An exploration of multinational enterprise knowledge resources and foreign subsidiary performance

Yulin Fang a, Michael Wade b, Andrew Delios c, Paul W. Beamish d,*

a College of Business, City University of Hong Kong, 83 Tat Chee Avenue, Kowloon, Hong Kong, China
b IMD Business School, Ch. de Bellerive 23, P.O. Box 915, CH-1001 Lausanne, Switzerland
c Department of Strategy & Policy, National University of Singapore, 1 Business Link, 117592 Singapore, Singapore
d Ivey Business School, Western University, 1151 Richmond Street N, London, Ontario, Canada N6A 3K7

A R T I C L E   I N F O

Keywords: Knowledge transfer
International diversification
Synergy
Subsidiary performance
Foreign direct investment
Japanese firms

A B S T R A C T

Successful international expansion requires that parent firms simultaneously transfer multiple MNE knowledge resources and their foreign subsidiaries effectively absorb and utilize the knowledge. In this study, we examine the relationships between multiple knowledge resources (technological and marketing knowledge), the relatedness between parents and foreign subsidiaries, and subsidiary performance. Relatedness is specifically linked to the type of knowledge being transferred from the parent (i.e., technological relatedness versus market relatedness). We hypothesize that subsidiary performance improves with (1) the integration of a parent firm’s technological and marketing knowledge resources, (2) high technological (market) relatedness between a parent firm and subsidiaries for transfer of parent technological (market) knowledge and (3) the co-presence of high technological and market relatedness. We find general support in our analysis of pooled cross-sectional data on more than 4000 observations of foreign subsidiaries from 572 Japanese MNEs across 47 countries. Theoretical implications and future research are discussed.

© 2012 Elsevier Inc. All rights reserved.

1. Introduction

The success of an MNE’s internationalization depends on its capacity to transfer knowledge to foreign subsidiaries and, in turn, on the capability of these subsidiaries to use that knowledge (Dunning & Lundan, 2008, chaps. 5 and 11). Numerous research efforts have been made to understand the determinants of a successful cross-border knowledge transfer (e.g., Gupta & Govindarajan, 2000; Williams, 2007; Winter & Szulanski, 2001) and the performance implications for foreign subsidiaries (e.g., Delios & Beamish, 2001; Fang, Wade, Delios, & Beamish, 2007). Two streams of literature have shaped the growth of this research area. The first stream, based on the resource-based view of the firm (Barney, 1991), contends that sustainable, superior subsidiary performance comes from the possession, transfer and deployment of the parent’s valuable, rare, and inimitable resource (Capron & Hulland, 1999; Caves, 1996; Chatterjee & Wernerfelt, 1991; Delios & Beamish, 2001; Fang et al., 2007). The second stream, based on absorptive capacity theory, has focused on the ability of subsidiaries to effectively manage knowledge transferred from their parent (Cohen & Levinthal, 1990; Zahra & George, 2002). Research in this area has shown that subsidiaries with a higher absorptive capacity learn more from their parent firms, resulting in superior subsidiary performance (Bjorkman, Stahl, & Vaara, 2007; Dhanaraj, Lyles, Steensma, & Tihanyi, 2004; Lane, Salk, & Lyles, 2001).

These two research streams, while important, contain two major shortcomings. First, they tend to focus on only one side of the knowledge transfer dyad – either the parent or the subsidiary – and remain largely disconnected from the other. We argue that effective knowledge transfer can only take place if the following conditions are present: the sender’s knowledge resources are valuable, the recipient has the ability to absorb those knowledge resources, and the recipient can effectively utilize those knowledge resources, once absorbed (Gupta & Govindarajan, 1991, 2000). Treating the two sides of the knowledge transfer dyad as independent, and assessing their performance impacts on subsidiaries separately, could preclude the development of a more complete picture of a successful knowledge transfer.

Second, most empirical research examines knowledge transfer within a single knowledge domain, and thus ignores the multifaceted nature of knowledge needed for subsidiary operations. The building and ongoing operation of a subsidiary, especially that of a self-sustained business operation, requires a broad scope of knowledge transfer. That is, a considerable portion
of the total knowledge endowment of a subsidiary needs to be transferred from the parent (Winter & Szulanski, 2001). For instance, a greenfield foreign subsidiary needs both technological knowledge to manufacture its products and marketing knowledge to better compete in the local markets it serves. Competitive advantage can be enhanced when these two knowledge resources are jointly present (Grant, 1996). The extant empirical research has only examined the joint effect of multiple knowledge resources on corporate-level performance, without a focus on the joint effect of parent knowledge on subsidiary performance in the context of parent–subsidiary knowledge transfer (e.g., Song, Droge, Hanvanich, & Calantone, 2005; Tanriverdi & Venkatraman, 2005), or the direct, independent effects of parent knowledge resources on subsidiary performance. In the absence of empirical research on the integration of multiple knowledge resources (e.g., Delios & Beamish, 2001; Fang et al., 2007), there remains little empirical evidence as to the extent to which joint presence of multiple parent-firm knowledge resources collectively affects subsidiary performance in the context of knowledge transfer dyads.

Building on dynamic capability theory and the knowledge transfer literature, this study addresses these shortcomings and adds to the literature on multinational knowledge transfer by addressing the following research question: ‘What is the impact on subsidiary performance of the interaction between multiple parent knowledge resources, between parent and subsidiary knowledge resources, and between multiple subsidiary knowledge resources?’ To concisely address these complex interaction effects, we limit our discussion within the context of the simultaneous transfer of two types of strategically important parent firm knowledge resources: technological and marketing knowledge. These two types of knowledge are chosen because they are not only known as the complementary knowledge domains from which MNEs seek to develop synergies (e.g., Chatterjee & Wernerfelt, 1991; Song et al., 2005; Tanriverdi & Venkatraman, 2005; Teece, 1986), but also vital to an MNE’s internationalization strategy (Anand & Delios, 2002). We hypothesize that synergistic effects of subsidiary performance can result from (1) the interaction between parent technological and marketing knowledge resources, (2) the interaction between parent technological (marketing) knowledge resources and subsidiary technological (market) relatedness, and (3) the interaction between subsidiary technological and market relatedness. We find general support in our analysis of over 4000 observations of foreign subsidiaries from 572 Japanese MNEs across 47 countries.

The research described in this paper is part of a larger stream of work that investigates firm internationalization based on Japanese foreign direct investments (Beamish, 2011). Specifically, this study extends research on subsidiary performance implications of parent knowledge resources (e.g., Delios & Beamish, 2001; Fang et al., 2007). Prior studies investigated the independent effects of parent knowledge stocks on subsidiary performance, cross-sectionally (Delios & Beamish, 2001) and temporally (Fang et al., 2007). More recent research examined these relationships in the context of different levels of expatriate involvement (Fang, Jiang, Makino, & Beamish, 2010). The present study extends these lines of research by exploring the important issue of how subsidiary performance results from the interaction between different parent knowledge resources, and how the additional variables of subsidiary relatedness interact with parent knowledge resources, and with each other, to impact subsidiary performance.

2. Background and hypotheses

In this study, technological knowledge is defined as a parent firm’s ability to generate product-related activities, that are often embodied in product R&D, production processes, special tools and machinery, and proprietary expertise (Chatterjee & Wernerfelt, 1991). Technological knowledge is an upstream asset that is intrinsically fungible across different geographic areas (Anand & Delios, 2002). Marketing knowledge is defined as the intangible resources that enable a firm to analyze markets, build and maintain brands, and develop plans to sell products and services (Capron & Hulland, 1999). Marketing knowledge is seen as an important downstream asset that is less fungible geographically (Anand & Delios, 2002). Upstream (technological) and downstream (marketing) knowledge are recognized as two complementary knowledge domains that MNEs leverage for business expansion (Song et al., 2005; Teece, 1986).¹

The theory of dynamic capabilities has been used to explain and predict the synergistic benefits to a firm that result from the integration of technological knowledge and marketing knowledge (Song et al., 2005). The dynamic capabilities perspective posits that a firm can leverage the performance impact of its existing internal and external resources through development, integration and reconfiguration (Drmevich & Kriauciuonas, 2011; Eisenhardt & Martin, 2000; Teece, Pisano, & Shuen, 1997). Although successful in conceptualizing how firms leverage multiple existing knowledge resources to yield higher performance returns, the theory assumes the firm, rather than the parent–subsidiary dyad, as being the unit of analysis and thus does not completely explain how the two knowledge resources are integrated during the process of knowledge transfer from parent to subsidiary.

Integrating the knowledge transfer literature (Easterby-Smith, Lyles, & Tsang, 2008) into dynamic capability theory, we propose that there are two mechanisms through which technological knowledge and marketing knowledge jointly affect a subsidiary’s performance. The first mechanism focuses on central integration, i.e., the dynamic capability of the parent (knowledge sender) to integrate the two types of knowledge before transferring them to its subsidiaries (Winter & Szulanski, 2001). The second mechanism focuses on local integration, i.e., the dynamic capability of the subsidiary to receive, integrate and locally assimilate the two types of knowledge transferred from the parent (Todorova & Durisin, 2007; Zahra & George, 2002).

In the next section, we present our research model and hypotheses. In this study, we only consider interaction and moderation effects. The existence of significant and substantive direct effects has been established in prior work (Delios & Beamish, 2001; Fang et al., 2007; Lane et al., 2001). We report on these direct effects in the data analyses, but for the sake of brevity, we do not present hypotheses for these relationships.

2.1. Central integration – dynamic capabilities of the parent

The first knowledge transfer mechanism suggests that the parent firm integrates multiple knowledge resources at its headquarters and then relays the combined form of knowledge, as applied through a set of business activities, to its subsidiaries. The subsidiaries, in turn, are required to replicate these knowledge resources as is, without needing to understand their causes, consequences, and interdependence (Williams, 2007). This approach to knowledge transfer reflects the “dynamic capabilities of the center” (Winter & Szulanski, 2001), or the capabilities that reflect the parent’s ability to adaptively reconfigure and integrate the existing firm resources to address changing environments (Teece et al., 1997), particularly those surrounding individual subsidiaries. For example, the successful

¹ Technological and marketing knowledge are not the only examples of MNE knowledge resources. A firm’s knowledge of other tasks, such as logistics management and human resources management, is also important. Future research may examine the synergistic effects of other strategic knowledge resources.
design and implementation of a template business model, led and coordinated by the restaurant chain McDonald’s headquarters, entails the effective integration of technological knowledge, including an understanding of the values and features of each market’s products, the procedures involved in local production; and marketing knowledge, including the advertising tactics specific to each distinct local market (Winter & Szulanski, 2001). Such an integrative use of these two types of knowledge produces synergistic values beyond which either could provide independently. Thus, based on the approach of central integration of multiple knowledge resources, we hypothesize that the joint presence of parent technological knowledge and marketing knowledge, once integrated and transferred to the subsidiary, will contribute positively to subsidiary performance.

**H1.** A foreign subsidiary’s performance is positively associated with the interaction of its parent firm’s marketing and technological knowledge resources (in addition to the main effects of each knowledge resource on subsidiary performance).

### 2.2. Local integration – dynamic capabilities of the subsidiary

The second knowledge transfer mechanism stresses the dynamic capabilities of the subsidiary (knowledge recipient) to integrate multiple knowledge resources. In this case, the subsidiary needs to receive parent knowledge and then integrate the transferred knowledge locally, a dynamic capability possessed by the subsidiary, which is commonly understood as absorptive capacity (Volberda, Foss, & Lyles, 2010). While absorptive capacity could be affected by other factors (Lane & Lubatkin, 1998; Lane et al., 2001), in this study we propose that relatedness between parent and subsidiary would play an important role in affecting the effectiveness of the subsidiary receiving related knowledge from the parent. Consistent with our earlier choices of knowledge at the parent side, we focus on technological relatedness and market relatedness. Technological relatedness refers to the subsidiary’s prior knowledge relative to the parent’s products, whereas market relatedness refers to the subsidiary’s prior knowledge relative to the parent’s market situation.

Subsidiary relatedness facilitates the dynamic capability of the subsidiary to receive and assimilate parent knowledge, for the following reasons. First, related subsidiaries are more familiar with the knowledge transferred from the parent than unrelated subsidiaries, and therefore are more capable of absorbing knowledge from the parent (Lane et al., 2001). For instance, Lane et al. (2001) found that a subsidiary’s dynamic capability to assimilate knowledge is higher if its business is related to that of its parent and its local culture is compatible with that of the parent. Similar conclusions are drawn in other studies (Vaara, Sarala, Stahi, & Bjorkman, 2012). Conversely, if subsidiaries are unrelated to their parents, for example in terms of a cultural difference between the home and host countries, their relative knowledge assimilation capacities are lower (Bjorkman et al., 2007).

Second, related subsidiaries feature higher inter-unit homophily, defined as the degree to which two or more interacting units are similar in specific attributes ( Rogers, 1995). When interacting units share similar attributes such as common meanings, concerns, and priorities, the communication of new ideas is more likely to have a greater effect on knowledge gain (Rogers, 1995). For instance, related businesses tend to have a similar dominant logic (Lyles, 1991; Mjoen & Tallman, 1997); that is, managers regularly face similar types of problems (Bettis & Prahalad, 1995), such as similar business objectives and the usage of strategic resources (Grant, Jammine, & Thomas, 1988; Lane et al., 2001). Similar dominant logics between a subsidiary and its parent affect the subsidiary’s ability to appropriately exploit parent knowledge (Bjorkman, Barner-Rasmussen, & Li, 2004; Lane & Lubatkin, 1998). Research has shown that related subsidiaries are likely to result in more learning from its parent (Lane et al., 2001), a higher likelihood of survival (Kogut, 1989), and superior performance (Andersson, Forsgren, & Holm, 2002; Wade & Gravill, 2003). Conversely, if a subsidiary is involved in an unrelated business, it is unlikely that the underlying rationale for collaboration is that of learning from each other (Inkpen, 1997).

Third, related subsidiaries have a higher motivation to learn from their parent because knowledge residing with the parent is more valuable and relevant. Relevance provides the pathways through which new knowledge connects to prior knowledge (Schulz, 2003). For instance, when a subsidiary shares the product designs, interfaces, parts, and manufacturing processes of its parent, it can reuse that knowledge within the firm to reduce development and production costs, and speed up new product development (Meyer & Lehnerd, 1997), resulting in synergies arising from related product knowledge across business units (Bettis, 1981; Rumelt, 1982). Such relevant experience and knowledge is a strong motivation for subsidiaries to assimilate knowledge from the parent (Gupta & Govindarajan, 2000; Minbaeva, Pedersen, Bjorkman, Fey, & Park, 2003), and leads to strengthened knowledge inflows to the subsidiary (Schulz, 2003). Due to the ability of relatedness to enhance familiarity, inter-unit homophily, and the motivation to exchange knowledge between parent and subsidiary, we believe that subsidiary relatedness can allow subsidiaries to more effectively receive and assimilate knowledge transferred from the parent.

In the case of technological knowledge transfer, the subsidiary first applies its technological dynamic capability to acquire and assimilate the parent’s technological knowledge (Ciabuschi, Dellestrand, & Kappen, in press). A higher level of technological relatedness to the parent can enable the subsidiary to acquire and assimilate a larger proportion of a parent’s given technological knowledge (Cohen & Levintal, 1990; Phene & Almeida, 2008), which leads to a greater impact of the parent’s technological knowledge on subsidiary performance. Using prior related knowledge as an indicator of technological knowledge transfer capability, other studies have shown a link to improved local business operations (Lane & Lubatkin, 1998; Lane et al., 2001).

**H2.** A foreign subsidiary’s technological relatedness to its parent positively moderates the relationship between its parent-firm’s technological knowledge and subsidiary performance. Thus, the greater the level of technological relatedness, the stronger the relationship between a parent firm’s technological knowledge and subsidiary performance.

Similarly, market relatedness allows the subsidiary to acquire and assimilate a larger portion of marketing knowledge from its parent. Although a brand’s value can be transferred to new products or to new product categories (Bergen, Dutta, & Shugan, 1996; Park & Srivivasan, 1994), a brand’s transfer to a foreign subsidiary may present challenges due to differences in consumer markets and consumer knowledge within different countries, along with other sources of institutional variance (Katsikeas, Samiee, & Theodosiou, 2006). Such differences in host country markets require that a firm understand local customer preferences and communicate the brand in a manner that favors local customers’ interests (Day, 1994). Thus, subsidiaries with prior related market knowledge would be in a better position to assimilate useful marketing knowledge from the parent, which can lead to a greater impact on subsidiary performance.

**H3.** A foreign subsidiary’s market relatedness to its parent positively moderates the relationship between its parent-firm’s marketing knowledge and subsidiary performance. Thus, the greater
the level of market relatedness, the stronger the relationship between a parent firm’s marketing knowledge and subsidiary performance.

Once technological and marketing knowledge have been transferred from the parent firm, the subsidiary can proceed to adapt and integrate its into local operations (Cohen & Levinthal, 1990; Zahra & George, 2002). As discussed earlier, adapting and integrating valuable technological and marketing knowledge can produce synergistic results. The subsidiary can realize these results through mutual adaptation of the assimilated technological and marketing knowledge (Hong & Nguyen, 2009). The higher the subsidiary and parent’s technological relatedness, the more effectively parent firm technological knowledge can be adapted. Similarly, the higher the subsidiary and parent’s market relatedness, the more effectively the parent firm’s marketing knowledge can be adapted. From a dynamic capability perspective, these two types of relatedness can facilitate the local reconfiguration of transferred knowledge, and integrate both with existing operations, and with each other (Eisenhardt & Martin, 2000; Kogut & Zander, 1992; Teece et al., 1997). It follows that the joint presence of strong technological and market relatedness can facilitate the mutual adaptation and collective integration of these two types of knowledge, leading to superior subsidiary performance. Thus, we hypothesize:

H4. A foreign subsidiary’s performance is positively associated with the interaction between the subsidiary’s market and technological relatedness (in addition to the main effects of each capacity on subsidiary performance).

3. Methodology

3.1. Sample and data

The data we used to test the hypotheses in the research model were drawn from sources on Japanese foreign direct investment (FDI). We chose Japanese firms as the data sample for a number of reasons. First, Japan is one of the leading sources of FDI in the world and is the second-largest foreign investor in the United States (after the United Kingdom). Moreover, Japanese firms hold the largest stock of FDI in Asia. They also have a leading FDI position in many European countries (Beamish & Inkpen, 1998). Second, compared with Western firms, most large Japanese firms centralize their R&D investment at the home base (Gerybadzea & Reger, 1999; Granstrand, 1999; Lam, 2003). Likewise, the Japanese firms’ advertising efforts largely originate at the parent level. Subsidiaries benefit from the marketing expertise and brand loyalty created by the centralized market efforts (Chang, 1995). This provides a basis for the assumption that, at least for Japanese multinational firms, most technological and marketing knowledge reside with the parent firm and that transfer takes place vertically from the headquarters to the subsidiaries. Researchers have also found that even in MNEs in other countries, knowledge transfer more frequently takes place in a top-down vertical fashion than via other routes (Gupta & Govindarajan, 2000). Hence, Japanese FDI constitutes an appropriate empirical setting in which to test the proposed theoretical model.

We sourced parent data from the Nikkei Economic Electronic Databank System (NEEDS) tapes, which report annual corporate financial information for all public companies listed on the four Japanese stock exchanges. We sourced data on foreign subsidiaries from multiple editions of Japanese Overseas Investments, a publication of Toyo Keizai. The corporate information from NEEDS was then matched to the subsidiary data using a unique four-digit security code. The same data source was used to examine the direct effects of technological and marketing knowledge in prior research (e.g., Delios & Beamish, 2001; Fang et al., 2007).2

We drew data at the country level from sources that were utilized in previous academic work. We gathered data on culture from Hofstede (1980), data on politico-regulatory environments from Henisz (2000), and data on economic conditions from the global competitive index of the World Economic Forum (2000). After linking country, parent, and subsidiary data and removing cases with missing values, the full sample comprised 4485 observations from 1640 subsidiaries of 572 parent firms across 47 countries, within an observation period between 1992 and 2003 (wholly owned subsidiaries – 48%, joint ventures – 52%, Asia – 52%, North America – 23%, Europe – 20%, others – 5%).

3.2. Measures

We utilized a subjective measure of subsidiary performance, as compiled in the annual surveys conducted by Toyo Keizai, due to a lack of publicly available subsidiary-level financial performance data. The content validity of this particular measure has been demonstrated in the literature (Delios & Beamish, 2001; Isobe, Makino, & Montgomery, 2000). We measured technological knowledge and marketing knowledge using a parent firm’s R&D and advertising intensity, respectively. R&D intensity is widely considered to be a major source of technological knowledge acquisition because it effectively captures the scale of a firm’s R&D activities that are conducted to accumulate knowledge about addressing technological changes (Cohen & Levinthal, 1990; Zahra & George, 2002). Numerous studies have used R&D intensity as a proxy for technological knowledge (Chang, 1995; Delios & Beamish, 1999; Fang et al., 2007; Kogut & Chang, 1991; Stimpert & Duhaime, 1997). We thus used a five-year average of the R&D intensity of the parent firm in the five years preceding the measurement of a subsidiary’s performance. Similarly, advertising intensity constitutes a major component of marketing knowledge because it captures the scale of a firm’s marketing and branding activities, and many empirical studies have used it as a common measure of a firm’s brand equity and marketing knowledge (Anand & Singh, 1997; Chang, 1995; Rossiter & Percy, 1997). We likewise used a five-year average of the parent firm’s advertising intensity in the five years preceding the measurement of a subsidiary’s performance.

We measured technological relatedness in terms of whether or not the subsidiary operated in the same industry as the parent. We differentiated between high versus low technological relatedness by comparing the two-digit Standard Industrial Classification (SIC) codes between a parent firm and its subsidiary, a proxy widely used for measuring product relatedness (Grant et al., 1988; Morosini, Shane, & Singh, 1998; Robins & Wiersema, 1995; Wade & Gravill, 2003). We also coded subsidiaries as operating in a related industry with related products when the SIC codes for the subsidiary and the parent were the same. If there was no match, we coded the subsidiary as operating in an unrelated industry with unrelated products.

We measured market relatedness according to the similarity of the subsidiary’s operating market to that of the parent. We differentiated between high versus low market relatedness using a variable that captured the aggregated effects of the cultural, political, and economic distances between the home country (Japan) and the host country. We also developed an aggregated formative measure of collectivity on country-level aspects to mitigate concerns that a single country attribute, such as culture, can have a weak predictive validity in explaining international differences.

---

1 We would like to thank Toyo Keizai and the Ivey Business School for their generosity in making the data available to us.
market distinctions if used in isolation (Dow, 2000). We did so by drawing on the view of modern social systems (Parsons, 1971), which suggests that societies consist of three basic subsystems; political conditions (Henisz & Delios, 2001), economic conditions (Woodard & Rolfe, 1993), and cultural conditions (Brouthers & Brouthers, 2001; Morosini et al., 1998). Accordingly, markets in different countries must be subject to a set of political, economic, and cultural boundaries that collectively differentiate one international market from another. Recent studies developed such measures at the firm level (Dow & Karunaratna, 2006; Goerzen & Beamish, 2003). We adapted them to the parent–subsidiary dyad level.

We measured the first component of market relatedness using Hofstede’s (1980) national cultural scores, by calculating an aggregate cultural relatedness between Japan and a host country by following the methodology of Kagut and Singh (1988). We calculated the political dimension by obtaining the absolute value of the difference between Japan’s and the host country’s political constraints scores (Henisz, 2000). The third component, a measure of economic disparity, was calculated by obtaining the absolute value of the difference between Japan’s and the host country’s economic competitiveness indexes (World Economic Forum, 2000).  

To produce a composite variable for market relatedness between Japan and the host country market, we applied a linear combination of the different scores for the culture, political constraints, and economic condition relatedness indexes to produce a formative indicator, following the statistical approach suggested by Hulland (1999). We chose the formative, rather than reflective indicator, based on the theoretical view of modern social systems in which the three components collectively constitute, but are not caused by, a modern social system (Parsons, 1971). The resultant formative factor was used as the proxy for the difference between the home and host-country markets, such that low values signified high market relatedness.

Control variables include measures of parent size and subsidiary size, each of which was a logarithmic transformation of the number of employees in a parent (Delios & Beamish, 2001; Dunning, 1993; Tallman & Li, 1996). We included the parent host country experience and its industry experience as control variables, which were calculated as the sum of subsidiary-years of operation in a host country and within a particular industry, respectively (Delios & Beamish, 2001). We also included measures for expatriate ratio, subsidiary age, entry mode, industry type as well as nation and region of the host country in the analyses (Fang et al., 2010).

### 3.3. Analytical techniques

We used ordered logistic regression to test our hypotheses. An ordered logistic regression model is an appropriate quantitative choice procedure when the dependent variable is ordinal but not ratio-scaled (Amemiya, 1981; Delios & Beamish, 2001). We used partial least square modeling to calculate a formative indicator of market relatedness (Hulland, 1999). We constructed interaction terms for the model by standardizing and multiplying respective parent/firm knowledge resources and subsidiary absorptive capacities (Aiken & West, 1991).

### 4. Results

Table 1 presents the correlation matrix of key variables. Low correlation values across most of the independent variables suggest that multi-collinearity did not threaten the results.

Table 2 presents the statistical results. Model 1 (i.e., the base model) shows the direct effects of all the independent and control variables while Models 2–5 show the hypothesized interaction effects (i.e., H1–H4, respectively). H1 states that a foreign subsidiary’s performance would be positively associated with the interaction of its parent firm’s marketing and technological knowledge resources. H1 is supported in Model 2 ($\beta = 0.09, p < 0.05$). The explanatory power of Model 2 significantly improved relative to Model 1 (Delta Chi-square = 6.5, $p < 0.05$).

We tested H2 in Model 3 with the interaction between subsidiary technological relatedness and parent technological knowledge. H2 was supported ($\beta = 0.16, p < 0.05$). The explanatory power of Model 3 was significantly improved relative to Model 1 (Delta Chi-square = 4.74, $p < 0.05$).

We tested H3 in Model 4 with the interaction between subsidiary market relatedness and parent marketing knowledge. H3 was also supported ($\beta = 0.35, p < 0.001$). The explanatory power of Model 4 was significantly improved relative to Model 1 (Delta Chi-square = 11.1, $p < 0.01$).

We tested H4 in Model 5 by examining the interaction between subsidiary technological relatedness and market relatedness to the parent. H4 was also supported ($\beta = 0.15, p < 0.01$). The explanatory power of Model 4 was significantly improved compared to the base Model 1 (Delta Chi-square = 3.85, $p < 0.05$).
TABLE 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketing knowledge</td>
<td>0.04</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Technological knowledge</td>
<td>0.13</td>
<td>0.04</td>
<td>0.12</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>Relatedness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market relatedness</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Technological relatedness</td>
<td>0.04</td>
<td>0.08</td>
<td>0.04</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Interaction effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1 Marketing × technological knowledge</td>
<td>-0.03</td>
<td>0.04</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.03</td>
</tr>
<tr>
<td>H2 Technological knowledge × Technological relatedness</td>
<td>0.11</td>
<td>0.02</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td>H3 Marketing knowledge × market relatedness</td>
<td>0.31</td>
<td>0.07</td>
<td>0.30</td>
<td>0.31</td>
<td>0.30</td>
</tr>
<tr>
<td>H4 Market × technological relatedness</td>
<td>0.09</td>
<td>0.07</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Organizational characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expatriate ratio</td>
<td>0.05</td>
<td>0.03</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Subsidiary size</td>
<td>0.04</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Subsidiary age</td>
<td>0.05</td>
<td>0.03</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Entry mode = JV</td>
<td>0.05</td>
<td>0.03</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Parent size</td>
<td>0.35</td>
<td>0.15</td>
<td>0.34</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>Host country experience</td>
<td>0.18</td>
<td>0.15</td>
<td>0.19</td>
<td>0.19</td>
<td>0.19</td>
</tr>
<tr>
<td>Industry experience</td>
<td>0.07</td>
<td>0.15</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>Regional variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Region = Asia</td>
<td>8656.10</td>
<td>8649.00</td>
<td>8651.00</td>
<td>8654.00</td>
<td>8652.00</td>
</tr>
<tr>
<td>Region = North America</td>
<td>298.50</td>
<td>305.00</td>
<td>303.24</td>
<td>309.60</td>
<td>302.35</td>
</tr>
<tr>
<td>Region = Europe</td>
<td>0.35</td>
<td>0.15</td>
<td>0.34</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>Incremental Chi-square</td>
<td>0.06</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Number of cases</td>
<td>4485</td>
<td>4485</td>
<td>4485</td>
<td>4485</td>
<td>4485</td>
</tr>
</tbody>
</table>

1. \( p < 0.1 \), two-tailed test.
2. \( p < 0.05 \), two-tailed test.
3. \( p < 0.01 \), two-tailed test.
4. \( p < 0.001 \), two-tailed test.

Note: Fixed effects for two-digit SIC codes for subsidiary industry, year of observation, and host-country nation dummies were included in the models but not reported.

5. Discussion

Our results reveal several important findings. First, subsidiary performance is strongly associated with the interaction effect of parent technological and marketing knowledge (see Fig. 1 for a plot of the interactions), implying that synergistic benefits arise from the integration of valuable resources by the parent. It is important to be aware of the synergistic effects arising from the combined usage of these knowledge resources because foreign subsidiary operations often require a broad scope of knowledge transfer from the parent, through which different types of knowledge must be leveraged to take effect simultaneously on subsidiary performance (Winter & Szulanski, 2001). However, previous research focused solely on the direct effects of parent knowledge on subsidiary performance (e.g., Delios & Beamish, 2001; Fang et al., 2007), and has not yet explicitly examined such synergistic effects in the context of parent/subsidiary knowledge transfer, except for limited qualitative investigations (e.g., Szulanski & Jensen, 2006; Winter & Szulanski, 2001). Our study complements existing research by offering quantitative empirical evidence.

Second, our research conceptually argues and empirically illustrates that relatedness helps the subsidiary more effectively absorb corresponding parent functional knowledge, thus amplifying subsidiary performance outcomes. We make this point by showing that a subsidiary’s market/technological relatedness moderates the effect of the parent’s marketing/technological knowledge on subsidiary performance, such that the effect of the respective parent knowledge on subsidiary performance is stronger when the subsidiary has a higher level of concerned relatedness (see the corresponding interaction plots in Figs. 2 and 3). We conducted ex post analyses by running the model using a mean-split sample of subsidiaries with only low market relatedness and found that the relationship between marketing knowledge and subsidiary performance was not significant. However, the same relationship was significant when the model was run with the sub-sample of high market relatedness. These moderating effects contribute to the literature by offering a plausible explanation for why the empirical results of the performance outcomes of knowledge transfer are not always consistent (Chatterjee & Wernerfelt, 1991; Martin & Salomon, 2003; Montgomery & Hariharah, 1991).

Third, our research shows that different forms of relatedness can interact to produce synergistic benefits to the subsidiary. The existing literature has only considered the direct, independent impacts of relatedness in a single functional knowledge domain (e.g., Abecassis-Moedas & Mahmoud-Jouini, 2008; Cohen &
This result is consistent with our hypothesis, and is particularly important in the international knowledge transfer context, in which subsidiaries often need to take multiple types of knowledge from parents. However, the plot also shows that when both types of relatedness are low, the subsidiary performance is higher than when one type of relatedness is high but the other is low. This result may suggest that subsidiaries which manufacture unrelated products in unrelated markets achieve higher performance not because they absorb and use parent knowledge, as assumed in our study, but because a very different logic underlies their existence. These subsidiaries may form part of a strategic investment portfolio with the purpose of spreading business risk, rather than gaining operational synergies. In the case of these subsidiaries, the parent may be acting more like a holding company, or silent investor, than an active partner (Dunning & Lundan, 2008).

5.1. Managerial relevance

The implications of our study for managers are clear: careful management of knowledge resources transfer and a high level of parent/subsidiary relatedness is required to maximize the opportunities to obtain satisfactory performance when undertaking international expansion. Successful knowledge transfer should be the product of a concerted effort between the parent, which shares valuable knowledge resources, and the subsidiary, which must be able to effectively assimilate the knowledge. Moreover, subsidiary managers should focus on cultivating multiple types of assimilation capabilities at the subsidiary level, as opposed to being exclusive to only a single type.

5.2. Limitations and future research

Our findings need to be interpreted with caution, however, as there are several limitations to our study. First, marketing and technological knowledge can be used to address both operational and dynamic capabilities, as the line between operational and dynamic capabilities is blurry (Helfat & Winter, 2011). Also, given our use of archival data, we utilized established intensity measures for marketing and technological knowledge resources (Delios & Beamish, 2001; Stimpert & Duhaime, 1997; Zahra & George, 2002). These measures could be cross-checked using other objective measures (Ernst, Lichtenhaler, & Vogt, 2011) or drawing on primary data collection methodologies, such as surveys or interviews (Capron & Hulland, 1999).

Second, as previously mentioned, most relatedness measures, including the ones used here, might have content validity issues (Robins & Wiersema, 1995) because they are indirect measures (Nayyar, 1992) and may only capture tangible relatedness (Davis & Duhaime, 1992). Recent research suggests that direct resource measures for parent–subsidiary relatedness are superior (Robins & Wiersema, 2003; Tanriverdi & Venkatraman, 2005). Third, the data, while largely supportive of the hypotheses, do not provide insight into the process issues, in terms of how knowledge is effectively transferred, reconfigured, and integrated across organizational units. In-depth qualitative analysis is required to more fully understand the processes and reasons behind the transfer and integration of knowledge between parents and subsidiaries within international contexts. Since knowledge can also flow from subsidiaries to their respective parent (Inkpen & Dinur, 1998), future empirical research should address two of the assumptions in our research: whether the technological and marketing knowledge flows actually took place, and whether the integration of complementary knowledge resources at the parent and subsidiary levels actually took place. Finally, while this study focuses on addressing the transfer of multiple knowledge resources, future research can look at how knowledge of different dimensions

Levinthal, 1990; Lane & Lubatkin, 1998; Minbaeva et al., 2003), and others in broad, generic terms (e.g., Bjorkman et al., 2007; Lane et al., 2001). We find that subsidiary performance is significantly associated with the interaction of subsidiary technological relatedness and market relatedness, and this interaction effect is much stronger than the direct effect of either form in isolation. Fig. 4 illustrates this interaction effect. It shows that subsidiary performance is the highest when both types of parent/subsidiary relatedness are high, in comparison to the other three scenarios.
6. Conclusion

This study adds new insights to the area of international knowledge transfer, with a joint focus on knowledge resources of the parent firm and the dynamic capability of the foreign subsidiary to assimilate that knowledge. Going beyond the respective direct effects of parent knowledge and subsidiary performance, we examined the synergistic effects arising from the joint presence of multiple parent knowledge resources and of multiple forms of parent/subsidiary relatedness. Our research highlights the synergistic value to subsidiaries arising from the joint presence of parent knowledge resources and parent/subsidiary relatedness, thus extending the existing literature from a single explanation to an interactive perspective.

Acknowledgements

This work was partially supported by the Research Grants Council of the Hong Kong Special Administrative Region, China (Grant number CityU 142810).

References


Lane, Kogut, Lyles, Park, Morosini, Minbaeva, Lane, Kogut, Meyer, Mjøen, Kogut, 38
knowledge
standing
Journal
from
Studies,
acquisition
propensity
replication
ventures.
C.
B.,
A.,
M.,
E.
S.,
H.,
X.,
P.
J.,
A.
&
A.,
of
Zander,
J.
Chang,
Wiersema,
Lubatkin,
Almeida,
Shane,
Srinivasan,
Strategic
International
(6):
New
York:
Press.
Diffusion
the
content
value
related
diversification
indexes.
Strategic
Management
Journal,
24:
30–59.
Rogers,
E.
M.
Diffusion
of
innovations
(4th
ed.).
New
York:
Free
Press.
Rossiter,
J.
R.,
&
Percy,
L.
(1997): Advertis-
ing
communication
and
promotion
management.
New
York:
McGraw
Hill.
Rumelt,
R.
P.
(1982): Diversification
strategy
and
profitability.
Strategic
Management
Journal,
3(4):
359–369.
Schulz,
M.
(2003): 
Pathways
of
relevance: 
Exploring
inflows
of
knowledge
into
sub-units
of
multinational
corporations,
Organization
Science,
14(4):
440–459.
Song,
M.,
Droge,
C.,
Hansvanič,
S.,
&
Calantine,
R.
(2005): 
Marketing
and
technology
resource
complementarity: An
analysis
of
their
interaction
effect
in
two
environmental
contexts.
Strategic
Management
Journal,
26(3):
259–276.
Stumpert,
J.
L.,
&
Duhaime,
I.
M.
(1997): 
Seeing
the
big
picture: 
The
influence
of
industry,
diversification,
and
business
strategy
on
performance.
Academy
of
Management
Journal,
40(3):
560–583.
Szulanski,
G.,
&
Jensen,
R.
J.
(2006): Presumptive
adaptation
and
the
effectiveness
of
knowledge
transfer.
Strategic
Management
Journal,
27–43(10):
937–957.
Tallman,
S.,
&
Li,
J.
T.
(1996): 
Effects
of
internationalization:
Japanese
FDI
strategies
in
Asia-Pacific.
Academy
of
Management
Journal,
39:
179–196.
Tanriverdi,
H.,
&
Venkatraman,
N.
(2005): Knowledge
relatedness
and
the
performance
of
multinational
firms.
Strategic
Management
Journal,
26:
97–119.
Teece,
D.
(1986): Profiting
from
technological
innovation: 
Implications
for
integration,
collaboration,
licensing,
and
public
policy.
Research
Policy,
15:
285–305.
Teece,
D.
J.,
Pisano,
G.,
&
Shuen,
A.
(1997): Dynamic
capabilities
and
strategic
management.
Strategic
Management
Journal,
18(7):
509–533.
Todorova,
G.,
&
Durisin,
R.
(2007): Absorptive
capacity:
Valuing
a
reconceptualization.
Academy
of
Management
Review,
32:
774–786.
Vaara,
E.,
Sarala,
R.,
Stah, G.
K.,
&
Bjorkman,
I.
(2012): The
impact
of
organizational
and
national
cultural
differences
on
social
conflict
and
knowledge
transfer
in
international
acquisitions.
Journal
of
Management
Studies,
49(1):
1–27.
Volberda,
H.
W.,
Foss,
N.
J.,
&
Lyles,
M.
A.
(2010): Absorbing
the
concept
of
absorptive
capacity:
How
to
realize
its
potential
in
the
organization
field.
Organization
Science,
21(4):
931–951.
Wade,
M.
R.,
&
Gravill,
J.
I.
(2003): Diversification
and
performance
of
Japanese
IT
subsidiaries:
A
resource-based
view.
Information
Management,
40(4):
305–316.
Williams,
C.
(2007): Transfer
in
context: 
Replica-
tion
and
adaptation
in
knowledge
transfer
relationships.
Strategic
Management
Journal,
28(9):
867–889.
Winter,
S.,
&
Szulanski,
G.
(2001): Replication
as
strategy.
Organization
Science,
12(6):
730–743.
Woodward,
D.,
&
Rolfes,
R.
(1993): The
location
of
export-oriented
foreign
direct
investment
in
the
Caribbean
Basin.
Journal
of
International
Business
Studies,
24:
121–144.
World
Economic
Forum.
(2000): The
global
competitiveness
report.
Geneva:
EMF
Foundation.
Zahr,
S.
A.,
&
George,
G.
(2002): Absorptive
capacity:
A
review,
reconceptualization,
and
extension.
Academy
of
Management
Review,
27(2):
185–203.