Multidimensional Integration in Practice:

An Empirical Study of Subsidiary Knowledge and Product Integration in Swedish Multinational Enterprises

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ABSTRACT.

Conceptual developments such as the "Transnational" or "Heterarchic" firm have been highly influential in research concerned with strategy and structural characteristics of the multinational enterprise. Distinguishing features of such organizations has been said to include high level of inter-subsidiary resource flows in multiple dimensions such as products, parts, components, information, knowledge and people. These features has been exploited in earlier empirical research; for instance the "Transnationality index", designed to examine the level of transnational integration across industries based on intra-firm international trade (Kobrin, 1991). However one of the major strengths of these archetypical organizations is their ability to transfer knowledge across the corporate system, creating possibilities for combining and recombining existing competences, something that generally has been neglected in empirical research based on larger samples of firms. This paper takes issue with these developments by conducting an empirical investigation of both product flows and knowledge flows in 89 subsidiaries belonging to 12 MNE´s. Our purpose is three-fold; first, we aim at providing a contemporary depicting of resource flows in MNE´s of today. Second, we argue that existing one-dimensional measures are providing a skewed picture of integration and based on this develop a two-dimensional measure designed to capture the two most influential and stressed features of conceptual work in this issue, internal product flows and knowledge flows. Finally, since both these resource dimensions have been stressed as important for the creation of competitive advantage, the relation between the two are examined. Major conclusions are that high inter-subsidiary resource flows primarily occur in the knowledge dimension; only a few subsidiaries are highly integrated in both dimensions; and that product flows are negatively related to knowledge flows which supports our argument of inadequate reflections of multinational organizations due to earlier skewed measures.

1. INTRODUCTION

Rhetorically, integration is often a corollary word to global strategy. If looked up in a dictionary it is explained by "The act or operation of integrating; the bringing together of parts into a whole." (Webster´s, 1996) Although it seems hard to pinpoint the actual meaning of integration in a business context by resting on this definition, we do see the existence of *parts*, and how they come into being a *system* of some kind. Questions immediately arise, such as "what is meant by a whole?" "who is the integrator?" and consequently "by what means does this happen?". Without complicating the issue, integration could here be described as an act of coordinating business activities and units to maximize the competitive advantage of the firm. This encompasses efficiency in terms of scale economies in production and standardization of product lines, but also use of knowledge and competences that can be generalized over a broader functional and geographical ground.

Global competition is becoming market- and borderless and MNE´s are required to adapt their strategies to the new challenges posed by the changing environment (Birkinshaw, et al., 1995). Environmental pressures placing demands on the MNE has been depicted in what is often referred to as the IR-framework[1] (Harzing, 2000; Prahalad & Doz, 1987). These pressures driving the strategic choices by the firm are fuelled by competitive action and/or structural characteristics of the industry (Birkinshaw, et al., 1995)[2]. The IR-framework emphasizes on one hand the need for multinational corporations to be close to their markets, i.e. *Locally Responsive*, serving local needs and adapting to local circumstances. Subsidiaries are seen as relative autonomous and self-sufficient. This archetypical picture of the MNE is one of a portfolio of independent businesses. In this case, each subsidiary has considerable freedom of decision, and has limited amount of contact with the HQ in terms of operational issues. The subsidiaries are allowed to adapt to the local circumstances, unconcerned with dependencies or contingencies stemming from other parts of the organization. *De facto* integration in such loosely coupled organizations is relatively low. MNE´s employing such a strategy has been called "multidomestic" (Bartlett & Ghoshal, 1987b). The other part of the framework says the MNE is exposed to pressures calling for the organization to integrate globally, i.e. adopt a *Global Integration* strategy. Here, the MNE is facing pressures for efficiency and coordination in order to attain maximum competitive advantages on a global level. Scale-economy, standardization and exploitation of comparative advantages are key issues, and the autonomy in decision enjoyed by subsidiaries of the multidomestic firm is replaced by rigid HQ control, avoiding duplication of work and keeping cost at minimum. Serving the entire global organization from a few, strategically placed production plants, subsidiaries primarily play the role of selling, marketing and maintaining the HQ with enough information to make decisions. This type of MNE has been referred to as "global" (Bartlett & Ghoshal, 1987b) and represents a view of the MNE that can be traced back to (Vernon, 1966), where subsidiary roles were passive towards the organization by primarily acting as pipelines for the distribution and sales of standardized products.

[1] It has been brought to our attention that the original sources of the IR-framework are the dissertation works of C.K. Prahalad and Yves Doz (unpublished, Harvard Business School). The authors have not had the opportunity to consult these references and thus choose to refer to work better known to them.

[2] This distinction is not easy to make and has been confronted with problems of cause and effect. Here, we choose to not address this issue as we feel it does not lie with the heart of this study.

Later 15 years the focus has shifted somewhat. Nowadays, the ability to tap into local knowledge and transferring this across the entire organization is often seen as a necessary component of strategizing (Bartlett & Ghoshal, 1987b; Birkinshaw, et al., 1995; Ghoshal & Bartlett, 1988; Gupta & Govindarajan, 1991). MNE´s are described as facing three conflicting pressures, one of local adaptation, one of efficiency by scale and additionally, one of assimilating external knowledge and diffusing this through the organizational system. Thus, it becomes imperative to appreciate innovations and knowledge stemming from local initiatives on a global level, integrating these as pieces in the strategizing process of the entire MNE (Bartlett & Ghoshal, 1987b; Ghoshal & Bartlett, 1988; Regner, 2002). This led to the development of archetypes such as the "transnational firm" (Bartlett & Ghoshal, 1989), and the "heterarchy" (Hedlund, 1986). These archetypes were believed to take care of the conflicting pressures by allowing for internal flows of "parts, components and finished goods; funds, skills and other scarce resources; and intelligence, ideas and knowledge" (Bartlett & Ghoshal, 1987a) and for each part to "contain information about the whole" (Hedlund, 1986). The internal resource flows of intangible resources allows for rapid reconfiguration of existing knowledge and development of new knowledge complementary to the existing one. Structuring for inter-unit communication and knowledge sharing is a step towards overcoming problems related to the fragmented dispersion of important skills over the corporate system, and creates a foundation for the rapid deployment and utilization of these skills. This has been captured as a critical ability of the MNE in the concept of "combinative capabilities" (Kogut & Zander, 1992). Similarly, the firm ability to integrate the knowledge of its employees has been argued to constitute an important organizational capability (Grant, 1996a). Firms exist because they as provide possibilities for coordinating and directing individually held knowledge towards production in ways unsustainable by markets.

Other authors have focused on other attributes of transnational organizations. Seizing the opportunities and possibilities of being globally present requires the construction of an intricate web of exchange relationships between business units, where components, parts and products frequently are manufactured at separate locations only to be brought together at the final stage before entering the market as goods to sell. Efficiency is a trait of the entire production system rather than of individual units or operations (Kaplinsky, 2000; UNCTAD, 2002). This aspect has become particularly emphasized in works on transnational integration, and has been argued to increase in importance with the level of technological complexity and returns to scale manufacturing (Kobrin, 1991).

The purpose of this paper is to examine the level of integration in some Swedish multinational organizations. Theoretical advancements such as the Transnational or Heterarchic firm suffers from a lack of empirical support, and there seems to be no real clarity and unity in the discourse to what extent firms actually do integrate their business activities. The characteristics presented above are often derived from logic reasoning, and the conceptual development might in this sense have gone too far too fast. In order to further enhance our understanding of the MNE and on which grounds it builds its territory there is a need for a contemporary depicting of the multinational phenomena. For instance, research has shown that there are often great costs involved in transferring knowledge and that there are imminent barriers to such transfer between units (Allen, 1977; Szulanski, 1996). We argue that in

the face of recent focus on knowledge as a foundation for creating competitive advantage, some of the earlier measurements of integration fail to capture this seemingly important aspect of multinational organizations. To do this, we develop a measure that consists of two dimensions; internal knowledge flows among subsidiaries, and internal flows of products, parts and components. Since both of these dimensions are stressed in work concerning integration, and both have their advocates as being important for competing globally, the relation between them becomes particularly interesting. Thus, we also aim to examine the relationship between product- and knowledge flows. We explore these voids by looking at flows of both knowledge and products among 89 subsidiaries belonging to Swedish MNEs.

1.1 The Integration Concept and Measurement

One of the rationales of this paper is that organizational integration is as much a question of utilizing knowledge spread across the corporate system as it is utilizing different characteristics of the value-chain activities based on their location, scale, and specialization. Since earlier empirical approaches to integration often have been one-dimensional, there is a discrepancy in this work compared to how integration has been treated theoretically. As this suggests, there have been calls for more nuances in the integration construct (Bartlett & Ghoshal, 1989), (Birkinshaw, et al., 1995; Kobrin, 1991; Mauri & Sambharya, 2001; Rosenzweig, 1993). One common construct is what usually is referred to as the *Transnationality index*, originally developed by (Kobrin, 1991) and subsequently used by a number of researchers and reports (e.g. (Mauri & Sambharya, 2001; UNCTAD, 2002). The *Transnationality index* is basically the level of international sales that are intra-firm. Despite its widespread acceptance, this operationalization of integration has a fundamental shortcoming that has been brought to the surface by recent years research focus on knowledge and its utilization as a prime resource for sustainable performance. As the author himself recognises, the *"...validity of this construct rests on the assumption that intrafirm flows of products across industries correlate with all other important intrafirm flows of resources and information."* (Ibid, p.20) He goes on, with some reservation, *"...the two most important intrafirm flows are products and technology, and the latter are often embodied in the former."* (p.19). Supporting his argument upon the work of (Magee, 1977) and (Teece, 1981; 1977), he argues that even though MNE´s may internalize flows of technology due to market imperfections, it would still be more feasible to transfer this technology as embedded in goods to avoid unwanted dissemination over firm borders. Although this might be a useful approach to other research questions, we feel that the transfer of technology embedded in an artefact might change work procedures at the receiving end, but will do so because the contextual conditions for acting have changed. This does not necessarily alter the recipient's behavioural patterns, or understanding of the underlying principles at work. Instead of enhancing innovative or learning capacity within the recipient there has simply been an intra-firm exploitation of technology. As stated by (Teece, 1977), while technology can be embodied in products this is only one form in which technology can be transferred. The other is the methods of organization, operation and other procedures that needs to accompany hardware transfer in order for this to be effectively utilized. The existence of such peripheral support facilitates the transfer and implementation. Furthermore, in this context, operationalizing knowledge

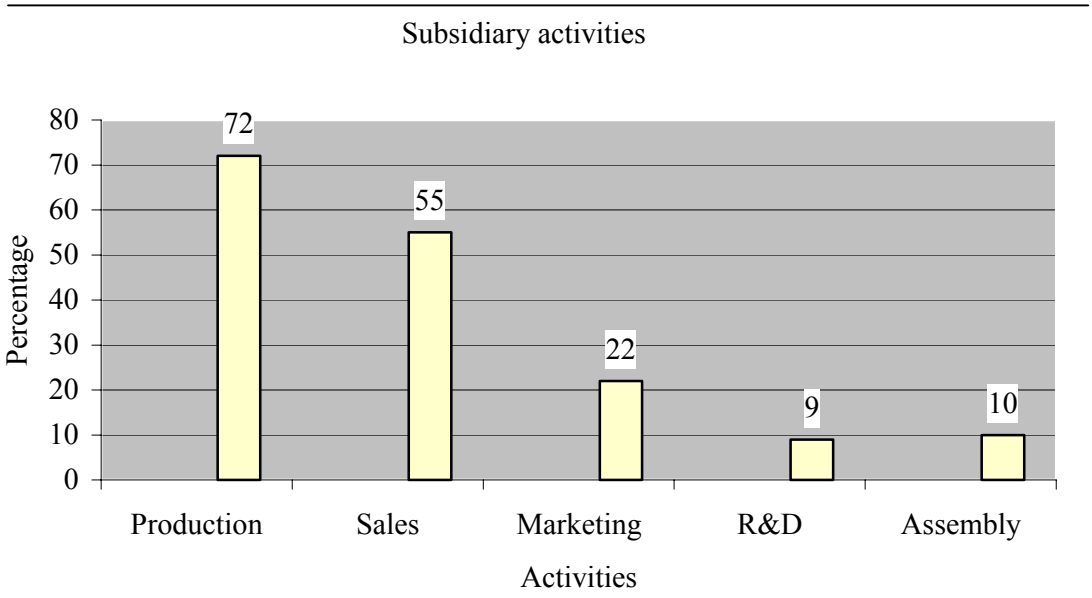
flows as an internal part of the product flow would not be reconcilable with our wish to embrace the multidimensional facet of integration. Only measuring product flows would be a too static measure in that it does not allow for examination of the spread of skills i.e. the possibilities of upgrading the underlying technology on which the scale and efficiency advantages are built. Thus, even if we were to conceptualize global competitiveness as resting primarily on efficiency in production, the incorporation of sustainability of competitive advantages, i.e. a more dynamic view, would necessitate a simultaneous measure of transfer of knowledge, innovations and capabilities extending beyond inclusions of these resources as embodied in goods. In the following, we will try to operationalize knowledge flows in a meaningful way to be able to include this in a measurement of the level of integration in the focal firms, and by doing so take a step towards a more comprehensive picture of how different resources are allocated and shared across multinational organizational systems. Accordingly we advocate integration as a multidimensional construct, in this case represented by two dimensions: inter-subsidiary flow of products and inter-subsidiary flow of knowledge.

2. METHODOLOGY, MEASUREMENT & DATA

During 2002, data from 89 subsidiaries was gathered over a time period of 3 months. To obtain sample subsidiaries, managers in 18 different divisions in a total of 12 Swedish MNE´s[3] were asked to identify the five "most important" subsidiaries in each division. These managers were then interviewed using a structured questionnaire form. The type of questions varied from Likert-type scales to open-ended questions. The reason we approached managers at the divisional headquarters instead of in the sample subsidiaries were difficulties in gaining access to lower level management. While questions can be raised on how well-informed divisional personnel are about the actual conditions in specific subsidiaries due to perception gaps and difficulties in getting correct information, this approach has the advantage of placing the interviewee in such a position were he/she can compare subsidiaries with respect to each question before answering. Furthermore, usually more than one person were involved in the interviews, part since the questions posed to the respondents reached across functional areas, and part to reduce biases in answers due to personal opinions on behalf of the respondents. For instance, a financial controller might answer questions about inter-subsidiary trade, but in order to obtain accurate data concerning administrative measures to facilitate knowledge flows, the CKO were consulted. The choices of respondents were done in cooperation with the focal firms. Geographically, these subsidiaries were dispersed over no less than 27 countries. Figure 1 shows the distribution of subsidiaries associated with different activities.

[3] The corporations were chosen out of the 20 largest Swedish MNE´s.

FIGURE 1: Distribution of subsidiary activities*



*Note: Some subsidiaries could not be associated with only one activity.

Not surprisingly our sample primarily consists of subsidiaries engaged in production (72%) and sales (55%).

2.2 Knowledge Flows

In literature concerned with knowledge several attempts to prescribe different characteristics to knowledge has been made. One of the most frequently used is the distinction between tacit and explicit knowledge, identified first by (Polanyi, 1966). Tacit knowledge is individually held and highly personalized, and can only be documented and communicated with difficulty. Usually, apprenticeship or other forms of direct contact with the holder of such knowledge is a prerequisite for decoupling it from its source. On the other hand, explicit knowledge is of such character that it can be expressed in numbers or text thus possible to document in reports, databases etc., and have no ties to certain individuals. We wish not to explicitly draw this line; rather our intention is to include both externalised knowledge about specific products or production processes as well as the knowledge transferable mainly through interaction between organizations and individuals, i.e. tacit knowledge in our measure. Though the tacit (or un-codified) knowledge sometimes is regarded as a primary foundation for competitive advantage, the act of codification substantially improves the possibility of transferring knowledge to other recipients. In fact, the distinction between tacit and explicit knowledge has been said to foremost lie in the transferability and the mechanisms for transfer (Grant, 1996b). The conversion from tacit knowledge into explicit such has been researched by for instance (Nonaka, 1994) and (Nonaka, et al., 1994) who identifies four modes of knowledge creation, where the mode of *externalisation* represents the making of tacit into explicit knowledge. The level to which subsidiaries tries to make new knowledge explicit, i.e. codify it, most likely has a bearing on the ease and magnitude with which knowledge can be transferred across the corporate system. We capture this

aspect by including extent to which *documents and reports* concerning the development of new products or productions processes is diffused among peer units.

It is usually assumed that knowledge drives innovative activities i.e. competences are required to improve, change and adapt current solutions to new situations. By developing new technology, features of this technology mirrors what is known in the organization or part thereof engaged in the development process. Usually, innovation processes do not only apply existing competences but also generates new such by the subsequent validation, testing and application of ideas and concepts to a tangible technology. As well the input (what is already known) as the output (the technology and newly found experiences) can be regarded as encompassing knowledge ranging from more tacit to more explicit character. When attempting to transfer technology from one, developing, unit to another organizational unit there will likely (depending upon the technological complexity of the innovation) be a need for interaction between personnel familiar with the core concepts of the technology and the personnel within the adopting unit responsible for the successful implementation of the innovation. Within the frames of these interactions, explicit knowledge as well as knowledge of more tacit character is of essence to secure a fruitful outcome of the project. Depending on the previous familiarity within the receiving unit of the technology to be transferred, such transfer usually requires corollary packages of un-embodied knowledge to support the implementation (Teece, 1977). For instance, as suggested by (Zander & Kogut, 1995), the speed and extent with which a technology is diffused among organizations are likely to be dependent upon the knowledge properties i.e. codification and how well-understood this knowledge is. In an attempt to address these aspects in our measure, we have designated one indicator to examine the *Adoption of Technology* as a separate measure. Both this indicator as well as the indicator *Documents and Reports* are measured along a 7-point Likert-type scale.

2.3 Product Flows

Measuring product flows is, on the other hand, a more hands-on operation. Product flows has been used extensively in measuring integration in global firms (for instance, the *Transnationality index*) and there thus exists measures that has been evaluated and tested already. Although we wish to acknowledge these attempts, limitations in our data leaves no room for a fine-grained measure – rather, we define integration in the product dimension as the amount of inter-subsidiary trade. Only artefacts and no services are included in this measure. The indicator measures the level of internal sales and internal purchases relative to total.

2.4 Validation of Knowledge Measure

Because knowledge and its nature is, and has been, a source of debate for a long time within many disciplines and multiple research fields, any attempt to construct a measurement should be carefully considered and evaluated before put into practice. Aiming at providing the reader with some confidence in our measure a rudimentary but nevertheless telling pre-test of the validity of the knowledge measure was performed using ANOVA analysis. To do this, a composite measure of the two items of knowledge flows presented above was constructed. This was done to obtain a measure

of integration in the Knowledge Dimension. The items were measured along a 7-point Likert type scale. As recommended by (Hair, et al., 1998) inter-item correlation should exceed 0.3 and item-to-scale correlations should exceed 0.5. While the item-to-scale correlation fulfils this (see Table 1), the inter-item correlation is low but significant at the 0.05-level (two-tailed). This is also reflected in the returned Cronbach alpha (0.3744). However, the composite measure are neither designed by evaluating different indicators loading on a certain variable, nor designed to measure the same aspect of knowledge transfer. Potentially they could be the outcome of employment of quite different mechanisms. Since the inter-item correlation is significant, although at a low level, it indicates that the two indicators move together but still represents different aspects of the knowledge flow. For our cause it would have been worse with too high inter-item correlation; then the indicators would not reflect different aspects of the knowledge flow, leaving us with a too narrow measure.

TABLE 1. Inter-item and item-to-scale correlations

INDICATORS	KF	DR	TA
Knowl. Flow	---		
Doc. & Reports	0.757**	---	
Tech. Adopt	0.811**	0.230*	---

* Significant at the 0.05 level (2-tailed)
** Significant at the 0.01 level (2-tailed)
Note: (N = 89)

In the next step, each respondent was asked to classify the focal subsidiary along with the in- and outflow and knowledge between the subsidiary and the rest of the division. The respondents were confronted with four statements concerning the structure of the knowledge flows. Each statement correlated to one of the different strategic contexts identified by (Gupta & Govindarajan, 1991), i.e. *Integrated Player* (high inflow, high outflow), *Global Innovator* (high outflow, low inflow), *Local Innovator* (low inflow, low outflow), and *Implementor* (high inflow, low outflow). This allows for an initial classification of the subsidiaries along a spectrum of integration in the Knowledge Dimension. Intuitively, the most integrated archetype would be the Integrated Player, followed by the Global Innovator and Implementer, and the Local Innovator would be the most autonomous. But, while it as argued above can be said that subsidiaries with both high inflow and high outflow are more integrated into the corporate organization than are those with only high in- *or* outflow, the implications of these archetypes for the *aggregated* amount of knowledge flows follow a different logic. Based on the arguments presented below, we expect to find two major groupings among our sample subsidiaries. The Local Innovator would exhibit the lowest amount of knowledge flows, and the other three groups would form one group with higher levels of knowledge flows.

According to (Teece, 1977), costs related to technology transfer, and especially to the transfer of "un-embodied" knowledge needed to support change in the receiving organization, are substantial. If a subsidiary has a limited amount of resources, any employment of some of these resources in certain

activities directly affects the unit's possibility to use the resources in other ways, in other activities. For instance, focusing on in-house development processes and R&D to create new knowledge about product development or production processes limits the amount of resources that can be used to receive and implement knowledge or technology from other units. Similarly, implementing new technology or knowledge in the production system draws time and effort from engineers that otherwise could have been engaged in own research or development efforts. Implementing organizational practices uses managerial time in meetings, projects and other coordinating activities, time that otherwise could have been spent in facilitating the diffusion of knowledge developed in-house. Following these arguments, there is a potential trade-off between creation and diffusion of knowledge and technologies. A discussion on this topic with MNE Centres of Excellence (CoE´s) in focus can be found in (Forsgren, et al., 2000). Based on these arguments, we argue that if the knowledge flows are highest for the archetypes *Implementer, Global Innovator* (subsidiary group A) and *Integrated Player* (subsidiary group B), and lowest for the archetype *Local Innovator* (subsidiary group C), this would be a primitive way of ensuring the validity of our measure of knowledge flows. Using these proposed groupings, an ANOVA test was performed to confirm that the inter-group differences indicated by the respondents answer to the statements were also reflected in the composite measure of knowledge flows. The ANOVA was chosen since it is a more accurate technique than multiple t-tests when there are more than two groups of sample data. One of the assumptions in ANOVA analysis is homogeneity of variance in the groups. To secure this, Levene-statistics was used. In this case, this test confirmed the null-hypothesis that the variances in the groups were homogeneous. As can be seen in Table 2, all groups differed significantly in mean values. The F-value of 7.191 is well above the cut-off at 3.15 and with significance value of 0.001, group differences are indicated as significant. As anticipated, the mean values of group 1 and 2 are similar. Since homogeneity of variance is confirmed, we chose Scheffe´s post-hoc test to confirm the results of the ANOVA analysis by comparing each group to all others. According to (Hair, et al., 1998) this test is the most powerful and conservative to Type 1 errors. Still, these multiple-comparison tests have problems in identifying group differences when there are small effect sizes. Results of this test confirm significant differences between group 1 and group 3, and between group 2 and group 3. Scheffe´s does not indicate significant differences between groups 1 and 2.

TABLE 2. Groupings, and ANOVA – test

ARCHETYPES	Group A	Group B	Group C		
Global Innovator	16	-	-		
Implementer 18	-	-			
Integrated Player	-	33	-		
Local Innovator	-	-	18		
Total	34	33	18		
ANOVA	Group A	Group B	Group C	F-value	Sig.
	5.250	5.0758	3.8889	7.191	0.001

Note: (N = 85)

According to these results our measure of knowledge flows correlates with the perceptions of our respondents. It is a crude way of examining validity, but in the face of the difficult task of constructing such a measure, there seems to be some degree of consistency between the managerial view of knowledge flows in and out from the subsidiaries and our composite measure.

2.5 Descriptive data analysis and the measure of Product Flows

The composite measure used to capture knowledge flows were constructed from two indicators both employing a Likert-type 7 point scale. The indicators were summed together and divided by 2, creating a single measure. As can be seen in Table 3 the most common values are 5 and 6, together representing 64% of the observations. Apparently, high knowledge flows are relatively common among subsidiaries of the MNE´s included in this study.

TABLE 3: Descriptive analysis of Knowledge Flows

Value*	1	2	3	4	5	6	7	Median	4.0
No of cases	2	7	10	13	28	29	0	Mean	4.9
Percentage	2.2%	7.9%	11.2%	14.6%	31%	33%	0%	Std. d.	1.34

*Range: 0.5 - 1.5, 1.6 - 2,5...

Table 4 presents the indicators of the product flows descriptively. As can be seen in the table, subsidiary internal purchasing and internal sales receive both low values; the large part of the sample in both indicators is found in the interval 0-20% (sales/purchases to total). It is interesting to note that in both indicators, and somewhat more apparent in the internal purchasing, there seem to many cases representing low levels of product flows, very few cases representing the "middle ground", while the group representing the highest values are somewhat more frequently represented.

TABLE 4: Descriptive analysis of Product Flows

INTERNAL SALES*					
Range	0-20%	21-40%	41-60%	61-80%	81-100%
No of cases	62	9	2	2	7
Mean	2.34	29.78	50.00	77.50	92.14
Percentage	75.6%	11%	2.4%	2.4%	8.5%
INTERNAL PURCHASES**					
No of cases	54	2	2	7	16
Mean	3.24	32.50	50.00	76.43	95.94
Percentage	66.7%	2.5%	2.5%	8.6%	19.8%

*Note: N=82
**Note: N=81

Although a very weak pattern, one can sense a tendency towards an either-or situation where subsidiary operations either are relatively un-integrated in the product dimension (75.6% / 66.7%) or if not so they are highly integrated (8.5% / 19.8%). Most obvious in the purchasing indicator, the "middle ground" representing 3/5 of the scale, are only populated by 13.6% of the sample, whilst the most integrated group in this indicator, which represents 1/5 of the scale, are populated by 19.8% of the sample. To construct a measure of product flows out of these indicators, the mean value was used. While there is a tendency among the sample units to either score high in internal purchases *or* internal sales (illustrated in scatter-plot, Appendix 1), and while the usage of the mean value of the indicators to examine the level to which they are incorporated into the organizational system ignores this aspect, we feel that it is a fair way of mirroring the integration. Even though some subsidiary roles automatically discriminates them from being regarded as highly integrated in the product dimension, for instance the role as sales unit, similar methods with this flaw has been extensively used before by other researchers, as described above. Furthermore, the separation of the indicators might shed light on internal structural differences in patters of integration across the corporate network, but we have no such intents in our investigation. Rather we wish to present a contemporary depicting of aggregated resource flows, and for this purpose, the mean value will be sufficient. It should however be noted, that this decision causes some cases exhibiting very high values in one indicator, but very low in the other indicator, to receive a mean value that might not accurately reflect the level of integration if the operations of the subsidiary and how they are defined and related to the operations of other subsidiaries are taken into account. In Table 5 the distribution of cases along our measure of product flows is presented.

TABLE 5: Measure of Product Flows, distribution of cases.

VALUE-RANGE	0-20%	21-40%	41-60%	61-80%	81-100%
No of cases*	50	10	13	1	4
Percentage	64 %	12.8 %	16.7 %	1.3 %	5.1 %
Std. dev.**	6.595	5.4711	3.2889	---	6.5748
Mean	5.1050	35.9000	48.2692	72.5000	88.1250

*Note: N=78
** Std. dev. for sample 24.927

Somewhat surprisingly it seems to be quite unusual with high internal product flows. The majority of the studied subsidiaries (64%) sells and/or buys less than 20% of their total input/output to other organizational units, indicating a relatively low level of integration in the product dimension. Furthermore, the mean value within the range of 0-20% is close to 5%. This could be explained by a large number of subsidiaries (26) that have no engagement in buying/selling products or components to any other corporate unit. Given the recent attention to organizational integration in multinational organizations (Bartlett & Ghoshal, 1989; Kobrin, 1991; Mauri & Sambharya, 2001; White & Poynter, 1990) and the emphasis on this as a prerequisite for competing in global businesses, especially within

sectors of complex technological solutions (Kobrin, 1991; Kogut, 1984), this result throws some new light on the issue.

2.6 Correlation between Product Flows and Knowledge Flows

Following the arguments put forward in the first section of this paper, there has been an implicit interpretation of some theoretical works within the field of strategy and structure as arguing for MNE´s as evolving towards more integrated structural characteristics (Malnight, 1996) to meet new challenges presented by changes in environment, shorter product life-cycles, more complex technology and the presence of equally global competitors. This increased need for organizational flexibility and adaptability would according to some authors be reflected in high internal resource flows between corporate units in terms of products, components, information, knowledge and financial resources. However, there is a lack of empirical evidence supporting these predictions, and those that exist have primarily focused on single dimensions such as product flows (Mauri & Sambharya, 2001; Milner, 1988), by using for instance the Transnationality index developed by (Kobrin, 1991), or knowledge flows (Gupta & Govindarajan, 1991; Gupta & Govindarajan, 1994). An unfortunate side-effect leading up to this is the sometimes assumed correlation between knowledge flows and product flows. To bring clarity to these issues we now take integrated approach where two dimensions are brought together to further enhance our understanding of the multinational phenomena. In this section we begin with investigating the level of integration in our sample subsidiaries. Finally, an analysis of the relation between the two resource dimensions is performed.

2.6.1 Level of Integration

Since the values in the knowledge dimension are received along a 7-point scale, the median is the value 4. The mean of the cases are 4.9. However, using the mean value as a basis for determining cut-off scores i.e. making the cut-off relative to the empiric material risks discriminating the possibility of entire populations as highly integrated. Thus, in determining the cutting scores for being regarded as highly integrated, we propose the definition that values above the scale median plus the standard deviation, i.e. 4.00 + 1.34 = 5.34 is highly integrated, and subsidiaries exhibiting knowledge flow values below 4.00 - 1.34 = 2.66 is low integrated. Using the present method, we create three new groups that determine their members by the level of integration. Units receiving values 1 - 2.66 is to be considered as low integrated in the Knowledge Dimension (Group 1), units receiving values 2.67 – 5.34 (Group 2), and units receiving values 5.35 – 7 as highly integrated (Group 3). Table 6 presents the three groups, their means values, cutting scores and number of members.

TABLE 6. Classification along integration in the Knowledge Dimension

Groups	Cutting Scores	No.	% of N	Mean value
Highly Integrated	(7 – 5.35)	49	55%	5.8878
Middle Integrated	(5.34 – 2.67)	31	35%	4.0806
Low Integrated	(2.66 – 1)	9	10%	2.2222

Note: (N = 89)

A similar operation was performed for the product dimension. The mean value for the sample was 21.4 and the standard deviation was 24.93. This renders the method described above obsolete. But a look at Table 5 reveals a sharp drop in number of cases from the range of 0-20% (50 cases) to 21-40% (10 cases). Thus, placing cut off values at 0-20%, 21-60% and 61-100% in the making of data groups seem to mirror the empiric material well (see Table 7). Taking larger ranges at the bottom of the scale would create a large group that incorporates subsidiaries with very different characteristics in terms of product flows. Although the ranges of the groups varies (Group 2 & 3 have twice the value range of group 1), the implications for managing a subsidiary are greater comparing the cases of no internal sales or purchases to selling or buying 20% of input/output internally (due to for instance resource dependence), than is the difference between two subsidiaries buying/selling 70% respectively 100% internally.

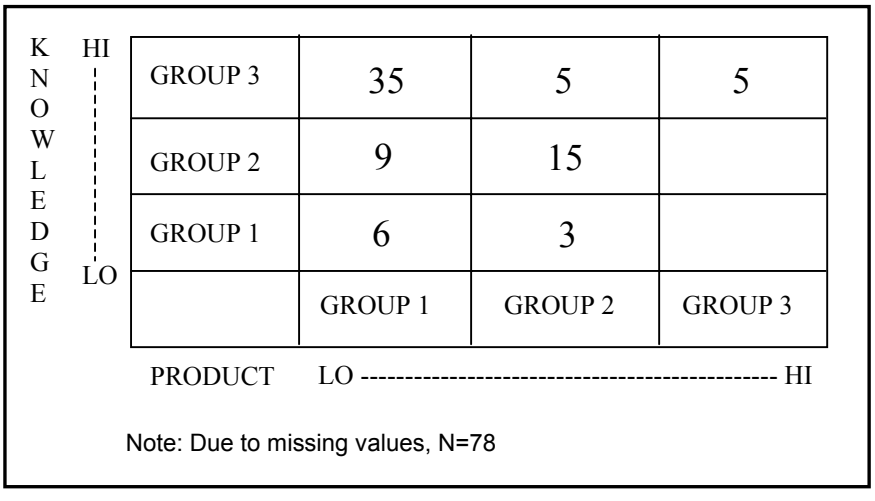
TABLE 7. Classification along integration in the Product Dimension

Groups	Cutting Scores	No.	% of N	Mean value
Highly Integrated	(61-100%)	5	6.4%	85.0000
Middle Integrated	(21-60%)	23	29.5%	42.8913
Low Integrated	(0-20%)	50	64%	5.1050

Note: (N = 78)

Now we have constructed the tools for examining Global Integration in a multidimensional manner. Each dimension is split into three categories along the level of integration in that specific dimension. This allows for an examination of the results through constructing a nine-field matrix, were each subsidiary is plotted according to the level of knowledge and product flow (See Figure 2). The modern MNE, represented by the characteristics of the “Transnational firm” would according to the conceptual models presented earlier exhibit high integration i.e. high amounts of inter-subsidiary resource flows. But while it is relatively common with high knowledge flows, the combination of high scores in the two dimensions seems to be rare.

FIGURE 2. Matrix Illustration of the Integration Level in Two Dimensions



Note: Due to missing values, N=78

Only five observations reside in the upper right corner of the matrix, representing high knowledge flows combined with high product flows. Of the total amount of observations, the combination of low product flows and high knowledge flows is the most common, constituting 45% of the total sample. It is also relatively common (19%) with the combination of groups 2 and B i.e. medium amount of knowledge flows as well as product flows. Two combinations are not represented, low and medium amounts of knowledge flows combined with high product flows.

2.6.2 The Relation between Resource Flows

To begin a deeper analysis of the statistical relationship between the product and knowledge flows presented here, a correlation matrix was used. As is the case in the matrix (Figure 2) the number of cases was reduced to 78 due to missing data. Table 8 shows that there actually is a weak negative relation between the two resource flows, even though it is indicated as non-significant (two-tailed, 0.215).

TABLE 8. Correlation matrix

Variable	PF	KF
Product Flow	-----	
Knowledge Flow	-0.142	-----

(Pearson)
Note: (N = 78)

3. FINDINGS

There is abundant research in the field of industrial marketing showing that by being in an exchange relationship, counterparts tend to adapt to each other over time. This can include organizational aspects as well as resource configurations, for instance planning, products, production processes and stocks (Hallén, et al., 1991). By interacting the counterparts learn from each other by solving problems emerging in the relationship related to for instance technology, resource configuration, market demands and so on. Thus, in market exchange, there seems to be a positive relationship between exchange of products and components, and the amount of knowledge shared and created through interaction between the units. However, our results indicate different corollary effects to engaging in a buyer-seller relationship *inside* a firm, than industrial marketing research has done for market transactions. While our results should be interpreted cautiously since the empiric material not is on a dyadic, but unit level, we advance some possible explanations to this phenomenon. First, on an empirical level, there could simply be a negative correlation between knowledge flows and product flows *in the same exchange relationship*. One possible explanation for this is that if a unit possess certain capabilities that are incorporated into its output, the receiver of this output has a limited use of this knowledge since it already is applied to the product. Low inter-

subsidiary knowledge flows are not necessarily results of barriers or problems related to the transfer of this knowledge (Allen, 1977; Szulanski, 1996), but simply to the usability of knowledge with respect to another organizational role, located further down the value-chain. Second, the result could be because exchange in the different dimensions (product and knowledge) takes place in *different exchange relationships*. While problem-solving activities in a buyer-seller relationship add on to the competence base of each part in the dyad, it must not necessarily result in knowledge being transferred. Rather, knowledge is jointly created. Outcomes of such problem solving in terms of knowledge and competences are different in different counterparts, due to 1) their earlier knowledge base and the specific expertise brought into the problem-solving process by the different units, and 2) the usability and relevance of certain knowledge for subsidiary activities. Instead these newly found competences and knowledge can be of vital importance to the operations of other units, likely such units involved in similar activities, with similar technology. This leads us to think of the MNE as constituted of several structures, each carrying different features. The structure of knowledge flows, for instance, is supporting the structure of product and component flows. Still any further advancement of these arguments tends to become mere speculations in the face of us lacking empirical data to support our arguments. We intend to develop this line of thought more extensively in future work.

Our research question also included the questioning of the commonness of transnationally organized MNE´s. However, giving a clear-cut answer to this seems difficult since 1) our sampling admittedly is biased (choosing the "five *most important* subsidiaries" in each division), and 2) integration in large is a question of the coordination and organization of a *system*, and it is hard to speak about the characteristics of this system by looking at individual subsidiaries. But with this said, a few interesting observations can be of value to the subject. First, there are only a few subsidiaries passing as highly integrated in both dimensions simultaneously. One tend to think that managers would value such subsidiaries more because they have a greater potential to affect the performance of the MNE as a whole, than do highly autonomous units, and that the sampling procedure would give a over-representation of highly integrated subsidiaries. If the sample is representative or over-represented by highly integrated units, the level of integration seems to be lower than one would expect considering the theories of "heterarchy" or the "transnational" firm, indicating that the evolution of the organizing of multinational firms diverge from these theories. This result is also supported by recent research indicating that costs of balancing trade-offs in configuration and coordination of international activity are interacting with the potential benefits form such strategy, creating a inverted U-shape relationship between global integration and performance (Mauri & Sambharya, 2001). Second, our sample showed high levels of knowledge flows among subsidiaries. Considering the sampling procedure again, it seems as the divisional managers value such units engaged in exchanging knowledge and technology more than high volume internal distributors of components, parts or products. This result goes hand in hand with the knowledge based view of the firm (Grant, 1996a; 1996b; Kogut & Zander, 1993) in that competitive advantage are built upon firm capability in transferring and integrating knowledge.

Finally, these findings have bearing on some methodological issues in the context of global integration. As noted earlier, there have been several studies in this area employing product flows as

the only indicator of level of integration, among them the well used index of transnationality (Kobrin, 1991). The results presented here indicate that product flows might not be a suitable measure of integration if we are to reflect a broader range of characteristics of firm behaviour, especially with recent focus on knowledge and its transfer and integration as fundamental to creation of competitive advantages in global industries. If global integration is to be portrayed as something more than utilization of comparative advantages, scale and scope, this should also be reflected in operationalization of the concept.

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APPENDIX 1. Histogram of Knowledge Flows