by host regions.

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Table 1: Typology of Large MNE Plants in Northern Ireland

Type	Strategic role of plant [#]		Description of type
I	Market restricted to British Isles (or part thereof), clones elsewhere serve other national markets	24%	Miniature replica
II	Serves a “macro-region” (e.g. EU market), clones elsewhere serve other macro regions	18%	Macro-region replica (New type)
III	Unique in group, markets unrestricted (world-wide)	24%	Product specialist
IVa	Unique in group but serves group customers only	12%	Rationalised manufacturer
IVb	One of several clones serving group customers only	21%	Rationalised manufacturer

[#] based on “functional role” and “scope of markets” and relationship with other group plants.

Note: one plant, which could not be classified according the above typology, is omitted from the table.

Table 2: Percentage of Plants Currently Using Best Practice Techniques by Ownership, Industry and Typology Sub-Group

Best Practice Techniques	Ownership		Industrial Sector		Plant Typology				All Plants
	Foreign Owned	UK/RoI Owned	Engineering	Other Sectors	Mini Replica	Macro Replica	Product Specialist	Rationalised Manufacturer	
Computer Aided Design	84.2	35.7	81.3	47.1	57.1	83.3	75.0	50.0	63.6
Computer Aided Manufacturing	78.9	84.6	87.5	75.0	83.3	83.3	87.5	75.0	81.3
Statistical Process Control	89.5	69.2	81.3	81.3	83.3	66.7	87.5	83.3	81.3
Automated Shopfloor Data Collection	68.4	46.2	62.5	56.3	50.0	50.0	62.5	66.7	59.4
Computer Integrated Manufacturing	68.4	7.7	56.3	31.3	50.0	66.7	37.5	33.3	43.8
Management Information System	89.5	84.6	93.8	81.3	83.3	83.3	100.0	83.3	87.5
Electronic Data Interchange	52.6	53.8	75.0	31.3	66.7	66.7	50.0	41.7	53.1
Just-In-Time Sourcing	63.2	57.1	75.0	47.1	71.4	66.7	75.0	41.7	60.6
ISO9000 Quality Certification	78.9	85.7	93.8	70.6	100.0	83.3	100.0	58.3	81.8
Total Quality Management	78.9	78.6	81.3	76.5	85.7	66.7	87.5	75.0	78.8
Teamworking	84.2	78.6	81.3	82.4	100.0	83.3	87.5	66.7	81.8

Notes: A further 9.4 per cent of plants indicated that at the time of the survey they were in the process of introducing Automated Shopfloor Data Collection. Percentages of plants in the process of introducing other best practice techniques were: Computer Integrated Manufacturing, 15.6 per cent; MIS, 3.1 per cent; Electronic Data Interchange, 9.4 per cent; Just-In-Time Sourcing, Total Quality Management and teamworking, 3.1 per cent.

Table 3: Use of Best Practice Techniques by MNE plants and Other NI Plants

Best Practice Techniques	MNE Plants	Locally-Owned Plants			All Northern Ireland Plants
		Less than 200 employees	More than 200 employees	All Locally- Owned	
Computer Aided Design	63.6	39.5	55.9	42.6	42.8
Computer Aided Manufacturing	81.3	40.1	58.5	42.0	42.6
Computer Integrated Manufacturing	43.8	23.6	36.2	24.8	24.1
Just-In-Time Sourcing	60.6	21.9	27.9	23.9	23.9
ISO9000 Quality Certification	81.8	54.4	88.7	58.1	58.5
Total Quality Management	78.8	32.8	53.9	35.3	36.2

Note: Proportions of locally-owned and all Northern Ireland plants using best practice techniques derived from the PPDS relate to 1996. It is likely that these utilisation rates underestimate the proportion of plants currently using each technique due to their relatively rapid diffusion. See Roper and Hewitt-Dundas, 1998, p. 43-52 for a discussion.

Sources: Company Interviews and Roper and Hewitt-Dundas, 1998.

Table 4: Mean Knowledge Gaps in Utilisation of Best Practice Techniques

Best Practice Techniques	Best Local Supplier to Local MNE Plant		Local MNE Plant to Best Practice in Group	
	N	Years	N	Years
Computer Aided Design	11	-0.7	18	-0.1
Computer Aided Manufacturing	14	+0.1	22	-0.3
Statistical Process Control	12	-0.8	23	-0.1
Shopfloor Data Collection	9	-1.3	21	-0.7
Computer Integrated Manufacturing	10	-1.2	19	+0.2
Management Information System	12	-1.3	26	-0.1
Electronic Data Interchange	11	-1.7	18	-0.3
Just-In-Time Sourcing	13	-0.6	18	-0.1
ISO9000 Quality Certification	16	-0.9	23	-0.7
Total Quality Management	15	-0.6	24	-0.7
Teamworking	12	-1.3	24	-0.6

Note: Negative figures indicate a lag. Positive figures indicate a lead.

Table 5: Percentage of MNE Plants Engaged in Different Knowledge Transfer Activities with Suppliers by Plant Type

Knowledge transfer activities	Ownership		Sector		Plant Typology				All Plants
	Foreign owned	UK/RoI owned	Other sectors	Engineering	Mini replica	Macro replica	Product specialist	Rationalised manufacturer	
	(n=19)	(n=14)	(n=17)	(n=16)	(n=7)	(n=6)	(n=8)	(n=12)	
A. Product-related knowledge	47.0	40.5	37.3	51.8	57.1	55.6	45.8	28.5	44.2
Weekly contact to discuss technical issues	63.2	42.9	41.2	68.8	57.1	66.7	37.5	58.3	54.5
Monthly contact to discuss technical issues (*)	78.9	71.4	76.5	75.0	71.4	66.7	75.0	83.3	75.8
Monthly feedback on supplier performance (*)	16.7	21.4	23.5	13.3	42.9	0.0	25.0	9.1	18.8
Quarterly or more frequent feedback on performance	38.9	28.6	35.3	33.3	<u>71.4</u>	<u>33.3</u>	<u>37.5</u>	<u>9.1</u>	34.4
Collaboration with supplier on product development	38.9	50.0	35.3	53.3	42.9	66.7	62.5	18.2	43.8
B. Process-related knowledge	43.9	35.7	35.3	46.1	45.7	60.0	32.5	32.1	40.3
Monthly or more frequent visits to suppliers (*)	15.8	21.4	23.5	12.5	14.3	33.3	0.0	25.0	18.2
Quarterly or more frequent visits to suppliers	42.1	35.7	35.3	43.8	28.6	83.3	25.0	33.3	39.4
Visits to audit suppliers	55.6	35.7	29.4	66.7	57.1	66.7	62.5	18.2	46.9
Visits to inspect suppliers' premises	50.0	50.0	47.1	53.3	57.1	50.0	25.0	63.6	50.0
Advice on selection/use of process equipment/technologies	27.8	35.7	29.4	33.3	42.9	50.0	25.0	18.2	31.0
Assist suppliers in improving their manufacturing processes	44.4	21.4	35.3	33.3	42.9	50.0	25.0	27.3	34.3
C. Organisational knowledge	44.5	49.1	38.0	55.5	54.8	50.0	58.3	30.3	46.2
Ongoing quality audits of suppliers' products	66.7	64.3	58.8	73.3	71.4	66.7	75.0	54.6	65.6
Assist suppliers to implement quality assurance systems	38.9	61.5	37.5	60.0	50.0	66.7	62.5	27.3	48.0
Introduce suppliers to new managerial/organis'nal techniques	27.8	21.4	17.6	33.3	42.9	16.7	37.5	9.1	25.0
D. Strategic knowledge	41.9	42.4	38.3	46.3	44.6	58.2	52.2	23.9	42.2
Visits to discuss strategic issues	27.8	35.7	29.4	33.3	28.6	33.3	50.0	18.2	65.5
Notification of production plans more than 3 months ahead	56.3	76.9	53.3	78.6	50.0	100.0	71.4	50.0	46.9
Information on business opportunities elsewhere in group	50.0	42.9	47.1	46.7	57.1	66.7	62.5	18.2	25.0
Provided guidance on strategic/financial aspects of business	33.3	14.3	23.5	26.7	42.9	33.3	25.0	9.1	31.3

Note: Figures for each aggregate category are simple averages of the percentage of MNE plants engaged in each type of knowledge transfer activity. However, where two frequencies are reported for any particular activity (e.g. monthly and quarterly), those indicated by (*) are omitted from these averages. Underlined values are significantly different under an ANOVA test ($p < 0.10$).

Table 6: Proportion of MNE Plants Engaged in Interaction with Northern Ireland and Other Suppliers

Knowledge transfer activities	Percentage of all MNE plants engaged in knowledge transfer activities with:			Percentage of MNE plants with Northern Ireland suppliers that are engaged in knowledge transfer activities with any of these local suppliers
	Northern Ireland supplier(s)	Non-local supplier(s)	Any supplier	
Product-related knowledge				
Weekly contact to discuss technical issues	40.6	53.1	54.5	58.3
Monthly contact to discuss technical issues	56.3	71.9	75.8	80.7
Monthly feedback on supplier performance	15.6	18.8	18.8	17.4
Quarterly or more feedback on performance	31.3	34.4	34.4	39.1
Collaboration on product development	31.3	40.6	43.8	39.1
Process-related knowledge				
Monthly or more frequent visits to suppliers	9.4	18.2	18.2	13.0
Quarterly or more frequent visits to suppliers	31.3	34.4	39.4	39.1
Advice on selection/use of process equipment	(x)	(x)	31.0	39.1
Assistance in improving manufacturing process	(x)	(x)	34.3	34.8
Organisational knowledge				
Ongoing quality audits of suppliers' products	56.3	65.6	65.6	56.5
Assistance with quality assurance systems	38.7	45.2	48.4	42.9
Introduction to managerial/organis'l techniques	(x)	(x)	25.0	30.4
Strategic knowledge				
Notification of production plans 3 months ahead	(x)	(x)	65.5	60.9
Information on business opportunities in group	40.6	40.6	46.9	52.2
Guidance on strategic or financial matters	(x)	(x)	25.0	26.1

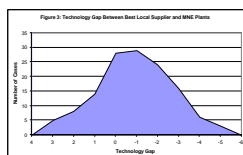
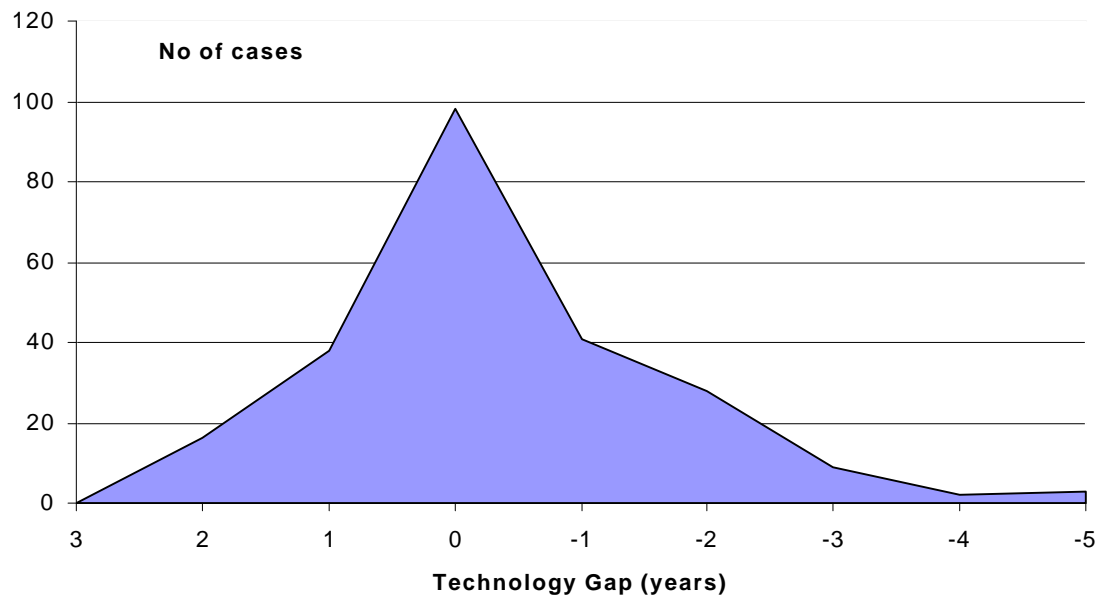
Note: the distinction between interaction with local and non-local suppliers was not made for all knowledge transfer activities – these cases are indicated by (x).

Table 7: Perceived Impact of MNE Plants on their Local Suppliers - Comparison with PACEC Study of Large Foreign Investors into the UK

Impact on suppliers	N Ireland MNE plants on their local suppliers	Large foreign investors on their UK suppliers (PACEC)
General performance		
Increase in sales	73%	77%
Improvement in productivity	56%	50%
Increase in investment	58%	70%
Increased in employment	48%	53%
Aspects of competitiveness		
Decrease in prices	88%	40%
Improvement in quality	83%	77%
Improvement in level of service	83%	60%
Improvement in delivery performance	79%	

Note: Northern Ireland figures, based on Table 7.8, record the percentage of plants reporting a “moderate”, “significant” or “very significant” impact.

Figure 2: Technology Gaps Between NI MNE Plants and Group Best Practice



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