EFFECTS OF SUBSIDIARY AUTONOMY ON INNOVATION DEVELOPMENT AND TRANSFER INTENSITIES

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ABSTRACT

This paper focuses on innovation development and transfer in Multinational Companies (MNCs). First, we explore the effects that subsidiary autonomy has on the intensity of innovation development and internal transfer by subsidiaries. Autonomy has received wider attention in recent years, but its influence on subsidiary innovativeness and internal transfer of innovations is still much unexplored. Second, the much debated relationship between subsidiaries' innovation development and transfer intensities is explored. In the literature, it is argued that the more innovations are developed, the more the subsidiary is transferring them internally within the organization. However, there are studies pointing out that, due to the multiplicity of roles, a subsidiary increasingly engaged in developing activities also has difficulties engaging in transfer. Three hypotheses are tested by means of a variance-based structural equation modeling (SEM-PLS) technique in a sample of 85 innovation projects developed in 63 subsidiaries in 14 countries. The results show how autonomy is important to enhance subsidiary innovativeness, and that the more a subsidiary is innovating, although being autonomous, the more it will transfer the new competence to sister units.

Keywords: Autonomy**;** Innovation development; innovation transfer; subsidiary.

1. INTRODUCTION

Innovation and the management of its process are recognized in international business literature as MNCs' core capabilities leading to and sustaining their competitive advantage (e.g., Ghoshal & Bartlett, 1988; Zander, 1991; Holm & Pedersen, 2000; Doz et al., 2001). From the work done specifically on these issues, we get a picture of how the MNC advantage is increasingly based on its ability to tap into different countries and contexts around the world where it absorbs and develops new competences (e.g., Kogut & Zander, 1992; Cantwell, 1992; Cantwell & Santangelo, 1999; Doz et al., 2001). The more possibilities a MNC has to develop new competences and innovations, the better its overall competitive strength, as competence and innovation generated at one site can be transferred and exploited at many others throughout the internal organization of subsidiaries (e.g., Kogut & Zander, 1992 and 1993). For instance, a new product transferred from one subsidiary to others located in different markets is a remarkable result in terms of cost savings, time to market and market presence for the MNC.

In this context, subsidiaries have been gaining value as a locus of innovation (e.g., Holm & Pedersen, 2000; Birkinshaw & Hood, 2001; Andersson & Forsgren, 2000; Andersson et al., 2007). In fact, research that explores the roles of MNCs as sources of innovation and vehicles for cross border transfer of competence (e.g., Bartlett & Ghoshal, 1990; Hedlund & Rolander, 1990; Kogut & Zander, 1993) evolved during the last years into new, more fine-grained directions where the subsidiary is the focus of analysis. A particular aspect is how subsidiaries today have two distinct and important roles (e.g., Forsgren, 1997; Andersson et al., 2001 and 2002): innovation and development of new competences by interacting and searching in their local context and the transfer of these competences to sister units within the MNC. Consequently, studies looking at the different factors influencing subsidiary innovativeness, as well as at the

aspects that may hinder or facilitate the internal transfer of innovation and competence have been growing in number in recent years.

Previous studies point out how autonomy has a positive effect on a subsidiary's innovative potential (Young and Tavares, 2004). In this paper we conceptualize autonomy as a measurement of the subsidiary's influence in decision-making. It is the degree to which the foreign subsidiary of the MNC has strategic and operational decision-making authority (O'Donnell, 2000). Nevertheless, some studies, such as the one carried out by Forsgren (1997), depict the difficulty for the subsidiary to carry out the transfer when it is already engaged in development activities within its local context. These impediments to transfer have been related among other things to subsidiary autonomy (Forsgren, 1997). In this way research on transfer barriers (e.g., Von Hippel, 1994; Simonin, 1999, Andersson et al., 2001 and 2002) question the potential "transfer intensity" of subsidiaries engaged in own autonomous development activities. In this paper we are interested in shedding light on this dubious relationship between innovation development and transfer intensities. Simply put: Does innovating more lead to more innovation transfer? In this regard our aim is to explore what Forsgren (1997) has identified as the potential "MNC advantage paradox" and explore the actual influence that autonomy has on subsidiaries' development and transfer intensity. Our results show how autonomy enhances subsidiary innovativeness but, surprisingly, autonomy is not hindering transfer intensity. We also confirm the assumption that innovation development at the subsidiary level fosters the MNC's overall competitive advantage through transfer practice.

In the next section we present the theoretical background, while in the successive, the model and hypothesis are formulated. The presentation of the methods and results will be followed by a discussion. The paper concludes with some comments on limitations and future research issues.

2. THEORETICAL BACKGROUND

In this paper we focus explicitly on innovation projects developed by subsidiaries in MNCs and we adopt the distinction between the processes of innovation development and transfer (Forsgren et al., 2005). We define innovation development as the process, led by a specific subsidiary (i.e., the "developing subsidiary"), of transforming an idea into a completed form that is acceptable to potential adopters, e.g., customers, suppliers, corporate sister units, etc. (Van De Ven, 1986). In addition, we define inter-unit innovation transfer as specific, purposeful, directed projects delimited in time and efforts, with the explicit goal of making the innovation transferred by the focal subsidiary to the recipient subsidiary available for usage (see Szulanski et al., 2004).

The importance of innovation development and competence transfer between different countries has been increasingly recognized in international business (Kogut, 1990, 1993; Dunning, 1993; Cantwell and Janne, 1997). Although these processes have been initially studied in relation to the MNC's structure, i.e., organizational capabilities and corporative context of the innovation (Van De Ven, 1986; Bartlett and Ghoshal, 1989; Nonaka, 1994; Lane and Lubatkin, 1998; Hansen, 1999), lately, the focus has shifted to the subsidiary and its contribution to the MNC's competitive strength. A subsidiary that has shown proficiency at developing innovations may receive a specific mandate or be labeled, for instance, as a centre of excellence (CoE) (e.g., Holm & Pedersen, 2000). If the subsidiary is recognized as a CoE, it is acknowledged as possessing

important capabilities necessary for the creation of value at the corporate level (Frost et. al., 2002).

This perspective on development and transfer of innovation and competence is also mirrored in recent MNC structure conceptualizations. In fact, scholars argue for the modern MNC as a differentiated organization in which the subsidiaries may have different strategic roles (Hedlund, 1986; Ghoshal & Nohria, 1989; Forsgren, 1989; Ghoshal & Bartlett, 1990; Gupta & Govindarajan, 1991; Malnight, 1996). The recognition of subsidiaries' different roles paves the way for a multi-center conceptualization of the MNC and it indicates that a subsidiary may well reach the parent company in terms of competence and strategic importance for the whole corporation (Forsgren, 1990; Forsgren et al., 1992).

The managerial implications derived by the subsidiaries' roles diversification has been dealt with from disparate stand points. For instance, there are discussions about control and how to manage the differentiated network by using different control systems that fit the specific situation of subsidiaries (Ghoshal & Nohria, 1989; Gupta & Govindarajan, 1991; Nohria & Ghoshal, 1994), as well as how top-management can actively intervene in the diffusion processes of innovation by stressing implementation through authority (Leonard-Barton & Deschamps, 1988). Moreover, as already mentioned, research has been dealing with it from a strategy and structure perspective (Hedlund, 1986; Birkinshaw & Hood, 1998; Holm & Pedersen, 2000). However, much less attention has been given specifically to the actual fulfillment of the dual role of developers and transferors of competence by the subsidiaries.

Forsgren (1997) closely examines and questions the potential of this dual role. Specifically, he argues that when the subsidiary has recognized and assimilated a new competence from its local business context, the question of diffusing it to other subsidiaries within the MNC arises. As mentioned earlier, the MNC's capability to take advantage through its different subsidiaries of the variety of knowledge sources, and to make use of this knowledge in locations other than its origin, is its true competitive advantage (e.g., Kogut & Zander, 1993). But researchers underline how transfer is often challenging to implement. It is argued that the greater the variation in the different subsidiaries' business contexts, the higher the potential to innovate but, at the same time, the more difficult it will be to exploit this new competence on a general basis. According to Forsgren (1997), these difficulties are mainly generated by the context specificity that characterizes the subsidiaries development activities that occur in close interaction with their local business counterparts and by its degree of autonomy. Being autonomous can make transfers more difficult. The argument is that while an autonomous subsidiary is in a better position to act independently on its own local activities, it might find it problematic to overcome great organizational distances when transferring newly developed competences to other MNC subsidiaries. Forsgren (1997) calls this situation "the advantage paradox of the MNC", because subsidiaries are not in the best position to transfer innovations when already highly engaged in developing autonomous activities in their local business context.

3. FRAMEWORK AND HYPOTHESES

The competitive strength of a multinational firm stands on two legs: the capability of creating new knowledge and the ability to transfer this knowledge among subsidiaries and countries (e.g., Bartlett and Ghoshal, 1989; Doz et al. 2001). In this paper we introduce the concepts of "development intensity" and "transfer intensity" to depict the relative amount of innovation

developed by a subsidiary compared to its sister units and the actual rate of developed innovations that are transferred to other units. This means that we are not looking at how difficult the transfer process has been but, in line with Forsgren (1997), we capture the effects of impediments to the transfer, i.e., the elements that influence the subsidiary's decision to start a new transfer project. Obviously, the intensity is also related to (experienced and foreseen) easiness of development and transfer activities.

Subsidiaries engaged in innovation development and transfer are subject to potential influence from subsidiary decentralization. Ghoshal and Bartlett (1988) found that autonomy facilitates the creation and diffusion of locally developed innovations, without impeding the adoption of parent company innovations. Other work has suggested a positive influence of subsidiary autonomy on local responsiveness, the formation of global mandates for subsidiaries and on performance. However, Forsgren (1997) and his colleagues (Andersson et al., 2001 and 2002) argue that externally embedded subsidiaries are potentially more innovative, but may concurrently be less able to internally transfer newly generated competence. Interestingly, autonomy might contribute to subsidiaries' capability to develop innovations, but it is questionable if it can contribute to sustain the ability to transfer. Moreover, contrary to the factors hindering the unfolding of the transfer process, such as knowledge tacitness and complexity (e.g. Kogut & Zander, 1992, 1993; Szulanski, 1996; Simonin, 1999), autonomy is clearly not directly dependent on the innovation or knowledge per se, but it is an organizational issue.

In the following section we will discuss and hypothesize about the influence autonomy might have on innovation development and transfer intensities.

3.1. Subsidiary Autonomy

The question of how to structure the multinational organization has been a central one in research on international management. Given the simultaneous demands for organizational integration and local responsiveness in the multinational firm (Doz & Prahalad, 1984; Taggart, 1998), a fundamental decision to be made is the degree to which firm activities should be hierarchically governed. Autonomy is a relative concept, that is, relative to other subsidiaries and to the parent corporation. However, autonomy is not exactly the same as decentralization. Gupta and Govindarajan (1991) refer to decentralization as the extent of decision-making authority that is delegated to the general manager of a subsidiary by corporate superiors. This clarifies one difference between autonomy which may either be delegated by HQ or developed by the subsidiary, and decentralization that concerns delegation. More fundamentally, decentralization refers to the permitted level of local decision-making authority, within which autonomous actions are possible.

Too much centralization in the headquarter-subsidiary relation would paralyze the organization; too little would bring chaos (Prahalad & Doz, 1981). As noted by Ghoshal & Nohria (1989) centralization is a fundamental element in the headquarter-subsidiary relation, and the problem of locus of decision-making has been one of interest to several different approaches used to study the multinational organization, such as influencing the organizing costs (Hennart, 1993) and the information processing capacity (Egelhoff, 1991) of the organization.

The contemporary multinational relies on subsidiaries that autonomously tap into local pockets of knowledge (Behrman and Fischer, 1980; Nobel and Birkinshaw, 1998; Doz et al., 2001; Ambos, 2005), build strong relationships with partners in the host country (Andersson and Forsgren,

1996; Schmid and Schurig, 2003; Asakawa, 1996; Andersson et al., 2007) or take strategic initiatives that create value for the corporation as a whole (Birkinshaw, 1997; Birkinshaw et al. 1998).

The interaction of the subsidiary with local business counterparts has proven to be critical. Trying to satisfy a customer need or a supplier problem may lead to innovation (e.g. Håkansson, 1989; Andersson et al., 2001). Innovations are developed through interaction and problem solving activities with local customers and suppliers (e.g., Von Hippel, 1988; Andersson et al., 2001 and 2002). In this way, the adapted and autonomous subsidiaries can further build and specialize their business and technical competence. Like this, they are in a better position to fulfill their market objectives (assuming the role of "local innovator"). Therefore we hypothesize that:

H1a. The higher subsidiaries autonomy, the higher the intensity of innovation development

Research on subsidiary roles focused on autonomy and the resulting impact on capability formation (e.g., Rugman & Bennett, 1982; White & Poynter, 1984). Those that have addressed autonomy specifically have suggested that autonomy may be good or bad depending on several factors such as task (White, 1986), cultural contingencies (Newman & Nollen, 1996) and specialized resources (Birkinshaw, et al., 1998). Moreover, as underlined by Young and Tavares (2004), autonomy cannot automatically be assumed to lead to improved effort unless it is associated with positive motivation. In addition, autonomy requires resources, which may take various forms including managerial, technological and financial resources, but also including information availability.

Thus, it is still unclear how much and what type of autonomy is necessary to develop meaningful initiatives or influence the subsidiary's contributory role (Young & Tavares, 2004). Therefore we postulate the following competing hypothesis.

H1b. The higher subsidiaries autonomy, the lower the intensity of innovation development

As mentioned earlier an MNC is essentially a business enterprise that spans multiple national territories and is commonly organized along geographical, functional and business lines. Such division of labour and specialization has lent itself to theoretical modelling of the MNC as a network, where some nodes have specific responsibility for the development and leveraging of specific capabilities. The responsibility can be defined in terms of a certain product line or capability, as having a "world mandate" (White & Poynter 1990), or as a "centre of excellence" (Holm & Pedersen 2000). A center of excellence with a "world mandate" has autonomy to develop, transfer, and even launch products within its mandate. Decentralization involves delegating the locus of authority and decision making with the purpose of improving the quality and quantity of ideas and knowledge that may be shared across the MNC (van Wijk et al. 2008). Moreover, distributing decision-making rights to a subsidiary can augment its perception of freedom and increase its motivation to transfer knowledge (Gupta & Govindarajan 2000). Overall, much research suggests a positive relationship between decentralized decision-making rights and corporate knowledge transfer (e.g. Sheremata 2000, Gupta & Govindarajan 2000; van Wijk et al. 2008).

Birkinshaw et al. (1998) showed that a subsidiary's contributory role (its contribution to the firm-specific advantage) is strongly correlated with subsidiary autonomy (see also Andersson &

Forsgren 1996). An explanation for this is that the subsidiaries that are most active in developing products and technology are also best placed to make informed decisions about roll-out processes, to manage the transfer process, and to aid sister units in the reception process.

H2a. The higher subsidiaries autonomy, the higher the intensity of innovations transfer

However, central coordination of technology transfer activities in the multinational organization is likely to encounter several problems. A fundamental limitation is the ability of the headquarters to acquire knowledge about the subsidiary, its environment, and activities. In the MNC this problem is pertinent, since the organizational configuration, almost by definition, implies large spatial distances combined with differences in language, culture and institutional settings. Further, as argued by Almeida & Phene (2004), subsidiaries are embedded in two different knowledge contexts, internal and external to the MNC. Interaction with the local environments have repeatedly been shown to influence knowledge development in subsidiaries (e.g., Almeida & Phene, 2004; Malmberg, et al., 1996).

Ghoshal and Bartlett (1988) argue that subsidiaries having no decision rights, that is, those with low autonomy, neither create nor diffuse innovations. An autonomous subsidiary has the possibility to create more innovations (Ghoshal & Bartlett 1988), although, at the same time, autonomy might involve certain risks as it becomes increasingly distant from the rest of the corporation (Forsgren 1997). Birkinshaw et al. (1998) showed that a subsidiary's contributory role (its contribution to the firm-specific advantage) is strongly correlated with subsidiary autonomy. But, leaving the subsidiary to act autonomously could lead to limited efforts by the subsidiary to engage in transfers, given that resources are already committed to other activities

that would directly benefit the subsidiary, such as innovation development. On these bases we formulate the following competing hypothesis:

H2b. The higher subsidiaries autonomy, the lower the intensity of innovations transfer

A last hypothesis concerns the mere direct relationship between intensity of innovation development and transfer. Subsidiaries with low levels of autonomy neither create nor diffuse innovations (Ghoshal and Bartlett, 1988). However, we still don't know much about the actual relationship between the intensity of innovation development and the subsequent intensity of transfers. Assuming that innovations have to be developed if any transfer is to occur, we postulate a positive relationship between the intensity of development and the intensity of transfer.

H3. Intensity of innovation development influences intensity of innovation transfers to other sister units

The three hypotheses are summarized in Figure 1.

("Figure 1 goes about here")

4. METHODS

In this section we begin by presenting the sample selection, the questionnaire and the field research conducted to explore the hypothesized relationships. We then go on to present the measurement of the constructs and the data analysis technique used to test the hypotheses.

4.1. Sample

For the empirical testing of our model we drew a convenience sample of innovation projects from 23 MNC. Following a snowball sampling procedure, we identified 85 innovations developed at 63 different subsidiaries from a total of 14 advanced economies.

4.2. Questionnaire and Field Research

In order to collect information on the innovation and transfer projects and about specific characteristics of the MNCs and subsidiaries under study, we designed a structured questionnaire. It was pre-tested, and later administered, through personal interviews. The pre-test was first carried out with a group of executive MBA students and a couple of subsidiary managers from MNCs running innovation projects at the time. Their qualitative assessment of the content of our instrument provided relevant information to help establish face validity. In addition, to ensure a common understanding and interpretation of the questions in the questionnaire, the researchers involved in the project and field work discussed its content. Companies were contacted by mail with an explanation of the purpose of the study and were asked to participate. Follow-up phone calls were conducted to schedule a first meeting to both present the project and identify innovation projects, subsidiaries and potential respondents. These potential respondents were contacted, in general, by e-mail. Finally, we administered the questionnaire through in-person interviews to the managers and engineers responsible for projects and who were heavily involved in the processes of innovation development and/ or transfer. The interaction between the nine scholars of the research team and the respondents further helped to establish face validity. The data collection was carried out between 2002 and 2005 and the interviews lasted between two and four hours (the latter when a visit to the facilities and a practical demonstration of the innovation

under investigation were also carried out). The language used in all cases was English provided that the managers had proficiency in this idiom.

We were concerned about a possible common method variance bias (Chang, Witteloostuijn, & Eden, 2010; Podsakoff & Organ 1986). However, we used different scales to measure our constructs and they appeared separated in the questionnaire. As a post hoc statistical procedure to detect its potential presence, we carried out a Harman's one-factor test, which assumes that if a significant amount of common method bias is present, either a single factor will emerge from the test or a "general" factor will account for the covariance in the independent and criterion variables (Podsakoff & Organ, 1986). Our exploratory factor analysis identified five factors with eigenvalues over 1 and accounting for between 35.8 and 6.5% of the variance. We therefore consider the presence of common method variance bias in our set of indicators improbable.

4.3. Measurement of Variables

We measured our latent constructs with multiple indicators and 1 to 7 point Likert scales (see Table 1). In general, the lack of established measures to operationalize most of the constructs, encouraged us to develop original items to accurately capture their content. This is consistent with our exploratory approach. However, we based our measures on previous work when there were published items or scales.

("Table 1 goes about here")

"Subsidiary autonomy" was operationalized as the relative influence of the unit compared with division/ business area HQ considering decisions on investments in R&D, investments in

acquisitions, to introduce new products domestically and to introduce new products internationally. These indicators for autonomy were adapted from previous empirical studies (Ghoshal & Bartlett 1988, Andersson & Forsgren 1996, Andersson et al., 2007). Innovation development and transfer intensities were designed to capture the relative productivity of the subsidiary when developing innovations in comparison to other units, and when transferring them to other units within the division/ business area. In greater detail, "innovations development intensity" is reflected by the level of agreement with the statement "You develop many more innovations compared to other units in your division/ business area" for the items "core technology innovations", "product innovations" and "production process innovations". The same items are used to capture the content of "innovations transfer intensity" but as the answer to a question about the extent to which the innovations released by the subsidiary have been transferred to other units within the unit's division/ business area.

4.4. Control variables

We use a variety of controls to partial out the effect of some other variables with potential to explain the variance of our endogenous constructs. First, we employ "subsidiary size" (operationalized as its number of employees). The literature shows that the association between subsidiary size and autonomy is not straightforward. Some studies found a negative relationship between size and autonomy (Hedlund, 1981; Picard, 1977), while others have identified a positive association (Gates & Egelhoff, 1986; Harzing, 1999). Second, subsidiary age (measured by the number of years the subsidiary has been within the MNE). The date of establishment of a subsidiary may be regarded as a key consideration, since age implies experience. Although Young et al. (1985) found no clear link between the age of a subsidiary and its degree of decision-making autonomy, most other literature has found a generally positive association

(Harzing, 1999; Taggart & Hood, 1999; Van den Bulcke & Halsberghe, 1984). Third, "unit activities" (measured by four dummy variables: "basic research", "technical development", "production" and "marketing and sales"). In respect of decision-making across particular activity/functional areas, previous research has been considering the potential effects of specific areas such as manufacturing, marketing and R&D (see review in Young and Tavares, 2004).

4.5. Data Analysis Technique

The data were analyzed using the Partial Least Squares (PLS) technique (Wold, 1982), which is a variance-based Structural Equation Modeling (SEM) and second-generation multivariate analysis method (Fornell, 1982). PLS is considered a powerful method of analysis because of its minimal demands in terms of measurement scales, sample size, and residual distributions. Three issues, in particular, make PLS a suitable data analysis technique for our study. First, the fact that our study is exploratory in the sense that there are neither established theories about some of the relationships described by our model, nor scales to measure most of our constructs. Second, 15 of our 17 indicators are non-normally distributed in our sample, according to the Kolmogorov-Smirnov test that we performed ($p < 0.05$) in order to test this hypothesis. Third, our sample size is 85 innovations and PLS has been recommended for sample sizes between 30 to 100 cases minimum (Chin & Newsted, 1999).

5. RESULTS

When PLS is used as a data analysis technique, results are usually presented and interpreted sequentially in two stages that ensure that the researcher has suitable measures of constructs before drawing conclusions about the hypothesized relationships (Hulland, 1999). Firstly, the

characteristics of the measurement model are reported in terms of reliability and validity of the measures. The second stage contains an assessment of the structural model including, generally, information about the significance of the relationships, the amount of variance explained for the endogenous constructs, and the predictive relevance of the model.

The measurement model analysis provides support for our constructs and measures in terms of reliability and validity. First, most item loadings are above the suggested acceptance limit of 0.70 (see Table 2). However, the items "deciding on investments in R&D" and "introduce new products domestically" are 0.65 and 0.67 respectively. We decided to keep these items in the operationalization of their construct due to the fact that they have significant loadings ($p < 0.01$ and $p < 0.001$ respectively), their constructs show acceptable construct reliability and average variance extracted, and it is considered to be common practice in some specific situations such as initial steps of scales development, where even loadings between 0.5 and 0.6 can be acceptable (Chin, 1998).

("Table 2 goes about here")

Second, construct reliability, measured as the composite reliability of the multiple indicator-constructs (Werts, Linn, & Jöreskog, 1974), also achieves the recommended thresholds (see Table 2, column 3), meaning that each set of indicators is properly measuring the construct for which it is intended. Third, the average variance extracted or AVE (Fornell & Larcker, 1981) respects the recommended acceptance criterion of 0.5 for all the constructs, involving that the shared variance between the constructs and their indicators is greater than the amount of variance due to their measurement error (see Table 2, column 4). Fourth, the comparison of bivariate

correlations and square roots of the AVEs (see Table 3) shows that discriminant validity is also strictly respected by our constructs and measures.

("Table 3 goes about here")

The structural relationships between the six constructs in our model are tested by means of a 500 sub-sample bootstrap technique. The bootstrapping procedure generates a requested number of random samples from an original data set by sampling with replacement (Efron & Tibshirani, 1993). Two of the structural paths are significant while the relationship between "subsidiary autonomy" and "innovations transfer intensity" is not confirmed. In addition, the controls "subsidiary size", "years within the MNE" and "production" and "marketing and sales" as unit activities explain a significant portion of the variance of the dependents. We re-estimated the model including only the significant paths. The results show significant relationships again (see Table 4) between "subsidiary autonomy" and "innovations development intensity" ($\beta = 0.29$, $p < 0.01$) and "innovations development intensity" and "innovations transfer intensity" ($\beta = 0.42$, $p < 0.001$). We also obtained similar values for the controls.

("Figure 2 goes about here")

("Table 4 goes about here")

Second, the model explains a large proportion of the variance of the endogenous variables "innovations development intensity" ($R^2 = 0.30$) and "innovations transfer intensity" ($R^2 = 0.59$). In addition, the Stone-Geisser values ($Q^2 = 0.05$ and 0.23 respectively) suggest that the model has

predictive relevance (Geisser, 1975; Stone, 1974). We estimated this statistic by means of a "blindfolding" technique with the omission distance fixed at 9. The blindfolding technique provides an assessment of the validity of the paths by repetitively estimating the model parameters with random data points omitted (hold-out samples).

Finally, the global goodness-of-fit (Tenenhaus et al., 2005) value (GoF = 0.33) involves the general quality of the measurement and structural models, taken together, to be reasonably good. All findings above are discussed in the next section, where the implications for academia, MNC and subsidiary managers, and policy makers are also presented, and the limitations of the study and future research issues are described.

6. DISCUSSION AND LIMITATIONS

This paper has been dealing with the process of innovation development and transfer in MNCs. First, we investigate the effects that autonomy has on both subsidiary innovation development and transfer intensities. Second, following studies that point out the potential trade-off between the output of development and transfer activities by subsidiaries our research contributes by empirically testing the relationship between the intensities of subsidiary innovation development and transfer.

Our results show that autonomy is an important driver of subsidiaries' innovation intensity (H1a). Subsidiary autonomy is, as Andersson and colleagues (2001) suggest, a necessary ingredient to local adaptation and success in running activities in a local market. Though beneficial to the development of new competences through increased interaction with local customers and suppliers, autonomy is (surprisingly) not influencing the transfer intensity (H_2), leaving this issue

open for further research. In this regard, maybe the distinction between transfer intensity and problems and inefficiencies encountered during the actual transfer process is worth making as autonomy (negative) effects may show up during the process.

Additionally we confirm that the more innovative a subsidiary is, the higher its internal transfer intensity to sister units (H3). This means that subsidiaries are critical to sustain MNC competitive advantage, though other issues remain untapped. For instance, this opens up for quality and efficiency questions such as whether or not it is good to transfer more simply because we develop more or if everything that we develop is worth transferring. These issues are often left out in previous studies, more concerned with the positive effect of innovation and knowledge management practices.

Important managerial implications from our results appear natural. First, it seems that the more subsidiary innovativeness is fostered, the more transfers to other units will occur. Second, we have seen how autonomy is beneficial to the innovative activity of the subsidiary and does not seem to harm transfer intensity. Concluding we can say that autonomy is a desirable result of subsidiary development in line with previous studies of for instance Birkinshaw and Morrison (1995) and Forsgren, et al. (1992). Moreover, we can also suggest that overall subsidiary autonomy is beneficial not just to the subsidiary but to the rest of the MNC as the more the subsidiary innovates the more related competence will be transferred. Obviously, to get a complete picture related to the investigated phenomenon further research should cover also the antecedent of autonomy. This is also in line with previous studies underlining the dynamic cycles generated by subsidiary initiates and related outcomes.

However, our findings need to be interpreted with some caution because of some limitations. Among them, it is the study's cross-sectional nature, which inhibits the possibility of making causal inferences between the different exogenous and dependent constructs tested in our model. Second, although the sample of our study is unique since it is very diverse while specifically related to the phenomenon of innovation transfer and development in business units, we cannot argue in favor of its representativeness. The international validity of the findings should, therefore, be assessed by carrying out studies with representative samples from different countries. Finally, the present sample is biased towards successful innovations, i.e., failure is undersampled (Denrell, 2003) since, in general, the respondents selected innovations which had been already developed and transferred by their subsidiaries. Future research can therefore focus on overcoming the above mentioned limitations and also empirically test whether or not the relationship between development and transfer intensity is linear.

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Figure 1. Model and hypotheses

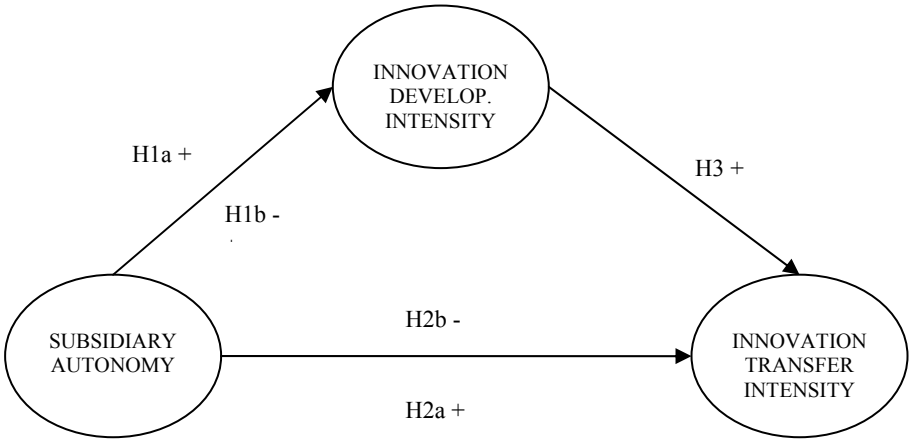

Figure 2. Results

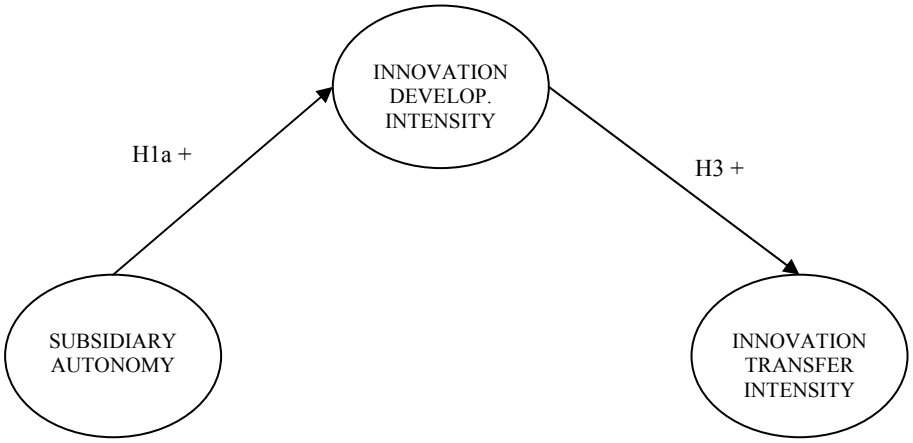

Table 1.

Constructs operationalization.

Construct/ Indicator	Scale	Label	Mean	Standard deviation
Subsidiary autonomy[c]		**SA**		
Deciding on investments in R&D	1 to 7	SA1	4.39	1.64
Deciding on investments in acquisitions	1 to 7	SA2	2.23	1.47
Introduce new products domestically	1 to 7	SA3	5.03	2.10
Introduce new products internationally	1 to 7	SA4	4.17	1.96
Innovations transfer intensity[a]		**ITI**		
Core technology innovations	1 to 7	ITI1	4.02	2.10
Product innovations	1 to 7	ITI2	4.67	2.22
Production process innovations	1 to 7	ITI3	3.87	2.08
Innovations development intensity[b]		**IDI**		
Core technology innovations	1 to 7	IDI1	4.68	1.87
Product innovations	1 to 7	IDI2	5.00	1.69
Production process innovations	1 to 7	IDI3	4.04	1.84
Controls				
Subsidiary size (number of employees)	Ratio	Size	740.10	1078.04
Years within MNE	Ratio	Years	21.23	19.77
Manufacturing (vs. other industries)	Dummy	Manuf	0.87	0.34
Unit activities: Basic research	Dummy	Basic	0.54	0.50
Unit activities: Technical development	Dummy	Devel	0.94	0.24
Unit activities: Production	Dummy	Produ	0.54	0.50
Unit activities: Marketing and sales	Dummy	Sales	0.66	0.48

[a] To what extent have innovations released by your organization during the past five years been transferred to other units within your division/ business area.

[b] You develop many more innovations compared to other units in your division/ business area.

[c] What is the relative influence of your unit compared with division/ business area HQ considering the following decisions?

Table 2.

Item and construct reliability and average variance extracted.

Construct/ Indicator	Item reliability Loading	Construct reliability Composite reliability	Convergent Validity Average Variance Extracted (AVE)
Subsidiary autonomy		.80	.50
Deciding on investments in R&D	.65		
Deciding on investments in acquisitions	.73		
Introduce new products domestically	.67		
Introduce new products internationally	.78		
Innovations transfer intensity		.82	.62
Core technology innovations	.76		
Product innovations	.76		
Production process innovations	.82		
Innovations development intensity		.87	.69
Core technology innovations	.86		
Product innovations	.83		
Production process innovations	.80		

Table 3.

Discriminant validity: Correlations and square root of the average variances extracted (AVE[a]).

Construct	ITI	IDI	SA	Size	Years	Manuf	Basic	Devel	Produ	Sales
ITI	**.78**									
IDI	.64	**.83**								
SA	.29	.35	**.71**							
Size	.31	.21	.30	**1**						
Years	.53	.45	.25	.04	**1**					
Manuf	.04	.05	-.02	.07	-.05	**1**				
Basic	.23	.25	.14	.22	.14	.14	**1**			
Devel	.03	.08	-.11	.13	.10	-.10	.17	**1**		
Produ	-.34	-.16	.00	.10	-.17	-.07	-.23	.17	**1**	
Sales	-.24	-.18	.15	-.04	-.06	-.20	-.31	.14	.63	**1**

[a] Diagonal values in bold are the square root of the variance shared between the reflective constructs and their measures.

In order to achieve discriminant validity diagonal elements must be larger than off-diagonal.

Table 4.

Endogenous constructs: Effects, explained variances and Stone-Geisser Q^2 test.

Effects on endogenous variables	Direct effect	t value (bootstrap)	Variance explained	Stone-Geisser Q2
Effects on Innovations development intensity			.301	.05
Subsidiary autonomy	.29 **	(2.93)	.102	
Years within the MNE (control)	.36 ***	(5.59)	.163	
Unit activities: Marketing and sales (control)	-.20 *	(2.25)	.036	
Effects on Innovations transfer intensity			.586	.23
Innovations development intensity	.42 ***	(4.15)	.271	
Subsidiary size (control)	.24 *	(2.05)	.075	
Years within the MNE (control)	.29 **	(2.87)	.156	
Unit activities: Production (control)	-.25 **	(2.44)	.084	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (based on a Student $t_{(499)}$ distribution with one tail).