

# DETERMINANTS OF TRANSNATIONAL NEW PRODUCT DEVELOPMENT CAPABILITY: TESTING THE INFLUENCE OF TRANSFERRING AND DEPLOYING TACIT OVERSEAS KNOWLEDGE

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*Based on a survey of 90 transnational product introductions, we find that the transnational product development capabilities of organizations significantly depend upon their ability to transfer and deploy tacit knowledge concerning overseas markets. Specifically, we find that organizations which use cross-national teams, teams with members who have prior overseas experience, or teams whose members communicate frequently with overseas managers in order to acquire information about tacit differences among countries have greater transnational product development capabilities. This study contributes to our understanding of how organizations transfer and deploy knowledge across borders for competitive advantage and makes an important contribution to the literature on global strategy. Copyright © 2001 John Wiley & Sons, Ltd.*

## INTRODUCTION

In recent years, interorganizational competition has not only intensified, its nature has fundamentally changed: it has become more knowledge based, and the sources of competitive advantage have shifted unmistakably from physical assets to intellectual resources (Prahalad and Hamel, 1990; Quinn, 1992; Stewart, 1997). While this emergent knowledge-based competition has affected a wide spectrum of organizations, it has raised some particularly significant challenges for firms competing internationally. The home-based sources of knowledge and 'ownership advantages' that had long enabled organizations to compete effectively in international markets (Dunning, 1980) are no longer adequate today. Global rivals now wrest

competitive initiative by harnessing knowledge from sources in multiple countries in order to generate new product ideas as well as to build manufacturing know-how and technological strength. Indeed, with the increasing globalization of our economy, the ability to transfer and deploy knowledge across borders has become one of the central competitive concerns for many organizations.

To date, however, we have a limited understanding of how organizations manage this transfer and deployment effectively. Prior studies have viewed knowledge flows between headquarters and subsidiaries of multinational companies (MNCs) largely as control or administrative mechanisms (e.g., Egelhoff, 1988; Gupta and Govindarajan, 1993; Nobel and Birkinshaw, 1998). Consequently, not much is understood about the optimization of such international knowledge flows as a means for creating competitive advantage.

On the other hand, the competitive implications of organizations' knowledge have recently attracted a great deal of attention in the strategic

Key words: tacit knowledge; firm capabilities; global strategy; transnational new product development

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management literature (e.g., Cohen and Levinthal, 1990; Grant, 1996; Spender, 1996; Zander and Kogut, 1995). Of particular interest has been the competitive significance of a firm's tacit knowledge (Nonaka, 1994). Tacit knowledge largely 'indwells' in the minds of people as perspectives on, or images of, reality (Polanyi, 1966). The inherent difficulties in its codification and communication pose significant barriers to the replication of this kind of knowledge by rival organizations—which makes tacit knowledge a key differentiator and therefore potentially an important strategic resource (Conner and Prahalad, 1996). However, the competitive implications of tacit knowledge have not yet been adequately tested in the international arena. Some studies have recognized that, as one of the 'sticky' properties (von Hippel, 1994) of location-specific knowledge, tacitness makes knowledge especially difficult to transfer across country borders (Kogut and Zander, 1993; Teece, 1977), but not much is understood about how firms overcome this difficulty and harness tacit knowledge from geographically dispersed sources. Also lacking are empirical studies validating the growing belief that tacit knowledge may have a significant impact on firm capabilities.

In an effort to fill in some of these gaps in our understanding, this study investigates the impact of the international transfer and deployment of tacit knowledge on a firm's capabilities for developing new transnational products. Transnational products are those that are developed simultaneously for multiple markets, and which contain both features that are standardized across markets and features that are responsive to individual local markets. Unlike global products that are developed with an emphasis on the similarities among country markets (Levitt, 1983; Samiee and Roth, 1992), transnational products reflect an MNC's concurrent emphasis on similarities and differences among countries in their product development efforts (Bartlett and Ghoshal, 1989). The simultaneous development of products for multiple markets might also be called a sprinkler strategy—in contradistinction to a waterfall strategy, whereby products are first developed for a single country market and variations are subsequently and independently developed for other markets (Ganesh and Kumar, 1996; Kalish, Mahajan, and Muller, 1995; Ohmae, 1985).

## BACKGROUND AND MOTIVATION FOR THE STUDY

In designing our study of the impact of international transfer and deployment of knowledge on firm capabilities, we chose to focus on transnational new product development for two reasons. First, the transfer and deployment of overseas knowledge is a central component of the transnational new product development process (Takeuchi and Porter, 1986). Because transnational products are developed with both features that adapt to unique country requirements and those that are standardized across markets, companies must become adept at discerning the differences among countries in order to address what may be conflicting requirements. Since knowledge of unique country conditions typically lies dispersed in a firm's overseas subsidiaries (Ohmae, 1990), the capability to develop new transnational products fundamentally depends on how proficiently MNCs transfer and deploy knowledge from multiple country sources.

Second, transnational product development has significant implications for the competitiveness of MNCs in worldwide markets. A firm's transnational approach to product development provides many advantages over competitors who manage development either as a purely domestic process or as a portfolio of independent activities in different countries (Ghoshal, 1987; Porter, 1986; Yip, 1995). For example, integrating development activities across countries eliminates duplication of efforts and saves costs, making products more price competitive (Porter, 1986). It also allows firms to leverage ideas generated in one geographic market into other geographic markets (Bartlett and Ghoshal, 1989). Moreover, launching new products simultaneously in multiple country markets reduces the risks of preemptive entry by rivals in those markets (Chen and Stucker, 1997; Hamel and Prahalad, 1985). In addition, a transnational approach enables MNCs to combine the advantages of local responsiveness and the efficiency that comes with centralization (Bartlett and Ghoshal, 1989; Prahalad and Doz, 1987). While adaptation of certain product features to unique country requirements enables products to penetrate individual markets, standardization of other features may enhance their competitiveness by providing operational efficiency. Such compelling advantages have in

fact made transnational new product development a central aspect of some firms' strategy for competing in worldwide markets (Bartlett and Ghoshal, 1989).

Despite its significance, however, the development of new transnational products has not been examined sufficiently in empirical studies. Prior studies have focused primarily on the feasibility of standardizing global products across markets (e.g., Boddewyn, Soehl, and Picard, 1986; Cavusgil, Zou, and Naidu, 1993; Samiee and Roth, 1992), as opposed to the development processes of transnational products. Similarly, studies of global R&D have centered their attention on the location, coordination, or evolution of worldwide R&D activities (see Cheng and Bolon, 1993, for a review) rather than on the issues involved in product development for worldwide markets. Research on the diffusion of knowledge within MNCs (e.g., Bartlett and Ghoshal, 1989; Gupta and Govindarajan, 2000) has also failed to highlight the ways in which various approaches to transferring and deploying knowledge across borders specifically affect MNCs' capabilities for developing transnational products. We believe that transnational new product development provides an apt and useful context in which to investigate the impact on firm capabilities of international knowledge transfer and deployment.

## RESEARCH FRAMEWORK

Our research framework was designed to examine how the transfer and deployment of tacit overseas knowledge influences the transnational new product development capabilities of MNCs. The study was built on the premise that tacit knowledge is an important aspect of new knowledge creation and provides a strong impetus for innovation (Madhavan and Grover, 1998; Nonaka, 1994; Nonaka and Takeuchi, 1995).

### Definitions

We define tacit overseas knowledge as 'the knowledge of the differences among overseas markets that is difficult to codify and transfer in a systematic way.' Note that *difficulty in codification and transfer* is a central attribute of tacit knowledge (Grant, 1996; Nonaka, 1994; von Hippel, 1994; Zander and Kogut, 1995). We focus on

knowledge about the *differences*<sup>1</sup> among overseas markets because addressing unique requirements of multiple countries is a fundamental issue facing firms developing transnational products (Cavusgil *et al.*, 1993; Jain, 1989).

We define transnational new product development capability as 'the ability to consistently and successfully introduce new products simultaneously in multiple country markets.' We focus on *consistency* of new product introductions, since random or sporadic new product successes will not enable firms to achieve or maintain market dominance (Leonard-Barton, 1995; Nobeoka and Cusumano, 1997). We qualify these introductions as *successful*, since market success is a key measure of any business process capability (Amit and Schoemaker, 1993; Barney, 1991). Finally, we also include *simultaneity of introductions*, since the integration of product development activities across countries and the development of products that concurrently meet the requirements of several countries are essential to the concept of transnational new product development (Bartlett and Ghoshal, 1989; Porter, 1986).

### Tacit overseas knowledge and transnational product development capabilities

As they strive to meet the requirements of multiple country markets simultaneously, product developers must address the differences among countries (Jain, 1989). Knowledge about these differences may be tacit or explicit (Subramaniam, Rosenthal, and Hatten, 1998). Many country requirements entail explicit knowledge, since they are based on universally accepted and objective criteria. For instance, transmission systems for televisions differ from country to country based on universally accepted engineering specifications such as PAL, SECAM, or NTSC. Similarly, cordless telephones must respond to individual countries' regulatory laws regarding frequency ranges. Such differences are not subject to individual interpretations or perspectives, can easily be codified and communi-

<sup>1</sup> While a broader view of tacit overseas knowledge could include tacit similarities as well as differences, we chose to focus our analysis on tacit differences among countries. We present the implications of this choice subsequently when we discuss our results.

cated internationally, and are consequently likely to be understood in the same way by most competitors.

On the other hand, many differences among country markets involve tacit knowledge—an unspoken and often subtle understanding of differences in cultures, tastes, habits, or customs (Jain, 1989; Subramaniam *et al.*, 1998). Takeuchi and Porter (1986), for example, describe the cultural expectations that made Campbell's soup unpopular in Brazil. Brazilian housewives apparently felt they were not fulfilling their 'proper' role if they served soup they could not call their own, and hence preferred using dehydrated soup starters (made by Campbell's competitors) to which they could add their own ingredients. The understanding of such unique country requirements is tacit, as it is based upon the personal perspectives and interpretations of the individuals observing consumer behavior.

Since such cultural quirks lack objective criteria for consistent description, they can have multiple interpretations—with each interpretation, or version of tacit knowledge, having different implications for the design trade-offs of the new transnational product being developed. For instance, preferences for the shapes of television cabinets vary with cultures and may be interpreted in several ways, making it very difficult to codify knowledge about them and transfer it across borders (von Hippel, 1994). Unlike the ability to grasp explicit differences, the insight needed to arrive at these interpretations evolves as one builds one's personal experiences with the culture. Even then, the knowledge will reside primarily in the minds of subsidiary managers located in overseas markets, who are, moreover, unlikely to perceive and understand it in exactly the same way as their firm's global competitors do.

Consequently, such tacit insights provide rich potential for identifying market opportunities that are not easily detected by competitors. For example, Sanyo spotted a unique innovation opportunity for its cordless telephones by interpreting a tacit difference in habit between its U.S. and home consumers. Facing frequent complaints about cordless telephone batteries failing to recharge in the U.S. market, they discovered the problem to be associated with a cultural trait peculiar to the United States: American consumers tended to snack while using the telephone, and hence soiled the physical contacts for battery

recharging. The design for Sanyo's new transnational cordless telephone harnessed this insight by incorporating an electromagnetic battery-recharging feature as opposed to the conventional means of physical contact terminals. Because tacit knowledge can work in this way to turn idiosyncratic experiences and interpretations into unique market opportunities, the transfer and deployment of such knowledge can be a key driver of innovation (Nonaka and Takeuchi, 1995).

### **Transferring and deploying tacit overseas knowledge**

Of course, while tacit knowledge may originate as individual experiences and perceptions (Polanyi, 1966), for organizations to harness this knowledge and turn it into innovative capabilities, these experiences of individual subsidiary managers must be processed into a collective understanding among the MNC's innovation team, and then transformed into explicit transnational product feature options (Madhavan and Grover, 1998; Nonaka and Takeuchi, 1995). From an information-processing theory perspective, the extent of tacit overseas knowledge assimilated into the transnational new product development process could be seen as a function of a 'fit' between the tacitness in the overseas information acquired and the richness of the information-processing mechanisms employed (Galbraith, 1977; Tushman and Nadler, 1978).

A 'fit' indicates how well organizations make sense of and apply the information they acquire in a specific context (Daft and Lengel, 1986). The concept of 'fit' is based on the premise that organizations need to match ambiguous or difficult to acquire information with rich information-processing mechanisms (Gresov, 1989; Van de Ven and Delbecq, 1974). Because tacit information is difficult to codify and transfer, assimilating such information effectively requires the use of rich information-processing mechanisms (Subramaniam *et al.*, 1998).

For example, Sanyo says it positions its cordless telephone as a product with a 'soft appearance,' but the company is fully conscious of the vagueness of the term, recognizing that it must acquire information about what 'soft appearance' means to its customers in different country markets. As there are numerous possible interpretations of 'soft appearance' even within a single

country, a comprehensive understanding of all the local nuances of such a quality exists only in the minds of the relevant overseas managers, who must base their definitions on their own experiences and beliefs. A product development team at Sanyo's headquarters is unlikely to grasp all the nuances of its diverse overseas managers' knowledge about 'soft appearance' if the team relies upon lean<sup>2</sup> information-processing mechanisms such as written memos or reports in order to acquire that information. The depth and breadth of this kind of impressionistic understanding are very difficult to document comprehensively in memos and reports. Such a tacit knowledge base is more likely to be harnessed effectively by the development team if it employs richer mechanisms such as face-to-face contact with overseas managers (Daft and Lengel, 1986; Krauss and Fussell, 1991). Using these richer modes of information exchange, the developers can review various design alternatives in considerably greater detail, and they can utilize the overseas managers' knowledge more effectively in the product design process. Hence, the effectiveness of transferring and deploying tacit overseas knowledge is a function of a 'fit' between tacit information and rich information-processing mechanisms. Moreover, since MNCs which achieve such a 'fit' will be more effective at transferring and deploying tacit overseas knowledge, they are also more likely to have greater transnational product development capabilities (see Figure 1).

### Hypotheses

Our hypotheses build upon the three approaches by which MNCs engaged in transnational new product development projects might effectively transfer and deploy tacit knowledge through a 'fit' between the extent of tacitness in the information they acquire and the richness of the mechanisms they use to process this information.

One approach is to use cross-national teams to process tacit information about overseas markets. Cross-national teams co-locate the managers who possess the requisite tacit overseas information

with other managers who can assist in interpreting that information and applying it in product design. Co-location enhances the media richness of information transfer (Clark and Marshall, 1981; Daft and Lengel, 1986), and facilitates the effective sharing of deep-rooted perspectives, beliefs, and experiences. Consequently, cross-national teams are considered one of the primary mechanisms for sharing tacit information (Madhavan and Grover, 1998; Nonaka, 1994). Sanyo's use of face-to-face contact between team members to capture knowledge about country-specific perceptions of 'soft appearance' is a case in point. Co-location also enables groups to bring the sources and users of 'sticky' information together and so to enhance their problem-solving abilities (von Hippel, 1994). Enhancing the communication and application of tacit knowledge in this way should ultimately strengthen transnational product development capabilities. Hence:

*Hypothesis 1: A 'fit' between the extent of tacitness in overseas information acquired and the use of cross-national teams will enhance transnational new product development capability.*

A second approach is to include on the product development team that must process this kind of tacit information members who have had prior overseas experience. Such experience provides the team with a greater ability to make sense of new country-specific information, to absorb it effectively, and to apply it to the creation of new knowledge (Bower and Hilgard, 1981; Cohen and Levinthal, 1990). Dierickx and Cool (1989) describe this ability as 'asset mass efficiencies'—the snowball effect by which prior knowledge enables its holders to add more effectively to new knowledge. Nonaka and Takeuchi (1995) provide some examples of Nissan's use, for their transnational car design, of engineers who had had European market experience and therefore had some tacit knowledge about European driving conditions. This prior experience and the consequent tacit knowledge about the relevant overseas markets enhanced the team's ability to absorb related new knowledge about those markets. This leads to our second hypothesis:

*Hypothesis 2: A 'fit' between the extent of tacitness in overseas information acquired and*

<sup>2</sup> Based on Daft and Lengel (1986), we view richness of information-processing mechanisms as a continuum, with *lean* mechanisms connoting the low end of that continuum. Hence, while face-to-face contact is an example of a rich media of information exchange, written memos are an example of a lean media of information exchange.

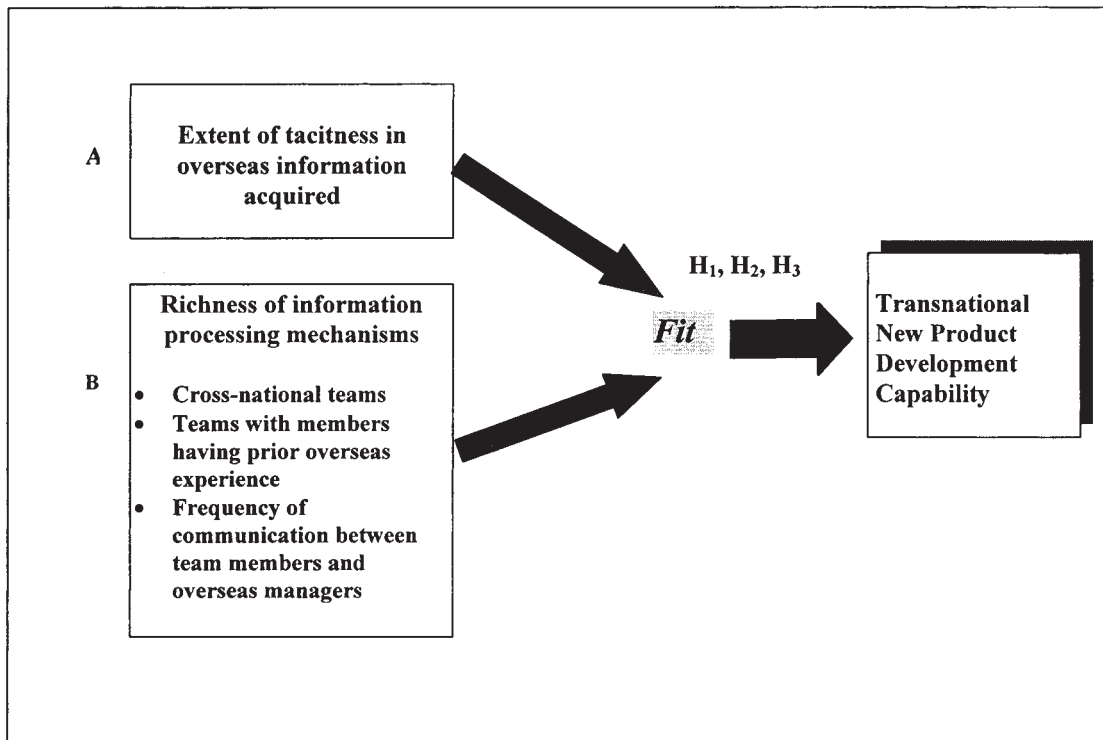


Figure 1. Transferring and deploying tacit overseas knowledge for transnational new product development capability

*the use of teams with domestic members who have prior overseas experience will enhance transnational new product development capability.*

A third approach to processing tacit overseas information is to increase the communication intensity of project teams (Allen, 1977; Tushman and Nadler, 1978). Intensive communication enables individuals to build strong ties (Krackhardt, 1992) and share their beliefs and experiences so as to transfer tacit information more effectively (Madhavan and Grover, 1998; Nonaka, 1994). Frequent communication between MNC headquarters and subsidiary managers is also known as an effective diffuser of knowledge across borders (Egelhoff, 1988; Ghoshal, Korine, and Szulanski, 1994; Nohria and Ghoshal, 1994). Thus, the greater the frequency of communication between project team members and overseas managers, the more effectively will tacit information about the differences among countries be processed, resulting in greater deployment of such knowledge. Hence:

*Hypothesis 3: A 'fit' between the extent of tacitness in overseas information acquired by the project team and the frequency of communication between team members and overseas managers will enhance transnational new product development capability.*

## METHODOLOGY

In conducting our research, we used a cross-sectional survey of key informants to collect primary data from a set of companies competing in worldwide markets. The survey was administered to key members of transnational new product development teams. A single informant speaking on behalf of the team provided information about each transnational new product development process. The survey was administered across multiple industries in the consumer packaged goods, consumer durables and industrial product sectors. Its scope was restricted to manufactured products. We selected for the survey only products that had been on the market for between 1 and 5 years.

## Sampling

Sampling of companies and their transnational new product development processes presented some unique problems. Not all MNCs develop transnational products, nor do all product development projects within a single MNC involve transnational products. Hence we concluded that sending questionnaires randomly to a set of MNCs was not likely to result in adequate meaningful responses. We first created a target sample base of companies that were likely developers of transnational products. Then we identified managers who were involved with transnational new product development projects and could serve as key informants for this study.

Through multiple approaches, we created a target sample base of 152 companies (see Appendix A). First, we solicited the help of ACNielsen, a major market research company in the United States, in identifying 90 of their client companies involved in transnational new product development. Based on discussions with their representatives, we selected a list of marketing and R&D managers of these companies who were likely to be involved in transnational new product development. Second, we identified 22 more MNCs that were corporate sponsors of six research centers of the university where this research was conducted. From these corporate sponsors we obtained a list of managers who were likely to be involved in transnational new product development. Third, we added 40 more MNCs that were known from prior academic and business articles to be developing transnational products. For these companies we created a mailing list of informants from the Directory of Corporate Affiliations.

We then invited these 152 MNCs to participate in our study. Fifty-seven of them participated, giving us a response rate of 37.5 percent. An independent *t*-test comparing mean revenues (obtained from secondary sources) of the responding and nonresponding companies revealed no significant differences (at  $p < 0.05$ ), ruling out any significant response bias. Since many of these MNCs were involved in developing several distinct categories of transnational products, we encouraged them to give us multiple responses. We received a total of 102 responses from different divisions and product categories within these 57 MNCs. We discarded 12 of these responses: three pertained to non-

manufactured products (software and franchise expansion); five responses were about new products not yet launched; and four more were incomplete. This left a total of 90 usable responses from 45 multinational companies. Of these 90 responses, 43 were from the consumer packaged goods sector, 23 from the consumer durables sector, and 24 from the industrial products sector (see Appendix B for details on the companies and product categories).

The sampling process was by design nonrandom, since transnational new product development is not widely practiced but is rather a strategic choice adopted by some MNCs. However, our sample represented a broad cross-section of product categories and firms. Several of the firms represented are leading multinational companies who account for a significant portion of the global economy. Twenty-two of these companies were ranked in the 1997 *Fortune* 1000 list in terms of revenue. Of these 22 companies, eight were ranked in the top 100, of which four were in the top 50. Many of these companies have been cited in prior studies as exemplary competitors in worldwide markets (for example, see Yip, 1995). A majority of the companies in the sample were U.S. based. Three companies in the sample were based in Europe, one in Japan and one in South Korea.

## Key informants

We used key informants to provide data on transnational new product development processes. Selecting appropriate informants is critical, since the reliability of information about activities related to a group or an organization depends on whether the selected persons have the requisite knowledge or are in a position to have it. All managers who responded to our survey were members of transnational new product development teams and were also in the upper middle management level of their companies. A majority of the informants (62%) were senior managers carrying titles of Director, Vice President or President. They thus had the appropriate vantage point from which to provide information on the complex and multilevel activities involved in transnational new product development. Also, 92 percent of the informants represented the functions of R&D/Engineering, Marketing and General Management, all of which are critical functions for new product development.

### Survey instrumentation

We developed the survey instrument in several phases. The first phase consisted of several hours of interviews with managers involved in the practice of transnational new product development. These interviews gave us an appreciation of how this practice was actually conducted in multinational companies. Using this understanding as a background, we then systematically searched the literature on new product development, international business, strategic management, and organization theory for relevant scales. This search resulted in only a few scales that were applicable to the conceptual framework and hypotheses of this study. For a majority of the constructs, therefore, we developed new scales.

### Measures

The measure for the dependent variable—transnational new product development capability—was developed by integrating key indicators from previous related studies. These indicators include: (a) frequency of new product introductions (Nobeoka and Cusumano, 1997), (b) order of market entry (Banbury and Mitchell, 1995), (c) simultaneous entry in multiple markets (Porter, 1986), (d) the ability to be responsive to market requirements, (e) the ability to be competitive in terms of price (Bartlett and Ghoshal, 1989), and (f) the ability to penetrate new overseas markets (Yip, 1995). (See Appendix C, #1.)

The measure for the degree of tacitness was adapted from Zander and Kogut (1995). Three dimensions from their study relevant to this context were complexity, codifiability, and observability of information about the differences among countries. That is, when the information about the differences among countries was more complex, less codifiable, and more difficult to observe, that information was considered more tacit and less explicit. Based on these concepts, we developed some fine-grained measures to capture the construct (see Appendix C, #2).

We used a dummy variable denoting the presence/absence of overseas managers in the project teams in order to measure co-location or the existence of cross-national teams (see Appendix C, #3). Similarly, we used a dummy variable denoting the presence/absence on the project team of domestic managers with prior overseas experience

in order to measure the use of teams with such members (see Appendix C, #4). Following Ghoshal *et al.* (1994), we measured communication intensity as the frequency of interactions between project members and overseas managers via telephone, fax, and e-mail (see Appendix C, #5).

### Pilot testing

We pilot tested the face validity of these scales with 16 managers involved in transnational new product development. We spent a minimum of 2 hours with each of these managers, discussing every question and indicator with them so as to ascertain that they understood the constructs and were interpreting the questions accurately. Based on their feedback, we reworded some of the questions for greater clarity and comprehensibility.

### Measurement properties

All constructs using multiple indicators were tested for their reliability. Cronbach alphas for all the constructs were well above the recommended value of 0.7 (see Appendix C). Furthermore, the constructs were tested for their convergent and discriminant validity. Each construct was paired with another construct, and all the pair combinations were factor analyzed using varimax rotation. The indicators of each construct loaded only on their own construct for all the pairs of constructs. Hence, convergent and discriminant validity requirements were satisfied for these constructs (detailed results available on request). In addition, we developed a measure for business performance as a means to test the predictive validity of our dependent variable. Following Venkatraman and Ramanujam (1987), this measure captured multiple dimensions of business performance—namely, how satisfied managers were, *vis-à-vis* their competitors, with their division's growth in sales, growth in market share, return on investment and return on sales. A significant zero-order correlation of 0.49 ( $p < 0.01$ ) between transnational new product development capability and business performance confirmed the predictive validity of the dependent variable.

### Control factors

We used seven variables to control for factors, other than the tacit overseas knowledge leveraged

by the project team, which might have an influence on transnational new product development capability. The first two variables—brand image in overseas markets and overseas market share—were chosen because, as factors influenced by some of the same ‘other’ variables that affect transnational new product development capability, they covary with that capability. Because of this covariance, using these control variables enables us to control for several of these ‘other’ factors that are impossible to enumerate comprehensively and to incorporate into the framework. We controlled for industry by using two dummy variables to indicate whether the product was a consumer packaged good, a consumer durable, or an industrial product.

The remaining control variables were chosen because their influence on transnational new product development capability can be inferred from prior studies. The stronger a firm’s worldwide marketing infrastructure is, the better its structure will be for competing in worldwide markets (Porter, 1986), and hence the more likely it will be to have greater transnational new product development capabilities. Similarly, the greater the number of countries targeted for transnational new product development, the greater the firm’s chances for simultaneous introductions in multiple markets—and hence the greater its likelihood for higher transnational new product development capability. Next, the higher the market concentration, the lower the likely market rivalry, and hence the greater the odds of the new transnational product’s being successful in the market place (Porter, 1980). Finally, we used permeability of managers across borders to represent an organizational factor believed to enhance the international flow of knowledge and therefore the chances of innovation. Based on Bartlett and Ghoshal (1989), this construct represents the frequency with which managers from headquarters and overseas subsidiaries of the focal organization visit one another and interact informally with one another (see Appendix C, #6 to #11).

## RESULTS

Table 1 summarizes the means, standard deviations, and zero-order correlations among the constructs used for testing the hypotheses.

We used multiple regression analysis to test

our hypotheses.<sup>3</sup> Table 2 presents the results of the regression analysis.

Model 1 is the test for the control variables. Together the control variables contribute to an adjusted  $R^2$  of 0.564, and the  $F$ -statistic is highly significant ( $p < 0.001$ ). This confirms our *a priori* expectations of the influence of the selected control variables on transnational new product development capability. Model 2 is the test of the main effects of the extent of tacitness in overseas information and cross-national teams. The results reveal that the main effects are not significant, and taken individually neither the extent of tacitness in overseas information nor the use of cross-national teams is significant. Model 3, which is a test of Hypothesis 1, confirms that the interaction between the degree of tacitness in overseas information and the use of cross-national teams is significant at  $p < 0.001$ . This result supports Hypothesis 1.

Model 4 tests the influence of the main effects of the extent of tacitness in overseas information and the use of teams with members who have prior overseas experience. The results reveal that the main effects are not significant. Model 5, which tests Hypothesis 2, confirms that the interaction between the extent of tacitness and the use of teams with domestic members who have prior overseas experience is significant at  $p < 0.05$ . This result supports Hypothesis 2.

Model 6 is the test of the main effects of the extent of tacitness in overseas information and the frequency of communication between project team members and overseas managers. The results reveal that taken individually the extent of tacitness and the frequency of communication of team members with overseas managers are not significant explanators of the variance in transnational new product development capability. Model 7, which tests Hypothesis 3, reveals that their interaction is significant. This result supports Hypothesis 3.

Overall, all the hypotheses are strongly sup-

<sup>3</sup> Factor analysis with varimax rotation confirmed that all multiple indicator variables loaded on a single factor. Considering the factor scores as weights, the respective weighted averages of the indicators were used to compute the value of each multiple indicator variable. Furthermore, as suggested by Venkatraman (1989), interactions were computed by multiplying respective independent variables after transforming them by centering them around their mean to avoid multicollinearity problems.

Table 1. Means, standard deviations and zero-order correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Mean</i>	5.15	0.7	0.81	5.14	0.47	0.29	4.9	4.53	4.07	6.89	3.64	4.71	5.89
<i>Standard deviation</i>	1.49	0.46	0.40	1.62	0.5	0.46	1.61	1.52	0.96	5.03	1.85	1.53	1.38
1. Extent of tacitness	1.00												
2. Cross-national teams	-0.019	1.00											
3. Teams with members with prior overseas experience	0.066	0.097	1.00										
4. Frequency of communication	0.086	0.421**	0.111	1.00									
5. Industry represented (A)	-0.115	0.104	-0.027	0.131	1.00								
6. Industry represented (B)	0.091	0.068	0.084	-0.164	-0.60**	1.00							
7. Brand image	-0.048	0.167	-0.038	0.109	0.279**	0.035	1.00						
8. Overseas market share	0.04	0.012	-0.067	0.107	0.060	0.035	0.662**	1.00					
9. Worldwide marketing infrastructure	-0.016	0.147	0.344**	-0.001	0.050	0.046	0.212*	0.135	1.00				
10. Number of countries targeted	-0.092	-0.073	0.070	-0.063	0.099	-0.001	-0.070	-0.047	-0.133	1.00			
11. Market concentration	0.167	0.244*	0.057	0.176	0.005	0.081	0.083	0.118	0.015	-0.066	1.00		
12. Permeability of managers across borders	0.035	0.243*	0.312**	0.197	0.067	-0.080	0.099	0.169	0.015	-0.068	-0.005	1.00	
13. Transnational new product development capability	0.039	0.253*	0.151	0.128	0.092	0.078	0.656**	0.616**	0.206*	0.038	0.244*	0.333**	1.00

\* $p < 0.05$ , \*\* $p < 0.01$

Table 2. Regression results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Control variables							
Geographic scope	0.039*	0.042*	0.047*	0.020 <sup>+</sup>	0.038*	0.039*	0.039*
Industry represented (A)	-0.199	-0.247	-0.231	-0.106	-0.142	-0.195	-0.273
Industry represented (B)	-0.045	-0.019	-0.022	-0.122	-0.052	0.052	0.018
Worldwide infrastructure	0.129	0.106	0.09	0.065	0.129	0.129	0.149
Market concentration	0.127*	0.09 <sup>+</sup>	0.05	0.122*	0.122*	0.122*	0.117*
Overseas market share	0.226**	0.249**	0.299***	0.237**	0.223**	0.223**	0.194**
Brand image	0.410***	0.383***	0.341***	0.426***	0.41***	0.41***	0.425***
Permeability of managers across borders	0.235***	0.207**	0.232***	0.233***	0.285***	0.232***	0.230***
Independent variables							
(A) Extent of tacitness		0.024	0.034	0.03	0.026	0.018	0.037
(B) Cross-national teams		0.389	0.475 <sup>+</sup>				
(C) Teams with members having prior overseas experience				0.214	0.185		
(D) Frequency of communication						0.060	0.018
Interaction between A & B			0.587***				
Interaction between A & C					0.379*		
Interaction between A & D							0.092*
Model statistics							
R <sup>2</sup>	0.604	0.619	0.685	0.625	0.644	0.61	0.64
Adjusted R <sup>2</sup>	0.564	0.570	0.639	0.575	0.592	0.553	0.577
F	15.09***	12.51***	15.03***	12.64***	12.34***	11.78***	11.79***
Change in R <sup>2</sup>			0.066		0.019		0.030
F for change in R <sup>2</sup>			5.44***		1.55		2.25 <sup>+</sup>

<sup>+</sup> $p < 0.1$ ; \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ;  $N = 90$

ported. Also the difference in  $R^2$  between the interaction models and the main effects models are significant for two out of the three hypotheses (for Hypothesis 1 at  $p < 0.001$  and for Hypothesis 3 at  $p < 0.1$ ).

### Sensitivity to firm effects

Several of the firms that participated in the study gave us data for multiple projects, and we wanted to test the robustness of our results after controlling for firm effects. However, controlling for all the firms in the sample was not feasible because of limited degrees of freedom to test the results. Hence, we created a subsample of 40 projects from 11 MNCs that had each contributed information on three or more projects. Table 3 presents the results after controlling for the firm effects of these MNCs through ten dummy variables.

Models 11, 12, and 13 reveal that two out of the three hypotheses are supported in the truncated sample test. The interactions between the extent of tacitness in overseas information and the use of cross-national teams (Hypothesis 1)

and the frequency of communication between project team members and overseas managers (Hypothesis 3), respectively, remain significant. However, the interaction between the extent of tacitness in overseas information and the use of teams with prior overseas experience loses its significance. Our interpretation of these truncated sample test results is that the results of the broader study are fairly robust.

### DISCUSSION

Transnational new product development capability is a key driver in establishing a firm's competitive advantage in worldwide markets. Prior research, while clearly emphasizing the importance of a transnational approach to new product development if one is to compete effectively in today's global business environment (e.g., Bartlett and Ghoshal, 1989; Takeuchi and Porter, 1986), has not focused on how this capability could be effectively developed. Our study highlights ways in which organizations can create this critical capability by transferring and deploying tacit

Table 3. Regression results controlling for firm effects

	Model 11	Model 12	Model 13
Control variables			
Ten dummy variables for 11 companies	(not reported <sup>a</sup> )	(not reported)	(not reported)
Geographic scope	-0.0016	-0.018	-0.032
Worldwide infrastructure	0.130	0.016	0.003
Market concentration	0.228*	0.273*	0.223*
Overseas market share	0.387*	0.372*	0.157
Brand image	0.185	0.388*	0.405**
Permeability of managers across borders	0.099	0.113	0.113
Independent variables			
(1) Extent of tacitness	-0.078	-0.002	0.062
(2) Cross-national teams	0.838		
(3) Teams with members having prior overseas experience		0.392	
(4) Frequency of communication			0.112
Interaction between 1 & 2	0.670*		
Interaction between 1 & 3		0.350	
Interaction between 1 & 4			0.18*
Model statistics			
$R^2$	0.82	0.825	0.823
Adjusted $R^2$	0.657	0.659	0.663
$F$	5.041***	4.96***	5.14***

<sup>a</sup>The beta coefficients of the 10 dummy variables were nonsignificant and are not reported for sake of brevity.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ ; \*\*\*\* $p < 0.001$ ;  $N = 40$

overseas knowledge. The study finds significant positive effects of transferring and deploying tacit overseas knowledge after controlling for the effects of several other factors known to influence organizational performance. Our findings provide compelling evidence that organizations effectively transfer and deploy tacit overseas knowledge for greater transnational new product development capabilities by acquiring information about tacit differences among countries through rich information-processing mechanisms.

Differences among countries have long been understood to complicate the process of developing products simultaneously for multiple country markets (e.g., Boddeyn *et al.*, 1986; Buzzell, 1968). Moreover, cultural differences among countries have been singled out as prime culprits in creating difficulty (Jain, 1989). However, prior studies have neither examined nor even noticed the competitive implications of the choices firms make about which kinds of differences they will address. Our study suggests that it is useful to focus on tacit differences among countries despite the intrinsic difficulties in doing so, since tacit information could provide firms with unique insights leading to greater innovation opportunities. Indeed, our results confirm that firms which harness tacit insights about overseas markets are more likely to have greater transnational new product development capabilities.

### Focus on tacit differences among countries

In our study we chose to limit our consideration of tacit overseas knowledge to knowledge about tacit differences, as opposed to tacit similarities, among country markets. We did so because we believe understanding the differences among countries is a critical issue for managers developing transnational products. Indeed, even in focusing solely on tacit differences, our study finds unequivocal support for the positive effects of tacit overseas knowledge on transnational product development capability. However, it is important to recognize that knowledge about tacit similarities among countries may also be significant and might well complement a firm's knowledge about tacit differences. Future studies could examine whether including similarities in tacit overseas knowledge might refine our understanding of the variance in transnational product development capabilities. It is possible that the effects

would be greater simply because deploying more tacit overseas knowledge of any kind might lead to greater capability. It is also possible that the additional effects would not be significant, or even that researchers would find that tacit similarities had already been accounted for: when overseas managers provide information about what they believe to be unique characteristics of their own markets, centralized transnational product development teams may be sifting through that information and picking up cues about similarities as well. In addition to examining the effects of understanding tacit similarities, future studies could also broaden the analysis to include other aspects of tacit knowledge in order to test their impact on firm capabilities.

### CONTRIBUTIONS

This study makes several important contributions to theory, methodology, and business practice. From a theoretical standpoint, it contributes to the global strategy literature by providing new insights into a previously unaddressed but critical aspect of competing in worldwide markets. By considering knowledge as a primary asset within organizations, this study also contributes to the emerging knowledge-based view of the firm. This view contends that the competitive advantage of a firm lies in its ability to create, store, and apply knowledge (Conner and Prahalad, 1996; Spender, 1996; Zander and Kogut, 1995). Of particular interest to this research stream has been the significance of tacit knowledge within organizations. Tacit knowledge is now widely believed to be an important and untapped source of competitive advantage. This study is one of the first to provide empirical evidence of the critical role of tacit knowledge in influencing firm capabilities.

From a methodological perspective, this study develops new measures for key constructs such as tacit knowledge and firm capabilities. The measures exhibit acceptable properties and could therefore provide valid approaches for future studies, which might refine as well as apply them. From a managerial perspective, this study provides guidelines for managers who must make some critical choices in the process of developing new transnational products. It emphasizes the importance of designing transnational products with features geared toward differences among

countries that are not apparent to all competitors.

A few possible limitations of this study may be apparent. One is our use of a single informant for each project. However, our focus on very specific project-team-level activities (as vs. broader issues such as organizational culture where one might find considerable heterogeneity across different subunits) and our collection of information from a knowledgeable project team member mitigate the general weakness associated with the use of a single informant (Venkatraman and Grant, 1986). Another related problem might be a common method bias. However, considering that all the hypotheses were based upon interaction effects rather than main effects, it is unlikely that the common method bias would have produced our results. In other words, it is unlikely that managers would have an 'interaction-based theory' in their minds that could be systematically biasing their responses and these results.

Finally, it should also be noted that the incremental  $R^2$  of the effects of tacit knowledge are small compared to the cumulative effects of all the control variables put together. These effects are nevertheless important, since they underscore a relatively unconventional approach managers might take to enhance transnational new product development capabilities. Discerning such an atypical approach to enhancing their capabilities provides companies with fresh avenues and more opportunities to maintain or widen their lead over their competitors. This is particularly true as multinational rivals are fast reaching parity in how they compete, and companies can no longer afford to ignore approaches that create differential capabilities—even if their effects are small. We believe that our study has an important role to play in disseminating to practitioners such new ideas and approaches.

## CONCLUSIONS

Our study sheds light on some important but unaddressed aspects of innovation processes of firms competing in worldwide markets. We examined the ways in which firms effectively transfer and deploy overseas knowledge in order to create superior capabilities for transnational new product development. Our evidence confirms that the transfer and deployment of tacit overseas knowl-

edge is associated with greater transnational new product development capabilities. Our results also reveal that the effective deployment of such knowledge entails its acquisition by product development teams through rich information processing mechanisms. These mechanisms include cross-national teams, teams with members who have prior overseas experience, and frequent communication among project team members and overseas managers.

## ACKNOWLEDGEMENTS

This study has been supported by the Carnegie Bosch Institute through a grant on the topic 'Knowledge in International Corporations' and the Boston University Systems Research Center. This material is also based on the work supported by the National Science Foundation under grant number SBR-9422284 to the second author. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

We wish to thank Luis Martins, Michael Lubatkin, Steve Floyd, Michael Hitt, Robert Nixon, William Schulze, and Mark Youndt for their comments on earlier drafts of this paper. We also thank Steve Rosenthal, Sushil Vachani, and Kenneth Hatten for their inputs. We are grateful to two anonymous reviewers for their helpful suggestions.

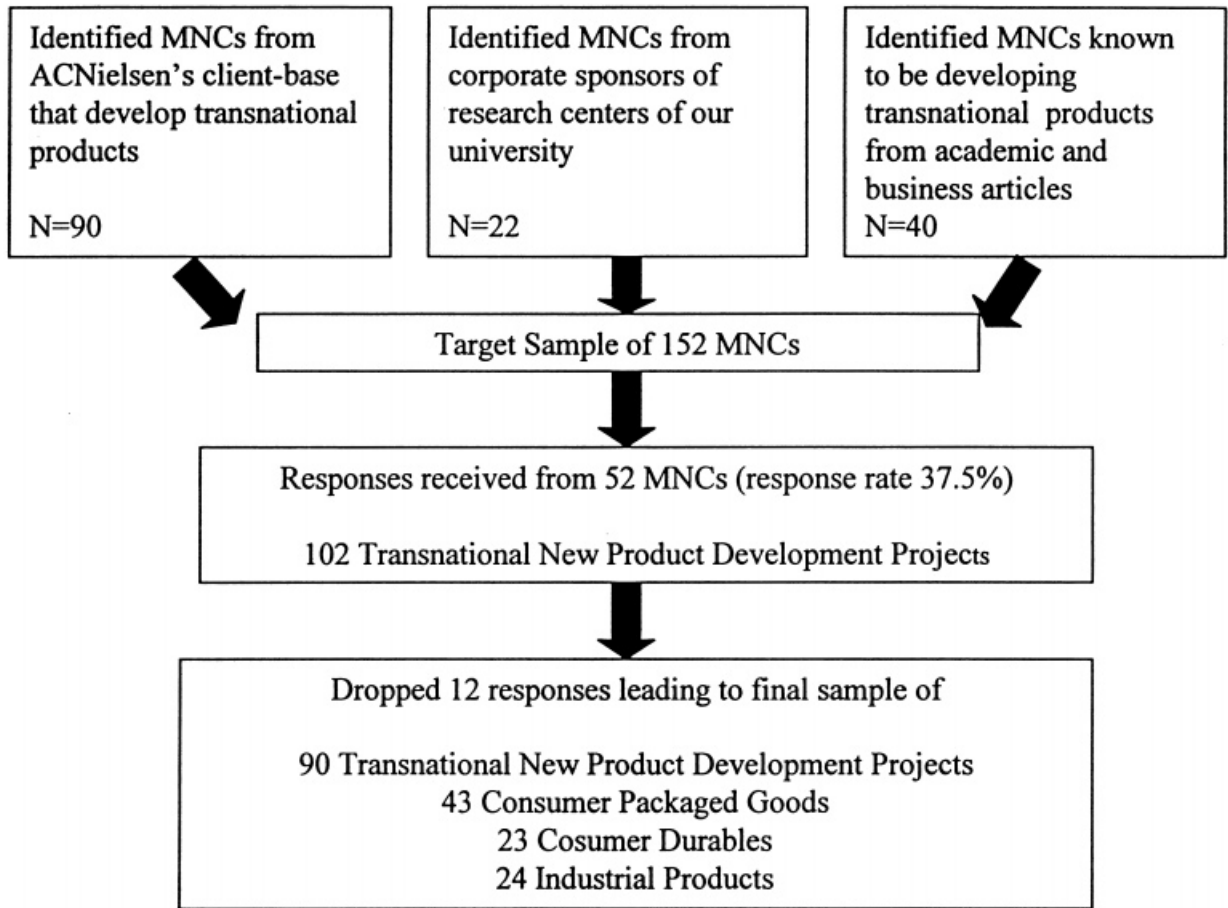
## REFERENCES

- Allen TJ. 1977. *Managing The Flow of Technology: Technology Transfer and the Dissemination of Technological Information within the R&D Organization*. MIT Press: Cambridge, MA.
- Amit R, Schoemaker P. 1993. Strategic assets and organizational rents. *Strategic Management Journal* **14**(1): 33–46.
- Banbury CM, Mitchell W. 1995. The effect of introducing important incremental innovations on market share and business survival. *Strategic Management Journal*, Summer Special Issue **16**: 161–182.
- Barney JB. 1991. Firm resources and sustained competitive advantage. *Journal of Management* **17**(1): 99–120.
- Bartlett CA, Ghoshal S. 1989. *Managing Across Borders*. Harvard Business School Press: Boston, MA.
- Boddewyn JJ, Soehl R, Picard J. 1986. Standardization

- in international marketing: is Ted Levitt in fact right? *Business Horizons* 29(6): 69–75.
- Bower GH, Hilgard ER. 1981. *Theories of Learning*. Prentice-Hall: Englewood Cliffs, NJ.
- Buzzell R. 1968. Can you standardize multinational marketing? *Harvard Business Review* 46(6): 102–113.
- Cavusgil ST, Zou S, Naidu GM. 1993. Product and promotion adaptation in export ventures: an empirical investigation. *Journal of International Business Studies* 24(3): 479–506.
- Chen M-J, Stucker K. 1997. Multinational management and multimarket rivalry: toward a theoretical development of global competition. *Academy of Management Proceedings*, Boston, 2–6.
- Cheng JLC, Bolon DS. 1993. The management of multinational R&D: a neglected topic in international business research. *Journal of International Business Studies* 24(1): 1–18.
- Clark HH, Marshall CR. 1981. Definite reference and mutual knowledge. In *Elements of Discourse Understanding*, Aravind J, Webber BL, Sag IA (eds). Cambridge University Press: Cambridge, UK; 10–63.
- Cohen WM, Levinthal DA. 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly* 35: 128–152.
- Conner KR, Prahalad CK. 1996. A resource-based theory of the firm: knowledge versus opportunism. *Organization Science* 7(5): 477–501.
- Daft RL, Lengel RH. 1986. Organizational information requirements, media richness and structural design. *Management Science* 32: 554–571.
- Dierickx I, Cool K. 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Science* 35: 1504–1511.
- Dunning JH. 1980. Toward an eclectic theory of international production. *Journal of International Business Studies*, Spring–Summer: 9–31.
- Egelhoff W. 1988. *Organizing the Multinational Enterprise: An Information Processing Perspective*. Ballinger: Cambridge, MA.
- Galbraith JR. 1977. *Organization Design*. Addison-Wesley: Reading MA.
- Ganesh J, Kumar V. 1996. Capturing the cross-national learning effect: an analysis of an industrial technology diffusion. *Journal of the Academy of Marketing Science*, 24(Fall): 328–337.
- Ghoshal S. 1987. Global strategy: an organizing framework. *Strategic Management Journal* 8(5): 424–440.
- Ghoshal S, Korine H, Szulanski G. 1994. Interunit communication in multinational corporations. *Management Science* 40(1): 111–122.
- Grant RM. 1996. Prospering in dynamically-competitive environments: organizational capability as knowledge integration. *Organization Science* 7(4): 375–387.
- Gresov C. 1989. Exploring fit and misfit in multiple contingencies. *Administrative Science Quarterly* 34(3): 431–453.
- Gupta AK, Govindarajan V. 1993. Coalignment between knowledge flow patterns and the strategic systems and processes within MNCs. In *Implementing Strategic Processes: Change, Learning and Cooperation*, Lorange P, Chakravarthy B, Roos J, Van de Ven A (eds). Basil Blackwell: London; 329–346.
- Gupta AK, Govindarajan V. 2000. Knowledge flows within multinational corporations. *Strategic Management Journal* 21(4): 473–496.
- Hamel G, Prahalad CK. 1985. Do you really have a global strategy? *Harvard Business Review* 63(4): 139–148.
- Jain S. 1989. Standardization of international marketing strategy. *Journal of Marketing* 53(1): 70–79.
- Kalish S, Mahajan V, Muller E. 1995. Waterfall and sprinkler new product strategies in competitive global markets. *Journal of International Marketing* 2(1): 29–52.
- Kogut B, Zander U. 1993. Knowledge of the firm and the evolutionary theory of the MNC. *Journal of International Business Studies* 24(4): 625–645.
- Krackhardt D. 1992. The strength of strong ties. In *Networks and Organizations*, Nohria N, Eccles B (eds). Harvard Business School Press: Boston, MA; 216–239.
- Krauss RM, Fussell SR. 1991. Constructing shared communicative environments. In *Perspectives on Socially Shared Cognition*, Resnick LB, Levine JM, Teasley SD (eds). American Sociological Association: Washington DC; 172–200.
- Leonard-Barton D. 1995. *Well-Springs of Knowledge: Building and Sustaining the Sources of Innovation*. Harvard Business School Press: Boston, MA.
- Levitt T. 1983. The globalization of markets. *Harvard Business Review* 61(3): 92–102.
- Madhavan R, Grover R. 1998. From embedded knowledge to embodied knowledge: new product development as knowledge management. *Journal of Marketing* 62(4): 1–12.
- Nobel R, Birkinshaw J. 1998. Innovation in multinational corporations: control and communication patterns in international R&D operations. *Strategic Management Journal* 19(5): 479–496.
- Nobeoka K, Cusumano MA. 1997. Multi-project strategy and sales growth: the benefits of rapid design transfer in new product development. *Strategic Management Journal* 18(3): 169–186.
- Nohria N, Ghoshal S. 1994. Differentiated fit and shared values: alternatives for managing headquarters–subsidiary relations. *Strategic Management Journal* 15(6): 491–502.
- Nonaka I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science* 5(1): 14–37.
- Nonaka I, Takeuchi H. 1995. *The Knowledge Creating Company*. Oxford University Press: New York.
- Ohmae K. 1985. *Triad Power: The Coming Shape of Global Competition*. Free Press: New York.
- Ohmae K. 1990. *The Borderless World: Power and Strategy in the Interlinked Economy*. Harper Perennial: New York.
- Porter ME. 1980. *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. Free Press: New York.
- Porter ME. 1986. Competition in global industries: a

- conceptual framework. In *Competition in Global Industries*, Porter ME (ed). Harvard Business School Press: Boston, MA; 16–60.
- Polanyi M. 1966. *The Tacit Dimension*. Routledge & Kegan Paul: London.
- Prahalad CK, Doz Y. 1987. *The Multinational Mission: Balancing Local Demands and Global Vision*. Free Press: New York.
- Prahalad CK, Hamel G. 1990. The core competence of the corporation. *Harvard Business Review* **68**(3): 79–91.
- Quinn JB. 1992. *Intelligent Enterprise: A Knowledge and Service Based Paradigm for Industry*. Free Press: New York.
- Samiee S, Roth K. 1992. The influence of global marketing standardization on performance. *Journal of Marketing* **56**(2): 1–17.
- Spender JC. 1996. Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, Winter Special Issue **17**: 45–62.
- Stewart TA. 1997. *Intellectual Capital: The New Wealth of Organizations*. Currency Doubleday: New York.
- Subramaniam M, Rosenthal SR, Hatten KJ. 1998. Global new product development: preliminary findings and research propositions. *Journal of Management Studies* **35**(6): 773–796.
- Takeuchi H, Porter ME. 1986. Three roles of marketing in global strategy. In *Competition in Global Industries*, Porter ME (ed.). Harvard Business School Press: Boston, MA; 111–146.
- Teece DJ. 1977. Technology transfer by multinational firms: the resource cost of transferring technological know-how. *The Economic Journal*, **87**(346): 242–261.
- Tushman ML, Nadler DA. 1978. Information processing as an integrating concept in organization design. *Academy of Management Review*, **3**(3): 613–624.
- Van de Ven AH, Delbecq AL. 1974. A task contingent model of work-unit structure. *Administrative Science Quarterly* **19**(2): 183–197.
- Venkatraman N. 1989. The concept of fit in strategy research: toward verbal and statistical correspondence. *Academy of Management Review* **14**(3): 423–444.
- Venkatraman N, Grant JH. 1986. Construct measurement in organizational strategy research: a critique and proposal. *Academy of Management Review* **11**(1): 71–87.
- Venkatraman N, Ramanujam V. 1987. Measurement of business economic performance: an examination of method convergence. *Journal of Management* **13**(1): 109–122.
- von Hippel E. 1994. Sticky information and the locus of problem solving. *Management Science* **40**(4): 429–439.
- Yip GS. 1995. *Total Global Strategy*. Prentice-Hall: Englewood Cliffs, NJ.
- Zander U, Kogut B. 1995. Knowledge and the speed of transfer and imitation of organizational abilities: an empirical test. *Organization Science* **6**(1): 76–92.

**APPENDIX A: OUR SAMPLING APPROACH**



Note: Appendix B provides the list of MNCs and product categories surveyed. The list presents a broad description of the transnational product categories surveyed. We however got responses from projects that were associated with a finer distinction among these product categories. For example, among refrigerators there were different responses for refrigerators designed for tropical climates, and large size refrigerators. Similarly among baby foods, our responses reflected products that differed in terms of price points or the geographic regions they were targeted for. We took care to ensure that each of our responses reflected an independent transnational new product development project and a distinct associated transnational product category.

**APPENDIX B: COMPANIES AND PRODUCT CATEGORIES REPRESENTED IN THE SAMPLE**

Sr.No.	Company	Product Category
1.	3M	Sponges, Cosmetics
2.	Abbot Laboratories	Baby food
3.	Alberto Culver	Shampoo
4.	Bausch & Lomb	Contact lenses
5.	Becton Dickinson	Digital thermometers, Insulin injectors
6.	Black & Decker	Cordless drills
7.	British-American Tobacco	Cigarettes
8.	Brown Group	Children's footwear
9.	Caterpillar Company	Hydraulic excavators
10.	Cummins	Diesel engines
11.	Daewoo	Dishwashers, Hydraulic excavators, Forklift Trucks, Machine tools
12.	Duracell	Batteries
13.	Eastman Kodak	Films, Digital cameras
14.	Fuji Xerox	Copiers
15.	GE Appliances	Refrigerators
16.	Gillette	Writing instruments, Razors
17.	Hallmark Cards	Greeting cards
18.	Helene Curtis	Cosmetics
19.	Hershey Foods	Chocolate confectioneries
20.	Hewlett Packard	Medical imaging devices, Printers, Digital cameras
21.	Honeywell	Temperature control systems
22.	Jafra Cosmetics	Cosmetics
23.	Johnson & Johnson	Toothbrushes
24.	Liptons	Food products
25.	L'Oreal	Cosmetics
26.	Lucent Technologies	PBX systems
27.	Maytag	Dishwashers, Refrigerators
28.	Mead Johnson	Baby foods
29.	Motorola	Cellular telephones
30.	Nortel	PBX Systems
31.	Ocean Spray Cranberries	Food products
32.	Oral-B	Toothbrushes
33.	Osram Sylvania	Fluorescent lamps
34.	Parker Pen Company	Writing instruments
35.	Philips	Digital cameras
36.	Polaroid	Digital cameras, Films
37.	Reckitt & Colman	Air freshners
38.	Reebok	Athletic shoes
39.	Siemens	Induction motors, Generators
40.	Smith Kline Beecham	Toothpaste
41.	Tambrands	Tampons
42.	Tennant	Machine tools
43.	Trane Company	Room air conditioners
44.	Whirlpool	Refrigerators, Washing machines
45.	Wyeth-Ayerst International	Baby food

**APPENDIX C: CONSTRUCTS AND THEIR MEASURES**

1. Transnational New Product Development Capability (Cronbach Alpha: 0.84)

With respect to your key competitors, please rate how your *product category currently fares*, on the following dimensions:

- Frequency of new global product introductions
- Being first in the market with new product introductions
- Ability to introduce new versions simultaneously in several markets
- Ability to respond to unique requirements of different countries
- Ability to price competitively
- Ability to penetrate new overseas markets

Measured on a 1 to 7 scale: Much worse than competition — About the same — Much better than Competition

2. Extent of tacitness in overseas information (Cronbach Alpha: 0.81)

Please indicate the characteristics of the information acquired *from overseas locations* (about differences among overseas markets, manufacturability in overseas plants etc.) The information your project acquired:

Was simple	Was complex
Was easy to comprehensively document in manuals or reports	Was difficult to comprehensively document in manuals or reports
Was easy to comprehensively understand from written documents	Was difficult to comprehensively understand from written documents
Was easy to precisely communicate through written documents	Was difficult to precisely communicate through written documents
Was obvious to all competitors	Had subtle nuances known only to a few competitors
Was easy to identify without personal experience in the overseas locations	Was difficult to identify without personal experience in the overseas locations

Measured on a 1–7 scale 

Note: This question was preceded by two other questions that provided the survey respondents the background for this construct. These questions were:

1. How significant for your project was the following information to develop the new global product? (on a 1–7 scale: Was of no significance — Was of great significance)
2. How new or novel was the following information used by your project for developing the new global product? (on a 1–7 scale: Not at all new — Substantially new)
3. For each of these questions, the indicators were:
  - Information on overseas market preferences
  - Information on the feasibility of manufacturing various design alternatives in overseas plants
  - Information on differences among overseas markets

## 3. Cross-national teams

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Dummy variable — measured as 1 if there were overseas members in the team, 0 otherwise.

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## 4. Teams with domestic members having prior overseas experience

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Dummy variable — measured as 1 if the team had domestic members who were posted in overseas offices for at least a year, 0 otherwise.

---

## 5. Frequency of communication (Cronbach Alpha: 0.86)

---

How frequently did the following activities with regard to your project occur?

- Telephone conversations with overseas managers
- Faxes to and from overseas managers
- Email to and from overseas managers

Measured on a 1–7 scale: Very rarely (once a year) — Moderately (monthly) — Very frequently (daily)

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## 6 &amp; 7. Brand image in overseas markets and overseas market share (Control Variables)

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With respect to your key competitors, please rate how your product category currently fares, on the following dimensions:

- Brand image in key overseas markets
- Market share in key overseas markets

Measured on a 1–7 scale: Much worse than competition — About the same — Much better than competition

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## 8. Worldwide Marketing Infrastructure (Control Variable)

- Marketing/Sales offices that supported your product category

Measured with respect to ‘presence in important country markets’ of this indicator, on a 1–5 scale: In none 0% — In very few < 10% — In some (10–50%) — In most (50–90%) — In almost all (90–100%)

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## 9. Market Concentration (Control Variable)

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The market served by the global product:

- Had many competitors                      Had few competitors

Measured on a 1–7 scale.

---

## 10. Number of countries targeted (Control Variable)

---

Requirements of how many countries were important considerations for the new global product’s design?

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## 11. Permeability of managers across borders (Control Variable) (Cronbach Alpha: 0.88)

---

How prevalent were the following practices in your Division (at the time of the project)?

- Regular visits to HQ by overseas managers (middle management)
- Regular visits to overseas subsidiaries by HQ managers (middle management)
- Informal interactions between HQ and overseas subsidiary middle managers

Measured on a 1–7 scale: Very rare — Moderately prevalent — Extremely prevalent.

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