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International diversification and firm performance: Role of information technology investments

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Abstract

The empirical studies to date have not found consistent support for the performance advantages of international diversification. One reason suggested by internalization theory is that leveraging firm specific assets is critical for enhancing performance from international diversification. We develop and empirically test the hypothesis that investment in information technology helps in leveraging firm specific assets across country borders and thereby contributes to enhanced performance from international diversification.

Keywords: International diversification; Performance; Information technology investments; Information processing; Coordination

1. Introduction

International diversification is said to confer a number of advantages including economies of scale and scope (Ghoshal, 1987), the ability to configure activities globally to gain access to skills and reduce costs (Kogut, 1985a; Porter, 1986), shift production in response to market changes (Kogut & Kulatilaka, 1994), and learn and innovate faster and less expensively (Bartlett & Ghoshal, 2000). However, empirical studies have not found consistent support for the performance advantages of international diversification.[3] A growing number of studies seeking to resolve this inconsistency have drawn on internalization theory (Buckley & Casson, 1976; Caves, 1982; Rugman, 1979) to suggest that international diversification by itself does not enhance performance, but that it is the leveraging of firm specific assets – mainly intangible assets – across country markets that confer performance advantages (Kotabe, Srinivasan, & Aulakh, 2002; Mishra & Gobeli, 1998; Morck & Yeung, 1991).

Leveraging firm specific assets requires enhanced levels of information processing and coordination to recognize and exploit opportunities across country borders (Bartlett & Ghoshal, 2000; Kogut, 1985b; Prahalad & Doz, 1987). Since the investments required to acquire this information processing and coordination capability are non-trivial, firms are likely to vary in this respect and consequently in their ability to gain from international diversification (Kogut, 1985b). While the extant empirical work following the internalization theory perspective has examined the effect of *possessing* firm specific intangibles, specifically in research and development and in marketing as indicated by

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[3] While some studies (e.g., Ehrunza & Senbet, 1981; Tallman & Li, 1996) have found a positive performance impact, other have found a negative impact (Christophe, 1997; Click & Harrison, 2000).

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investments in R&D and advertising respectively (Kotabe et al., 2002; Mishra & Gobeli, 1998; Morck & Yeung, 1991), firm level differences in the capability to *leverage* assets across borders have not been examined. In this paper, we propose and test the idea that by promoting information processing and coordination capability required for leveraging firm specific assets, investment in information technology (IT) enhances performance from international diversification.

2. Information processing, coordination, and leveraging firm specific assets

Internalization theory suggests that since multinational corporations (MNCs) have certain disadvantages associated with being foreign in local markets, such as unfamiliarity with the local culture (Hymer, 1976; Zaheer, 1995), successful MNCs should possess firm specific assets that give them an advantage over local firms (Buckley & Casson, 1976; Caves, 1982; Rugman, 1979). Assets that provide internalization advantages include capabilities in R&D and marketing, as well as superior processes, routines, know-how, and capabilities in other activities. These assets are typically characterized as tacit and therefore not easily tradable, giving MNCs an advantage in internalizing their transfer and application across country borders (Kogut & Zander, 1993). Thus, according to the internalization theory perspective, leveraging firm specific assets across country markets is essential for achieving enhanced performance from international diversification (Morck & Yeung, 1991).

Leveraging requires matching potential opportunities with relevant assets that can be deployed to exploit the opportunities. Given the multiple country markets in which internationally diversified firms operate and the assets and capabilities that develop within various country units, potential opportunities and relevant assets to exploit these are likely to be spread across multiple countries (Bartlett & Ghoshal, 2000). Country units that experience a market development that presents a potential opportunity may not recognize it as such if they are unaware of the relevant capabilities that reside elsewhere in the firm. Under these circumstances, relevant capabilities developed by country units may remain under-leveraged. Promoting organization wide awareness of potential opportunities and capabilities, therefore, is important for MNCs to recognize a fuller set of opportunities to leverage its assets (Kogut, 1985b). In addition to recognizing opportunities, leveraging requires creating and managing interdependencies between various country units to make and implement decisions that reconcile the often contradictory needs for global integration and national responsiveness (Bartlett & Ghoshal, 2000; Kogut, 1985b). Creating organization wide awareness of opportunities and capabilities as well as creating and managing interdependencies between various country units place heavy demands on firms for information processing and coordination (Bartlett & Ghoshal, 2000; Prahalad & Doz, 1987).

We argue that by promoting information processing and coordination capability, investments in IT can help firms recognize and exploit opportunities for leveraging firm specific assets and thereby enhance performance from international diversification. In what follows we discuss how the information processing and coordination promoted by investments in IT facilitate three aspects of the leveraging process: (1) promoting organization wide awareness of opportunities and capabilities, (2) making leveraging decisions in a manner that addresses the dual needs of global integration and national responsiveness, and (3) coordinating and controlling the implementation of leveraging decisions.

2.1. Promoting organization wide awareness of opportunities and capabilities

Recognizing opportunities on a worldwide basis requires managers to hold a much broader view of their relevant market than is typically the case with managers in firms that are organized to promote administrative efficiency. Specifically, many authors have observed that it is often administratively efficient to organize either on the basis of geography or on the basis of global products because the firm can have clear lines of authority and responsibility (Kogut, 1985b; Prahalad & Doz, 1987). However, the administrative efficiency comes at the cost of the firms' ability to recognize opportunities on a worldwide basis because the information gathered, exchanged and processed in such organizations are for the most part contained within the geographic or product units. In addition, the data collected and processed tend to reflect the parochial perspectives of either the geographic organizations or the global product units and therefore opportunities that may otherwise be evident may not be seen. For example, Prahalad and Doz (1987) observe that when a firm is organized by geography, product-oriented performance data across countries may be absent and consequently it will be difficult to see the opportunities to leverage the firm's multi-market presence by

integrating product related activities across these countries. Similarly, in an MNC organized along product lines ''where each product group pursues its own worldwide strategy independently through its own subsidiaries, opportunities for fruitful coordination at the national level in various countries may not even be seen'' (Prahalad & Doz, 1987: 189).

Consequently, reorienting the managers' world-views to consider worldwide opportunities involves dealing with the increased costs and complexities associated with promoting and managing a much broader and robust system of information processing (Prahalad & Doz, 1987). Specifically, the scope of data and information gathering for both operational and strategic matters must be broadened to support both global product as well as country market perspectives (Prahalad & Doz, 1987). In addition, channels for information exchange and communication must be broadened. While frequent communication between corporate office and foreign units helps the foreign units to showcase locally developed capabilities and the corporate office to become familiar with the globally distributed capabilities (Ghoshal, 1987), the corporate office (HQ) may not always have the relevant information to assess where these capabilities are applicable (Buckley & Casson, 1998). Given their closeness to the market, country units experiencing opportunities may have more information, and therefore be in a better position to evaluate the relevance of capabilities developed elsewhere in the corporation (Kogut, 1985b). Therefore, broadening channels to promote both vertical communication and information exchange between HQ and subunits, as well as lateral communication and information exchange between country units will assist in the recognition of opportunities on a worldwide basis (Buckley & Casson, 1998). Finally, the firm may also have to make information on organizational capabilities available to all units in easily and readily accessible form to promote the evaluation of these capabilities by various units for possible leveraging.

IT can help firms manage the increased and complex information processing demands discussed above. IT enabled accounting and database systems, and technologies including enterprise resource planning (ERP) and enterprise applications integration (EAI) facilitate the collection, classification, and integration of large amounts of data (Dewett & Jones, 2001; Hasselbring, 2000). The use of multiple indexing schemes in these enterprise systems allows managers to aggregate and view the data from multiple perspectives. When used as part of a corporate network, managers in various country operations can enjoy easy and timely access to the data. IT enabled intranets and other communication technologies can support the increased communication needs both between the HQ and country units as well as between various country units. IT enabled bulletin boards and discussion lists, for example, can connect employees across country operations for the exchange of information, ideas and experiences (Bartlett, 1996). When capabilities of hyper text and multimedia are used to create richer representations of ideas and issues, electronic bulletin boards can support the exploration of differentiated meaning and facilitate dialogue and exchange of ideas among individuals with diverse backgrounds such as those across national context divides (Tenkasi & Boland, 1996). IT enabled codification and digitized storage of locally gained experiences and know-how allow multiple country units to gain easy access to these resources promoting the leveraging of organizational knowledge and capabilities (Bartlett, 1996). While codifying tacit aspects of learning and knowledge is difficult (Kogut & Zander, 1993), by using capabilities such as video and simulation and integrating these with rich textual narratives, IT can help approximate the codification and access to the tacit along with the explicit aspects of knowledge (Thomas, Sussman, & Henderson, 2001).

2.2. *Making leveraging decisions*

Decisions to leverage assets do not automatically or easily follow from awareness of opportunities because such decisions often require balancing tradeoffs between global efficiency and local responsiveness as well as the commitment of managers whose units are affected by the decision (Bartlett & Ghoshal, 2000; Prahalad & Doz, 1987). For example, a decision to develop a global product by linking expertise spread across multiple country operations involves the participation of these multiple country units in the effort. Country units may vary in their expected resource commitments to the project due to differences in resource endowments and expertise in various country operations. In addition, country units may also differ in the benefits expected from the project due to differences in national responsiveness requirements across country markets. In this context, obtaining the necessary commitment from all parties involved may require coordinated decision making to address the interests and conflicts between the country organizations as well

as between the country organizations and the global product effort.

Extant literature (e.g., Bartlett & Ghoshal, 2000: 506; Prahalad & Doz, 1987) suggests that the formal organization structure by itself may be a ''blunt instrument'' for making leveraging decisions and that more sophisticated systems such as committees and taskforces with membership representing both the global and local perspectives may be required. IT can help make leveraging decisions in at least two ways. First, IT systems such as ERP and EAI which enable the capture, classification, and integration of greater amounts of information can supply the data required to clarify tradeoffs between competing interests allowing the committees and taskforces to arrive at more informed decisions (Holsapple & Sena, 2005; Prahalad & Doz, 1987; Teece, 1998), thereby reducing the chances for excessive bargaining and suboptimal compromises (Chi & Nystrom, 1998). Second, the clearer understanding of tradeoffs can help corporate managers tailor benefits and recognition granted to various units to better reflect their resource commitments, and thereby promote procedural justice which is important to gain the commitment of participating units' managers (Kim & Mauborgne, 1991, 1993).

2.3. Coordinating and controlling implementation

Implementing decisions to leverage assets across borders requires managing and coordinating activities that involve multiple country units (Govindarajan & Gupta, 2001). Coordinating activities that involve multiple country units is challenging because problems and progress in one country unit may affect schedules and work processes in another country unit (Martinez & Jarillo, 1991). Controlling such joint activity is also a problem since attributing performance of jointly performed tasks to individual units is difficult (Baliga & Jaeger, 1984; Chi & Nystrom, 1998). IT can help deal with these problems.

Groupware allow geographically dispersed units to plan and schedule tasks in an electronic workspace helping to integrate and synchronize changes, generate multiple views of the project's plans, progress and changes, and compile overall status reports (Boutellier, Gassmann, Macho, & Roux, 1998; Howe, Mathieu, & Parker, 2000). Advanced systems that support distributed cognition, such as SPIDER, can help address cognitive problems associated with work groups that span different cultural and country contexts (Boland, Tenkasi, & Te'eni, 1994). The IT enabled ability to track progress in almost real time allows corporate and other managers involved to better monitor and evaluate the coordinated activity and to reallocate resources to better accomplish the coordinated tasks (Dewett & Jones, 2001). In addition, IT-powered communication media (such as intranets and video conferencing) and vertical information technologies (such as enterprise-wide accounting systems) can provide corporate headquarters with better and faster access to detailed operating information (Hill & Jones, 2004; Jones & Hill, 1988) which is required for evaluating performance and exercising control over interdependent units (Chi & Nystrom, 1998; Hill & Hoskisson, 1987).

In summary, the internalization theory perspective suggests that international diversification in itself may not enhance firm performance, but that it is the leveraging of firm specific assets across country markets that enhances performance from international diversification. We have argued that by promoting information processing and coordination required to (a) recognize opportunities for leveraging assets, (b) make leveraging decisions in a manner that considers the dual strategic needs of global efficiency and national responsiveness, and (c) coordinate and control the implementation of these decisions, IT investments help in leveraging firm specific assets across country operations. Consequently, we expect that firms with greater investments in IT would enjoy greater performance from international diversification.

Hypothesis. The relationship between international diversification and firm performance will depend in part on the firms' investments in IT, such that greater investment in IT will foster greater performance (defined as Tobin's q in this study) from international diversification.

3. Analytical methods, sample, and measures

3.1. Analytical methods

We test the hypothesis on a sample of US firms, using regression analysis. Our hypothesis relates to the interaction effect or the joint effect of international diversification (ID) and IT investment (IT) on firm performance (Q). We follow the approach outlined by Aiken and West (1991) in testing the interaction effect. The predicted value Q can be written as:

$$Q = B_0 + B_1 \times \mathrm{ID} + B_2 \times \mathrm{IT} + B_3 \times \mathrm{ID} \times \mathrm{IT} + B(\mathrm{controls}) \quad (1)$$

Regrouping the terms:

$$Q = [B_1 + B_3 \times \mathrm{IT}] \times \mathrm{ID} + [B_0 + B_2 \times \mathrm{IT} + B(\mathrm{controls})] \quad (2)$$

A positive and significant value for B_3 will mean that the regression of Q on ID depends on the specific value of IT, supporting our hypothesis. Conversely if B_3 is not significantly different from zero, our hypothesis will be rejected. We perform two sets of regressions, one using a "flow" measure of IT investment (i.e., IT investment made in a year) for our main analysis, and the other using a measure of IT investment "stock" to check robustness of our findings.

3.2. Sample

To test our hypothesis we utilize data on IT investments as reported in surveys from industry media sources. Prior research has relied on surveys conducted by industry media sources such as *Information Week* or *Computerworld* (Anderson, Banker, & Hu, 2004; Bharadwaj, Bharadwaj, & Konsynski, 1999). Following these studies, we use the annual IT expenditures data compiled by such sources and available for the latest year. Specifically, we use *Information Week*'s IW500 data for 1997. Data for other variables of interest were also collected for the same year from various sources. After excluding private firms and those for which data on other required variables could not be obtained, we had a total of 131 firms in the sample. We also collected IT investment data for the years 1995 and 1996 from the same source to construct a measure of IT investment stock, which we use in our analysis to check robustness of our findings.[4]

With average sales of 9.8 billion dollars, the sample firms were comparable in size to the set of S&P 500 firms.[5] The average ratio of foreign sales to total sales for the sample was 24.46%, and the average firm in the sample operated in 11.37 countries.[6] Firms in the sample operated in a variety of industries with 61.8% having their primary business in manufacturing (SIC codes in the 2 and 3 series), 12.2% in transportation and communications (SIC codes in the 4 series), 13% in wholesale and retail (SIC codes in the 5 series), 9.9% in services (SIC codes in the 7 and 8 series), and 3.1% in basic industries (SIC codes in the 0 and 1 series).

3.3. Measures

3.3.1. Firm performance

We used Tobin's q to measure firm performance. As a forward looking measure of firm performance, Tobin's q better captures some of the potential for future performance that may be associated with international diversification which accounting measures of current profit performance may not capture. In addition, using Tobin's q helps avoid some of the problems that beset accounting measures of performance (Bharadwaj et al., 1999). We used Chung and Pruitt's (1994) formula and data from COMPUSTAT to compute Tobin's q. Specifically, Tobin's q was calculated as follows: Tobin's q = (MVE + PS + DEBT)/TA; where MVE = the fiscal year end market value of firm, PS = the liquidating value of the firm's outstanding preferred stock, DEBT = (current liabilities − current assets) + (book value of inventories) + (long-term debt), and TA = the book value of total assets. Chung & Pruitt's formula allows for the computation of Tobin's q using basic financial and accounting information, and has been shown to provide values that are at least 96.6% compatible with Tobin's q values obtained using the more theoretically correct Lindenberg and Ross's (1981) model which is extremely complex and cumbersome to construct (Chung & Pruitt, 1994: 70). Given its computational benefits and high accuracy, the Chung & Pruitt's formula has been used extensively to measure Tobin's q in prior research (Weber & Dudney, 2003). Data for the computations were obtained from COMPUSTAT.

3.3.2. International diversification

International diversification has typically been measured in terms of the intensity of international involvement and/or in terms of the geographic scope of international operations (Hitt, Hoskisson, & Kim, 1997; Lu & Beamish, 2004; Tallman & Li, 1996). A popular indicator of the intensity of international involvement is the foreign sales to total sales ratio and the number of countries in which a firm operates is a typical measure of the geographic scope of international operations (Tallman & Li, 1996). Authors have argued that as a multi-faceted construct, international diversification is best measured as a composite index (Gomes & Ramaswamy, 1999; Sullivan, 1994). Following prior work, we used principal component factor analysis to create a composite index measure of international

[4] The sample size for our robustness analyses was smaller ($N = 84$) owing to data availability.

[5] A t-test showed no difference between mean sales for the sample and for the set of S&P500 firms.

[6] Thirty-three firms had no foreign country operation or foreign sales.

diversification that incorporates both the intensity of international operations and the geographic scope of international operations (Duru & Reeb, 2002; Gomes & Ramaswamy, 1999). Specifically, we used principal component factor analysis to reduce the two variables – foreign sales to total sales ratio and number of countries in which firms operate – into a single composite index of international diversification. Data to compute the foreign sales to total sales ratio was obtained from COMPUSTAT and data on the number of countries in which firms operate was obtained from the International Directory of Corporate Affiliations. For factor analysis to provide a useful composite index, it is necessary that the two variables be highly correlated and that they load on a single factor/component. The two variables were indeed highly correlated (0.65, $p < 0.000$) and loaded on a single component that explained 82.72% of the cumulative variance. The two variables had a loading of 0.91 each on the extracted component. These results of the factor analysis indicate that our composite measure is a useful index of international diversification. In additional analysis, we also used the two indicators separately rather than in a composite index to compare the effect of each aspect of international diversification.

We also considered another method to create a composite measure of international diversification using foreign market sales and scope – the entropy index – which has been used in prior research by Hitt et al. (1997). We did not use this measure, however, because of its limitations in capturing the geographic scope of international operations. Specifically, Hitt et al.'s measure is based on aggregating sales by geographic market segment reported by firms in their annual reports. Since the relevant accounting rule guiding geographic segment reporting (SFAS No. 14) required disclosure of results for geographic segments that account for more than 10 percent of firm sales, the total number of country operations for which firms could report disaggregated data is artificially restricted to a maximum of 10. In addition, to our knowledge, sales data broken down by country market is not available anywhere else. The limitation of using Hitt et al.'s entropy measure in capturing the geographic spread of international operations would be rather substantial since firms in our sample operated in an average of 11.37 countries, with 41.2% of firms operating in more than 10 countries.

3.3.3. IT investment

IT Investment was measured as IT investment made in 1997 divided by number of employees. The IT investment numbers represent the annual, corporation-wide, capital and operating budget for information systems and services, including expenditures for hardware, software, staff, and data communication (Bharadwaj et al., 1999). Since employees effect communication and coordination using IT, we measure IT investment per employee rather than per dollar of sales. Data on IT investment were obtained from Information week's IW500 surveys and employee data were obtained from COMPUSTAT. In addition to using this ''flow'' measure of IT investment made in 1997, as described latter in Section 4.1 we also used an alternative IT investment ''stock'' measure to check robustness of our findings.

Consistent with calls to use controls for industry and firm level effects when studying performance implications of strategies (Dess, Ireland, & Hitt, 1990), a number of industry and firm level variables were used in the analyses as controls. Specifically, we controlled for industry capital intensity (measured as the weighted average total assets to sales for the industries in which the firm competed, using the proportion of firm sales in each industry as weights), industry performance (measured as the weighted average market to book value for the industries in which the firm competed, using the proportion of firm sales in each industry as weights), firm size (measured as log of sales), capital structure (measured as the ratio of total liabilities to sales), R&D intensity (measured as the ratio of R&D expenditures to sales) and advertising intensity (measured as the ratio of advertising expenditures to sales).[7] These measures were adopted from prior research and the data for these variables were obtained from COMPUSTAT.

Capital intensity is an indicator of exit barriers, and it has been argued that firms will assume the risks associated with sunk investments only when the promise of profitability is high (Bettis, 1981). Consequently the association between capital intensity and firm performance is expected to be positive. Following prior empirical work that found a positive association between industry performance and firm performance (Bharadwaj et al., 1999), we also expect a positive

[7] Because fewer firms report R&D and advertising expenditures in their annual reports, data on advertising intensity in particular and R&D intensity were missing for a number of firms. Since GAAP conventions require firms to report R&D and Advertising expenses that are deemed ''material'', prior works have replaced missing values with zeros (Bharadwaj et al., 1999). We followed these prior works and replaced missing values with zeros. In addition, we ran our analyses without these variables and found that our results did not qualitatively change.

relationship. Firm size is associated with economies of scale and hence is expected to have a positive association with performance (Hitt et al., 1997). R&D intensity and advertisement intensity can indicate research and marketing capabilities, respectively, and have been shown to have a positive influence on firm performance (Capon, Farley, & Hoenig, 1990). Similarly, prior work has shown that a firm's capital structure (debt in particular) has a negative effect on firm performance (Hitt et al., 1997).

4. Results

Table 1 provides the means, standard deviations, and correlations for the variables.

To avoid multicollinearity problems that are likely in regression models with interaction effects, following the suggestions of Aiken and West (1991), we centered the independent variables of interest. The variance inflation factors (VIFs) in our regression models were substantially lower than the threshold value of 10, indicating that multicollinearity is not a problem affecting our results (Belsley, Kuh, & Welssch, 1980; Hair, Anderson, Tatham, & Black, 1998). We also conducted tests to assess normality and constant variance assumptions. The Kolomogorov-Smirnov (KS) test for normality showed that the null hypothesis of normality cannot be rejected, and an examination of the standardized residuals did not indicate departures from the constant variance assumption. The results of the regression analysis are shown in Table 2 (Models 1 and 2). The model with the interaction term has a significant F statistic and an R^2 of 0.52, and the change in R^2 after adding the interaction term of interest is also significant. The VIFs for the models were below 2. Five control variables, namely industry performance, industry capital intensity, capital structure, R&D intensity and advertising intensity are significant in the expected direction. Results for the IT investment variable and the international diversification variable should be interpreted with caution since in centered regression models that include their interaction terms these variables do not represent constant effects. Rather, they represent the effects of the variables when the variables they interact with are at their means (Aiken & West, 1991). The overall effect of these variables, represented by $[B_1 + B_3 \times (\mathrm{IT})]$ for international diversification in Eq. (2) for example, can only be discerned when the interaction effect is also taken into account. The result for the IT investment variable, therefore, shows that IT investment has a significant and positive effect on performance for firms with average level of international diversification. The lack of significance for the international diversification variable indicates that international diversification does not have a significant effect on performance for firms with average level of IT investment. Importantly, the interaction term for international diversification and IT investment is significant and positive supporting our hypothesis.

To evaluate the overall effect of international diversification on firm performance and to get a visual sense of the impact of IT investment on the international diversification-performance relationship, we computed and graphed the *simple slopes* (Aiken & West, 1991: 12) obtained from our regression results. Simple slopes refer to the slopes of the regression of Q (firm performance) on ID (international diversification) conditional on particular values of IT (IT investment). We computed these slopes for the effect of international diversification on firm performance when IT investment

Table 1
Means, standard deviations, and correlations

		Mean	S.D.	1	2	3	4	5	6	7	8	9	10
1	Firm performance	1.68	1.41										
2	Industry performance	2.87	1.48	0.46**									
3	Industry capital intensity	1.68	1.24	0.28**	0.33**								
4	Firm size	3.76	0.43	0.16	0.04	−0.08							
5	Capital structure	0.66	0.42	−0.23**	−0.08	0.29**	0.08						
6	R&D intensity	0.02	0.04	0.54**	0.36**	0.32**	0.04	−0.17					
7	Advertising intensity	0.01	0.03	0.41**	0.41**	0.09	0.31**	−0.08	0.20*				
8	IT investment	5.28	4.57	0.26**	0.28**	0.27**	0.11	0.26**	0.22*	−0.00			
9	International diversification	0.00	1.00	0.37**	0.40**	0.19*	0.16	−0.04	0.57**	0.37**	0.13		
10	Foreign sales total sales ratio	0.24	0.20	0.25**	0.30**	0.15	0.10	−0.02	0.47**	0.28**	0.07	0.91**	
11	Country count	11.37	13.24	0.43**	0.44**	0.20*	0.18*	−0.05	0.57**	0.40**	0.16	0.91**	0.65**

$N = 131$.
* $p < 0.05$ (2-tailed).
** $p < 0.01$ (2-tailed).

Table 2
Main analysis results (IT investment as IT investment "Flow" in 1997)[a]

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	0.03 (0.93)	0.36 (0.91)	0.17 (0.94)	0.43 (0.90)	−0.01 (0.92)	0.14 (0.93)	0.17 (0.93)	0.32 (0.90)
Industry performance	0.14^{+} (0.08)	0.14^{+} (0.08)	0.13 (0.08)	0.14^{+} (0.08)	0.14^{+} (0.08)	0.14^{+} (0.08)	0.13 (0.08)	0.14^{+} (0.08)
Industry capital intensity	0.16^{+} (0.09)	0.20* (0.09)	0.16^{+} (0.09)	0.20* (0.09)	0.16^{+} (0.09)	0.17^{+} (0.09)	0.16^{+} (0.09)	0.19* (0.09)
Firm size	0.29 (0.23)	0.17 (0.23)	0.27 (0.23)	0.16 (0.22)	0.29 (0.23)	0.24 (0.23)	0.26 (0.23)	0.19 (0.22)
Capital structure	−0.80** (0.26)	−0.69** (0.25)	−0.82** (0.25)	−0.71** (0.24)	−0.78** (0.25)	−0.73** (0.26)	−0.79** (0.25)	−0.73** (0.25)
R&D intensity	12.49*** (3.36)	9.51** (3.43)	11.22*** (3.32)	7.84* (3.30)	13.14*** (3.18)	12.16*** (3.28)	12.02*** (3.36)	8.63* (3.37)
Advertising intensity	13.37** (4.36)	13.74** (4.24)	12.64** (4.37)	13.50** (4.18)	13.63** (4.29)	13.70** (4.28)	12.85** (4.36)	13.69*** (4.17)
IT investment	0.05* (0.02)	0.05* (0.02)	0.05* (0.02)	0.05* (0.02)	0.05* (0.02)	0.05* (0.02)	0.05* (0.02)	0.05* (0.02)
International diversification (ID)	−0.04 (0.12)	−0.02 (0.12)						
ID × IT investment		0.06** (0.02)						
Country count (CC)			0.00 (0.01)	0.00 (0.01)			0.01 (0.01)	0.01 (0.01)
Foreign sales total sales ratio (FSTS)					−0.50 (0.54)	−0.42 (0.54)	−0.80 (0.61)	−0.58 (0.59)
CC × IT investment				0.01***(0.00)				0.01*** (0.00)
FSTS × IT investment						0.14 (0.11)		−0.18 (0.14)
R^2	0.48	0.52	0.48	0.53	0.49	0.49	0.49	0.54
R^2 change		0.03**		0.05***		0.01		0.05**
F	14.20***	14.26***	14.22***	15.34***	14.38***	12.99***	12.90***	12.81***

$N = 131$. We also ran four other versions of Models 1 and 2: one using IT investment by sales as the IT investment measure, one using IT investment by assets as the IT investment measure, one using additional controls for the interactions between ID and R&D intensity and ID and advertising intensity, and one using an industry adjusted measure of firm performance as the dependent variable. Our findings did not change with any of these alternative models.

[a] Unstandardized coefficients reported. Standard errors are within parenthesis.

* $p \leq .05$.

** $p \leq .01$.

*** $p \leq .001$.

$^{+}$ $p \leq .10$.

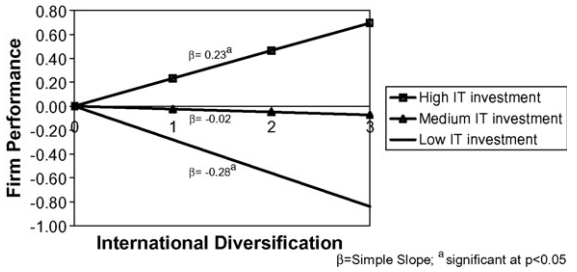

Fig. 1. Impact of international diversification on firm performance at various levels of IT investment.

levels are high (one standard deviation above the mean), medium (mean), and low (one standard deviation below the mean). We also calculated the standard errors of these slopes to test whether the slopes are significantly different from zero. The slopes for the effect of international diversification on firm performance were 0.23, −0.02, and −0.28 respectively for high, medium, and low levels of IT investment. The numbers indicate that a unit change in international diversification is associated with a 0.23 unit increase in Q for firms with high IT investment, a 0.28 unit decrease in Q for firms with low IT investment, and a 0.02 unit decrease in Q for firms with medium IT investment. In addition t tests indicate that slopes for high and low IT investments are significantly different from zero ($p < 0.05$). As the regression result for the international diversification variable indicated, the slope for the effect of international diversification on firm performance at the medium IT investment level (i.e., when IT investment is at its mean) is not significantly different from zero. Fig. 1 illustrates the relationship between international diversification and firm performance at high, medium and low levels of IT investment.

We performed additional analysis to understand the separate effects of the two aspects of international diversification. Since the indicators for international involvement intensity and geographic scope of international operations were highly correlated, we approached this analysis cautiously, first using the two variables along with their respective interaction terms with IT investment separately in regression analyses. We then proceeded to examine the effects of the two variables along with their respective interaction terms in the same model. Models 3 and 4 of Table 2 show results when only the variable for geographic scope of international operations (number of countries in which firms operate, simply referred to as country count) is used and Models 5 and 6 show results when only the variable for intensity of international involvement (foreign sales total sales ratio) is used. While the results for the control variables, IT investment and the two international diversification indicators are similar to our original models (Models 1 and 2), the interaction term is significant in the case of geographic scope but not significant for the intensity of international involvement. VIFs for these models were also below 2, indicating that multicollinearity is not a problem. Models 7 and 8 show results when both aspects of international diversification are examined together in the same model. These results are similar to findings from the previous runs (Models 3 to 6), highlighting the significant interaction for the geographic scope aspect of international diversification and not for the intensity of international involvement aspect. Maximum VIF for these models was a little above 2 (2.397) but still much below the threshold value of 10, indicating that these results are also not affected by multicollinearity.

4.1. Robustness of results

Since annual outlays for IT can be lumpy, we checked the robustness of our results to using a measure of IT investment stock instead of the annual IT investment "flow" to even out some of the lumpiness. Following Dewan, Michael, & Min (1998), we assume that IT expenses create assets with a service life of three years and use IT investment data for the three years 1995 through 1997 to create a proxy for IT investment stock.[8] Table 3 shows results when the IT investment stock variable is used instead of our original IT investment measure.

Models 1 and 2 show results for the main model (comparable to Models 1 and 2 in Table 2) when IT investment stock is used as the measure of IT investment. The model with the interaction term has a significant F statistic and an R^2 of 0.63. The R^2 change when adding the interaction term is also significant. Results for the control and other independent variables are comparable to those in Model 2 of Table 2 with the difference that IT investment variable is not significant in the present model and R&D intensity barely fails to be significant (p value of .105). The lack of significance for IT investment suggests that, measured as IT stock, IT investment does not have a significant impact on firm performance when international diversification is at its

[8] Assuming IT investments lose one third of their value each year, IT stock was calculated as the sum of IT investment in 1997 plus two-thirds of IT investment in 1996 plus one-third of IT investment in 1995, divided by the number of employees in 1997. After accounting for missing values, the sample size for the robustness analysis was 84.

Table 3
Robustness test results (IT investment as IT investment "Stock" in 1997)[a]

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	−0.08 (1.26)	0.10 (1.18)	0.03 (1.26)	0.10 (1.11)	−0.12 (1.24)	−0.05 (1.25)	0.01 (1.24)	−0.02 (1.10)
Industry performance	0.27* (0.12)	0.21+ (0.11)	0.24+ (0.12)	0.15 (0.11)	0.28* (0.12)	0.28* (0.12)	0.24* (0.12)	0.14 (0.11)
Industry capital intensity	0.31* (0.12)	0.44*** (0.12)	0.32** (0.12)	0.44*** (0.11)	0.30* (0.12)	0.34** (0.13)	0.31* (0.12)	0.38*** (0.12)
Firm size	0.21 (0.31)	0.14 (0.29)	0.22 (0.31)	0.19 (0.27)	0.21 (0.30)	0.17 (0.31)	0.20 (0.30)	0.24 (0.27)
Capital structure	−1.02** (0.36)	−0.91** (0.33)	−1.03** (0.35)	−0.89** (0.32)	−0.98** (0.35)	−0.96** (0.36)	−0.96** (0.35)	−0.87** (0.31)
R&D intensity	12.70** (4.49)	7.32 (4.47)	10.82* (4.29)	5.50 (3.96)	14.20** (4.34)	12.86** (4.56)	12.91** (4.43)	7.59+ (4.19)
Advertising intensity	9.97+ (5.38)	11.09* (5.04)	8.67 (5.39)	11.47* (4.80)	10.46* (5.25)	10.47* (5.26)	9.07+ (5.33)	12.06* (4.77)
IT investment	0.03 (0.02)	0.01 (0.02)	0.03 (0.02)	0.01 (0.02)	0.03 (0.02)	0.03 (0.02)	0.03 (0.02)	0.01 (0.02)
International diversification (ID)	−0.06 (0.17)	0.05 (0.16)						
ID × IT investment		0.06*** (0.02)						
Country count (CC)			0.01 (0.01)	0.01 (0.01)			0.02 (0.01)	0.02 (0.01)
Foreign sales total sales ratio (FSTS)					−0.90 (0.75)	−0.73 (0.77)	−1.34 (0.81)	−0.82 (0.74)
CC × IT investment				0.01*** (0.00)				0.01*** (0.00)
FSTS × IT investment						0.10 (0.11)		−0.17 (0.11)
R^2	0.58	0.63	0.58	0.67	0.58	0.59	0.59	0.69
R^2 change		0.06***		0.10***		0.01		0.10***
F	12.68***	14.26***	12.79***	17.01***	13.07***	11.71***	11.93***	14.46***

$N = 84$.

[a] Unstandardized coefficients reported. Standard errors are within parenthesis.

* $p \leq .05$.

** $p \leq .01$.

*** $p \leq .001$.

+ $p \leq .10$.

mean. This, however, does not imply that IT investment has no effect on firm performance overall. The significant interaction effect in fact suggests that the effect of IT investment varies with the level of international diversification. In this respect, the result for IT investment is quite consistent with our results in the original model in Table 2. Most importantly, the positive and significant coefficient for the interaction term confirms the support we found for our hypothesis in our original model. We also computed and analyzed the simple slopes for the overall effect of international diversification at various levels of IT investment measured as IT stock, similar to the results underlying Fig. 1. Results of the simple slope analysis are also consistent with results from our original model: slope for the effect of international diversification on firm performance is positive and significant for high (mean + one standard deviation) IT investment, significant and negative for low (mean minus one standard deviation) IT investment, and not significant for medium (mean) IT investment.[9]

We also ran our other models for the separate effects of the two aspects of international diversification with our IT stock measure. These results are shown in Models 3 through 8 of Table 3. These results when compared with Models 3–8 of Table 2 show that while the results for control variables vary somewhat, and the IT investment variable is not significant as with Models 1 and 2, the results for the overall model fit and for the variable of interest – the interaction term – are consistent with comparable models in Table 2. The maximum VIF value for the robustness models (2.394) was also much below the threshold value of 10 suggesting that these results are also not affected by multicollinearity. Overall, the results of our analyses using IT stock support our main findings and indicate that out results are robust to using this alternative measure of IT investment.

5. Discussion and conclusion

Our results show that the performance impact of international diversification is a positive function of the level of IT investment. The performance impact could be significantly positive (for firms with high IT investment), significantly negative (for firms with low IT investment), or neutral (for the average internationally diversified firm; i.e., firms with average level of IT investment). This supports our thesis, developed from internalization theory that the performance impact of international diversification depends on firm level investments to promote information processing and coordination required to leverage firm specific assets across country borders. Our additional analysis for the separate effects of the two international diversification aspects shows that the performance impact of geographic scope varies with the level of IT investment such that greater IT investment is associated with a greater performance impact for geographic scope but no such effect is found for intensity of international involvement. Since greater geographic scope implies an increase in the set of countries across which a firm operates, information processing and coordination promoted by IT for matching globally distributed opportunities and capabilities are particularly relevant and critical for capturing advantages associated with increased geographic scope. In contrast, since greater foreign sales to total sales ratio can stem from operating in just a few countries or even in a single foreign country, the information processing and coordination promoted by IT for matching globally distributed opportunities and capabilities are not as relevant or critical for capturing advantages accruing from increased foreign sales intensity. This difference in the importance of information processing and coordination promoted by IT, we believe, explains why IT investment is significant in the case of geographic scope but not in the case of intensity of international involvement. In essence, the additional analysis results suggest that the information processing and coordination promoted by IT investments are more consequential for firm performance when international diversification involves expansion of geographic scope rather than increases in foreign sales intensity. Overall, our work points to a compelling explanation for the conflicting findings of prior studies on the performance impact of international diversification. Specifically, the conflicting results may stem from attempts to detect performance effects of international diversification without considering firm level differences in the capability to leverage firm specific assets across country borders.

Our finding that capturing the performance potential of international diversification requires investments to develop organizational capabilities, specifically in information processing and coordination, beyond levels prevalent in the average firm moves the empirical literature closer to conceptual works on the performance impact of international diversification. Conceptual works have long argued that organizational capability in information processing and coordination is

[9] In the interest of brevity the figure depicting these results is not included in the paper. It is available from the authors.

essential to capture value from international diversification. For example, explaining the performance advantages of international diversification, Kogut (1985a) noted the potential advantages to be gained from locating operations overseas, but in an accompanying article Kogut (1985b) outlined the organizational capabilities (including information processing and coordination) required to capture these advantages. Likewise, Porter (1986) identified coordination of international operations as one of the two key elements of international diversification strategy. Similar emphasis on information processing and coordination capability can be found in the works of others who have made seminal contributions to the study of international diversification (Bartlett & Ghoshal, 2000; Prahalad & Doz, 1987). Extant empirical studies on the performance impact of international diversification have acknowledged the importance of coordination and information processing costs (Gomes & Ramaswamy, 1999; Lu & Beamish, 2004), but have not examined the effect of firm level differences in information processing and coordination capability. Our study begins to address this gap between conceptual and empirical literatures, and the significant results we find suggest that further empirical work that fleshes out and incorporates organizational capabilities required to capture the potential advantages of international diversification will help in developing a better understanding of the performance effects of international diversification.

For practicing managers, our findings imply that successfully extracting value from international diversification requires investments in IT. Consequently, managers contemplating greater international diversification should also consider complementary investments in IT to enhance their firms' information processing and coordination capabilities. This increase in IT investments will be particularly important if the push to increase international diversification would involve an increase in geographic scope. The full suit of enterprise applications including ERP, intranet and other communication systems, and systems that support distributed cognition and work would be relevant technologies for investment. In selecting from competing versions of these systems, managers should seek ones that incorporate data, communication, and interface platforms that simultaneously facilitate (a) the global aggregation and communication of information at or near real time and (b) the local accommodation of country specific compliance and information needs. Systems with the following key features have been argued to support such simultaneous needs (Miranda, 2003): (a) unicode, a technology that enables the encoding and storage of information from any of the major written languages in use today, (b) consistent data model, which enables a single definition of employees, customers, suppliers, partners, and business events for use across the firm, (c) automatic conversion of documents into the receiver's language, a technology feature that automatically translates documents prepared in one country's language, currency, and custom into the language, currency and custom of the receiving country, (d) interoperability among systems, which ensures that as the firm upgrades its IT systems the upgrades will seamlessly work with systems already in place, and (e) global supportability, which ensures that an MNC's operations around the world can receive technical support for the IT systems locally.

In addition, while our findings show that greater IT investment is required to capture performance gains from international diversification in general, it is likely that some MNC strategies call for relatively greater IT investment than other strategies. Specifically, strategies involving greater integration of worldwide operations, similar to Bartlett and Ghoshal's (2000) global and transnational strategies, will demand greater information processing and coordination and hence greater IT investment than strategies involving relatively less integration such as Bartlett and Ghoshal's (2000) multidomestic strategy. Taking the MNC's strategy into consideration in deciding IT investment level will therefore help managers balance the benefits of IT investment with the costs involved.

There are a few limitations to our study. First, we do not consider the non-IT driven information processing and coordination mechanisms such as face-to-face meetings and socialization. It is our contention that the information processing and coordination promoted by the other mechanisms are not perfect substitutes for those promoted by IT (Dewan et al., 1998). To the extent that firms utilize non-IT driven information processing and coordination mechanisms, the effect of IT investment in our model is likely to be weaker. The significant result that we find in our model is therefore more persuasive. Nevertheless, further research that also incorporates the non-IT driven information processing and coordination mechanisms can shed more light on the overall impact of information processing and coordination capability on the relationship between international diversification and firm performance.

Also, there are some limitations pertaining to our data. The IT investment measure obtained from IW500 is self reported and hence subject to some biases and errors. However, the data reported in IW500 have been

found to correlate highly with data from other survey sources (Bharadwaj et al., 1999). In addition, the aggregate IT investment numbers in our study were consistent with IT investment averages in other studies. Finally, our data pertained to US firms and although we cannot imagine systematic reasons why our results would be different for firms from other countries, we also cannot confirm the applicability of our findings to firms from other countries.

In conclusion, our study contributes to the literature on one of the central issues in international business research – the performance consequence of international diversification – in at least two ways. First, our findings lend further support to the internalization theory perspective on the performance consequence of international diversification. Since extant support for the internalization theory perspective comes from studies that focus on the *possession* of firm specific assets and we focus on investment required to *leverage* firm specific assets, the support we find is complementary to the support that internalization theory perspective has received from prior empirical research. Second, we extend the empirical literature in the area by incorporating and testing the impact of an indicator of organizational capability that conceptual works have long considered important for extracting value from international diversification. In doing so, we bridge an important gap between the conceptual and empirical research on the performance impact of international diversification.

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