# Knowledge flows in MNCs: An empirical test and extension of Gupta & Govindarajan's typology of subsidiary roles

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## AN EMPIRICAL TEST AND EXTENSION OF GUPTA & GOVINDARAJAN'S TYPOLOGY OF SUBSIDIARY ROLES

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**ABSTRACT**

This study offers an empirical test and extension of Gupta & Govindarajan's typology of subsidiary roles based on knowledge inflows and outflows. A four-fold typology of subsidiary roles – global innovators, integrated players, implementors and local innovators – is tested using a sample of 169 subsidiaries of MNCs headquartered in the US, Japan, UK, Germany, France and the Netherlands. Results confirm the typology and show that different subsidiary roles are associated with different control mechanisms, relative capabilities and product flows. In comparison to earlier studies, our results show an increased differentiation between subsidiaries, as well as an increase in the relative importance of both knowledge and product flows between subsidiaries suggesting that MNCs are getting closer to the ideal-type of the transnational company.



Key words: knowledge flows, typology, subsidiary roles, control mechanisms, capabilities, transnational

# INTRODUCTION

In 1986 Porter (1986: 17) noted that "we know more about the problems of becoming a multinational than about the strategies for managing an established multinational". Since the mid 1980s, however, there has been a growing stream of research on the management of headquarters-subsidiary relationships, and in particular on the systems and processes that multinational companies (MNCs) use to coordinate and control their network of subsidiaries (e.g. Egelhoff, 1988; Bartlett & Ghoshal, 1989; Ghoshal & Nohria, 1989; Martinez & Jarillo, 1991). With this has also come the realization that different subsidiaries might play different roles within the MNC network and that this might lead to a need to differentiate control mechanisms across subsidiaries.

One of the most influential contributions in this respect has been Gupta & Govindarajan's 1991 *Academy of Management Review* article that proposed a typology of subsidiary roles based on knowledge flows within the MNC. The Social Science Citation Index (SSCI) reports more than a hundred citations to this seminal article, 60% of which occurred in the last five years alone. Surprisingly, even though from the nineties onwards we find a large number of empirical studies dealing with subsidiary roles (e.g. Martinez & Jarillo, 1991; Roth & Morrison, 1992; Birkinshaw & Morrison, 1995; Taggart, 1997a/b; Nobel & Birkinshaw, 1998; Ambos & Reitsperger, 2004), the original typology proposed by Gupta & Govindarajan has not been subjected to much empirical verification. Given that this typology has remained so influential even in recent years, it is important to verify whether a subsidiary typology based on knowledge flows is a meaningful way to classify MNC subsidiaries.

As far as we are aware, only Gupta & Govindarajan's (1994) own study provided such a test. In stark contrast to the authors' earlier conceptual article, however, this empirical article seems to have made a rather modest impact on the field. The SSCI lists only twelve citations to it. Moreover, Gupta &

Govindarajan's empirical study suffered from a number of limitations. First, following their conceptual study, each of their hypotheses only distinguished two opposite subsidiary roles and simply expected the remaining two roles to fall in between. In our study we clearly differentiate *all four* subsidiary roles. Second, in Gupta & Govindarajan's study the four subsidiary types were constructed by using median splits. As they acknowledge themselves, however, a median split might lead in some "noise" in the results as it uses an arbitrary cut-off point. Our study will therefore use a K-means cluster analysis to verify whether a natural empirical pattern emerges that confirms Gupta & Govindarajan's theoretical model. Thirdly, even though Gupta & Govindarajan hypothesised differences *between* subsidiary roles, their analysis only provided an overall ANOVA, without any pairwise tests for specific differences, an aspect that will be duly addressed in our study.

Given that there is increasing recognition that internalization of knowledge flows might well be the most important function of foreign direct investment and that the effective and efficient management of knowledge flows is possibly the most important source of competitive advantage for MNCs (Kogut & Zander, 1993; Doz, Santos & Williamson, 2001; Bartlett, Ghoshal & Birkinshaw, 2004), it seems appropriate to revisit Gupta & Govindarajan's typology. This article will therefore provide both an empirical test of the Gupta & Govindarajan typology and a test of part of their propositions with regard to control mechanisms. In addition, it will extend the original typology by investigating differences in subsidiary capabilities and product flows. Finally, it will provide a more detailed analysis of the differences between HQ and subsidiary flows as well as a further refinement of the Local Innovator role.

There are several reasons why a typology of subsidiaries can be useful for both academics and students. First, it can reduce the complexity of multinational organizational reality into a manageable number of related characteristics, making it easier to understand and explain the functioning of multinational companies. Second, if meaningful organizational typologies can be discovered they can then be

used in a predictive way. When certain characteristics are shown to cluster in distinct typologies, the presence of one or more of these characteristics in other samples can lead to a prediction of the remaining elements. This would make it easier to compare and integrate different studies in the field and may go some way to remedy the "lack of (both) conceptual integration and empirical corroboration" in the field of international business and management (Macharzina & Engelhard, 1991:24).

## SUBSIDIARY ROLES AND HQ-SUBSIDIARY RELATIONSHIPS

### PREVIOUS RESEARCH ON SUBSIDIARY ROLES

Gupta & Govindarajan (1991) see the MNC as a network of transactions that comprise capital flows, product flows and knowledge flows. They argue that of these three, knowledge flows are particularly important given that the proportion of global and transnational MNCs, in which knowledge flows are considered to be particularly important, is rising (Bartlett & Ghoshal, 1989), and that relatively little is still known about the management of knowledge flows, either in a domestic or an international context (Gupta & Govindarajan, 1991: 772). Gupta & Govindarajan distinguish two aspects of knowledge flows: the magnitude of transactions (the extent to which subsidiaries engage in knowledge transfer) and the directionality of the transactions (whether subsidiaries are the provider or receiver of knowledge). Combining these two dimensions they define four generic subsidiary roles: *Global Innovator* (high outflow, low inflow), *Integrated Player* (high outflow, high inflow), *Implementor* (low outflow, high inflow) and *Local Innovator* (low outflow, low inflow).

The Global Innovator (GI) subsidiary is a fountainhead of knowledge for other units. This subsidiary role has become more important as MNCs move toward a transnational model in which individual subsidiaries can act as a center-of-excellence for specific product lines (Bartlett & Ghoshal, 1989). Integrated Players (IP) also engage in knowledge transfer to other organizational units, but at the same time they are at the receiving end of knowledge flows from other units. As such this type of sub-

sidiary is a very important node in the MNC network. Subsidiaries with an Implementor (IM) role do not typically engage in extensive knowledge creation and hence provide little knowledge to other organizational units. They are heavily dependent on knowledge inflows from either HQ or other subsidiaries though. Local innovators (LI) are self-standing subsidiaries, who do engage in knowledge creation, but do not transfer this knowledge to other organizational units, nor receive knowledge from them. Typically, this situation occurs when local knowledge is seen as too idiosyncratic to be of much use in other organizational units. After thus defining subsidiary roles based on knowledge flows, Gupta & Govindarajan (1991) went on to formulate propositions about the type of control mechanisms best suited to the different subsidiary roles. We will return to this when formulating our own hypotheses. First, however, we briefly review other empirical studies on subsidiary typologies.

In a study about creation, adoption and diffusion of innovation by subsidiaries of MNCs, Ghoshal and Bartlett (1988) described three different types of subsidiaries. Some subsidiaries created innovations but did not adopt or diffuse any (similar to LIs), others created and adopted innovations, but did not diffuse them (no clear equivalent in Gupta & Govindarajan's typology), while the third group performed all three functions (similar to IPs). Birkinshaw & Morrison (1995) also provide a three-fold typology (local implementer, specialized contributor and world mandate) that integrated some of the previous literature. However, in doing so they did not seem to do full justice to Gupta & Govindarajan's typology as they combined very different types (LI and IM) into one category and categorized the GI as being tightly integrated and coordinated. Focusing specifically on R&D subsidiaries, Nobel & Birkinshaw (1998) proposed a three-fold typology of local adaptors (similar to IMs), international adoptors (no clear equivalent in Gupta & Govindarajan's typology) and global creators (a cross between GIs and IPs). Ambos & Reitsperger (2004) also focused on R&D subsidiaries and created a typology based on two dimensions: technological mandate (capability exploiting vs. capability augmenting) and task-related interdependence (work received from and delivered to other units). The first

could be broadly equated to knowledge outflow (with capability augmenting signifying high outflow), while the second would be expected to be related to both inflow and outflow. Thus while the Integrated Research Unit (capability augmenting and high interdependence) and the Local Adaptor (capability exploiting and low interdependence) can be clearly linked to Gupta & Govindarajan's IP and LI respectively, the Global Development Unit (capability exploiting, high interdependence) and Center of Excellence (capability augmenting and low interdependence) are not pure IMs and GIs. However, the range of subsidiary types in this typology probably comes closest to Gupta & Govindarajan's typology.[1] One further study (Roth & Morrison, 1992) focused on one particular subsidiary role: global mandate or center of excellence, a cross between Gupta & Govindarajan's GIs and IPs.[2] Table 1 compares the different subsidiary roles, taking Gupta & Govindarajan's typology as a starting point. As mentioned above, the original Birkinshaw & Morrison (1995) classification did not seem to do full justice to Gupta & Govindarajan's subsidiary types and hence we have reclassified the Gupta & Govindarajan types based on Birkinshaw & Morrison's description of their three subsidiary types and their findings with regard to intra-company purchases.[3]

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Table 1 about here
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## THEORETICAL FRAMEWORK AND HYPOTHESES

Following Gupta & Govindarajan (1994) and Martinez & Jarillo (1991) we decided to focus on two main aspects of control and coordination mechanisms: decentralization or subsidiary autonomy and a more subtle/informal type of control that – following Harzing (1999) – we have coined control by socialization and networks. Decentralization/autonomy refers to the extent of decision-making authority that HQ delegates to the subsidiary. Centralization versus autonomy has been one of the key research themes in international management since the publication of Michael Brooke's *Centralization and Autonomy* (1984). However, in a recent extensive review of the literature Young & Tavares (2004) identify the relationship between subsidiary roles and autonomy as one of the areas requiring still further research.

Gupta & Govindarajan (1991) argue that the greater the magnitude and scope of knowledge creation expected from the subsidiary, the greater the need for the exercise of autonomous initiative, measured as the subsidiary manager's locus of control, the level of decentralization, and the size of bonus relative to salary. They predict that decentralization is likely to be highest for GIs, medium for IPs and LIs and lowest for IMs. Gupta & Govindarajan (1994) did not find any significant differences in the level of decentralization between subsidiary roles, nor did the other measures related to the need for autonomous initiative (subsidiary manager's locus of control, size of bonus relative to salary) perform as expected.

We suggest another perspective that might be more commensurate with Gupta & Govindajaran's conception of the MNC as a network of flows. As Birkinshaw & Hood (1998) indicate one of the core assumptions of the network model centers around the fact that subsidiaries can develop their own unique resource profile. This in turn decreases their dependence on other entities in the MNC network and increases what, in the context of resource dependency theory, is defined as resource power. The more a subsidiary can function without the rest of the firm, the higher both its independence and resource power and hence its ability to attain a high degree of autonomy vis-à-vis its headquarters (Forsgren & Pahlberg, 1992). On the other hand, high knowledge flows between a subsidiary and other parts of the MNC might point at strategically sensitive activities at the subsidiary that HQ will want to control (Young & Tavares, 2004). From this perspective it would not seem logical to assume – as Govindarajan and Gupta (1991) do – subsidiaries that operate completely independently from both HQ and other subsidiaries (LIs) to show the same level of autonomy as subsidiaries that are highly integrated with the rest of the MNC (IPs). In contrast to Gupta & Govindarajan, we would therefore expect the highest level of autonomy for LIs. These subsidiaries are essentially stand-alone operators with a high level of independence from HQ and other subsidiaries. They also need a high level of autonomy to respond to their idiosyncratic host country requirements. GIs would also need a

relatively high level of autonomy as they develop new knowledge and skills that are transferred to HQ and other subsidiaries without being a major recipient of knowledge inflows. However, given the higher strategic importance of GIs, it is expected that the level of autonomy granted towards these subsidiaries is slightly lower than for LIs. Both IMs and IPs would be expected to experience even lower levels of autonomy due to their higher resource dependence on HQ and other subsidiaries. However, autonomy for IPs is expected to be slightly higher than for IMs as they do perform a knowledge-creation role for other sub-units as well and hence are in a more powerful position vis-à-vis HQ.

These assumptions are supported by Ghoshal & Bartlett (1988) who found autonomy to be highest in their equivalent of LIs and medium in their equivalent of IPs. Also in accordance with this hypothesis, Birkinshaw & Morisson (1995) found strategic autonomy be significantly lower for their Local Implementer (IM) than for their World Mandate (GI), while their Specialized Contributor (IP) had a medium level of autonomy. Nobel & Birkinshaw (1998) predicted both their equivalent of IMs (Local adaptors) and their equivalent of IPs/GIs (International Creator) to display moderate levels of centralization (moderate autonomy), but found autonomy to be higher for Local adaptors. This difference was not significant though.[4] Hence:

*Hypothesis 1: The level of autonomy granted to subsidiaries will be lowest for Implementors, low for Integrated Players, medium for Global Innovators and highest for Local Innovators.*

Control by socialization and networks includes mechanisms such as participation of subsidiary managers in international task forces and international training programs, informal communication with other organizational sub-units and socialization of subsidiary managers. A decade and a half ago, Martinez and Jarillo (1989, 1991) already argued that these kind of informal and subtle control mechanisms are becoming more and more important in MNCs, an argument that has been repeated many times since. In contrast to their arguments with regard to autonomy, Gupta & Govindarajan (1991) do refer to the

extent of interdependence between a subsidiary and the rest of the MNC when formulating their hypotheses with regard to more informal mechanisms of control. They indicate that the level of interdependence is directly linked to the level of knowledge inflow and outflow and that this will hence be highest for IPs, medium for GIs and IMs and lowest for LIs. They list four control mechanisms that can be used to manage this interdependence: formal integrative mechanisms, intensity of communication, corporate socialization and the nationality of subsidiary managers. The first three are part of what we have defined above as control by socialization and networks and were tested in Gupta & Govindarajan (1994). Except for corporate socialization, their results were as expected.

Although in this case we agree with Gupta & Govindarajan's argumentation on a general level, we feel that it is important to distinguish between GIs and IMs. Although both display the same level of knowledge flows, the former are characterized by high *out*flows, while the latter are characterized by high *in*flows. From a resource-dependency perspective, this is a key distinction. In addition, it is also important to look at the portfolio of control mechanisms used towards a particular subsidiary. We would argue that the dependencies created by knowledge *in*flows for IMs can be effectively controlled by granting these subsidiaries a low level of autonomy. Hence use of control by socialization and networks can be substantially lower for IMs than for GIs where this more subtle and informal type of control might encounter less resistance than control through centralization of decision-making.

Earlier partial support for the arguments above is presented by Ghoshal & Bartlett (1988) who found normative integration and communication (part of our control by socialization and networks) to be highest in their equivalent of IPs and lowest in their equivalent of LIs. Birkinshaw & Morisson (1995) found no significant differences on normative integration. Nobel & Birkinshaw (1998) predicted their equivalent of IMs (Local Adaptors) to display low levels of socialization and their equivalent of IPs/GIs (International Creators) to display high levels of socialization. However, none of the measures

used to test this provided significant differences between the three subsidiary types. Ambos & Reitsperger (2004) argue that social control (our control by socialization and networks) is ineffective for subsidiaries that are endowed with a mandate to search for new knowledge and hypothesize that HQs will refrain from imposing strong social control on their centers of excellence (GIs). In partial support of our arguments above, they find social control to be lower for their equivalents of GIs and LIs than for their equivalents of IPs and IMs. Hence:

*Hypothesis 2: The level of control by socialization and networks will be lowest for Local Innovators, low for Implementors, medium for Global Innovators and highest for Integrated Players.*

Gupta & Govindarajan (1991) suggest (but do not systematically incorporate) a number of other factors that might be included in a subsidiary typology and that in turn might also influence the design of control mechanisms used by HQ. Two of these factors – the level of local capabilities and variations in product flow patterns – are included in this article to extend Gupta & Govindarajan's original typology. Product flows were chosen because they are one of the two remaining categories of intra-MNC transactions identified by Guptat & Govindarajan (1991, 1994). Capabilities were chosen because they can be expected to be closely related to knowledge flows. The network model of the MNC provides very clear predictions of the expected level of capabilities in different types of subsidiaries. Capabilities can be interpreted as a reflection of the existing stock of knowledge within a subsidiary (Foss, 2004) and are underlying the specialized resource development within subsidiaries and the subsequent transfer of knowledge. We would therefore expect subsidiaries with a significant outflow of knowledge to have a higher level of underlying capabilities relative to other subsidiaries, while the reverse would be true for subsidiaries for a significant inflow of knowledge. Hence GIs would be expected to have the highest relative capabilities, followed by IPs and LIs, while IMs would display the lowest level of relative capabilities. Unfortunately, there is not much earlier empirical research we can draw on in this respect. Birkinshaw & Morisson (1995) did not find any significant differences between their three subsidiary

types in relative capabilities in four areas (R&D, manufacturing, sales and service). In contrast to their hypothesis, Roth & Morisson (1992) found that global subsidiary mandates (a cross between Gupta & Govindarajan's IPs and GIs) did not have capabilities that exceeded that of sister companies. However, both studies overall found very few significant differences. We therefore put forward the original hypothesis described above:

*Hypothesis 3: Global Innovators and Integrated Players will have higher levels of capabilities than Local Innovators and Implementors. Global Innovators will report the highest level of capabilities, while Implementors will report the lowest level of capabilities.*

With regard to product flows, we would expect a positive relationship with knowledge flows, since knowledge flows could either be embedded in product flows or needed as a complement to product flows. In confirmation of this assumption, Birkinshaw & Morisson (1995) found their equivalent of IMs and IPs to source a much larger proportion of their purchases from other organizational units than their equivalent of GIs. Hence:

*Hypothesis 4: Global Innovators and Local Innovators will have a higher level of external product inputs and a lower level of inputs from either HQ or other subsidiaries than both Integrated Players and Implementors.*

A similar positive relationship would be expected with product outflows. However, since for any subsidiary a large proportion of product outflows could be expected to go to external customers, differences are expected to be less important for product outflows than for product inflows. Hence:

*Hypothesis 5: Implementors and Local Innovators will have a higher level of external material outputs and a lower level of outputs to HQ/other subsidiaries than both Integrated Players and Global Innovators. However, differences in output destination will be smaller than differences in sources of input.*

# METHODS

## DATA COLLECTION AND SAMPLE

Data for this study were collected through a questionnaire survey. The questionnaire was developed after an extensive review of the relevant literature on headquarters-subsidiary relationships. It was subsequently pilot-tested in a focus group consisting of five postgraduate students from five different countries. These students had between 4 and 10 years of managerial work experience in multinational corporations. Pilot testing focused on both content and questionnaire design. After modification, the questionnaire was pilot-tested again with a different (but equally diverse) student group. Further modifications were made and the questionnaire was subsequently pilot-tested by four subsidiary managing directors, which resulted in some minor changes to enhance comprehensibility. The final questionnaire had a total of 149 questions, measuring a range of aspects of the headquarters-subsidiary relationship.

Questionnaires were mailed to the subsidiary managing directors of 2754 subsidiaries of MNCs headquartered in the USA, Japan, Germany, the UK, France and the Netherlands. Subsidiaries were located in more than 50 different countries. Data were collected in 2002. The sample was drawn from the Dun & Bradstreet Who Owns Whom database. Four very different manufacturing industries were selected that included MNCs from most of the six home countries: motor vehicles and parts, chemicals, food & beverages and electronics. For each home country 3-5 MNCs were selected[5], resulting in a total of 82 MNCs. For each MNC, 30-50 subsidiaries were selected, taking care to not select more than 5 subsidiaries in each subsidiary country. Subsidiaries with less than 25 employees were excluded, as were pure service subsidiaries.

Of the 2754 questionnaires, 553 were returned undeliverable. After an initial mailing and one follow-up mailing, a total of 174 questionnaires were returned. Five of them contained more than 15%

missing values and were hence discarded, leaving a total response rate of 8%. Although very low, this response is not unusual for multi-country studies with high-level executives as respondents. Harzing (1997) reported that response rates for international mail surveys typically varied between 6% and 16% and key studies in the field (Ghoshal & Nohria, 1989) have been based on response rates of 15%. Ghoshal & Nohria's data were collected nearly twenty years ago. Intensification of the pace of business as well as the increasing use of mail surveys are likely to have led to a substantial decline in willingness to respond to mail surveys.

The resulting sample of 169 subsidiaries represented nearly 50 different MNCs, with the number of responses per MNC varying from 1 to 5. Only 6 MNCs were represented by 5 subsidiaries and hence our sample is unlikely to be biased by parent company-specific characteristics. Non-response bias was evaluated in a number of ways. First, we tested whether responses on the key variables in this study differed systematically between respondents in the original mailing and respondents in the reminder. In this procedure late respondents are treated as a proxy for non-respondents. No significant differences were found for any of the key variables in our study. Secondly, we compared responding and non-responding firms on size (number of employees), age, industry and country of headquarters. No significant differences were found on any of the variables. We can therefore be reasonably confident that non-response bias is not a problem in our study.

**MEASURES**

Given our relatively small sample size and the fact that many questionnaires had incidental missing values, we decided to use the EM (expectation-maximization) method to estimate missing values. The advantage of the EM method is that, unlike mean substitution, it does not reduce variability in the sample and preserves the underlying relationships in the data (Hair, Anderson, Tatham & Black, 1998). It is generally considered superior to list or pair-wise deletion, mean sustitution or imputation by

multiple regression (Roth, 1994; Fichman & Cummings, 2003), especially with more than 10% missing values. We used 15% missing values as the cut-off point[6], but 85% of our sample had less than 5% missing values (for a questionnaire with around 150 questions). This would seem to indicate that our questionnaire was generally well-understood and felt to be applicable to the subsidiary's circumstances.

Subjective constructs in our study were all measured with multi-item scales. Our measures of *knowledge flows* were taken from Gupta & Govindarajan (2000). However, given the large number of constructs in our questionnaire, we decided to reduce their seven areas of knowledge flows to four: (1) product design, (2) marketing, (3) distribution, (4) management systems and practices. Following Gupta & Govindarajan (2000), the respondent was asked to indicate on a scale from 1 to 7 the extent to which the subsidiary engaged in the transfer of knowledge and skills in the areas above, in each of the following four directions: (1) provides knowledge and skills to HQ ($\alpha = 0.89$), (2) provides knowledge and skills to other subsidiaries ($\alpha = 0.83$), (3) receives knowledge and skills from HQ ($\alpha = 0.71$), (4) receives knowledge and skills from other subsidiaries ($\alpha = 0.82$). The *autonomy* measure was adapted from Otterbeck (1981) and asked the respondent to assess - on a five point scale - the influence HQ would normally have on a range of issues varying from selection of suppliers to design of advertising for the local market. The Cronbach reliability coefficient for this 6-item scale was $\alpha = 0.82$. *Control by socialization and networks* was measured using a four-item scale measuring the participation of subsidiary managers in international task forces and international training, the extent of informal communication with HQ and other subsidiaries and the level of shared values with HQ (Harzing, 1999). The Cronbach reliability coefficient for this 4-item scale was $\alpha = 0.65$. The measure for *subsidiary capabilities* was adapted from Holm & Pedersen (2000) and asked the respondents to evaluate their subsidiary's capabilities relative to other subsidiaries on functions ranging from R&D to logistics and human resource management to the management of international activities. The Cronbach reliability coefficient for this 9-

item scale was a = 0.78. *Product flows* were measured by two questions asking respondents to estimate the percentage of their subsidiary's input/output from/to five different entities: HQ, other subsidiaries in the same country or abroad and external suppliers (customers) in the same country or abroad. The two measures for subsidiaries and suppliers (customers) were subsequently averaged.

In order to assess discriminant validity, we conduct pairwise factor analyses for all constructs in our study. The pairs were selected based on the conceptual relatedness of the two constructs, i.e. constructs that could be expected to be most closely related were compared. This provides a more stringent assessment of discriminant validity than random comparisons. The two knowledge outflows constructs were compared, as were the two knowledge inflows constructs and the two pairs of knowledge flows constructs from the same sources (both HQ or both subsidiary). All four factor analyses resulted in two clearly distinguishable factors with very few cross-loadings. Subsequently, knowledge inflows from HQs were compared with autonomy and control by socialization networks respectively, while centralization and control by socialization and networks were also subjected to a pairwise comparison. The two type of control mechanisms can be expected to be conceptually related to each other, as well as to dependence from HQ through knowledge inflow. All three comparisons resulted in two clearly distinguishable factors with factor loadings generally above .60 and only two cross-loadings (out of 28) over .30 (but below .40). Since subsidiary capabilities can be expected to be conceptually related to knowledge outlflows, a factor analysis was conducted with both knowledge outflows to subsidiaries and to HQ. Pairwise comparisons were also made with autonomy and control by socialization and networks. In each of the four comparisons subsidiary capabilities were clearly separated from the other construct with only three (out of 52 possible) cross-loadings over .30 (but below .40). However, in each of the four comparisons, capabilities in production, R&D and managing international activities were loading on a different factor than the six capabilities in support functions (HRM, IT, purchasing, mar-

keting, finance, logistics). We therefore decided to separate capabilities into two constructs: capabilities in support functions (Cronbach a = 0.77) and capabilities in strategic functions (Cronbach a = 0.64) and conduct our analyses for both the composite and separate constructs.

Our data was self-reported from single respondents. This leaves our study vulnerable to common method variance. However, a factor analysis of all interval variables in this study resulted in eleven factors with an eigenvalue above 1 and a first factor that accounted for only 18% of the variance. If a large amount of common method variance was present than either a single factor would emerge or the first factor would account for the majority of variance in the variables (Podsakoff & Organ, 1986). The results indicate that common method variance is not likely to be a major concern in this study.

## RESULTS

Table 2 contains the means, standard deviations and zero-order correlations for all variables used in this study. Confirming Gupta & Govindarajan's (2000) findings for knowledge flows, the largest flows take place from headquarters to subsidiaries. The mean inflow from headquarters is virtually identical in both studies (3.81 vs. 3.75). However, the other flows are all substantially higher in our study (Knowledge Outflows to HQ: 3.02 vs. 2.39, Knowledge Inflows from Subsidiaries: 2.86 vs. 2.21, Knowledge Outflows to Subsidiaries: 3.22 vs. 2.36). So even though inflows from HQ are still significantly greater (at $p < 0.001$) than the other three types of knowledge flows, it appears that in the decade between the two studies (data for Gupta & Govindarajan's study were collected in 1991) MNCs might have become more interdependent and less hierarchical. The pattern of intercorrelations between the four different types of knowledge flows is very similar to that in Gupta & Govindarajan's study and the average correlation is virtually identical (.33 vs. .32). The significant, but generally rather low, intercorrelations confirm Gupta & Govindarajan's (1991, 2000) claim that although the four types of knowledge flows are related, they are distinct variables, both conceptually and empirically.

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Table 2 about here
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**FORMATION OF KNOWLEDGE FLOW CLUSTERS**

Following Gupta & Govindarajan (1994) responses for the two types of knowledge inflow (from HQ and from other subsidiaries) were combined as a composite measure of knowledge inflow. A composite of knowledge outflow was similarly constructed and following Gupta & Govindarajan, median splits among these two composite measures were used to identify the strategic role of a particular subsidiary in the global MNCs network. Figure 1 visually displays the mean scores of the four subsidiary types score on knowledge inflow and outflow. As Gupta & Govindarajan indicate, however, a median split might lead to some "noise" in the results as it uses an arbitrary cut-off point. We therefore conducted a K-means cluster analysis using the four original knowledge measures to verify whether a natural empirical pattern would emerge that confirmed Gupta & Govindarajan's theoretical model.

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Figure 1 about here
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A range of cluster solution from 2 to 6 clusters was attempted. The 2 and 3 cluster solutions resulted in clusters that were differentiated only by low-high or low-medium-high flows and did not separate inflows from outflows. The 4-6 cluster solutions did provide this separation. The four-cluster solution – that is consistent with our a-priori theoretical model – reached convergence in a lower number of iterations (5) than the other solutions. It also showed the lowest number of non-significant pairwise comparisons (12.5%) and hence provided maximum differentiation between the types. The cluster mean scores for the 4-cluster solution are also portrayed in Figure 1. They are rather close to the mean scores based on median-split, but the Integrated Player type shows a more pronounced profile.

Given two input variables, it is not surprising that a four-cluster solution emerged as the best solution. However, as we can see in Figure 1 and Table 3, this four-cluster solution fits the theoretical model very well. A further test of the validity of the clusters is provided by examining them for industry-specific and home-country specific effects. This tests whether the clusters truly reflect the existence of different subsidiary roles within the same MNC, rather than a tendency for specific industries or home countries to have subsidiaries with a high level of knowledge inflows and outflows. We found no significant variation in the proportion of industries (chi-square: 6.081, df: 12, p = 0.912) or home countries (chi-square: 12.705, df: 18, p = 0.809) present in the four clusters. In the remainder of this article we will use the empirical classification rather than the enforced median split.

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Table 3 about here
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**TESTING OF THE HYPOTHESES**

In order to facilitate comparison across variables and strategic roles, as well as a comparison with the results reported in Gupta & Govindarajan's (1994), all variables were standardised prior to testing the hypotheses. Table 4 provides the results of our ANOVA analyses. We have reproduced the comparable results of Gupta & Govindarajan's (1994) article in this table. Our results provide full support for Hypothesis 1. The lowest level of autonomy is found for IMs, followed by IPs and GIs, while the highest level of autonomy is found for LIs. Support is also found for Hypothesis 2. As expected the highest level of control by socialization and networks is present in IPs, the lowest level in LIs, while GIs and IMs fall in between these two extremes. As predicted GIs show a higher level of control by socialization and networks than IMs, although this difference was not significant.

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Table 4 about here
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In terms of our extension of the Gupta & Govindarajan typology, we find the relative level of capabilities to differ according to the prediction in Hypothesis 3. IPs and GIs show a significantly higher level of relative capabilities than LIs and IMs and GIs show the highest and IMs the lowest level of relative capabilities. This is true for both capabilities in support functions and more strategic capabilities, although the differentiation is slightly larger for the latter. Hypothesis 4 is largely supported as well. External inputs and inputs from HQ perform fully as expected with GIs and LIs showing higher levels of external inputs and IPs and IMs showing higher levels of input from HQ. The level of input from other subsidiaries is not as low as expected for GIs, however, although results for the other three subsidiary types confirm our expectations. Figure 2 shows the differences in product inflows in a visual way. As can be seen clearly in the upper part, the higher knowledge inflow from both HQ and subsidiaries for IPs and IMs is associated with higher levels of internal product inflows as well. In contrast, GIs and LIs that are characterized by low levels of knowledge inflows, draw most of their inputs from external suppliers. With regard to the destination of outputs (Hypothesis 5) results are less clear-cut. Although outputs to subsidiaries and external customers broadly follow the predicted pattern (i.e. are respectively high and low for GIs and IPs and low and high for IMs and LIs) differences are minimal and not significant. Differences in outputs to HQs are not significant either and the pattern of results does not support Hypothesis 5. We do, however, find support for the latter part of the hypothesis that predicted that differences in output would be less significant than differences in input. As is clearly depicted in the lower part of Figure 2, the large majority of outputs in any type of subsidiary are directed towards external customers and differences in other output destinations are therefore small. We can observe though that while for IMs most of intra-company outputs go to HQ, for GIs and LIs and to a lesser extent IPs other subsidiaries are more important trading partners.

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Figure 2 about here
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**SENSITIVITY ANALYSIS**

Earlier studies (see e.g. Harzing & Sorge, 2003) have found MNC country-of-origin effects for most of the variables studied in this paper. In addition, the industry in which the subsidiary operates as well as characteristics such as subsidiary age, size and entry mode (greenfield vs. acquisition) might have an impact on the level of autonomy, control by socialisation and networks and relative capabilities as well as product in- and outflows. Therefore, we conducted a GLM analysis to ascertain whether the results with regard to subsidiary type hold up when these control variables are included. The GLM procedure is a statistical technique that provides regression analysis for one dependent variable by one or more factors and/or variables. In contrast to linear regression analysis, this technique allows a combination of categorical and continuous independent variables, without the necessity to recode categorical data into individual dummy variables.

Inclusion of these control variables did not change the significance levels or magnitude of the difference between the four subsidiary types for autonomy, control by socialisation and networks and capabilities. Very few of the control variables reached significance. Only industry (food & beverages showing higher levels and electronics showing lower levels of autonomy) and entry mode (lower levels of CBSN for acquisitions) reached the 0.05 level of significance. Results for product flows did not change either. However, in this case subsidiary size had a significant impact in four of the six analyses, with larger subsidiaries having higher levels of external and lower levels of subsidiary inputs and delivering higher levels of their output to HQ and lower levels to external customers. In addition, entry mode significantly influenced external inputs (higher for acquisitions) and HQ inputs (higher for greenfields). We can therefore be relatively confident that the different characteristics found for our subsidiary typology based on knowledge flows are robust.

## DISCUSSION AND CONCLUSION

Our results show a high level of support for the predictive validity of the Gupta & Govindarajan typology based on knowledge in- and outflows. However, the specific levels of control mechanisms in the different types of subsidiaries in our study differed from Gupta & Govindarajan's hypotheses. We argued that rather than equating LIs and IPs with regard to their level of autonomy, and GIs and IMs with regard to their level of control by socialization and networks, it would be more consistent with Gupta & Govindarajan's implied network model of the MNC to differentiate between all four subsidiary types. Subsidiary types were shown to differ as expected on autonomy (hypothesis 1) and control by socialization and networks (hypothesis 2). As a further validation of the typology, capabilities (hypothesis 3) and product inflows (hypothesis 4) were shown to differ in predictable ways between the four subsidiary types. Overall, this suggests that the level and direction of knowledge flows is an important factor in differentiating subsidiary roles. We would therefore encourage researchers to renew their attention to Gupta & Govindarajan's (1991) typology and design empirical studies to further test and refine this typology.

We did not find support for hypothesis 5 that tested for differences in outflows of products. As we already indicated above, differences were not expected to be as large for product outflows as for product inflows. However, in combination with our other results, the small differences for product outflows do point to an interesting aspect of our test of the Gupta & Govindarajan typology. GIs seem to be oriented more towards other subsidiaries than towards HQ. Their knowledge outflows to subsidiaries are higher than to HQ (see Table 3) and they show higher net knowledge flow balance with subsidiaries than with HQ. The IMs show a reverse pattern with a relatively strong orientation towards HQs (see Table 3). This difference is also reflected in differences in product outflows. For IMs the largest part of their intra-company outflows goes to HQ, while for GIs subsidiaries are the dominant intra-

company trading partner. GIs might therefore be more typical in networked MNCs [transnationals in Bartlett & Ghoshal's (1989) typology], where inter-subsidiary flows are as important or more important than flows between HQs and subsidiaries. IMs might be expected to dominate in global MNCs following a hub-and-spoke organizational model (Bartlett & Ghoshal, 1989). In addition, Table 2 shows that (lack of) autonomy is significantly related only to knowledge flows to and from HQ, while control by socialization and networks is related to all knowledge flows and more strongly to subsidiary knowledge flows than to HQ knowledge flows. Future researchers might want to explore these differences between inter-subsidiary flows and HQ-subsidiary flows in more detail. Although Gupta & Govindarajan (1994) measured both types of flows, they were aggregated in their empirical tests.

Another aspect of the typology that merits further exploration is the Local Innovator type. Following Monteiro, Arvidsson & Birkinshaw (2004), we tried to identify whether, within the group of LIs, there were subsidiaries that were virtually completely isolated from HQs and other subsidiaries instead of just having a rather low level of in- and outflows. Again following Monteiro et al. (2004) we took an average level of knowledge transfer of 2.00 or lower as the cut-off point. As a result, 17 of the LI were shown to be Isolated Local Innovators, with a mean knowledge flow of 1.72. These isolated LIs were similar to other LIs on many characteristics studied in this article, though they enjoyed a slightly higher level of autonomy and a lower level of control by socialization and networks. However, they did differ very significantly in their level of capabilities, which for the ILIs was -.74 (lower than for our IMs) and for the remaining LIs -.05. The LI type might therefore possibly be seen as consisting of two rather different groups of subsidiaries. The first group possesses an average level of capabilities. These capabilities, however, are not shared to a significant degree with other parts of the MNC network through knowledge flows, probably because they are locally bound. On the other hand, the second group has a very low level of capabilities and seems nearly completely isolated from the remainder

of the MNC network, which could lead to a self-reinforcing cycle. We agree with Monteiro et al. (2004) that this group of subsidiaries is very worthy of further study.

Our study's limitations are shared with those of most other international mail surveys. We have already dealt with the issues of common method variance in the methods section. In addition, we have been unable to test whether our model has normative merits, i.e., would a fit between subsidiary type and type of control lead to better performance? Given that both the measurement of fit and the measurement of performance are fraught with problems, it might be difficult to empirically test this proposition. This means that we cannot provide firm recommendations to headquarters and subsidiary managers in terms of the desirability of fit between the different factors presented in the subsidiary typologies. We can, however, reassure subsidiary managers that their subsidiaries can play very different roles in the multinational network and that not every subsidiary can be expected to create knowledge that is relevant for HQ and other subsidiaries. In this context it would also seem appropriate for headquarters to manage these different types of subsidiaries differently, especially in terms of the level of autonomy granted to them and the type of control mechanisms that are applied. In addition, an identification of isolated Local Innovators might allow headquarters to design mechanisms to avoid the self-reinforcing cycle that may isolate these subsidiaries even further.

In sum, our study provides strong support for the notion that subsidiaries can take on different roles within MNCs, that these roles can be meaningfully conceptualized based on knowledge inflows and outflows, and that these roles are associated with different control mechanisms, relative capabilities and product flows. As such our first contribution to IB theory was to test and extend Gupta & Govindarajan's (1991) subsidiary typology that – although widely cited – has so far been subject of very limited empirical verification. In comparison to earlier empirical studies such as Gupta & Govindarajan (1994) and Birkinshaw & Morisson (1995), our study showed a relatively large number of empirically

verifiable differences between subsidiaries. Our second contribution was to show that it is important to differentiate between knowledge *in*flows and *out*flows and between flows to and from HQ on the one hand, and to and from other subsidiaries on the other. In a direct comparison with Gupta & Govindarajan's (2000) results – that were based on data collected in 1991 – we found subsidiary knowledge inflows and outflows to have increased substantially. It would therefore seem that more and more companies are getting closer to the ideal-type of the transnational corporation (Bartlett & Ghoshal, 1989) and that differentiation in subsidiary roles within the MNC has increased. However, much of the literature in international management still focuses on HQ-subsidiary relationships. Future empirical studies would therefore do well to make inter-subsidiary relationships a major part of their investigation. Our third and final contribution was to identify, following Monteiro et al. (2004), Isolated Local Innovators as a subsidiary type worthy of further exploration. Overall, we would argue that time has come for the next generation of studies in HQ-subsidiary relationships, one that further investigates lateral relationships between subsidiaries rather than focusing on hierarchical relationships between HQs and subsidiaries, and one that further differentiates between different types of locally oriented subsidiaries.

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*Table 1: Comparison of subsidiary typologies*

| G&G (1991, 1994) Authors | Global Innovator | Integrated Player | Implementor | Local Innovator | Other |
|---|---|---|---|---|---|
| Ghoshal & Bartlett (1986) innovation | | Creation<br>Adoption<br>Diffusion | | Creation<br>No adoption<br>No diffusion | Creation<br>Adoption<br>No diffusion |
| Roth & Morrison (1992) | Global mandate | Global mandate | | | |
| Birkinshaw & Morrison (1995) | Specialized contributor | World mandate | Local implementer | Local implementer | |
| Birkinshaw & Morrison (1995) reclassification | World mandate | Specialized contributor | Local implementer | | |
| Nobel & Birkinshaw (1998) | International creators | International creators | Local adaptors | | International adaptors |
| Ambos & Reitsperger (2004) | Centers of excellence | Integrated research unit | Global develop-ment unit | Local adaptor | |

*Table 2: Means, standard deviations and zero-order correlation coefficients for all variables under study*

| | | Mean | StD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Knowledge flows from HQ | 3.82 | 1.15 | | | | | | | | | | | | |
| 2. | Knowledge flows from other subsidiaries | 2.86 | 1.21 | .383 *** | | | | | | | | | | | |
| 3. | Knowledge flows to HQ | 3.02 | 1.51 | .298 *** | .206 *** | | | | | | | | | | |
| 4. | Knowledge flows to other subsidiaries | 3.22 | 1.40 | .130 | .309 *** | .643 *** | | | | | | | | | |
| 5. | Decision-making autonomy | 2.30 | 0.74 | -.328 *** | -.084 | -.224 ** | -.029 | | | | | | | | |
| 6. | Control by socialization & networks | 3.86 | 1.26 | .297 *** | .340 *** | .248 *** | .398 *** | -.097 | | | | | | | |
| 7. | Capabilities | 4.37 | 0.84 | -.030 | -.025 | .241 ** | .311 *** | .223 ** | .149 | | | | | | |
| 8. | % Inputs from HQ | 27.7 | 33.14 | .311 *** | -.106 | .250 ** | -.015 | -.432 *** | .079 | -.122 | | | | | |
| 9. | % Inputs from other subsidiaries | 22.84 | 30.16 | .108 | .257 ** | .050 | .099 | -.291 *** | .168 * | -.135 | -.276 *** | | | | |
| 10. | % Inputs from external suppliers | 48.65 | 38.41 | -.337 *** | -.108 | -.234 ** | -.053 | .608 *** | -.198 * | .217 ** | -.636 *** | -.562 *** | | | |
| 11. | % Outputs to HQ | 7.19 | 20.71 | .221 *** | -.002 | .122 | -.070 | -.035 | .017 | -.012 | .088 | -.195 * | .063 | | |
| 12. | % Outputs to other subsidiaries | 12.41 | 22.65 | -.067 | .089 | .061 | .142 | -.070 | -.033 | .069 | -.224 * | .167 * | .054 | -.058 | |
| 13. | % Output to external customers | 80.90 | 29.47 | -.104 | -.087 | -.143 | -.080 | .100 | -.001 | -.059 | .097 | -.011 | -.059 | -.602 *** | -.744 *** |

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, all 2-tailed

*Table 3: Knowledge balance (outflow-inflow) with HQ and subsidiaries for different types of subsidiaries*

| Subsidiary type | Knowledge from HQ | Knowledge to HQ | Knowledge from subs | Knowledge to subs | Knowledge balance from HQ* | Knowledge balance from subs |
|---|---|---|---|---|---|---|
| **Local Innovator (n=50)** | 2.88 | 1.73 | 1.93 | 2.03 | 1.15 | -.10 |
| **Global Innovator (n = 51)** | 3.42 | 3.69 | 2.71 | 4.28 | -.27 | -1.57 |
| **Implementor (n = 35)** | 4.70 | 2.24 | 3.42 | 2.24 | 2.46 | 1.18 |
| **Integrated Player (n = 33)** | 4.89 | 4.78 | 3.92 | 4.41 | .11 | -.49 |

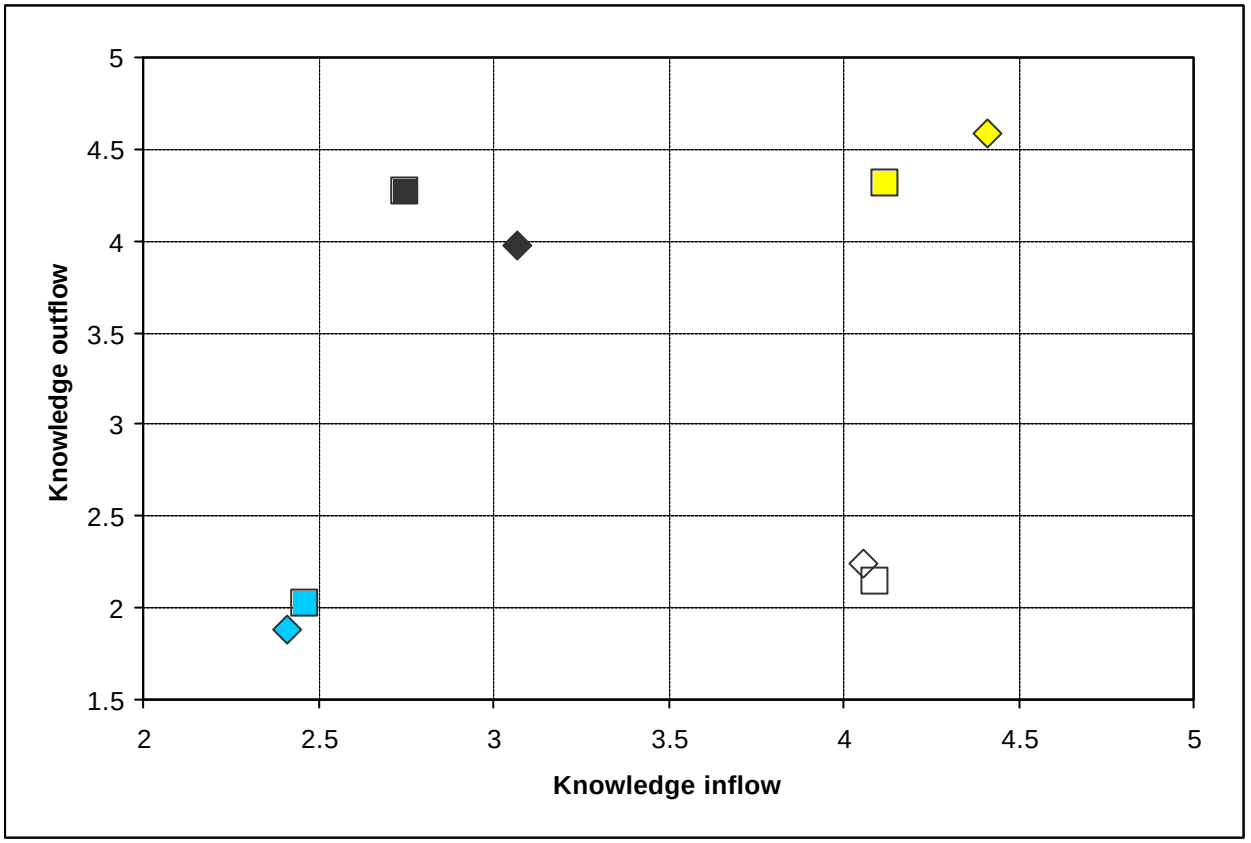
* A positive balance indicates a subsidiary receives more knowledge than its provides, a negative balance means a subsidiary provides more knowledge than it receives.

*Table 4: Differences in control mechanisms, capabilities and product flows across subsidiary types*

| | GI | IP | IM | LI | F-value | Sign. diff.* | Support |
|---|---|---|---|---|---|---|---|
| **Differences in need for autonomous Initiative; Gupta & Govindarajan (1994)** | | | | | | | |
| Corporate-subsidiary decentralization | High** | Med | Low | Med | 0.54 | --- | No |
| | .04 | -.03 | -.10 | .08 | | | |
| Subsidiary president locus of control | High | Med | Low | Med. | 3.12* | --- | Partial |
| | .07 | .19 | -.27 | .00 | | | |
| Size of bonus relative to salary | High | Med | Low | Med. | 4.43** | --- | No |
| | -.21 | -.17 | .13 | .28 | | | |
| **Differences in level of autonomy** | | | | | | | |
| Level of autonomy from HQ | Med | Low | Lowest | High | 8.38*** | IM < GI, LI | Yes |
| | .03 | -.23 | -.50 | .48 | | IP < LI | |
| **Differences in control by socialization and networks; Gupta & Govindarajan (1994)** | | | | | | | |
| Lateral integration | Med | High | Med | Low | 13.36*** | --- | Yes |
| | -.07 | .40 | .00 | -.40 | | | |
| Corporate-subsidiary communication | Med | High | Med | Low | 7.65*** | --- | Partial |
| | .19 | .29 | -.13 | -.27 | | | |
| Inter-subsidiary communication | Med | High | Med | Low | 9.05*** | --- | Yes |
| | .06 | .32 | -.03 | -.34 | | | |
| Corporate socialization | Med | High | Med | Low | 4.60** | --- | No |
| | -.35 | .08 | .27 | -.04 | | | |
| **Differences in control by socialization and networks** | | | | | | | |
| Control by socialization and networks | Med | Highest | Low | Lowest | 10.66*** | LI < GI,IP | Yes |
| | .15 | .65 | -.15 | -.48 | | IM < IP | |
| **Differences in capabilities** | | | | | | | |
| Subsidiary capabilities | Highest | High | Lowest | Low | 6.709*** | IM, LI < IP, GI | Yes |
| | .38 | .21 | -.45 | -.21 | | | |
| Subsidiary capabilities (support) | .30 | .21 | -.33 | -.21 | 4.273** | IM < IP, GI | Yes |
| | | | | | | LI < GI | |
| Subsidiary capabilities (strategic) | .36 | .13 | -.44 | -.15 | 5.426*** | IM < IP, GI | Yes |
| | | | | | | LI < GI | |
| **Differences in product flows** | | | | | | | |
| Inputs from HQ | Low | High | High | Low | 3.32* | LI, GI < IP, IM | Yes |
| | -.18 | .28 | .29 | -.21 | | | |
| Inputs from other subsidiaries | Low | High | High | Low | 3.20* | LI < IP, IM | Partial |
| | .02 | .22 | .24 | -.33 | | | |
| Inputs from external suppliers | High | Low | Low | High | 2.64* | IM, IP < GI, LI | Yes |
| | .16 | -.39 | -.44 | .40 | | | |
| Outputs to HQ | High | High | Low | Low | .720 | None | No |
| | -.14 | .14 | .11 | -.03 | | | |
| Outputs to other subsidiaries | High | High | Low | Low | 2.08 | IM < GI | Partial |
| | .22 | .07 | -.31 | -.05 | | | |
| Outputs to external customers | Low | Low | High | High | .939 | None | Partial |
| | -.09 | -.17 | .18 | .07 | | | |

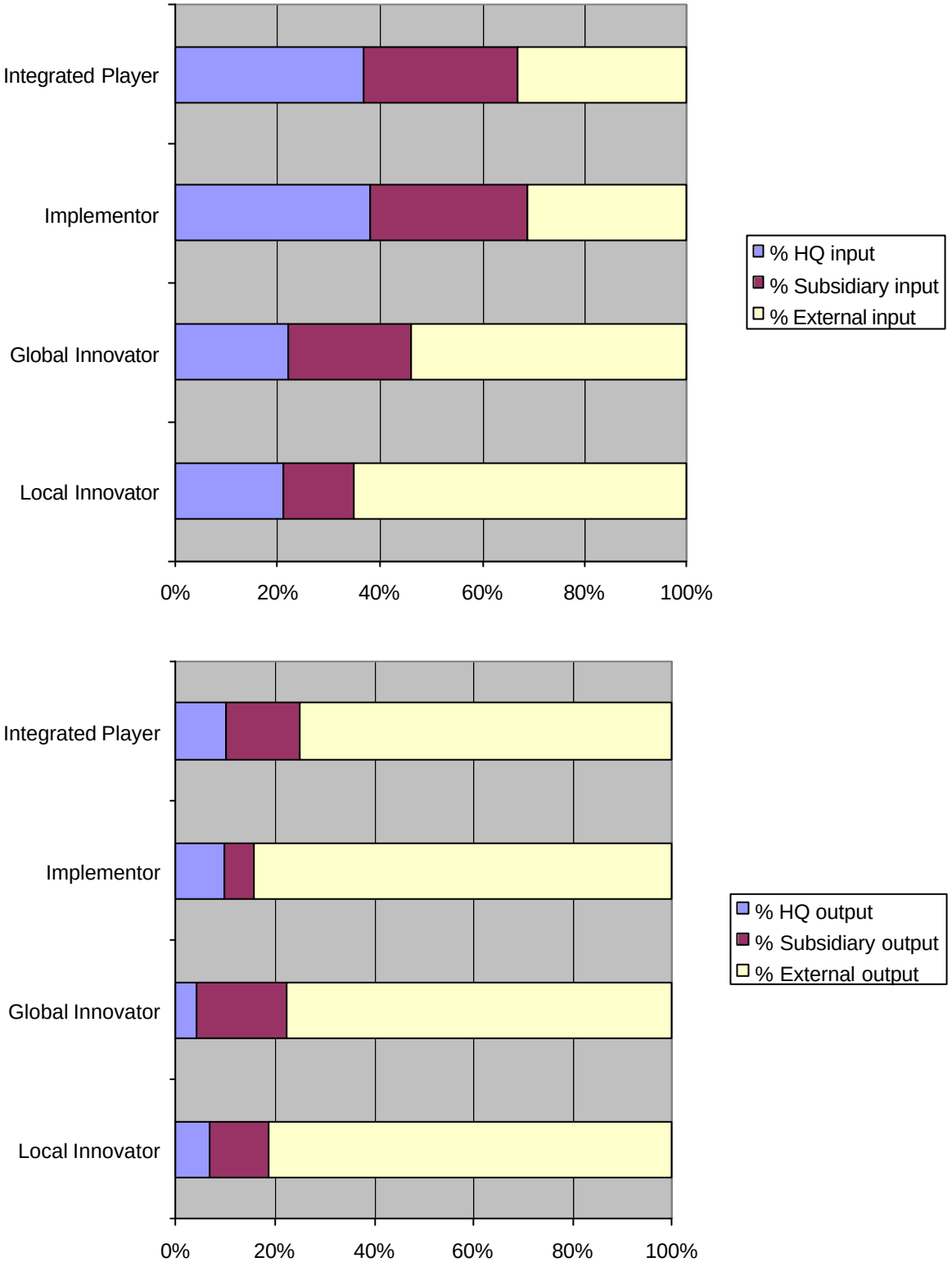
* Gupta & Govindarajan (1994) did not conduct tests for the significance of differences between individual subsidiary types. Pairs reported are significantly different at $p < 0.05$ (2-tailed).
** First line provides the theoretical prediction for each of the variables.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, all 2-tailed

*Figure 1: Position of subsidiary type mean scores on knowledge inflow and knowledge outflow**




* Squares depict subsidiary type mean scores based on median split; diamonds depict subsidiary type mean scores based on cluster analysis.

*Figure 2: Product flows from and to various sources for four subsidiary types.*



[1] A comparison of external and internal partners for the different subsidiary types confirms this interpretation. Local adaptors (LIs) and Centers of Excellence (GIs) have closer contacts with local external partners such as suppliers and customers, while Global Development Units (IMs) and Integrated Research Units (IPs) have closer contacts with internal partners such as central R&D.

[2] Some other typologies have been tested, but they are less easily linked to Gupta & Govindarajan typology. Martinez and Jarillo (1991) characterized subsidiaries with regard to their level of integration with HQ and other subsidiaries and their level of responsiveness to the local environment and define three subsidiary roles: autonomous, receptive and active. Taggart (1997a) extended this framework to include a fourth – quiescent – subsidiary role. In a string of publications (Ghoshal & Nohria, 1989; 1993; Nohria & Ghoshal, 1994) Ghoshal and Nohria distinguished four types of subsidiaries based on the level of environmental complexity and local resources: hierarchies, integrative, clans and federative subsidiaries. Finally, Taggart (1997b) defined four roles (vassal, militant, partner and collaborator) based on two dimensions: autonomy and procedural justice.

[3] Birkinshaw & Morisson (1995) found their Local Implementers and Specialized Contributors to source a much larger proportion of their purchases from other organizational units than their World Mandates. Given this result, it is difficult to maintain that their Local Implementer category includes both IMs and LIs as the latter are very independent from HQ. It would seem more appropriate to assume their Local Implementer category represents Gupta & Govindarajan's (1991) IMs only. Further although B&M equated Gupta & Govindarajan's GIs as Specialized Contributors and IPs as World Mandates, the data on intra-company purchases do not seem to support this classification either, since IPs should be expected to show much more intra-company purchases than GIs.

[4] Only three of the thirteen comparisons on control mechanisms in this article were found to be significant at $p < 0.05$ and none of these three fully supported the hypothesized differences.

[5] We were not able to completely balance the sample frame as the Netherlands has no MNCs in the motor vehicles and parts industry and few MNCs in the electronics industry and Germany has few MNCs in both the electronics and food & beverages industry.

[6] Cases with more than 15% missing data (5 in total) were discarded from the analysis.