CREATIVE TRANSITION AND THE ROLE OF MNE SUBSIDIARIES IN HOST-COUNTRY INDUSTRIALISATION

Robert Pearce
University of Reading, Department of Economics, RG6 6AA Reading- Berks, UK

Marina Papanastassiou*
Athens University of Economics and Business
Department of International and European Economic Studies
76 Patission street, 104 34, Athens Greece
Tel. 00 301 82 03 168
Fax. 00 301 82 14 122
e-mail: marinap@aueb.gr

ABSTRACT

A very pervasive characterisation of multinational enterprises (MNEs) is that their operations are innately 'footloose', with limited embeddedness in individual host countries. Thus many of those host-country characteristics that are normally believed to attract new 'inward investment' are also intended to change as the host economy proceeds through those processes of development whose initiation the MNE's original commitment was designed to be part of. The key theme of this paper is that the footloose scenario takes an unduly asymmetrical view of the availability of dynamic and evolutionary procedures. This now provides the scope to use geographically-decentralised approaches to securing all the variegated competitive needs of a modern enterprise. At a mainly tactical level subsidiaries with an efficiency-seeking orientation play roles within carefully-coordinated production networks that seek to optimise the competitive supply of the MNE's standardised and mature staple product lines. Beyond this, however, aspects of strategic competitiveness require the systematic regeneration of product range and technological scope. Thus a medium-term dimension of strategic competitiveness pursues innovation of new products, encompassing perceptions of new market needs, evolutionary reapplication of existing technologies and the interjection of new technological potentials that are coming on stream from scientific research. To secure the longer-term aims of strategic competitiveness MNEs need a current commitment to the more fundamental regeneration of core technologies that can provide the key bases for eventual more radical innovation. This paper presents information from a survey analysis of foreign MNE operations in the UK in order to elaborate on aspects of these companies as dynamic differentiated networks. In the survey a questionnaire was sent to 812 manufacturing subsidiaries of MNEs located in the UK. Satisfactory replies were received from 190 of the subsidiaries.

JEL Classification: F23

* Author to whom correspondence should be addressed.

Creative transition and the role of MNE subsidiaries in host-country industrialisation

Introduction

A very pervasive characterisation of multinational enterprises (MNEs) is that their operations are innately 'footloose', with limited embeddedness in individual host countries. From this can be derived the presumption that MNEs are unlikely to be able to provide support for *sustained* processes of national industrial development and growth. Thus many of those host-country characteristics that are normally believed to attract new 'inward investment' are also intended to change as the host economy proceeds through those processes of development whose initiation the MNE's original commitment was designed to be part of.

The most explicit context for this proposition resides in the emergence (through perhaps the last third of the 20th century) of *efficiency seeking* (Dunning, 1993a; Behrman, 1984) as a strategic motivation of the modern MNE. Thus, activating a growing potential for use of international (or intra-regional) trade as a strategic asset, MNEs increasingly located parts of their productive scope (final product assembly, component manufacture, stages of vertically-integrated manufacturing processes) in particular countries where current input availability (the countries' sources of static comparative advantage) matches the processes' factor needs, so as to optimise cost efficiency. Through the provision of firm-specific sources of competitiveness (product and process technology; management and marketing expertise; international market access) that are not available as effectively in indigenous firms, an MNE's activity

increases the effective operationalisation of potential local comparative advantage.[1] This plays a positive role in the industrial development that is sought by the host country.

However, success in host-country industrialisation is manifest in changes in the rewards expected for local inputs (through, in the case of labour in particular, changes in their characteristics as a result of reinvestment, e.g. in education and training). This breaks the optimising match between the attributes provided by the MNE and the complementary local inputs that had originally asserted the subsidiary's competitive status intra-group (its cost-effective positioning in the company's supply network). With comparable standardised inputs available in other countries at a new lower cost than in the initial location the MNE is assumed to exercise the footloose option and relocate production to a new site.[2] This scenario therefore sees efficiency-seeking as a self-obsolescing form of support for industrialisation, and thus as one that will ultimately hollow-out the bases of the development it helped to initiate.

The key theme of this paper is that the footloose scenario takes an unduly asymmetrical view of the availability of dynamic and evolutionary procedures. The assumption of pure efficiency-seeking excludes the possibility of subsidiaries changing their scope by their own volition, instead being defined in an immutably static form around those MNE-group sources of competitiveness with which they were initially supplied. Inability to secure adjustment to the factor changes implied by host-country development is thus expected to lead to loss of intra-group competitiveness and to closure. By contrast with this prediction, recent understanding of competitive evolution within MNEs indicates the significant emergence of the potential for individual subsidiaries to take steps to generate differential in-house scopes, which will reflect the

upgraded, and increasingly creative and dynamic, sources of host-country competitiveness. This possibility reflects a second strand in the ways in which the contemporary MNE activates globalised dimensions in support of the pursuit of sustainable competitiveness. Thus alongside the need to utilise dispersed networks of supply facilities in order to produce existing goods in the most competitive fashion (efficiency seeking) MNEs are now also moving towards globalised approaches to product innovation and the generation and acquisition of significant new technologies (knowledge seeking).

Accession to knowledge-seeking responsibilities (notably as activated in the form of localised product development) represents a highly desirable dynamic possibility that *is* available to the more enterprising and entrepreneurially-driven MNE subsidiaries. It is usually expected to be built around distinctive subsidiary-level technological and creative capacities that are ultimately embodied in new products developed within the facility. These unique competences (that provide the subsidiary with a distinctive competitive status within its group) will themselves derive from the ability to internalise and individualise elements of host-country technology and creative skills (tacit knowledge) that are themselves becoming richer and more valuably idiosyncratic as the local economy develops. It is then possible to assert a dynamic symmetry between the evolutionary potentials available to those subsidiaries that can claim a role in the dispersed creative and learning processes within their MNEs' development programmes and the enhanced capabilities that emerge within host countries as the latters' development upgrades their sources of comparative advantage. Far from alienating MNE subsidiaries this scenario sees them as being positively motivated by the potential to

access and operationalise those newly emergent (and higher-cost) host-country competences that reflect reinvestment towards sustainable development. As MNEs activate these local knowledge attributes in support of their own development they may, in the process, add dimensions to their commercial effectiveness and provide extra resources for further technological progress, thus reinforcing the sustainability of host-country development.

The perspectives outlined above characterise the contemporary MNE as organising its global operations as a 'dynamic differentiated network'.[3] This now provides the scope to use geographically-decentralised approaches to securing all the variegated competitive needs of a modern enterprise. At a mainly tactical level subsidiaries with an efficiency-seeking orientation play roles within carefully-coordinated production networks that seek to optimise the competitive supply of the MNE's standardised and mature staple product lines. Beyond this, however, aspects of strategic competitiveness (Pearce, 1999a) require the systematic regeneration of product range and technological scope. Thus a medium-term dimension of strategic competitiveness pursues innovation of new products, encompassing perceptions of new market needs, evolutionary reapplication of existing technologies and the interjection of new technological potentials that are coming on stream from scientific research. To secure the longer-term aims of strategic competitiveness MNEs need a current commitment to the more fundamental regeneration of core technologies (through precompetitive basic research) that can provide the key bases for eventual more radical innovation.[4]

The remaining sections of this paper present information from a survey analysis of foreign MNE operations in the UK in order to elaborate on aspects of these companies as

dynamic differentiated networks. One aspect of this is, of course, that at a point in time a subsidiary may have a primary focus on one of the number of differentiated objectives that MNEs need to pursue in order to secure all the levels and dimensions of competitiveness discerned earlier. Thus the next section introduces a typology of subsidiary roles and presents evidence on their relative prevalence amongst MNEs' operations in the UK.

The crucial facet of the modern MNE for host countries, we have suggested, is, however, that the status of these subsidiaries need not be unchanging and, indeed, cannot be if they are to be integral with local industrialisation and development. They are part of dynamic MNE networks and can gain (or lose) stature within those networks in ways that should reflect the changing quality of local inputs. We argue in section 3 that the defining momentum in subsidiary upgrading is through a process of creative transition (Papanastassiou and Pearce, 1999, 1994), in which they move from dependence on pre-existing parent-group technology to a status which is essentially defined by their own unique knowledge scope, generated from attributes of the host-country economy and science-base. Section 3 thus evaluates seven sources of technology that can be activated within MNEs' UK subsidiaries and derives hypotheses as to how the presence of these may be related to the roles played (as derived in section 2). Regression tests of these hypotheses are reported and discussed in section 4, with section 5 providing conclusions.

In the survey a questionnaire was sent to 812 manufacturing subsidiaries of MNEs located in the UK, which represented all the relevant cases that could be identified from the National Register Publishing Company's *International Directory of Corporate Affiliations.*[5] Satisfactory replies were received from 190 of the subsidiaries.

Roles of subsidiaries

The categorisation of subsidiaries used here adopts a variant (Papanastassiou and Pearce, 1999, pp. 24-30; Pearce 1999b, 1999c) of the scope typology (White and Poynter, 1984; D;Cruz, 1986).[6] Here subsidiaries are differentiated along three dimensions of scope; *product* scope (the extent of the product range produced); *market* scope (the extent of the geographical market area supplied); *functional* scope (how many of the functions that would be operationalised in a fully-mature independent company are available at the subsidiary level).

The first subsidiary type discerned is the *truncated miniature replica* (TMR), whose motivation is the *market-seeking* one of supplying the national market of the subsidiary's host country with all those parts of the parent MNE group's existing product range that are applicable to local demand. In this sense it can be considered a miniature replica of the parent company. In terms of functional scope, however, this type of subsidiary will be severely truncated, with none of the crucial innovation-oriented activities (substantive R & D; creative market research; strategic or entrepreneurial management) that could provide the basis for independent progress and significant embeddedness in the host-country economy. The host-country characteristics that attract TMRs are the size and growth potential of local demand for the MNE's established goods and levels of tariff and other protection that prevent supply through trade.

The expectation is that in most mature industrial economies the conditions conducive to market-seeking TMR-type behaviour as a priority in MNEs have declined in relevance. Two developments underpin this expectation. Firstly, the emergence of much freer trading conditions, which expose the inefficiencies likely to be endemic to TMRs

(i.e. those traditionally imputed to most import-substituting industrial activity). Secondly, the increasing availability in many of the main host countries of potentially valuable creative inputs (technology; research capacity; provocative new product ideas; distinctively skilled engineers and other personnel), which makes the knowledge dependence of TMRs wasteful from the point of view of overall MNE competitive regeneration. This indicates that hierarchical MNEs, operating through a portfolio of TMRs (a multidomestic strategy in Porter's [1986] terms), represents the archaic structure from which the more flexible and responsive dynamic differentiated network is emerging. It also points to the bases for the two crucial strategic imperatives that we discern in contemporary MNEs, efficiency-seeking and knowledge-seeking. The remaining elements of the typology formalise these motivations at the subsidiary level. Meanwhile the survey evidence in table 1 suggests that, whilst in relative retreat,[7] TMR behaviour is still significant amongst MNEs' subsidiaries in the UK.[8]

The scope typology sees efficiency-seeking as the responsibility of *rationalised product subsidiaries* (RPS). These share with TMRs an, essentially dependent, production of goods that are already well-established amongst the MNE's competitive product range and also possess a comparably constrained functional scope.[9] By contrast, however, RPSs will have a much wider market scope but a much narrower product scope than TMRs. Thus RPSs will have emerged in MNEs as the result of a rationalisation process in which previously TMR subsidiaries now focus on the supply of a small subset of their previous product range, and export this to wider geographical market area. In general terms this specialisation boosts productive efficiency by allowing for full

Table 1: Roles of subsidiaries in the UK

	Roles of subsidiaries (average response)[1]			
	TMR	RPS1	RPS2	WPM/RPM
By industry				
Food	2.56	2.33	1.11	2.67
Automobiles	2.24	2.33	1.65	2.35
Aerospace	2.33	2.17	1.33	2.17
Electronics and electrical appliances	2.33	2.53	1.41	1.96
Mechanical engineering	2.08	2.27	1.33	2.36
Instruments	2.33	2.10	1.33	2.36
Industrial and agricultural chemicals	2.14	2.03	1.48	2.17
Pharmaceuticals and consumer chemicals	2.27	2.55	1.45	1.91
Metal manufacture and products	2.09	1.90	1.22	2.20
Other manufacturing	2.44	1.73	1.20	1.80
Total	2.26	2.24	1.38	2.15
By home country				
USA	2.28	2.24	1.52	2.27
Japan	2.31	2.41	1.32	2.03
Europe	2.13	2.07	1.29	2.09
Total[2]	2.26	2.24	1.38	2.15

Subsidiary roles

TMR - to produce for the UK market products that are already established in our MNE group's product range.

RPS1 - to play a role in the MNE group's European supply network by specialising in the production and export of part of the established product range.

RPS2 - to play a role in the MNE group's European supply network by producing and exporting component parts for assembly elsewhere.

WPM/RPM - to develop, produce and market for the UK and/or European (or wider) markets, new products additional to the MNE group's existing range.

Notes:

1. Respondents were asked to evaluate each role as (i) our only role, (ii) a predominant role, (iii) a secondary role, (iv) not a part of our role. The average response is calculated by allocating a value of 4 to 'our only role', 3 to 'a predominant role', 2 to 'a secondary role' and l to 'not a part of our role'.
2. Includes subsidiaries of MNEs from Australia and Canada.

Source: Papanastassiou and Pearce (1999).

realisation of economies of scale and by lowering X-inefficiency by placing the subsidiary in a vastly more competitive environment. The choice of specific location for a particular RPS should then provide a further source of efficiency if the input needs of its production process matches the relative resource availability of the local economy.

It is the scope to use within a RPS precisely those process technologies that require the inputs that represent a current under-utilised source of comparative advantage in the host economy that provide the potential for MNEs to generate a short-term impetus to industrialisation processes. However, in a pure-RPS, optimised cost-efficiency means combining standardised MNE technologies with undifferentiated host-country inputs with minimal resources having to be committed to the adaptation of either.[10] This means that a pure RPS will not encompass any natural sources of dynamism (pointing towards potentials beyond supply of its allocated products) or be in any sense distinctively embedded in the local economy (its operations can be reproduced elsewhere with equal ease). It is thus pure-RPS behaviour that provides the basis for the footloose characterisation of MNEs.

In the survey respondents were asked to evaluate two variants of the RPS role. The first (RPS1) related to the supply of final products, whilst the other (RPS2) covered an operation that focused on production of component parts. As table 1 shows RPS1 now matches TMR in overall prominence,[11] but RPS2 is much less prevalent and is thus least significant of the four subsidiary roles evaluated.[12]

A temporary way forward for a RPS that is rendered vulnerable in the fashion suggested above may be upgrading within this cost-driven mode of behaviour. Thus the relocation of supply of its original goods to other (lower-cost) subsidiaries elsewhere may

be replaced by the allocation to it of responsibility for producing another part of the extant range[13] requiring higher-quality (and higher-rewarded) local inputs. Again, however, neither the newly-transferred MNE technology and supporting capabilities, nor the local inputs would (if this represents merely an upgrading of pure-RPS behaviour) require significant alteration in the process. The innate lack of locally-generated dynamism or embeddedness at the subsidiary level is replicated, albeit at a higher level of productivity and in supply of higher-value goods. Ultimately this reformulating of pure-RPS behaviour becomes increasingly less viable as a host-country's capacities become more distinctive (i.e. the more completely types of dynamic or created comparative advantage replace those standardised inputs that can be routinely applied to extant technologies). The use by subsidiaries of these increasingly differentiated and creative potentials in the host country cannot now support the cost-effective use of existing MNE technologies in a routine RPS fashion, but can be applied in a dynamic and synergistic way with available elements of the group's knowledge scope in order to secure localised product development capabilities.

The logical desire of entrepreneurial management in increasingly mature and well-developed RPSs to secure survival through metamorphosis to product development status requires the build-up of in-house capabilities (R & D; creative marketing; talented engineering staff) that reflect those increasingly knowledge-based and skill-oriented attributes of the local economy that are replacing the ones that were more applicable to routine cost-efficient production. However, these attributes represent investments in the generation of future supply capabilities, and can be interpreted as overheads that are alien to the current needs of a pure RPS. Yet it can also be suggested that the needs of a MNE

that is truly acting as a dynamic differentiated network lead to a selective tolerance for certain degrees of 'impurity' (resource development commitment) that does not relate to the short-term cost-efficiency aim.

Thus dynamic competitive processes emerge *within* the contemporary MNE. The inevitable aim of any forward-looking RPS management, in a host country that is providing increasingly differentiated and creative capacities, is evolution to product development responsibilities. MNE central planners recognise the crucial value of tapping into those dispersed creative potentials that are emerging throughout the global economy, and accept that local subsidiaries are the best means of detecting, accessing and operationalising them. Balancing the short-term aim of efficient production of existing goods and the longer-term need to regenerate the product range then sets a crucial challenge to planners that are seeking to optimise globalised inputs to both priorities. Profligacy in allowing creative overhead expenditures in too many RPSs may compromise current competitive efficiency. Too little apparent sympathy for decentralised initiative, however, may place most RPS management on the defensive (enforcing a reluctant short-term cost emphasis) and stifle the potential vibrancy of dispersed learning processes.

Ultimately, though, it appears that the interests of MNE groups, individual subsidiaries and host countries[14] can coalesce around the emergence of the third type of facility, the knowledge-seeking *product mandate*. These subsidiaries take full responsibility for the initial development, supply and sustained competitive progress of particular product lines. They may do this for a distinct regional group of countries (as a regional product mandate [RPM]) or for the full global marketplace (as a world product

mandate [WPM]). Thus the WPM/RPM has an extensive market scope. Its product scope is definitionally indeterminate,[15] but is likely to be quite narrow in practice as these subsidiaries focus on the most efficient regeneration of those elements of the group's range where they have asserted an individualised capability. Clearly the crucially distinctive dimension of the PM is its functional scope, with vital status for a powerful in-house R & D unit (in turn often collaborating with local university laboratories to most effectively tap into the most influential aspects of scientific research), a deep commitment to market research,[16] the generation of a talented process-engineering group and the core drive of entrepreneurial management.

Successful PMs assert an individualised status within their MNE's innovative and supply networks by operating a dynamic and mutually-enriching interface between the group's core competitive competences and aspects of the host-country's sources of created comparative advantage. Such subsidiaries can provide the higher rewards that attract distinctive local inputs away from indigenous enterprises through their ability to combine them with more effective complementary capacities (elements of the MNE's core technologies, management and marketing techniques). For the MNE this provides a unique extension to its product range and, hopefully, other more generalised additions to knowledge scope that can be utilised elsewhere in the group. Thus logical PMs should be coherent with existing and evolving MNE capabilities so as to provide positive group externalities beyond direct product development.[17] For host countries the PM mode of behaviour provides benefits both through dynamism (since it is inherent to the motivation of such subsidiaries to pursue and support those upgraded local capacities that will emerge in economic development) and embeddedness (since it is the unique facets of

local inputs that make them attractive to MNEs). The survey evidence showed a strong emerging presence of PM subsidiaries in the UK (table 1).[18]

Sources of technology used in subsidiaries

The metamorphosis of TMR or RP subsidiaries into WPM/RPM operations can be seen as essentially defined by a fundamental repositioning of their technological status. This we have designated as a process of creative transition. In the case of TMRs and RPSs the existence and nature of the subsidiary is determined by other host-country characteristics (market size; trade restraints; costs of standardised inputs; etc.) with its capability to play the role entirely dependent on the import of those aspects of established group technology that are appropriate to the goods to be supplied. The subsidiary is *allocated* a role and also the group-originated competences to play it. In the case of PMs the causation is reversed. It now becomes the in-house technology and skill-related competences that are generated by the subsidiary itself that allow such units to *claim* an individualised PM-type status in the group. To investigate the technology content of subsidiary evolution and creative transition the survey asked respondents to evaluate the relevance of seven sources of technology in their operations.

The first of these sources of technology was defined as 'existing technology embodied in established products we produce' (ESTPRODTECH). This clearly represents the source of technology around which TMR and RP subsidiaries would be expected to most strongly assert their position, so that positive relationships are hypothesised for the regression tests. By contrast the PM subsidiaries seek product development processes that moved away from existing embodied technology and towards

mainly individualising host-country sources, so a negative relationship is predicted. In fact 7.7% of respondents rated ESTPRODTECH as their only source, with 74.6% considering it a major one and 13.3% more a secondary one. Thus this technology is indeed as widely pervasive as would be expected, but rarely so totally dominant as to exclude room for other sources (which may be either supporting its effective use or seeking to supplant it in the process of subsidiary evolution).

The second MNE-group-originated source of technology available to subsidiaries was defined as 'technology of our MNE group from which we introduce new products for the UK/European market that differ from other variants introduced in other markets' (GROUPTECH). Here the subsidiary is perceived as having the potential to access significant elements of its group's core technologies (especially recently generated ones) in a disembodied form, and to provide one (of perhaps a number) of the ways in which it is applied commercially.[19] Access to GROUPTECH can provide an early possibility for subsidiaries to move from dependence on standardised group technology towards an interdependent association with how the scope of group knowledge capacity evolves and is applied. The most logical context for this is in product development so that there is a clear prediction of a positive relationship between GROUPTECH and PM. By contrast the aim of a pure RPS to utilise ESTPRODTECH as effectively as possible provides no room for the differentiating capacities of GROUPTECH, which is thus expected to be negatively related to these roles. Though TMRs may perform some locally-responsive adaptation this is unlikely to require essentially new technologies, so that (though a little less decisively than for RPS) GROUPTECH is again expected to be negatively related to this role. GROUPTECH was reported as the only technology source for 4.4% of

Table 2: Relative importance of sources of technology in MNE subsidiaries in the UK

	Technology sources (average response)[1]						
	EST PROD TECH	GROUP TECH	OWN LAB	GROUP LAB	OTHER FIRM	LOCAL INST	ENGUN IT
By industry							
Food	2.89	2.22	2.50	1.78	1.56	1.67	2.00
Automobiles	2.72	2.18	1.83	2.65	1.71	1.39	2.00
Aerospace	2.60	2.50	1.50	1.83	1.17	1.33	2.17
Electronics	2.79	2.35	1.98	2.33	1.43	1.32	2.13
Mechanical engineering	2.85	2.46	1.85	2.00	1.42	1.62	2.19
Instruments	2.82	2.00	2.27	2.18	1.45	1.73	2.50
Industrial chemicals	3.24	2.21	2.31	2.31	1.62	1.52	1.79
Pharmaceuticals	3.00	2.40	2.30	2.40	1.70	1.60	1.70
Metals	2.91	2.09	1.91	1.82	1.27	1.36	2.09
Other manufacturing	3.13	2.47	1.71	2.14	1.29	1.50	1.64
Total	2.86	2.30	2.02	2.22	1.48	1.48	2.02
By home country							
USA	2.78	2.25	2.15	2.18	1.57	1.62	2.06
Japan	2.88	2.35	1.78	2.23	1.31	1.27	2.02
Europe	2.91	2.30	2.12	2.25	1.57	1.55	1.88
Total[2]	2.86	2.30	2.02	2.22	1.48	1.48	2.02

Sources of technology

ESTPRODTECH - existing technology embodied in established products we produce.
GROUPTECH - technology of our MNE group from which we introduce new products for the UK/European market, that differ from other variants introduced in other markets.
OWNLAB - R & D carried out by our own laboratory.
GROUPLAB - R & D carried out for us by another R & D laboratory of our MNE group.
OTHERFIRM - R & D carried out in collaboration with another firm.
LOCALINST - R & D carried out for us by local scientific institutions (e.g. universities; independent labs; industry labs).
ENGUNIT - development and adaptation carried out less formally by members of our engineering unit and production personnel.

Notes:
1. Respondents were asked to grade each source of technology for their operations as (i) our only source, (ii) a major source, (iii) a secondary source, (iv) not a source. The average response was calculated by allocating 'only source' the value of 4, 'major source' the value of 3, 'secondary source' the value of 2, 'not a source' the value of 1.
2. Includes subsidiaries of MNEs from Australia and Canada.

Source: Papanastassiou and Pearce (1999)

respondents, a major one for 44.2% and secondary one for 28.8%. Though, overall, this makes it less powerfully influential in subsidiaries' current operations than ESTPRODTECH, the fact that only 22.6% of respondents made no use of it also indicates a degree of presence that can often lessen the dependence on standardised technologies and provide an individualising impetus towards a subsidiary-level creative transition.

A more complete and definitive creative transition should depend, however, on technological inputs that are accessed or generated within the host country. The first, and potentially most powerful, possibility investigated was defined as 'R & D carried out by our own laboratory' (OWNLAB). Such in-house R & D can support subsidiary-level product development directly by working in close collaboration with other creative functions (marketing; engineering; strategic planning), help to generate less immediate potentials through its own more speculative (basic or applied) research and articulate and coordinate access to other knowledge inputs (either intra-group [GROUPTECH; GROUPLAB] or through local collaborations [OTHERFIRM; LOCALINST]). This provides a strong positive hypothesis for the relationship between OWNLAB and WPM/RPM operations. Equally decisively the cost priorities of pure RPS behaviour and its lack of need for any technological individualisation, generates a negative expectation for the relationship between OWNLAB and these roles. For TMRs we predict an

insignificant relationship with OWNLAB. The absence in TMRs of a comparable degree of cost obsession removes the key basis for the negative relationship predicted for RPS, but the likely presence of some potential for adaptation nevertheless seems unlikely to systematically generate the positive need for in-house R & D predicted for PMs.

OWNLAB was rated as their only source of technology by 3.5% of respondents, as a major one by 35.8% and as a secondary one by 20.1%. This may provide some immediate indication of in-house R & D as a crucial element in determining the overall position of technology in a subsidiary (i.e. the status of its creative transition). Thus whilst 40.7% of subsidiaries found no role for the results of in-house R & D, this source of technology was then rated as a major (or only) source for 66.0% of those that did use it.

We have suggested that one possible function for in-house R & D may be to formulate and organise access to other sources of R & D through collaborative arrangements. One such source returns us to intra-group interdependency in the form of 'R & D carried out for us by another R & D laboratory of our MNE group' (GROUPLAB). Once again we can hypothesise that this type of R & D support is most likely to be positively related to PM responsibilities in subsidiaries and negatively related to their commitment to the RPS roles. Such support might also provide the needed technological inputs to localised adaptation in TMRs if an in-house R & D unit is not considered necessary, but (as with OWNLAB) this does not generate a systematic expectation of a positive relationship. GROUPLAB was rated the only source of technology by 5.0% of respondents, a major one by 38.1% and secondary one by 30.4%. Thus it is actually present in more cases than OWNLAB, though most of the extra occurrences are as only a

secondary source. Nevertheless this does suggest that GROUPLAB can, on occasion, be acquired as a substitute for OWNLAB rather than as a supplement (we have indicated TMRs as one such context).

The first of two external sources of collaborative R & D was described as 'R & D carried out in collaboration with another firm' (OTHERFIRM). This is unlikely to be a source of technology that would be expected to systematically support product development in subsidiaries, but also is probably not naturally alienated by it (and indeed could provide supplementary problem solving capability on an *ad hoc* basis). Thus we have a neutral prediction for the relationship between PM and OTHERFIRM. Once again the dependent positioning of pure-RPS operations within mature MNE-networked supply provides no logic for either R & D or any overlapping interests with independent firms, so a negative relationship between OTHERFIRM and RPS is strongly asserted. TMRs might, however, provide a context for such R & D collaborations if host-country enterprises can use their experience to help solve problems relating to the improved application of MNEs' products and technologies to local-market needs and production conditions. In fact OTHERFIRM was a relatively rare source of technology, being absent from 58.9% of respondents' operations and only a secondary source in 35.0% more.[20]

The second source of collaborative R & D outside the firm was 'R & D carried out for us by local scientific institutions (e.g. Universities; independent labs; industry labs)' (LOCALINST). The expectation here is that the aim will be to secure an involvement in those very distinctive lines of scientific investigation which reflect the most distinguished research traditions of the host country. To an operating subsidiary the results of such research are most likely to provide inputs to quite original lines of product development

(positive relationship between LOCALINST and PM) and not to in any way target solutions to short-run problems with existing technology (negative relationships with not only RPSs but also TMRs). LOCALINST was not considered to be a source of technology by 56.5% of respondents and only a secondary one for 40.3%. This may, indeed, reflect the fact that the most likely content of MNE/local laboratory collaborations would involve speculative precompetitive research to help with the longer-term regeneration of the group's core technological capacity (i.e. the longer-term, rather than the medium-term, needs of strategic competitiveness). Producing subsidiaries (who would not normally be expected to use such radical new technology in their more evolutionary product development) may not be the best vehicles to articulate such collaborations, which are likely to be the province of stand-alone MNE laboratories.

The last source of technology was defined as 'development and adaptation carried out less formally by members of our engineering unit and production personnel' (ENGUNIT). The essence of this source is the tacit knowledge embedded in a subsidiary's experienced engineering personnel. This is likely to reflect both an understanding of the mainstream characteristics of the group's mature technology and certain elements of the subsidiary's own more distinctive (locally-derived) knowledge scope and heritage. To the extent that a TMR wishes to deepen its local competitiveness through adaptation of ESTPRODTECH it is ENGUNIT that possesses the unique mix of capabilities to help facilitate this. Thus we hypothesise a positive relationship between TMR and ENGUNIT. Perhaps more crucially we can also suggest that such competences in engineering personnel are ideally positioned to support OWNLAB (amongst other sources) in securing successful product development.

The prediction of a positive relationship between ENGUNIT and PM may, in fact, be a key manifestation of creative transition in that competences generated within earlier roles are being leveraged as a crucial element onto which an upgraded and extended technological scope can be effectively and realistically built. It may also serve the purpose of providing an anchor which restrains subsidiary-level product development as a coherent and logical (rather than illogical and disruptive) evolution in the MNE group's commercial scope and technological capacity. Though RPSs need sufficient routine engineering competence to assimilate and apply ESTPRODTECH locally, this does not extend to the sorts of adaptive capabilities that define ENGUNIT as a separate source of technology. Once again the prediction for RPSs is a negative relationship. Perhaps in line with these expectations for the positioning of ENGUNIT it was reported as a secondary (supporting) source by 54.5% of respondents, but as more than that by only 23.5%.

Table 3: Summary of hypotheses

	Independent Variable[1]			
Dependent variable[2]	TMR	RPS1	RPS2	WPM/RPM
ESTPRODTECH	+	+	+	–
GROUPTECH	–	–	–	+
OWNLAB	"	–	–	+
GROUPLAB	"	–	–	+
OTHERFIRM	+	–	–	"
LOCALINST	–	–	–	+
ENGUNIT	+	–	–	+

Notation:
+ Hypothesis of positive relationship
- Hypothesis of negative relationship
" Neutral prediction.
Notes:
1. For definitions see table 1.
2. For definitions see table 2.

Regression tests

Regression tests of the prevalence of sources of technology (reported in table 4) were carried out, controlling for industry and home-country of the subsidiary through dummy variables and using the four subsidiary roles as independent variables. The relevant hypotheses were generated in the previous section and are summarised in table 3.

Though several technology sources are correctly signed (GROUPTECH, LOCALINST, ENGUNIT, as well as the predicted insignificance of OWNLAB and GROUPLAB) the results for TMR are essentially weak and indecisive. This is most notably manifest for ESTPRODTECH which is not only insignificant but negatively signed. Generally this suggests that TMR status is now a strategically-archaic and incoherent residual role in which subsidiaries have moved some distance from an initial positioning around particular product technologies, without asserting a new status around other knowledge capabilities.

The results for RPS1 are rather more decisive, but in a manner that points to a somewhat different positioning than the pure form of this role. Here ESTPRODTECH is strongly positive as predicted, confirming the core imperative of the role as the supply of established products. But OWNLAB is also (against hypothesis) significantly positive, whilst other sources that point towards subsidiary-level technological differentiation (GROUPTECH, GROUPLAB, OTHERFIRM, ENGUNIT) are also positively (rather than negatively as predicted) signed.

Table 4: Regressions with subsidiaries' sources of technology as dependent variable

	ESTPROD TECH	GROUP TECH	OWNLAB	GROUP LAB	OTHER FIRM	LOCAL INST	ENGUNIT
Intercept	2.8738‡ (10.85)	2.1902‡ (5.68)	0.9336‡ (2.61)	2.4279‡ (6.27)	1.3004‡ (4.81)	1.8209‡ (7.30)	1.1469‡ (3.94)
Food	-0.0560 (-1.02)	-0.0569 (-0.72)	0.0313 (0.41)	-0.0669 (-0.83)	0.0209 (0.37)	-0.0008 (-0.01)	0.0407 (0.65)
Automobiles	-0.4316* (-1.89)	-0.4362 (-1.34)	-0.2593 (0.85)	0.6105* (1.82)	0.2532 (1.09)	-0.2065 (-0.96)	0.1946 (0.78)
Aerospace	-0.2087 (-1.28)	0.0181 (0.08)	-0.2760 (-1.34)	-0.1330 (-0.59)	-0.1484 (-0.95)	-0.1849 (-1.28)	0.2157 (1.29)
Electronics	-0.0960† (-2.00)	-0.0602 (-0.89)	0.0246 (0.36)	0.0609 (0.86)	0.0133 (0.27)	-0.0410 (-0.91)	0.0938* (1.79)
Mechanical engineering	-0.0466 (-1.52)	-0.0275 (-0.65)	-0.0246 (-0.61)	-0.0033 (-0.07)	-0.0001 (-0.00)	0.0081 (0.29)	0.0588* (1.80)
Instruments	-0.0514 (-1.17)	-0.0657 (-1.03)	0.0276 (0.47)	0.0041 (0.06)	0.0087 (0.19)	0.0129 (0.31)	0.1201† (2.50)
Chemicals	-0.662 (-0.96)	-0.1134 (-1.16)	0.0861 (0.93)	0.0722 (0.72)	0.0436 (0.62)	-0.0519 (-0.65)	0.0046 (0.06)
Pharmaceuticals	-0.0190 (-0.65)	-0.0314 (-0.75)	0.0359 (0.91)	0.0167 (0.39)	0.0108 (0.36)	0.0090 (0.33)	-0.0121 (-0.38)
Metals	-0.0402	-0.0649 (-1.41)	-0.0236 (-0.55)	-0.0230 (-0.49)	-0.0088 (-0.27)	-0.0246 (-0.82)	0.0634* (1.82)
USA	-0.0067 (-0.56)	-0.0031 (-0.18)	-0.0025 (-0.15)	-0.0085 (-0.47)	-0.0034 (-0.28)	0.0073 (0.63)	-0.0086 (-0.64)
Japan	0.0012 (0.10)	0.0050 (0.30)	-0.0311† (-2.02)	-0.0130 (-0.77)	-0.0232† (-1.99)	-0.0244† (-2.27)	-0.0098 (-0.78)
TMR	-0.0444 (-0.81)	-0.0991 (-1.25)	-0.0509 (-0.69)	0.0465 (0.58)	-0.0724 (-1.30)	-0.0685 (-1.34)	0.0195 (0.32)

RPS1	0.1398† (2.44)	0.1087 (1.32)	0.1626† (2.12)	0.0282 (0.34)	0.0354 (0.61)	-0.0185 (-0.35)	0.0510 (0.82)
RPS2	-0.0557 (-0.75)	0.1405 (1.32)	-0.0596 (-0.59)	-0.1163 (-1.07)	0.1732† (2.28)	-0.0159 (-0.23)	0.1560* (1.90)
WPM/RPM	0.0681 (1.27)	0.0666 (0.86)	0.4799‡ (6.70)	-0.1213 (-1.56)	0.0298 (0.55)	0.0170 (0.34)	0.1444† (2.45)
R	0.0802	0.0604	0.3279	0.0946	0.1253	0.1322	0.1564
F	0.92	0.69	5.14‡	1.12	1.53	1.62*	1.95†
n	175	178	174	177	176	174	174

‡ significant at 1% † significant at 5% *significant at 10% n number of observations

As earlier discussion considered as a possibility, these sources of 'impurity' in a RPS's technological scope may be speculatively allowed as the potential bases of a creative transition to product development capacity. In line with this it can be observed that elsewhere in the survey (Papanastassiou and Pearce, 1999, p. 132) it was RPS1 subsidiaries that indicated the greatest fear of decline in their in-house R & D capacity. This is in line with a speculative and time-limited status for such an overhead expenditure that is targeting the capacity for evolution to a role that can then encompass such creative expenditures more naturally. Overall, then, it appears that in an industrially-mature and technologically-advanced economy such as the UK there are often calculated attempts to avoid the innate footloose propensity of the pure efficiency seeking behaviour of RPSs by coopting the evolutionary potentials of knowledge seeking.

RPS2 also produces unexpected results, with ESTPRODTECH here insignificant (indeed negatively signed) and OTHERFIRM and ENGUNIT significantly positive (with GROUPTECH also clearly positively signed). Particular aspects of creative positioning are again indicated by these results. It thus seems plausible that, in the UK at least, component supply subsidiaries are by no means always technologically-dependent suppliers of standardised inputs to mature products. Instead they may have responsibility for creation of new components as part of networked development of final products. Within the MNE access to GROUPTECH supports this process. In addition the strong relevance of OTHERFIRM indicates collaborative R & D to help RPS2 subsidiaries to extend their customer base outside their parent MNE's networks. In such close collaborative creative contexts it is then logical that a strong influence emerges for the

types of tacit knowledge and distinctive skills of ENGUNIT in securing coordination and effective technology exchange.

For WPM/RPM operations the key results confirm the positive significance of OWNLAB and ENGUNIT, demonstrating the decisive impulsion deriving from in-house capabilities in subsidiary-level product development. Mirroring this the negative sign on GROUPLAB (near to significance) and insignificance of GROUPTECH emphasise the complementary independence of PM operations from new technological inputs from other sources in the group. The danger that this might then be resulting in anarchic lines of subsidiary development that ultimately cannot be sustained in isolation, or that disrupt more orderly progress for the group, would seem to be mitigated by the influence of ENGUNIT (as explained in the previous section) and the unexpected positive sign for ESTPRODTECH. The presence of ESTPRODTECH indicates that the product development of PMs is substantially influenced by a core of mature and well-understood technology that has asserted itself as a defining competence of these subsidiaries during their earlier incarnation as TMRs or RPSs. Once again, in the technological scope of these PM operations, we can trace evidence of the creative transition process that secures subsidiary survival through a logical and evolutionary enhancement of technological scope.

Conclusions

The paper has used evidence from a wider analysis of foreign MNEs' operations in the UK to document aspects of these companies as dynamic differentiated networks, and to point towards a generalised understanding of the implications for host-country

industrialisation and development. The dynamic and variegated positioning of particular operating subsidiaries can be seen as conditioned by two broad strategic imperatives of the contemporary MNE. The first of these is efficiency seeking (activated through RPSs), in which individual subsidiaries play specialised roles in cost-effective supply networks for mature and standardised goods (that are expected to compete on a predominantly price basis). The second (the responsibility of WPM/RPMs) is knowledge seeking, in which a subsidiary detects and activates distinctive host-country technology and marketing insights into localised product-development operations, which can also have positive externalities for the MNE group (by providing synergistic spillovers that reinforce its wider, and longer-term, creative competences). The ability of subsidiaries to secure the metamorphosis from efficiency-seeking RPS status to the more creative and individualistic knowledge-seeking of WPM/RPMs is seen as the key dynamic potential in the modern MNE. The core of this evolution we discern as being defined by a process of creative transition. A crucial aim of the paper has thus been to secure an understanding of the technological content of this knowledge-driven process of subsidiary development.

Two vital dimensions of the creative transition process emerge from the analysis. The first of these is the sustained importance of those mature standardised technologies of the MNE group (designated as ESTPRODTECH) that are already embodied in successful products. These technologies not only play their anticipated role as the key group-supplied capacities around which RPSs assert a position in their MNEs' networks, but also prolong their relevance as one of the knowledge inputs into the operations of WPM/RPMs. The latter positioning indicates a strongly evolutionary content to the process of subsidiary development, in which ESTPRODTECH plays the valuable role of

anchoring such upgrading, in a coherent and logical fashion, within the wider parameters of the MNE group's technological trajectory.[21]

The second key element in creative transition is the role of subsidiaries in-house R & D labs (OWNLAB). The unexpected presence of these in RPSs can be interpreted as being at the core of the attempt to build up the restructured knowledge-scope perceived to be needed for the transition to the PM role. The decisive presence of in-house R & D in WPM/RPMs then confirms its crucial status in these operations, where it acts as a coordinating fulcrum from which such subsidiaries articulate beneficial interdependence within both the MNE group and the host country.

This characterisation of dynamic processes within the contemporary MNE indicates that host-country obsession with their footloose potentials can lead to a myopic policy perspective which fails to address the more sustained and regenerative possibilities. In effect we can argue that MNE operations in a particular country are entirely compatible with intensive development processes that encompass the precepts of modern growth theory (knowledge progress and enrichment of human capital) and are not constrained to use of traditional extensive sources of comparative advantage (standardised cost-effective inputs).[22] In our terms policy dimensions that target only RPS behaviour are inimical to true and sustainable development, but comprehension of creative transition and the dynamic scope of PMs can set up a symbiotic context of mutually-supportive knowledge enrichment for MNE/host-country cooperation.[23]

NOTES

[1] Kojima (1978) extols the virtues of such foreign direct investments as trade-creating and welfare-enhancing, since they relocate production from a newly comparatively disadvantaged sector in the MNE's home country to a *potentially* comparative advantaged sector in a host country. The 'footloose' characterisation of MNE motivation assumes that inevitably the newly activated sector in the host country will eventually itself become disadvantaged, so that Kojima's optimising trade-creation behaviour provokes a move to a third country which replicates the state of *potential* comparative advantage.

[2] In pure efficiency seeking the relevant firm-level assets are assumed to operate, within the companies, as a public good. Thus they can be reapplied with equal facility in a new location as soon as local cost rises alienate their competitiveness at the first site. Crucially for our exposition a pure efficiency-seeking subsidiary is assumed not to generate any forms of individuality (i.e. its own unique capabilities derived from more distinctive local inputs) that can embed it (in a non-replicable fashion) in the host-country economy.

[3] Other influential characterisations of the contemporary MNE, essentially compatible with that used here, include the heterarchy (Hedlund, 1986, 1993; Hedlund and Rolander, 1990; Birkinshaw, 1994), the horizontal organisation (White and Poynter, 1990), and the transnational (Bartlett and Ghoshal, 1989, 1990).

[4] Though this more scientifically-speculative and, at this stage, non-commercially-driven, research may be done in laboratories within subsidiaries a frequently observed alternative are stand-alone labs with close association with local universities' research units. The decentralisation of R & D in MNEs is, of course, a key component in the strategic evolution of MNEs that is central to this paper. Niosi (1999) provides a collection of recent papers on this. For analysis of MNEs' R & D in the UK, integral with the discussion here, see Papanastassiou and Pearce (1999, chapters 5-7).

[5] The initial mailout of the questionnaire was in late 1993 with a follow up in the early Spring of 1994. It was addressed, in the first instance, to the Managing Director, though there is evidence that in some cases the responsibility for reply was delegated to senior subordinates. The composition, by industry and home country, of respondents is given in Papanastassiou and Pearce (1999, p.15).

[6] Other studies that have used this approach to analysis of MNEs' operations in the UK include Papanastassiou (1995, 1999), Hood and Young (1988), Hood, Young and Lal (1994), Young, Hood and Dunlop (1988), Taggart (1996, 1999).

[7] See Papanastassiou and Pearce (1999, pp. 63-5) for evidence on the changing relative status of these subsidiary roles in the UK. Comparable evidence of role change, within the scope typology approach, can be found in Taggart (1996, 1999) and Hood, Young and Lal (1994). Studies detecting role change in terms of alternative subsidiary typologies include Taggart (1997, 1998) and Jarillo and Martinez (1990).

[8] TMR behaviour was defined for respondents as 'to produce for the UK market products that are already established in our MNE group's product range'. Of the respondents 8.1% considered this was their 'only' role, 37.3% felt it took a 'predominant' position, 27.0% rated it as a 'secondary' role and 27.6% did not include it.

[9] Indeed RPSs are likely to be even more comprehensively truncated than TMRs, since the latter might have some limited R & D and market-research capacity to secure the adaptation of existing goods to

local market conditions. This would not be applicable to the RPS, supplying goods to a wider market area for which their characteristics have already been fully formalised.

[10] Though it may be unavoidably necessary to train local labour in process-specific practices (as would be the case in whatever location the technologies were utilised) the need to train these workers in more routine and generalised industrial skills would be considered to be compromising to an RPSs cost effectiveness.

[11] RPS1 behaviour was defined for respondents as 'to play a role in the MNE group's European supply network by specialising in the production and export of part of the established product range. Only 3.2% of respondents said this was their only role, but 46.5% rated it as a predominant one and 21.6% more felt it took a secondary position.

[12] RPS2 behaviour was defined for respondents as 'to play a role in the MNE group's European supply network by producing and exporting component parts for assembly elsewhere'. Only 1.1% of respondents said this was their only role and only 6.1% considered it was a major part of their operations, whilst 70.2% did not include it in their activity.

[13] Whose production in another site may have lost competitiveness in a similar fashion.

[14] Birkinshaw and Hood (1997, 1998) document subsidiary development as responding to parent-company, subsidiary and host-country driven processes of resource accumulation.

[15] Theoretically a MNE would allow a PM subsidiary to proceed with all lines of development where it can convincingly indicate the possession of potentials that are unmatched elsewhere in the group's network.

[16] The actual international distribution of a PMs goods may, as with a RPS, make use of the existing networks of the MNE group. However, by contrast with the RPS (which is totally dependent on orders initiated by the network) the PM retains *responsibility* for distribution, using the established group network (to their mutual benefit) on a collaborative contractual (rather than imposed) basis (Papanastassiou and Pearce, 1999, p.29; Pearce, 1992).

[17] Poor central decision making could, however, allow too much scope to PMs whose initiatives lack coherence and cohesion with the mainstream of the MNE and may generate negative externalities by absorbing excessive resources from elsewhere in the group and thereby distort the more logical lines of progress (Pearce, 1999b).

[18] The PM roles were defined for respondents as 'to develop, produce and market for the UK and/or European (or wider) markets, new products additional to the MNE group's existing range.' This was the only role of 8.7% of respondents, the predominant one of 27.2% and a secondary one for 34.2%.

[19] This can be articulated most formally as part of a global innovation strategy (Papanastassiou and Pearce, 1999, pp. 93-95, p.101).

[20] This does not contradict the view of a strong growth in international strategic technology alliances (Dunning, 1993b; Chesnais, 1988; Hagedoorn, 1993), but does suggest that the very strategic nature of these leads to their being implemented at the parent-company, rather than subsidiary, level.

[21] The importance in WPM/RPM operations of the creative capacities within the tacit knowledge of engineers and production personnel (ENGUNIT) can also be interpreted as playing this role.

[22] Dunning (1994) suggests that a crucial contribution that governments should expect from MNEs' operations is a 'wider impact on the upgrading of the competitiveness of host countries' indigenous capabilities and the promotion of their dynamic comparative advantages.'

[23] In a detailed review of the operations of investment agencies in the EU Young and Hood (1994) note that these should be 'designed to facilitate both the successful start-up and the continuing development of a foreign affiliate in a host-country or region, with a view towards maximising the local economic development contribution of that affiliate'. Thus 'after-care programmes are designed to exploit the opportunities and minimise the threats of highly dynamic [MNE] networks….[so that] services of a strategic nature are designed to support an affiliate within its [multinational] corporate framework'.

References

Bartlett, C.A. and S. Ghoshal (1990), 'Managing innovation in the transnational corporation', in C.A. Bartlett, Y. Doz and G. Hedlund (eds), *Managing the Global Firm*, London: Routledge, pp. 215-255.

Bartlett, C.A. and S. Ghoshal (1989), *Managing Across Borders: The Transnational Solution*, London: Hutchinson Business Books.

Behrman, J.N. (1984), *Industrial Policies: International Restructuring and Transnationals*, Lexington, Mass: Lexington Books.

Birkinshaw, J.M. (1994), 'Approaching heterarchy - a review of the literature on multinational strategy and structure', *Advances in International Comparative Management*, 9, pp. 111-114.

Birkinshaw, J. and N. Hood (1998), 'Multinational subsidiary evolution: capability and charter change in foreign-owned subsidiary companies', *Academy of Management Review*, 23, 4, pp. 773-795.

Birkinshaw, J.M. and N. Hood (1997), 'An empirical study of development processes in foreign-owned subsidiaries in Canada and Scotland', *Management International Review*, 37, 4, pp. 339-364.

Chesnais, F. (1988), 'Technical cooperation agreements between firms', *STI Review*, 4, pp. 51-120.

D'Cruz, J. (1986), 'Strategic management of subsidiaries', in H. Etemad and L. Sıguin Dulude (eds), *Managing the Multinational Subsidiary,* London: Croom Helm, pp. 75-89.

Dunning, J.H. (1994), 'Re-evaluating the benefits of foreign direct investment', *Transnational Corporations*, 3, 1, pp. 23-52.

Dunning, J.H. (1993a), *Multinational Enterprises and the Global Economy*, Wokingham: Addison-Wesley.

Dunning, J.H. (1993b), *The Globalisation of Business*, London: Routledge.

Hagedoorn, J. (1993), 'Understanding the rationale of strategic technology partnering: inter-organisational modes of cooperation and sectoral differences', *Strategic Management Journal*, 14, pp. 371-385.

Hedlund, G. (1993), 'Assumptions of hierarchy and heterarchy, with applications to the management of the multinational corporation', in S. Ghoshal and E. Westney (eds), *Organisation Theory and the Multinational Corporation*, London: Macmillan, pp. 211-236.

Hedlund, G. (1986), 'The hypermodern MNC: a heterarchy?' *Human Resource Management*, 25, pp. 9-35.

Hedlund, G. and D. Rolander (1990), 'Action in heterarchies - new approaches to managing the MNC', in C.A. Bartlett, Y. Doz and G. Hedlund (eds), *Managing the Global Firm*, London: Routledge, pp. 15-46.

Hood, N. and S. Young (1988), 'Inward investment and the EC: UK evidence on corporate integration strategies', in J.H. Dunning and P. Robson (eds), *Multinationals and the European Community*, Oxford: Blackwell, pp. 91-104.

Hood, N., Young, S. and D. Lal (1994), 'Strategic evolution within Japanese manufacturing plants in Europe: UK evidence', *International Business Review*, 3, 2, pp. 97-122.

Jarillo, J.C. and J.I. Martinez (1990), 'Different roles for subsidiaries: the case of multinational corporations in Spain,' *Strategic Management Journal*, 11, pp. 501-512.

Kojima, K. (1978) *Direct Foreign Investment: a Japanese Model of Multinational Business Operations*, London: Croom Helm.

Niosi, J. (ed)(1999), The Internationalisation of Industrial R & D, (special issue), *Research Policy*, 28, 2-3.

Papanastassiou, M. (1999), 'Technology and production strategies of MNE subsidiaries in Europe,' *International Business Review*, 8, 2, pp. 213-232.

Papanastassiou, M. (1995), *Creation and Development of Technology by MNEs' Subsidiaries in Europe: the Cases of UK, Greece, Belgium and Portugal.* Thesis submitted for the degree of Doctor of Philosophy, University of Reading.

Papanastassiou, M. and R. Pearce (1999), *Multinationals, Technology and National Competitiveness*, Cheltenham: Elgar.

Papanastassiou, M. and R. Pearce (1994), 'Host-country determinants of the market strategies of US companies' overseas subsidiaries', *Journal of the Economics of Business*, 1, 2, pp. 199-217.

Pearce, kR. (1999a), 'Decentralised R & D and strategic competitiveness: globalised approaches to generation and use of technology in multinational enterprises', *Research Policy*, 28, 2-3, pp. 157-178.

Pearce, R. (1999b), 'The evolution of technology in multinational enterprises: the role of creative subsidiaries', *International Business Review*, 8 2, pp. 125-148.

Pearce, R. (1999c), 'Multinationals and industrialisation: the bases of inward investment policy', Department of Economics, University of Reading, Discussion Papers in International Investment and Management, No. 279.

Pearce, R. (1992), 'World product mandates and MNE specialisation', *Scandinavian International Business Review*, 1, 2, pp. 38-58.

Porter, M.E. (1986), 'Competition in global industries: a conceptual framework', in M.E. Porter (ed), *Competition in Global Industries*, Boston: Harvard Business School Press, pp. 15-60.

Taggart, J.H. (1999), 'US MNCs subsidiaries in the UK: characteristics and strategic roles', in F. Burton, M. Chapman and A. Cross (eds), *International Business Organisation*, London: Macmillan.

Taggart, J.H. (1998), 'Identification and development of strategy at subsidiary level', in J. Birkinshaw and N. Hood (eds), *Multinational Corporate Evolution and Subsidiary Development*, London: Macmillan.

Taggart, J.H. (1997), 'An evaluation of the integration-responsiveness framework: MNC manufacturing subsidiaries in the UK,' *Management International Review*, 37, 4, pp. 295-318.

Taggart, J.H. (1996), 'Multinational manufacturing subsidiaries in Scotland: strategic role and economic impact,' *International Business Review*, 5, pp. 447-468.

White, R.E. and J.A. Poynter (1990), 'Organisation for world-wide advantage,' in C.A. Bartlett, Y. Doz and G. Hedlund (eds) *Managing the Global Firm*, London: Routledge, pp. 95-113.

White, R.E. and J.A. Poynter (1984), 'Strategies for foreign-owned subsidiaries in Canada,' *Business Quarterly,* pp. 59-69.

Young, S. and N. Hood (1994), 'Designing developmental after-care programmes for foreign direct investors in the European Union,' *Transnational Corporations*, 3, 2, pp. 45-72.

Young, S., N. Hood, and S. Dunlop (1988), 'Global strategies, multinational subsidiary roles and economic impact in Scotland,' *Regional Studies*, 22, 6, pp. 487-497.