'The tacit knowledge problem in multinational corporations: a comparative analysis of Japanese and US MNCs' transnational learning strategies'

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Abstract

This paper argues that MNCs seeking to use overseas R&D for knowledge creation have to deal with two aspects of the tacit knowledge problem: the 'cognitive' and 'societal', conceptualised as the 'two-Polanyi' problem. Based on a comparative analysis of the 'knowledge incubators' of US and Japanese MNCs in the UK, the study explores how MNCs characterised by contrasting home-based models of learning and innovation adopt different strategies for dealing with the problem. The analysis shows that the US MNCs tend to adopt the 'learning region' strategy, using the local regional context as the main social space in which extensive network ties are constructed with local scientists to facilitate inter-organisational flows of tacit knowledge. In contrast, the Japanese MNCs adopt the 'communities of practice' strategy, focusing on the creation of tight organisational spaces across geographical boundaries to support site-specific learning and intra-organisational tacit knowledge transfer. The study illustrates how these two different strategies unfold in practice and the ways in which home-based models of learning interact with the local context to shape MNCs' abilities to harness local tacit knowledge.

Keywords: tacit knowledge; multinational corporations; transnational learning; research and development; innovation.

INTRODUCTION

Multinational corporations (MNCs) are unique knowledge creating organisations because of their structural position spanning diverse institutional contexts and their ability to transfer knowledge across national borders (Kogut and Zander 1993; 1995; Gupta and Govindarajan 2000). Recent research has emphasised the learning and knowledge creating aspects of foreign direct investment, and the growing importance of networks of foreign subsidiaries as new sources of competitive advantage (Frost and Zhou 2000; Birkinshaw 1997; Frost et al 2002). In the past, the ways in which MNCs created value from knowledge was conceptualised as a linear process of knowledge diffusion from the home country to overseas units. More recent theoretical and empirical research on MNCs increasingly recognises that knowledge creation occurs not only at the home base, but in all of a firm's far-flung dispersed units (Nohria & Ghoshal 1997; Frost 2001). The MNC is increasingly recognised as an international knowledge network that creates, integrates and applies knowledge in multiple locations (Almedia et al 2002; Subramanian and Venkatraman 2001). Especially in the science-based high-technology sectors, one notable recent trend has been the extension of firms' research and development (R&D) activities and competence portfolios on a global scale to augment their knowledge base and to gain access to unique human resources (Howells 1990; Florida 1997; Kuemmerle 1997). It has been noted that one of the main changes in the innovation strategies of MNCs since the early 1990s has been the move towards 'international learning companies', and the utilisation of overseas laboratories as 'knowledge incubators' to generate new scientific knowledge that can underpin their technological distinctiveness (Meyer-Krahmer and Reger 1999; Pearce and Papanasatassiou 1999; Lehrer and Asakawa 2002; 2003).

MNCs pursue global knowledge sourcing in the search of emerging new scientific knowledge and technological capabilities, a large part of which is tacit and embedded in local innovation networks and scientific human resources. The sharing and transfer of knowledge across organisational and national borders is inherently difficult. The problem is even greater in the case of tacit knowledge which is difficult to articulate and communicate across wide geographical and social spaces because of its

experiential and socially embedded nature. Several authors have highlighted the difficulties in transferring tacit knowledge across borders and the constraints that tacitness of knowledge places on international business expansion (Teece 1977; 1981; Martin and Solomon 2003 a&b). Much of the literature, however, stresses the high cost of codification as a major obstacle to the effective exploitation of tacit knowledge across national borders. In this paper, I argue that the 'tacit knowledge' problem that MNCs have to resolve goes beyond codification. There are two dimensions of the problem, which can be characterised by the different conceptions of tacit knowledge problem of the two Polanyis (Gertler 2003).

The first concerns the cognitive and experiential nature of tacit knowledge, that is the classic Michael Polanyi (1958; 1966) problem as depicted in his observation: 'we know more than we can tell'. Here, Polanyi draws our attention to the deeply personal and experiential nature of tacit knowledge that defies easy articulation and communication. He regards tacit knowledge as an understanding of 'know-how' acquired through experience in particular problem-solving circumstances. Tacit knowledge, in this sense, is a form of 'knowing' and is inseparable from action because it is constituted through action (Orilikowsaki 2002). It is learned by direct interaction and transmitted through shared experience and the development of common understanding in particular contexts. The experiential nature of tacit knowledge may create significant barriers to organisational learning and knowledge creation within the MNC because of the difficulty in engendering interactive learning and maintaining mutual knowledge (Cramton 2001; Sole and Edmonson 2002) within its geographically dispersed and socially diverse knowledge structures (Foss and Pedersen 2003; Becker 2001). MNCs face a distributed organisational learning problem in general but the problem becomes especially complex when the creation and transfer of new (tacit) knowledge is at stake, as in the case of global dispersion of R&D and innovation activities.

The second problem arises from the contextual and socially embedded nature of tacit knowledge, and the barriers that MNCs may encounter when they seek to create and transfer it across major societal boundaries. Karl Polanyi's (1944) work on the institutional foundations of economic activity suggests that larger institutional forces play an important part in shaping the social context and rules underlying the

production of knowledge. There is a large comparative literature demonstrating how the building of firm-level skills and knowledge accumulation are heavily influenced by wider socio-economic forces and the institutional framework at the national and regional levels (Whitley 1999; Lam 1997; 2000; Lam and Lundvall 2000). Boisot (1995) argues that there is a relationship between the codifiability of knowledge, societal culture and institutions. Lam (2000; 2002) demonstrates how patterns of tacit knowledge production within and between firms are powerfully shaped by wider societal factors, especially nationally constituted organisational forms and labour markets. For example, large Japanese firms characterised by stable employment relationships and strong organisational identities have been able to develop strong capacities for internal organisational tacit knowledge creation. By contrast, Anglo-American firms' tend to rely more on external tacit knowledge generation based on flexible, open occupational labour markets and inter-organisational flows of person-embodied tacit knowledge. This implies that the kind of network relationships and societal support needed for the generation and transmission of tacit knowledge may differ significantly between different national contexts. Thus, knowledge is tacit also in the sense that common rules and taken-for-granted assumptions shared between actors are important for its successful transfer. When MNCs seek to tap into locally embedded tacit knowledge and capabilities, they have to develop close external network relationships with a variety of local actors and manage the interaction between R&D communities in the home country and in the host region. The ease of local learning and tacit knowledge creation may depend on the dynamics of interaction between the MNCs and host-regional context, and the extent to which the R&D communities of MNCs are able to develop social and relational proximity with their local counterparts.

The main aim of this paper is to explore how MNCs, characterised by contrasting home-based models of organisational learning and innovation, adopt different strategies for solving these two dimensions of the tacit knowledge problem. It examines the problem under the US 'professional -oriented' and Japanese 'organisational-oriented' models of learning and innovation (Lam 2000; 2002). The study seeks to understand how MNCs draw on their distinctive home-based organisations and competencies to develop their transnational learning strategies, and how home-based models of learning interact with the local host country context to

shape MNCs' abilities to harness local tacit knowledge. The empirical research is based on four in-depth case studies carried out in the R&D laboratories of US and Japanese MNCs in the UK.

GLOBALISATION OF R&D: OVERSEAS R&D AS KNOWLEDGE INCUBATORS

Firms in most of the industrialised countries have increased the proportion of their R&D investments abroad since the mid-1980s (Roberts 2001). US firms were pioneer investors in R&D facilities abroad but Japanese firms only established their foreign R&D sites much later and their foreign subsidiaries have a lower level of R&D intensity compared with US firms (Doremus et al 1998; Cantwell 1995). As a result of their intensive investment activity since the mid-1980s, Japanese pharmaceutical and electronics firms in the mid-1990s operated 32 percent more R&D sites abroad than US firms and more than twice as many sites as European firms, according to Kuemmerle's survey (1999a).

The global dispersion of R&D has been driven by firms' needs to acquire new knowledge and capabilities, and to gain access to unique human resources (Cantwell 1995; Dunning and Wymbs 1999; Howells 1990; Florida 1997; Kuemmerle 1999a and b). Since the mid-1980s, the overseas R&D units of many MNCs no longer confine themselves to transfer parent company technology to host countries, but are developing major innovations for the global market by leveraging the unique knowledge resources of some host country environments. Gerybadze and Reger (1999) argue that the proliferation of national innovation systems and knowledge centres at various locations throughout the world has strengthened the incentives for MNCs to go for global knowledge sourcing. When deciding to establish or expand R&D abroad, firms are increasingly motivated by the wish to gain access to sophisticated resources that cannot be found anywhere else. These changes are clearly demonstrated in Pearce and Papanasatassiou's (1999) survey of the evolution of overseas R&D labs' in the UK. The authors distinguish three different roles of laboratories: support, locally integrated and internationally interdependent categories. The study shows that the internationally interdependent type, whose main aim is to

generate new scientific knowledge has emerged as the most prevalent type of laboratory in MNCs' units in the UK.

A key element in the global learning strategies of MNCs has been the growth of transnational collaborative relationships with academic institutions. This trend is particularly prominent in the science-based industries where the traditional barriers between scientific and technological disciplines are breaking down, and there is an increased interchange between basic and applied research. Forging close links with academic institutions helps to speed up innovation and also broaden the boundary of knowledge exploration. Large MNCs seek to establish strong links with local higher education institutions also to gain early access to the best students and academic researchers. In the dynamic technological fields, competitive advantage increasingly depends on tacit competence and unique configurations of knowledge resources. Recruitment of scientific personnel is one of the main ways for MNCs to tap effectively into new clusters of knowledge located abroad.

Although US firms have been able to draw upon a strong academic science base at home to support their radical innovation strategies, they are subject to intense competitive pressures to broaden the scope of innovative search. Since the early 1990s, many leading US MNCs have sought to create a global scientific space through their global R&D networks and academic links (Gerybadze and Reger 1999). Japanese firms are relative latecomers in setting up R&D facilities abroad. However, since the late 1980s, many Japanese firms in the electronics and pharmaceutical sectors have become increasingly concerned with the need to develop more creative research organisations with greater capabilities in basic research and radical innovation (Methe 1995; Roehl et al 1995; Methe and Penner-Hahn 1999). The relative weakness of the academic science base at home and the historical institutional separation between universities and industry (Coleman 1999; Nakayama and Low 1997; Hane 1999) have prompted Japanese firms to go abroad to search for productive university ties and set up basic research facilities. MNCs increasingly internationalise their university collaborations in general; but Japanese firms appear to have internationalised their university collaborations to a greater extent (Granstrand 1999).

Lehrer and Asakawa (2002; 2003) use the term 'offshore knowledge incubators' to describe R&D units established in a foreign environment with a strategic objective of building close ties with local universities and research organisations in order to capture and cultivate new scientific and technical knowledge to support the MNC's global innovation strategies. This type of overseas unit poses special managerial and organisational challenges for the MNC because of the tacitness and localised nature of the knowledge involved, and the open-ended knowledge creation process that they undertake within globally dispersed organisational contexts. The mandate of these overseas knowledge incubators is to search for new (breakthrough) scientific knowledge that potentially has high economic and commercial value for the MNC. New knowledge tends to be developed in tacit form and is highly personal, initially known by one person or a small team of discovering scientists, and is difficult to transfer to others (Zucker et al 2002a). The complexity of scientific and technical knowledge also means that such knowledge tends to remain tacit for a long time. Capturing such knowledge requires MNCs to foster interaction among scientists both among their employees and outsiders. A major challenge for the MNC, then, is the development of effective internal organisational mechanisms and external network relationships for capturing and transferring such knowledge across organisational and institutional boundaries.

TACIT KNOWLEDGE AND TRANSNATIONAL ORGANISATIONAL LEARNING

Tacitness of knowledge induces MNCs to locate their R&D close to local knowledge centres and expertise in order to exploit the innovative potential of spatial and social diversity of learning. However, the experiential and socially embedded nature of tacit knowledge makes the coordination of the geographically dispersed learning extremely complex and difficult. One can conceive of two different strategies for dealing with the problem. The 'learning region' strategy, popular among economic geographers and innovation scholars (Maskell and Malmberg 1999; Howells 2002; Lawson and Lorenz 1999), argues that spatial proximity and the creation of strong external knowledge networks closely embedding the firm in the local innovation systems may be a potential solution to the problem. The core assumption is that the local context provides the crucial social environment where actors develop relational proximity,

common codes of communication and shared norms which guide social interaction and facilitate the flow of tacit knowledge. In contrast, the second strategy, based on 'communities of practice' and the idea that the creation of organisational space and strong relational proximity could facilitate the flow of knowledge across geographical and institutional boundaries (Amin and Cohendet 2000; Brown and Duguid 1996; 2000a). It emphasises the importance of developing distinctive organisational contexts, shared work practices and identity as key factors promoting the generation and transmission of tacit knowledge.

The relative dominance of these two different strategies may vary between firms of different national origins, as suggested by the institutional approach that stresses the influence of home-based institutions on the structure and behaviour of MNCs (Whitley 1999; 2001; Morgan 2001; Pauly and Reich 1997; Doremus et al 1998). In a similar vein, the literature on national innovation systems stresses the impact of distinctive national institutions on firms' innovation patterns and technological trajectories (Lundvall 1992; Nelson 1993; Hollingsworth 2000; Pavitt and Patel 1999). Drawing on this earlier work, I argue in this paper that the transnational learning activities of MNCs and their strategies for harnessing tacit knowledge will bear the strong imprint of 'home country effects'. This does not imply the replication of home-based organisational forms and learning patterns in the global arena, but refers to the ways in which MNCs' draw upon their existing organisational competencies and expertise to develop their transnational learning strategies. In particular, I suggest that US MNCs will tend to adopt the 'learning region' strategy, taking advantage of their strong organisational capacity for external learning and knowledge creation through open professional networks spanning organisational and institutional boundaries (Saxenian 1996; Cohen and Fields 1999). In contrast, Japanese MNCs are more likely to use the 'communities of practice' strategy, relying on their unique organisational capacity for internal tacit knowledge creation through the development of shared identities and problem-solving routines within organisational networks (Nonaka and Takeuchi 1995; Dyer and Nobeoka 2000). The strong emphasis of Japanese firms on internal tacit knowledge creation, however, may limit their ability to exploit locally embedded tacit knowledge. One would also expect Japanese R&D laboratories in the U.K. to face greater institutional barriers to local

learning because of the greater divergence between the local institutions and Japanese MNCs' domestic ones.

The central aim of the empirical study is to examine the ways in which US and Japanese MNCs develop their transnational social spaces for learning, and how the two different strategies unfold in practice. To what extent can the MNCs resolve the 'two-Polanyi' tacit knowledge problem, namely, the 'cognitive' (Michael) and 'societal' (Karl) dimensions of the problem? While both sets of the MNCs have to deal with the cognitive aspect of the problem, the varying degree of institutional proximity between the home and local context would imply an asymmetry in the societal aspect of the problem. The comparison between the US and Japanese MNCs in the UK context brings out the importance of the varying degrees of institutional proximity: the Karl Polanyi problem.

RESEARCH METHODS AND THE SAMPLE

The research is based on four case studies of two US MNCs, one in the ICT sector (US-ICT) and the other in pharmaceutical (U.S-Pharma); and two Japanese MNCs also from the same two sectors (J-ICT and J-Pharma). They are all large multinational firms operating in the science-based industries. The two ICT firms are comparable in terms of their size, scale of R&D investment and the duration of their R&D operations in the UK. US-ICT's Bristol Laboratory was established in 1985 and, J-ICT's Cambridge Laboratory in 1989. The two companies in the pharmaceutical sector, however, cannot be claimed to be directly comparable because of the substantial differences in their size and R&D investment. Moreover, US-Pharma's R&D site in the UK was established in 1955; whereas J-Pharma's London Laboratory was initiated in 1990. The 'bias' of our sample is inevitable because of the contrasting national patterns of sectoral development in pharmaceuticals between the two countries.

The case studies focus on the MNCs' R&D laboratories in the U.K. All four units chosen for the study are research labs with the objectives of exploring new technologies or researching new scientific fields. They can be described as 'knowledge incubators'. The two U.S. laboratories are part of the globally distributed R&D centres; whereas the Japanese ones are campus-based laboratories, reflecting the

distinctive pattern of Japanese overseas R&D investments. Data were collected by semi-structured interviews with senior managerial and technical staff in R&D, human resource and academic liaison groups as well as those directly engaged in external collaborative activities. The semi-structured questionnaires cover three main areas: a) international R&D organisation and global knowledge sourcing strategies; b) patterns of interaction with local universities and research institutes and c) the role of human resource strategies in global coordination and local knowledge sourcing . A small number of interviews were also conduced with the MNCs' local academic partners in order to gain a deeper understanding of the knowledge transfer process.

In the case of the Japanese firms, interviews were also carried out with senior management at the headquarters in Japan. This was necessary for collecting essential company information not readily available in the U.K. The contacts with the headquarters were also important for gaining access to the laboratories in the U.K. The Japanese interview sample is much smaller owing to the difficulties in gaining access to key staff in Japan and the small scale of the local laboratories. Access to J-Pharma in Japan was relatively restricted and only four interviews were carried out. However, this was compensated by the fact that the two interviewees at the headquarters in Japan had previously worked in the overseas laboratories in the U.S. and U.K., and were able to provide rich information on the role of these laboratories.

The interviews in Japan were conducted in Japanese and, in the U.K., in English. The interviews with the two US MNCs were conducted between 1999 and 2000; and the Japanese MNCs during 2001. The interview sample is shown in Table 1. All the interviews were recorded and transcribed. These data were supplemented by company documents, press releases and other relevant published materials.

Table 1 about here

DEALING WITH THE 'TWO-POLANYI' TACIT KNOWLEDGE PROBLEM: A COMPARATIVE ANALYSIS OF THE CASE STUDIES

Table 2 gives a profile of the international R&D organization of the four companies studied. The case studies reveal some significant contrasts between the US and

Japanese MNCs' in their global R&D structures and coordinative mechanisms, and the ways in which they seek to tap into local knowledge. These differences generally support the hypothesis that the US MNCs have a tendency to adopt the 'learning region' approach whereas the Japanese, the 'communities of practice' approach.

Table 2 about here

International R&D organization and distributed organizational learning: integrated networks vs. hub model

MNCs adopt a variety of global R&D structures and management styles in coordinating globally dispersed R&D units (Chiesa 1996; Gassman and von Zedwitz 1999; Reger 1999). The two US MNCs examined here have sought to build an integrated form of network R&D organisation on a global basis since the early 1990s. An important policy focus of the R&D organisational restructuring in recent years has been to enhance global coordination and integration of the geographically distributed research laboratories into the global knowledge networks. The global R&D structure can be characterised as that of an 'integrated network' whereby the central R&D evolves into a competency centre among interdependent R&D units which are closely connected by flexible and diverse coordination mechanisms. In both the US case study companies, the development of global research programmes and projects play an increasingly important role in coordinating dispersed innovation. An important objective of the US MNCs' global knowledge sourcing strategies has been to broaden their global scientific space and external knowledge networks. The local laboratories enjoy a clearly defined and coordinated autonomy within the MNC groups in terms of their R&D and business strategies, and relationships with local education and research systems. Both companies manifest a strategic aim to build a systematic and all encompassing approach to the way they interact with local universities and research organisations. Gaining access to and recruitment of scientific personnel appears to be a key strategic objective of their academic links. Moreover, the companies also increasingly seek to enlarge their space for the search of scientific expertise by tapping into the wider European labour markets. The local regional context provides an important social context within which the US-MNCs construct their learning

spaces, and seek to integrate the local knowledge sources within their global R&D networks.

The two Japanese cases examined here are both university-based laboratories, and can be considered as typical of Japanese firms' approach to tapping into foreign scientific academic knowledge base (Turner et al 1997). They were established about ten years ago and the companies have made a large investment in them. They represent the European nodes in the companies' tripolar global research network. The R&D organisation of the Japanese MNCs approximates the 'hub model' : the central research laboratories at home maintain tight control over decentralised activities by means of long-term R&D programmes as well as resource allocation and close monitoring through personnel allocation. Both laboratories are managed by Japanese research scientists dispatched from central R&D at home. The pharmaceutical company's initial attempt to appoint a foreign research director and grant its London laboratory autonomy had proved to be 'unsuccessful' from the viewpoint of the parent company. This subsequently led the company to dispatch a Japanese research manager to re-integrate the overseas unit within its domestic research facilities (see below). The Japanese MNCs have sought to create tight ‘organisational spaces’ across geographical boundaries to support their transnational learning activities.

The cases studies also show that the two sets of companies use different integrative mechanisms for dealing with distributed organisational learning -- the Michael Polanyi tacit knowledge problem.

The US MNCs adopt a project team level coordination strategy focused on the development of integrative management practices that encourage individuals from different parts of the organisation to interact and communicate with each other once the knowledge creation task (project) has been identified. Within the US MNCs, the development of global research programmes provides a common cognitive space for integrating and guiding R&D activities among the dispersed scientific and technical communities. The US MNCs increasingly rely on multi-site projects for coodinating their globally dispersed R&D activities. For example, US-ICT’s corporate R&D is organised into four research programmes, corresponding to the four core business areas. These programmes cut across different laboratories which can be located

anywhere in the world. Labs are organised into departments which are subdivided into projects. The project groups constitute the basic structure of work organisation in the laboratories. The company places an increased emphasis on the development of global project teams and systematic human resource strategies to support global coordination and knowledge transfer. In the case of US-Pharma, the Central Project Management function has assumed an increasingly important role in coordinating globally distributed R&D. The company has recently developed a Common Planning and Scheduling Systems (COMPASS) which is universally adopted by the research labs worldwide. The intention, according to the project manager interviewed, is to have a set of common definitions and codes to enable the company to 'roll up' all the projects into a portfolio view. In both companies, projects provide focal points for developing common knowledge and shared practices within their global knowledge networks. Projects assume an identity within the global organisation, allowing the members to relate to it and provide a shared context for knowledge sharing. They also generate organizational standards and procedures that help to reduce the cognitive and social distance between project participants (Mendez 2003). In this regard, the project or task provides what Cramton (2001) refers to as the 'common ground' for generating 'mutual knowledge' that aids knowledge transfer in dispersed collaboration. Projects also allow the companies a great deal of organisational and spatial flexibility to extend their reach to different knowledge pools and resources both internally and externally. However, their temporary nature and the limited scope of 'common knowledge' built around specific tasks/teams mean that the flow of tacit knowledge may be confined within these boundaries.

The Japanese MNCs, by contrast, rely on an organisational level integrative strategy, aiming at maintaining a cohesive internal tacit knowledge production system.
In fact, a core strategy of the Japanese case study companies has been to limit the 'dispersedness' of their global knowledge structures so as to ease transnational learning. This is achieved by limiting the size of their overseas laboratories and the scope of their links with local institutions, and reducing the uncertainty in their knowledge search by focusing on specific technological fields closely related to their home-based core competencies. Both the Japanese laboratories looked at in the study are located on campus and focussed on specific technological fields. The two companies use a combination of formal control structures, and informal socialisation

and person-oriented mechanisms to integrate their geographically dispersed learning activities. The overseas laboratories are under the formal control of Corporate R&D Planning Group at home and, the managers and key technical staff responsible are Japanese. For example, J-ICT's European R&D sites are coordinated by a parent organization, the Corporate Technology Group, based in the UK. The management team of the Group is solely Japanese, comprising a general manager and four local laboratory managers, all of whom are Japanese. Indeed, a distinctive approach adopted by the Japanese MNCs is the reliance on expatriate managers (scientists) as key liaison persons in bridging the relationships between the home and local laboratories. These expatriate managers play a critical role in transferring home-based organizational routines and work practices to the local laboratories, and fostering strong inter-personnel connections between the home and local R&D communities. The manager of J-ICT Cambridge Laboratory is a Japanese researcher from the Central R&D who acts as the key liaison person between J-ICT and the local laboratory. He visits Japan twice a year to report on progress and decide the future objectives of the Cambridge Lab. J-ICT also makes intensive use of progress reviews and frequent written reports for monitoring the progress and research direction of the Cambridge Lab. Likewise, the director of J-Pharma London Lab is an experienced Japanese researcher dispatched from Central R&D who considered his task to be to 'integrate and bridge' basic and applied research, and to 'educate' the local researchers on drug development. One can argue that the Japanese MNCs have sought to extend their firm-centred communities of practice across geographical boundaries in order to promote common standards, routines and values (i.e. corporate culture) that supports the integration of dispersed R&D into corporate business strategies. While the US MNCs seek to develop project-related 'common knowledge' as a cognitive base to promote tacit knowledge transfer, the Japanese MNCs appear to rely on 'shared identity' to promote trust and attachment to the organisation in order to ease the transfer of tacit knowledge. Indeed, Nonaka and Takeuchi's (1995) model of organizational knowledge creation stresses the importance of socialisation and organizational emotional engagement in facilitating the sharing and transfer of tacit knowledge. This organisational integrative strategy, however, is costly and depends on the existence of a relatively stable organisational membership base. This inevitably means that it cannot easily be extended across wide spatial and social boundaries.

Network construction and local learning: 'strategic university partnerships' vs. 'embedded laboratory' approach

The case studies also show a significant contrast between the US and Japanese MNCs in their patterns of local learning and abilities to embed themselves in the local innovation networks. Here, a key problem facing the MNCs concerns the potential barriers to cross-societal learning arising from the contextual and socially embedded nature of tacit knowledge: the Karl Polanyi problem. Developing close network ties and personal links with local scientists are important for capturing locally embedded tacit knowledge. The evidence suggests that the US MNCs have been able to develop extensive network ties with the local scientific communities through strategic university partnerships and recruitment of scientific personnel to encourage the flow of person-embodied tacit knowledge across organisational boundaries. The Japanese MNCs, on the other hand, appear to be more limited in the scope of their local network construction and they have not developed the US-type of broad-based university links and human resource strategies. Instead, their local laboratories are rather small and set up as university research centres engaging in rather focused research collaboration with the university scientists. The recruitment of local scientific personnel does not appear to be a key motive behind the collaboration. This approach reflects a conscious strategy adopted by the Japanese companies to create their own distinctive organisational spaces and social network support within a foreign institutional context which differs significantly from the domestic one.

US MNCs: strategic university partnerships and scientific networks

The two US MNCs looked at in this study have sought to develop deep institutional links with key local universities and use wide external networks of scientists-collaborators to facilitate inter-organisational flows of knowledge. The main mechanisms for local knowledge sourcing comprise three components: a) developing 'strategic partnerships' with key universities for human resource flows and recruitment; b) use hybrid research organisations and collaborative projects to facilitate joint work and transfer of tacit knowledge; and c) using 'star scientists' as focal links in local innovation networks.

A key aspect of the US MNCs' strategies for tapping into the local labour markets and scientific communities has been the development of close ties with local universities and research organisations. The main objective of the companies is to focus attention and concentrate resources on a small number of key institutions from which they are most likely to acquire their people and knowledge. The term 'strategic partnership' is often used to denote an intention to forge long-term, multi-dimensional ties and trusting relationships with their preferred institutions. The relationships are usually sustained by a range of linking mechanisms including research collaboration, industrial inputs to curriculum development, student placements and exchange of scientific staff. Since the mid-1990s, US-ICT has been making a conscious policy effort to develop more systematic and stronger links with universities. A new position responsible for academic links was created in 1995 at the Bristol laboratories. The mandate of this new role is the development of a 'Strategic University Relations Programme' on a global scale together with their US counterparts. A strong focus is placed on long-term relationship-building rather than acquisition of specific expertise or technologies. The intention behind such partnerships, according to a senior manager responsible for university links in US-ICT, is to have 'early access to the best ideas and trusted access to the best people'. By becoming a trusted partner in the academic community, US-ICT would be in a better position to catch the students early but also have an opportunity to influence the education and training of future employees. Likewise, US-Pharma has sought to develop a more focused and targeted approach to the ways it relates to higher education institutions. The Director of Human Resources in Central Discovery described recruitment as a very 'tough' area. Forging closer academic links has become so important that the company has recently created 'strategic recruitment specialists' in chemistry and biology, staffed by scientists with PhD qualifications, to liaise and develop strategic relationships with their preferred institutions.

A major challenge facing MNCs' global knowledge sourcing concerns the development of organisational mechanisms for cultivating and capturing commercially valuable new scientific knowledge at the local level. New scientific breakthrough knowledge tends to be tacit and highly localised: usually held by a small team of discovering scientists and is difficult to transfer to others. According to

Zucker et al (2002a), a most effective means for the sharing and transfer of such knowledge requires bench level collaboration between firm and discovering academic scientists where one can see how the science is done. Discovering scientists are typically willing to transfer knowledge primarily in the context of their ongoing laboratory work. The participation of firm scientists in bench-level team work with discovering university scientists also facilitates the formation of a shared cognitive framework that makes the new knowledge understandable and useable for the firm. Hybrid research organisations and collaborative projects are the main mechanisms used by the US MNCs to engage local academic scientists in joint work. US-ICT, for example, set up a hybrid research institute in mathematics in the mid-1990s as part of the company's initiative to widen its research base and explore new avenues of knowledge. The hybrid research centre sits at the interface between UC-ICT Bristol Laboratories and its partner university in the region. It provides a forum for collaborative research and personnel exchanges. The core research staff comprise a mixed blend of US-ICT researchers, academic scientists jointly appointed by the company and university, and post-doctoral and PhD students working on projects jointly supervised by the academic and company scientists. These people represent a kind of 'joint human capital' shared between the company and the university. The professional networks and problem-solving experiences spanning the two sectors constitute important mechanisms for the joint production and sharing of new knowledge.

At the core of the US-MNCs' strategies for developing close ties to the local scientific communities is the desire to gain access to a small number of 'star scientists' who act as focal links in the local innovation networks. The term 'star scientist' is used to refer to the top, renowned academic scientists who have accumulated unique sets of scientific expertise and social networks that underpin their superior knowledge production capabilities (Zucker et al 2002a; Bozeman and Mangematin 2004). 'Star scientists' are vital sources of knowledge and academic interfaces for firms not only because of the value of their deep scientific expertise but more critically, their connections to the wider scientific networks and 'brokering' role in knowledge transfer. As noted by Murray (2004), a firm's close ties to an individual scientist may result in the scientist contributing both human and social capital in networks of collaboration. The social capital of the focal scientists includes their local laboratory

networks of researchers and doctoral students as well as the more widely dispersed academic peers in the specialist fields.

The two US companies looked at in this study have developed their local university partnerships through the personal contacts and deep engagement of such ‘star’ academic scientists in the collaborative relationships. US-Pharma, for instance, has recently engaged in a 5-year large-scale consortium research project with a university in Scotland. The engine behind the creation of the project was a 'star' bio-scientist who had developed strong personal links with the company through consultancy activities and advisory board membership. Over the years, this professor has become a vital source of intellectual capital for US-Pharma through joint research, and his key role in creating and transferring early discovery results (tacit knowledge) via direct personal contacts with the company scientists. More critically, he also acts as a magnet for attracting post-docs and other top scientists to his laboratory, providing a source of reliable researchers for collaborative projects, and a potential source of recruits for the companies. One of the professors, who engaged in a collaborative project with US-Pharma and other companies in the consortium, talked about how the companies were trying to pick some of his ‘star’ post-docs.

Likewise, US-ICT’s strategic partnership with a university in the west of England also revolved around a key scientist who had been an industrial researcher in computer science for fifteen years before joining academia. His relationship with US-ICT dated back to his years in industry where he had built a strong reputation in both the business and academic communities. His arrival at the university gave a strong impetus to the partnership through funding of research projects and drawing up a broad framework agreement to facilitate personnel-based exchanges including student placements, visiting staff arrangements and participation of firm scientists in curriculum development and project supervision. Thus, this professor not only represents a centre of expertise for US-ICT, he is also the main conduit through which the company gains early access to students and influences their training. He is also the focal point for the firm to establish a ‘local window’ of scientific contacts ‘to generate links with other kinds of research groups around the world’, to put it in the words of the professor.

It is apparent from the above analysis that the professional networks of scientists provide a common cognitive and social basis for the US MNCs to create permeable organisational boundaries and build close ties with the local scientific communities. The construction of extensive external networks ties through gaining proximity to key scientists and universities constitute a main channel for the MNCs to tap into local knowledge sources and capture emerging tacit knowledge.

Japanese MNCs: 'embedded laboratories'

Japanese companies' motives for developing overseas academic links are very different from those of their US counterparts. They appear to use globalisation as a strategy to compensate for the weakness of home-based institutions in basic science, and to 'disrupt' their established firm-centred learning patterns. Both the laboratories studied are located on campus and engaged in rather focused research activities through institutionalised collaboration with the partner universities. Locating their laboratories on campus serves two important purposes. The first is to gain immediate access to qualified scientific personnel. Japanese companies are relatively latecomers to the global R&D scene and their laboratories are 'unknown' entities to many European scientists. They are only too aware of the potential difficulties in competing with other well established European and US laboratories for talented scientists in a tight labour market. Thus, setting up university-based laboratories helps to project them as sponsors of world-class research and attract qualified local scientists (Lehrer and Asakawa 2002). The second purpose is to use the laboratories as focal points for constructing organisational spaces to facilitate on-site (*Genba*) learning and transfer of tacit knowledge. Both the laboratories are relatively small, enabling the companies to extend their 'communities of practice' (COP) across geographical boundaries through deep interactions with the various parties involved. The empirical evidence suggests that J-ICT's COP approach has met with greater success than that of J-Pharma. The latter's attempt to (re-) integrate its London Laboratory with the R&D system at home, after an initial 'hands-off' period, appeared to have caused intense organisational strain and alienated the local scientists.

'Embedded laboratory' as organizational space for transnational learning: J-ICT Cambridge Laboratory

J-ICT refers to its Cambridge Laboratory (JCL) as an 'embedded' laboratory. This involves the research group of JCL being physically located within the same building as MRC, the frequent sharing of research staff and information, and intimate co-operation in research. J-ICT considers the main advantage of an embedded laboratory to be the opportunity to interact-face-to face with the local researchers and develop a sense of shared understanding so as to influence the purpose and targets of research identified within MRC. The Japanese manager interviewed stressed the importance of 'working together' and being 'in the same place' for relationship building with the university scientists:

'So, as you see here, through the one door, J-ICT's area and the University's area are just next door. And in the daytime, you can't distinguish which person is a university person…So we have a very deep collaboration, close collaboration really. So far, I think everything came quite smoothly. The very important factor is that we are working so closely everyday…So we have been discussing the research and administration everyday…' (Japanese laboratory manager, JCL).

Indeed, one of the main roles of JCL is to integrate the fundamental research conducted at the university with the strategic objectives of the company. The subject areas and research direction of JCL are regularly discussed at an annual advisory committee meeting at Cambridge, involving people from J-ICT and the collaborating academics. As highlighted by the laboratory manager of JCL, the collaboration is not simply a case of 'asking university people, please do this sort of research and we want to receive some results'. Rather, as researchers from JCL and MRC work together, it strives to achieve common understanding and direct research towards the same goal, though not effortless. The following comments made by the Japanese manager and a Cambridge researcher are illustrative:

'The biggest difficulty is … we employ basically the researchers with physics background. So they have a strong motivation to achieve some research goals. But as an industry, we have certain direction and targets. So to discuss the target and also to reach an agreement, by concerning research from Japan, that is somehow one of the

most difficult parts. And also the approach and the way of thinking for the research here is very different from those in Japan…So it's very useful that we have the opportunity to discuss such a target from the beginning with University staff and also students so they understand fully what's going on. I think that's the most important benefit [of adopting the 'embedded laboratory' approach]' (Japanese laboratory manager, JCL).

'…It [the collaborative relationship] needed very careful day-to-day management, very strong communication on both sides.. So, on both sides, it takes a lot of work, a lot of day-to-day communication, both locally and between the local managers, and also between our manager here and the hierarchy in Japan. Between Prof X and the hierarchy with the Lab at the University and also at other levels within those hierarchies as well…' (Cambridge researcher, JCL).

At the time of the study, there were three on-going collaborative projects, one of which had reached a stage of product development in collaboration with the Central Research Laboratory in Japan. The project started ten years ago at the initiation of JCL, with research on single electron devices lasting for seven years representing a cumulative learning period necessary to gain the expertise which formed the foundation of this invention. JCL regards its role in interfacing 'the scientific' with the 'development' world being critical for the successful innovation. This interface involves the sharing and transfer of tacit knowledge between Cambridge and Central Research in Japan through developing common understanding and bridging the different cognitive frameworks between the Cambridge scientists and development engineers in Japan. A Cambridge researcher describes JCL as 'a buffer between the corporate side and the university side'. The Japanese manager pointed out that having the Japanese staff on-site at JCL was vital for the interface and knowledge transfer:

'…That's our role. That's the reason why we need the Japanese staff here, myself and two more Japanese'… And also the interface between the scientific world and the development world is very, very difficult to fill so we are working very hard…
For scientific purposes, to show the scientific results clearly, there is a certain way to prepare the sample and prepare the end results. But to use that for the actual products there are a lot more data necessary to show, to convince the people working in the

factory. So it takes more than the initial scientific work to get some engineering data. That's done jointly with people on the Central Research Laboratory. We don't have enough expertise here, but by collaborating with the people in Central Research, we try to get some necessary data.'

The evidence thus far suggests that the JCL-Cambridge collaboration has been a success, both in terms of tangible outputs and its apparent strategic importance for J-ICT. Both the J-ICT management and researchers at Cambridge described the partnership as 'stable and successful'. A number of factors might have contributed to this. Firstly, JCL has been able to embed itself within the University both physically and socially. It has established strong personal and social network ties, albeit on a limited scale, within the university, and engaged in reciprocal knowledge sharing. A senior Cambridge researcher interviewed emphasised the importance of the 'two way process' and how JCL 'brings in a lot of extra scientific expertise and knowledge to the university group'. Secondly, J-ICT has made large investments in its domestic R&D and established a strong scientific culture at its central laboratory at home. This facilitates scientific communication with the overseas researchers and the appropriation of scientific breakthroughs. Finally, and perhaps more critically, J-ICT has been able to extend its corporate COP to its overseas laboratory through an emphasis on management processes that lead to the formation of common understanding and shared identity among its local laboratory staff. Concern was placed not only on gaining access to scientific expertise, but also instilling a sense of shared identity through intense communication and subtle socialisation so that the key local researchers get to know the company and its established routines. A local Cambridge researcher talked about the importance of 'careful daily management' of relationships in 'little things' like wearing a suit when he visits the Japanese headquarters in Maidenhead 'because there everybody wears suits and if I turned up dressed up like this I wouldn't be taken seriously'. He also boasted the strong links that his team had developed 'with everybody at every level and also up to Board level within the Central Research Lab [in Japan]'. It appears that the intensive personal interaction and frequent two-way visits of researchers have facilitated the development of 'relationship specific heuristics' (Uzzi 1997) that helps to ease the cognitive and societal barriers to tacit knowledge transfer.

It is, however, worthy of note that JCL is relatively small. Its collaborative objectives and research focus have remained highly specific, and tightly connected with the product innovation strategy at home. This indicates that the innovative capabilities may be limited or circumscribed, in that if it were more extensive it would be able to conduct a more varied spectrum of research and broaden its scope of knowledge search.

'Embedded laboratory' and problems in local embedding: J-Pharma London Laboratory

J-Pharma London Laboratory (JLL) was initially conceived in order to focus on basic, curiosity driven research that may provide new drug candidates which would then be developed at the Tsukuba research laboratories in Japan. Initially the Lab was given sufficient independence to carry out this mandate. The appointment of a US scientist with strong connections with local academics represented a conscious attempt of J-Pharma to signal its commitment to basic research and locally embedding the laboratory. During the first 5 years, despite the formal centralised management structure, JLL was able to establish close links with the university and engaged in various exchange activities. This was made possible through the effort of the US scientist director and a small group of university academics initially involved in setting up the laboratory, as noted by one of the professors:

'… so with J-Pharma in the first five years, remember, the structure was identical. The Japanese had absolute control, J-Pharma had absolute control of what went on there [at JLL] but because of the Director and the people he hired and so on, it was terrific. There was a lot of flow back and forth, we collaborated with them, we published with them, as did other people in the University. Students were flown here. I mean, it was like part of the University, it was tremendous'.

However, after a few years without producing what was felt to be significant drug candidates it was reintegrated within the research activities of the Tsukuba lab. JLL currently collaborates on projects with the Tsukuba laboratory, whereby project team members concurrently conduct research on the same project. Tight control is maintained through project management and intensive two-way communication between the two labs via the internet and visits of researchers. The role of JLL

appears to have shifted from being that of an 'innovator' in the global R&D network to a 'contributor' within the product development system at home.

The reason given for this dramatic change of research orientation and management, according to the interviews with J-Pharma, was that following three or four years of investment, no new drug candidates had been discovered. It was stated in the interviews that the president of J-Pharma, an MBA graduate, became impatient for some return on the investment made. However, this expectation and the subsequent change of direction seem remarkable given the fact that J-Pharma's president had stated that the aim of JLL "is to produce good medicines for the central nervous system. It will take at least five to six years – and in many cases more than 10 years – to reach that stage" (FT, 1990). It can be argued that the change in research orientation partly reflects the 'failure' of J-Pharma to gain an understanding of the research process conducted at JLL and hence to evaluate its research progress appropriately. The tangible output of drug candidates used to evaluate the achievements of JLL may not be a sufficient measure of the success of the collaboration. The academic at the University of London responsible for the initial set up of JLL repeatedly pointed out in the interview that 'there were some very serious misunderstandings' about the nature of doing basic research and the role expected of JLL.

> '…the real problem was this misunderstanding about direction from the beginning. Their claim was they had always had the same thing in mind, they wanted to see drugs on line in three to five years and that was not on the table in the early years.…We on the Advisory Board were under the impression that what J-Pharma wanted was to have a first rate research institute focused on XX disease. Basically doing basic research for drugs that would emerge from principles fifteen, twenty years, this was long-term research… .'

It would appear that the 'misunderstanding' was partly caused by the different expectations and taken-for-granted assumptions of industry and those of basic science of university. The problem can be accentuated when it involves a Japanese company and western academic partner because of the added difficulties arising from 'cross-societal' differences in attitudes towards science and dominant modes of knowledge

production. Japanese society traditionally gives greater respect for engineers than scientists in laboratories and universities (Chikudate 1999; Coleman 1999). The dominant technical logic of Japanese pharmaceutical companies has been traditionally weighted towards development of products based on existing scientific knowledge as opposed to basic research needed to create new scientific knowledge (Methe 1995; Kneller 2003). Thus, Japanese companies may find it difficult to understand and appreciate the basic assumption of exploratory science upheld by western scientists. Chikudate (1999) notes that the cognitive and social distance between 'managerialism' of Japanese pharmaceutical companies and western 'scientism' often leads to communication breakdown in cross-border partnerships.

The dramatic shift in the research direction of JLL also reflects the strength of the dominant technical logic and power of control of existing organisational routines. Japanese pharmaceutical companies have traditionally built their success on using a cohesive internal product development system to achieve world product-output levels despite their small size compared with major global rivals (Roehl et al 1995). The system is geared towards internal tacit knowledge creation and transfer. The presence of a non-Japanese laboratory director at JLL posed a challenge to the cohesive product development system: it created difficulties in communication and internal tacit knowledge transfer from the viewpoint of the central laboratory. It was considered by head office that the foreign research director sought 'too much independence' and could not be held accountable for the direction of research: 'foreign director has his own thoughts and own opinions… our president thought the lab director should be Japanese' (interviews with manager at head office and Japanese director at JLL). Indeed, the change of research director at JLL, from an American academic scientist to a Japanese researcher with many years of drug development experience at home (but no previous overseas experience), can be considered as an attempt to re-integrate the local laboratory, and to harness and exploit its research results. Following the appointment of a Japanese research director, JLL became more integrated within J-Pharma.

The dramatic change in research direction and the departure of the US director resulted in very high staff turnover, with half of the research staff leaving, and the subsequent alienation of numerous academics and cessation of substantial links with

the university. There is now little formal collaboration between JLL and the university. Informal contacts and personnel exchanges also appear to be minimal. One of the key academics initially active in the links claimed that JLL is now 'a non-entity to the university'. He described the change in research direction as 'a shock, an enormous disappointment', and reckoned that 'none of the really good basic research at the university will ever find its way through the doors of J-Pharma'. This is because the community of academic scientists on campus no longer felt that they were connected. This raises questions about its long-term ability to build academic links and tap into the local knowledge networks. J-Pharma itself has also expressed doubts about the value on return for the investment in JLL and its long-term viability.

The collaboration between J-Pharma and the University of London has not been considered a success by both parties concerned. J-Pharma has not been able to sustain its initial effort in organisational learning, and has failed to establish close ties with the local academic community. The experience of JLL demonstrates the tension of adaptation and integration of this dispersed centre of learning within J-Pharma's global knowledge network (Asakawa 2001). This manifests an inherent management problem in global R&D amplified in a cross-societal context in that J-Pharma lacks the necessary organisational competence in managing its European laboratory and understanding the process of basic discovery research. Although J-Pharma is one of the most research-intensive Japanese pharmaceutical companies, its R&D investment remains very small. The company's traditional weakness in basic research and its strong reliance on a cohesive product development system means that it might not have developed the necessary organisational capacity for developing effective links with external networked actors and harnessing the tacit knowledge of research conducted abroad. Indeed, recent evidence suggests that Japanese pharmaceutical companies continue to pursue an ‘autarkic’ innovation strategy, relying predominately on in-house R&D for drug discovery and long-term employment of master level graduates in cohesive teams (Kneller 2003). This is despite the increased exposure of the industry to international competition since the late 1990s and signs of a breakdown of long-term employment in other sectors. Japanese pharmaceutical companies’ strong emphasis on in-house R&D stands in stark contrast with the network strategy pursued by their US and European counterparts. The

'misunderstandings' between the J-Pharma and its partner university highlighted in the case study are symptomatic of the communication and social distance between them.

DISCUSSION

The case studies show that the US MNCs have sought to use the local regional context as the main social space in which network ties are constructed with the local scientists to facilitate inter-organisational flows of tacit knowledge. They have been able to exploit their strong capacity for external learning through open professional network ties among scientists spanning industry and academia, and to extend the spatial reach of their global scientific space. Particularly notable are the ways in which the US MNCs use network ties with 'star scientists' for tapping into local scientific networks and broadening the scope of knowledge search. In contrast, the Japanese MNCs have relied on the creation of tight organisational spaces across geographical boundaries to support site-specific learning and intra-organisational tacit knowledge transfer. Learning within such communities of practice tends to focus on clearly defined agenda and is closely linked to the companies' core competencies. Key local scientists are used as 'bridging persons' for channelling the flow of knowledge between the local laboratory and the parent company. This approach builds on Japanese companies' traditional strength in promoting internal tacit knowledge production system through organisational bonds and shared identities. It also reflects a conscious adaptive strategy for reducing the learning uncertainties in a foreign institutional context that differs significantly from the domestic one. While both sets of companies have to deal with the 'Michael Polanyi' tacit knowledge problem, the Japanese MNCs are confronted with the added complexity of the 'Karl Polanyi' problem. Lehrer and Asakawa (2003: 774) also note that US and Japanese firms operating R&D laboratories in Europe face *asymmetric* conditions on the basis of their home-based systems. Their study shows that Japanese laboratories in Europe have encountered greater difficulties in managing the relationship with the external R&D occupational communities.

The different transnational learning strategies adopted by the two sets of companies illustrate the contrasting logics of two distinctive national models of learning manifest in the global context. The US 'professional-oriented' model of organisation

and knowledge building enables companies to have considerable flexibility to extend their human resources and learning systems across institutional and geographical boundaries. US firms have traditionally relied on open recruitment and inter-organisational mobility of scientific personnel as a main mechanism for acquiring person-embodied tacit knowledge to support their radical innovation strategies (Finegold 1999; Hage and Hollingsworth 2000; Whitley 2000). Moreover, they have historically established strong institutional links with academia leading to a greater degree of human resource mobility between the two sectors, and the formation of research networks within a global scientific space (Mowery and Rosengerg 1993; Hane 1999; Zucker et al 2002b; Mahroum 2000). The professional-oriented career structures and open employment systems facilitate the development of a decentralised global R&D structure through project management, and allow overseas units a greater degree of autonomy in local recruitment. It could be argued that US firms in general enjoy a 'comparative institutional advantage' in developing transnational learning spaces to broaden the scope of knowledge exploration. This advantage is reinforced when they locate their R&D units in an environment where labour market institutions and systems of higher education are congruent with those at home. Both the U.S. and U.K. employment systems are organised around liberal market institutions conducive to horizontal labour mobility and external learning. The two countries also share a similar background of having a strong higher education sector and research base. This institutional proximity appears to have eased horizontal network construction and led to a higher degree of local embeddedness of the US MNCs.

The Japanese MNCs, on the other hand, appear to be more limited in the scope of their local network construction and they have not developed the US-type of broad-based university links and human resource strategies. Japanese MNCs, in general, tend to be tightly integrated and seek to maintain a high degree of internal organisational proximity and coherence (Westney 1999). They develop their internationalisation strategies by building on and extending their existing technological expertise to overseas markets. This is achieved by maintaining a close integration between the technological competencies based at home and those developed overseas. Moreover, Japanese firms have historically built their innovative capabilities on a well-established firm-based internal labour market with a strong emphasis on internal tacit knowledge creation (Nonaka and Takeuchi 1995; Lam

1997). The high degree of intra-organisational mobility of R&D personnel is accompanied by a relative absence of horizontal mobility (Dirks et al 2000). The firm-based human resource system in R&D is further reinforced by the institutional separation between industry and academia, and the tendency among Japanese firms to 'grow' their own PhDs rather than recruiting those trained at universities (Nakayama and Low 1997; Westney 1993; Coleman 1999). Japanese firms have limited experience in conducting basic research and developing external network ties with the academic scientific community. Their strong emphasis on internal tacit knowledge creation has inhibited their ability to exploit locally embedded tacit knowledge in foreign contexts. Moreover, when then set up R&D units in the UK, they are operating in a host institutional environment very different from their domestic one, and have to deal with the tension of cross-societal differences in knowledge creation. The Japanese 'organisational-oriented' model of work organisation and learning cannot be easily enmeshed with the UK 'occupational-oriented' R&D communities (Lam 1997; Lehrer and Asakawa 2003). It would have been much more difficult for the Japanese MNCs to build the sort of horizontal networks connecting the company and external R&D communities as observed in the case of the US MNCs. Instead, the Japanese MNCs have sought to use firm-centred communities of practice as mediating mechanisms to support transnational learning. The extension of such communities of practice across geographical and institutional boundaries, blending action at a distance and local practices, provide a social space within which the companies seek to develop relational proximity with local collaborators to support the joint production of knowledge. One can argue that the Japanese companies are substituting the local context with organisational context as the main social space for local learning. The literature on communities of practice asserts that tacit knowledge will flow across regional and national boundaries if organisational proximity is strong enough (Amin 2000). The spatial reach of communities of practice, however, is inherently limited because 'you can only work closely with so many people…' (Brown and Duguid 2000b: 143). Hence, the limited embeddedness of the Japanese MNCs in the local innovation systems.

Of particular interest is the observation that the 'communities of practice' strategy appears to have met with greater success in the case of J-ICT than J-Pharma. This could be due to the relative strength of the two sectors in the Japanese national

innovation system and how this affects their capacity for external learning. There are substantial differences between the ICT and pharmaceutical industries in terms of their domestic R&D capabilities and global competitiveness (Kitschelt 1991; Odagiri and Goto 1996). The Japanese ICT and electronics industry has been able to maintain a large domestic R&D capability and sustain their global competitiveness over the last three decades. The J-ICT scientists have basic research experience and appear to be able to engage in 'knowledge trading' with local scientists, and thus opening up the potential for 'mutual assimilation' in their collaborative ventures. Conversely, the Japanese pharmaceutical industry is younger, firms are much smaller in size and have less well-developed domestic R&D capacity. There has been a significant historical under-investment in R&D in the pharmaceutical sector. It is apparent from the case study that J-Pharma had difficulties in understanding the basic assumption of discovery research which subsequently caused a communication breakdown between JLL and its university partners. Kneller (2003: 1823) notes that there is a tendency for Japanese pharmaceutical companies to seek mainly codified results from foreign partners rather than to engage in ongoing exchange involving tacit as well as codified knowledge. Since a firms' absorptive capacity is a function of its level of prior related knowledge and those with greater capacity in internal R&D are also able to contribute more as well as learn extensively from it (Cohen and Levinthal 1990), it could be argued that J-ICT's relative domestic strength in R&D has enabled it to have the absorptive capacity to appropriate the scientific discoveries made in their overseas units, and also to engage in more effective external learning. By contrast, J-Pharma may not possess the necessary organisational competence to engage in external learning and benefit from the knowledge gained from their overseas research facilities without significant augmentation of domestic research capabilities.

One could also argue that J-Pharma has experienced a greater degree of the 'Karl Polanyi' problem than J-ICT in the sense that it has faced greater problems in gaining acceptance as an 'insider' in the local R&D communities and building relational proximity with them. This again has to do with the international competitive strengths of the companies and their reputation in the global R&D community. J-ICT is a global leader in a sector in which Japan has gained international competitive strength and the associated model of organisation and management has been perceived as global 'best practice'. This implies that J-ICT may be perceived as a 'collaborator of choice' by its

academic partner and has been able to gain trust and exert influence over the collaborative relationship. By contrast, Japanese pharmaceutical companies are less known players in the global R&D communities and they are operating in a sector where European and US companies command greater international reputation (Thomas 2001). It is thus not surprising that J-Pharma has encountered greater difficulties in exerting control and influence over its UK university partner, and its subsequent attempt to do so has resulted in the alienation of the local scientists. Such sectoral differences appear to be less evident in the case of the US firms.

CONCLUSIONS

The knowledge-based perspective of MNC evolution argues that it is in the transfer of tacit knowledge across borders that the advantages of MNCs are most apparent (Kogut and Zander 1993; 1995). However, the tacitness of knowledge also places a major constraint on the extent it can be shared and transferred abroad. This paradox places tacit knowledge at the heart of understanding the global knowledge sourcing strategies of MNCs, and the dynamics of knowledge creation and transfer across geographical and institutional boundaries. In this paper, I argue that MNCs seeking to use overseas R&D for knowledge creation have to deal with two aspects of the tacit knowledge problem: the 'cognitive' and 'societal', conceptualised as the 'two-Polanyi' problem. Much of the existing analysis of MNCs' knowledge transfer problems has focused on the former, the Michael Polanyi problem, and the role of intra-corporate mechanisms in dealing with it. This paper draws attention to the latter, a much more complex and yet neglected aspect of the tacit knowledge problem -- the Karl Polanyi problem -- that MNCs have to face when they attempt to transfer and create knowledge across major institutional-societal boundaries. While these two dimensions of the problem are conceptually distinct, they are closely related in practice. One can argue that the 'Karl' problem represents an accentuation of the 'Michael' problem in a cross-societal context within which the cognitive barriers to knowledge transfer have their origins in the wider institutional environment. These institutional forces are not always obvious to firms but only become apparent when they attempt to engage in learning that spans institutionally defined contextual divides (Gertler 2003: 94).

The comparative analysis of the knowledge creating activities of US and Japanese MNCs in the UK context has brought out the varying degrees of the Karl Polanyi problem, and the ways in which they influence the abilities of the MNCs to engage in local learning. Institutional proximity between the home and host country environment eases local learning and tacit knowledge transfer as illustrated in the case of the US MNCs in the U.K. By contrast, the Japanese MNCs have encountered greater barriers to local learning partly because of the greater divergence between the local institutional environment and their domestic one. An important insight to be gained from the study is that the dynamics of interaction between the MNCs and its host country environment constitutes an important factor in shaping the nature and boundary of MNCs' transnational social space for learning. The study broadly supports the 'social embeddedness' thesis of the institutional perspective on MNCs, namely, home-based institutions provide the basis for the development of MNCs' transnational social spaces for learning (Morgan et al 2001; Whitely 1999; 2001). However, it also highlights the need to consider the role of host country institutions as part of the social context in which the learning activities of the MNCs are embedded. The focus on tacit knowledge, the transfer of which requires social and relational proximity, has brought this to the fore.

This study is based on a small number of selected case studies which inevitably limits its scope for broad generalisation. However, other secondary sources cited in the paper suggest that the problems faced by these MNCs are likely to be experienced by other companies from the two countries.

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Table 1 The Interview Sample

Company	**US-ICT**	**US-Pharma**	**J-ICT**	**J-Pharma**
No. of company interviews Position/background of staff interviewed	11 -Managing director of R&D Lab -Human resource manager -Academic liaisons manager (twice) -4 project leaders/tech managers (4 areas) -Principal engineer engaged in collaborative project - Director, hybrid research organization	16 -Vice President of Laboratory - HR Director - Learning and development manager - Recruitment and academic liaison manager - VP, Medicinal Discovery - Director, discovery biology - Director, medicinal technologies - Head of external technology acquisition group - Licensing and collaboration manager - Director, project management - 5 project leaders (engaged in collaborative projects)	7 Headquarters: General managers, R&D Group (2); General Manager of Global R&D; Managers, human resources and recruitment (3); Cambridge Laboratory: Manager (Japanese)	4 Headquarters: Director of Planning and Coordination in Clinical Research; Director (formerly coordinator and researcher in U.K. Lab); R&D Planning (formerly laboratory manager in U.S. Lab); London Laboratory: Research Director (Japanese); researcher (Japanese)
No of interviews with local academic partners	2	3	1	1

Table 2 A profile of the International R&D organisation of the four companies

Company	**US-ICT**	**US-Pharma**	**J-ICT**	**J-Pharma**
Industrial sector	Computing and communication	Pharmaceutical	Electronics, computing and communication	Pharmaceutical
Mode of international R&D organization	Integrated network	Integrated network	Hub model	Hub model
R&D Headquarters	USA and UK (Distributed lab)	USA	Japan	Japan
Global R&D structure and coordinating mechanisms	R&D is distributed between corporate laboratories and R&D groups at divisional level. Central R&D is globally distributed employing 800 people in six sites around the world. Research organised into four programmes (aligned with four businesses) that can be located anywhere in the world. Global project teams as coordinating mechanisms	Global R&D division employs approximately 12,000 employees, with six discovery sites. Central Research organized as a globally distributed network. Project management as a key managerial tool for the coordination of global R&D. Research teams and project managers located at different sites increasingly work in co-ordination with each other.	Seven corporate research labs in Japan, employing a total of 2,700 research staff, with the Central Research Lab being the largest, employing 930 research staff. Global (tripolar) research networks include four research and design centres in the U.S. and five sites in Europe. The facilities in the US employ a total of 60 people and, in Europe, around 30. The European sites are coordinated by a parent organization, the Corporate Technology Group, based in the U.K..	Central research in Japan functions as the nucleus of drug development activities and employs around 400 research staff. Overseas R&D facilities were commenced through the establishment of a research lab in Boston in 1989 (60 staff), and the initiation of the London lab in 1990 (40 staff). These together form the company's tripolar research network, with the Central Lab in Japan acting as the focal link. -Japanese expatriate managers/researchers as key coordinators.

			Japanese expatriate (research) manager from central R&D as key coordinating and liaison person.	
Role of local labs (Units investigated)	Bristol laboratories (UK) -the company's second largest research labs and is among the premier corporate research labs in Europe -employing around 200 people.	Central research (UK) - the company's European headquarters for the discovery and development of new drugs - the largest research facility outside the U.S. with 1,500 employees (640 R&D staff) at the site.	Cambridge laboratory (UK) - campus-based lab aiming at creating new concepts of advanced electronic/opto-electronics devices -employs 10 research staff and collaborates with 25 university researchers.	London laboratory (UK) - campus-based lab with its initial focus on basic research in cell and molecular biology, but has recently shifted towards more applied research working in close integration with central R&D in Japan. -employs 40 research staff including some scientists seconded from Japan.
Links with local universities/research	Strategic partnerships with local universities as part of global university relationships programme. Hybrid research organisation	Postdoctoral collaboration; grant and fellowship training programmes; and strategic research collaboration. Strategic recruitment specialists to develop strategic relationships with universities.	'Institutionalised' university partnership and 'embedded laboratory' approach; focused and limited in scope.	'Institutionalised' university partnership; focused and limited in scope.
Recruitment and local labour market links	Important; tapping into wider European labour market	Important; increasingly towards 'Europeanisation' for PhD and post-doctoral recruitment.	Not important	Not important