Received 30 May 2012
Revised 1 September 2012
Accepted 22 September 2012

Two paths to diversification

Performance implications of related diversification across two dimensions in professional service firms

Karthik Dhandapani
Department of Business Policy, Indian Institute of Management, Ahmedabad, India, and
Rajesh S. Upadhyayula
Department of Strategic Management, Indian Institute of Management, Kerala, India

Abstract

Purpose – The purpose of this paper is to examine the impact of related diversification across service offerings and industry domains for professional service firms (PSFs) in emerging economies by integrating the reputational and economies of scope perspectives of diversification. The paper also provides insights into how related diversification impacts small and medium sized firms differently.

Design/methodology/approach – Using unique data from the Indian Information Technology industry, the authors examine the impact of related diversification along service offerings and industry domains on export performance of firms.

Findings – The results show that related diversification across specializations and industry domains impact performance differently across different firm sizes. While the authors find that related diversification across service offerings has an inverted U shape with performance for the medium sized firms, they do not impact performance for small sized firms. Performance of small firms has a U shaped relationship with relatedness in industry domains. The study shows that reputation transfer across industry domains play a significant role in the performance of small size firms whereas the ability to realize economies of scope by cross selling multiple services across clients do matter for performance of medium sized firms.

Practical implications – Managers of small PSFs need to expand along related industry domains whereas managers from medium sized firms can experiment across service offerings to exploit economies of scope.

Originality/value – The study contributes to hitherto unexamined research on related diversification in PSFs. The study is one of the few studies to examine relatedness along more than one dimension in an intra-industry context.

Keywords Performance, Reputation, Economies of scope, Professional service firms, Related diversification

Paper type Research paper

Introduction

Research in strategic management has widely explored the relationship between diversification and firm performance (Rumelt *et al.*, 1996). One of the major gaps in the diversification-performance literature is that most studies have examined the diversification performance relationship at an inter-industry level. Few studies have examined the relationship between diversification and performance at an intra-industry level (Kekre and Srinivasan, 1990; Cottrell and Nault, 2004; Li and Greenwood, 2004; Tanriverdi and Lee, 2008; Kang *et al.*, 2011). Fewer studies have examined the issue of diversification in professional service firms (PSFs) (Greenwood *et al.*, 2005; Jennings *et al.*, 2006). This is surprising given the fact that over the last two decades,

International Journal of Emerging Markets
Vol. 10 No. 1, 2015
pp. 32-51

1746-8809
DOI 10.1108/IJOEM-05-2012-0048

academic research has focused on PSFs because they are increasingly seen as models of knowledge based economies (Starbuck, 1992; Jensen *et al.*, 2010). PSFs also represent one of the fastest growing industries (Aharoni, 1993). Very few studies have focused explicitly on how strategy affects performance of PSFs (Hitt *et al.*, 2001; Greenwood *et al.*, 2005; Jennings *et al.*, 2006). Greenwood *et al.* (2005) show that balanced diversification amongst PSFs positively affect their performance. However, amongst these studies too, there was no attempt to examine the performance implication of related diversification. Further, PSF literature has increasingly focused on diversification only across service offerings (Greenwood *et al.*, 2005) and has ignored the implications of diversification across industry domains on performance. This is also surprising given that the past research has underscored the importance of industry domain expertise in the performance of audit firms, another class of PSFs (Craswell *et al.*, 1995; Habib and Bhuiyan, 2011). This limits the application of insights of related diversification[1] to PSFs like Information Technology (IT) firms, advertising firms, management consulting, etc. where the industry domain expertise has considerable influence on the quality of the services rendered. These firms can choose to diversify either by offering a portfolio of services to the clients in the same industry domain or offer same services to clients in different industry domains or both. Till now, no study on PSF has considered whether these firms should diversify by offering more related services or by serving clients in more related industry domains. Our study tries to fill this gap by examining the implications of related diversification across twin dimensions of service offerings (hereafter referred to as service specializations) and industry domains in the context of Indian IT firms.

Moreover, studies have largely examined the diversification as a phenomenon across large firms (Mishra and Akbar, 2007). Very few studies focused on examining the diversification performance relationship across small and medium firms (Goddard *et al.*, 2008; Jennings *et al.*, 2006). Greenwood *et al.* (2005) indicated that the results derived from the sample of large firms may not be equally applicable for smaller firms. This is because motives of diversification may be different across small, medium and large firms. Hence, the effect of related diversification on performance may differ across the twin dimensions of service offerings and industry domains across small, medium and large sized firms. In this study, we examine the related diversification strategy performance relationship across different firm sizes.

At an overall sample level, our results do not show a relationship between related diversification and performance. However, our results for sub-sample analysis based on size of the firms show that related diversification across service specializations and industry domains impact performance differently across different firm sizes. While we find that related diversification in service specialization has an inverted U shape with performance for the medium sized firms, they do not impact performance of small firms. Performance of small firms has a U shaped relationship with the relatedness in industry domains. Thus our study extends the theory of related diversification in PSFs by showing that diversification performance relationship across service specializations and industry domains varies for differently sized firms.

This paper is structured as follows. In the next section, we introduce the theoretical underpinnings of diversification and hypothesize performance implications of related diversification across industry domains and service specializations. We then describe the setting, data, model followed by a presentation of results. Finally, we conclude with discussion and implications of our findings.

Theory and hypothesis

PSFs are referred to as knowledge engines for business (Lorsch and Tierney, 2002). PSF industry revenue is about US$700 billion worldwide (Scott, 1998). Lowendahl (2000) argues that PSFs are substantially different from manufacturing firms and to apply the theories of other organizations to PSFs would be incorrect. Various studies have highlighted that the PSFs require different theories of management because of their distinguishing characteristics (Lowendahl, 2000; Greenwood *et al.*, 2006; Malhotra *et al.*, 2006; Von Nordenflycht, 2010) . Von Nordenflycht (2010) describes high knowledge intensity as one of the key characteristics of PSFs. PSFs are known to have high knowledge intensity because of their ability to tackle client's unstructured problems. Mostly, the unstructured problems are solved by experts who possess distinctive competence in a particular area. This provision of solution to unstructured problems involves continuous interaction between clients and the service provider (Greenwood *et al.*, 2005). During these interactions experts combine their expertise in providing a particular service, knowledge about the industry domain of the client and the knowledge of the client's unique situation to exercise their judgement and provide customized solutions (Lowendahl, 2000; Teece, 2003; Greenwood *et al.*, 2005). The important point to emphasize is that during these interactions, the production of services by PSFs and consumption of services by clients is simultaneous (Miles *et al.*, 1995; Jensen *et al.*, 2010). Hence, clients cannot measure the quality of the service provided until after the services are delivered due to the intangible nature of these services as well as their co-terminus production and consumption (Greenwood *et al.*, 2002; Kaiser and Ringlstetter, 2010). One of the key implications of this highly knowledge intensive service is that the quality of the service cannot be measured by clients beforehand. Even ex-post, the quality of services is difficult to evaluate (Von Nordenflycht, 2010). This information asymmetry also makes it difficult for the service providers to sell such services to clients. Service firms use reputation to signal their quality and mitigate this information asymmetry (Nayyar, 1990). When PSFs expand their scope, the transferability of reputation across service specializations or industry domains would be a key consideration (Nayyar, 1990; Greenwood *et al.*, 2005).

The second key consideration of clients while selecting PSFs is their ability to economize on their search costs. Since clients wish to economize on their search costs, PSFs can become a "One stop shop" for their clients (Trebilcock and Csorgo, 2001). Firms have an incentive to diversify because during the course of its operations, it ends up with some excess capacity in its resources. The firms cannot use this excess capacity of resources by subcontracting them because they are usually firm specific and cannot be used outside the firm due to imperfect indivisibility of resources (Teece, 1982). Diversification helps in exploiting benefits from excess capacity of a resource (Barney, 1991; Markides and Williamson, 1996; Wernerfelt, 2006). So, PSFs can economize their selling costs (search costs of clients) as well as utilize the excess supply of the resources by diversifying into related service specializations or industry domains. For example, a consulting firm serving a pharmaceutical client on cost reduction strategies need to integrate its industry specific knowledge of pharmaceutical sector with their expertise to reduce costs. The same consulting firm can diversify into providing entry strategy services from its existing cost reduction strategy services to the same client. Hence, reputation transfer and economies of scope are two key considerations when PSFs expand their scope (Nayyar, 1993).

Studies on diversification have predominantly focused on examining diversification in PSFs across service specializations only (Greenwood *et al.*, 2005). Diversification is

necessarily seen only from production of goods or technical services point of view. Diversification across industry domains is not considered important. The importance of industry knowledge in PSFs is clear from the following quote from KPMG:

> Drawing on our *industry knowledge* allows us to understand our clients' unique business issues and quickly respond with clear and practical business advice. Our *industry professionals* combine local and global experience with the latest technical and *industry knowledge* to help clients achieve sustainable business performance (as quoted in Habib and Bhuiyan, 2011, emphasis added).

PSFs also diversify across industry domains to avoid conflict of interest while serving competing clients in the same industry (Kubr and Kubr, 2002). In case of the Indian IT industry, an IT service firm combines the knowledge of client's industry and firm's service specialization to provide customized services. A diversification in this case could either mean diversifying across the range of services or diversifying across industry domains (i.e. client industries) or both. For example, a firm offering ERP solutions in the banking domain could either expand along service lines by adding Data warehousing solutions to its banking clients or along industry domains by offering ERP solutions to say clients in Oil and Petroleum industry or both.

Moreover, there is a large firm bias in diversification performance studies (Bood, 2001). Greenwood *et al.* (2005) uses a sample of large firms to examine the relationship between diversification and PSF performance. Bood (2001) in his work on diversification strategy of small firms argues that the characteristics of small and medium sized firms are different from the large corporations. Small and medium sized firms are usually run by owner managers, are constrained by resources and face greater uncertainty in their environments in comparison to larger corporations (Todd and Javalgi, 2007; Varma, 2011). Accordingly, motives of diversification may be different across small, medium and large firms. Hence the effect of related diversification on performance may differ across the twin dimensions of service offerings and industry domains across differently sized firms. In this study, we hypothesize that the effect of reputation transfer and economies of scope differ significantly in related diversification across services specializations and industry domains.

Performance implications of related diversification across specializations

When firms diversify into multiple service specializations they are basically serving same clients or similar clients from the same industry domain. Accordingly, firms could cross sell services because they can use the knowledge of the client's business and expertise in one area to give better services in a related service offering (Greenwood *et al.*, 2005). Clients can also economize on their search costs and thus the PSFs can become a "One stop shop" for their clients (Trebilcock and Csorgo, 2001). So PSFs can economise on their costs by diversifying into related service specializations. Additionally, if a PSF is already providing a particular service to a client, the reputation of the PSF is already established with that client and hence reputation transfer becomes easier. This reputation transfer is also easier when PSFs sell their services to different clients within the same industry domain because clients use peer referrals for sourcing professional services (Mitchell, 1994). Thus, as the degree of relatedness increases across service specializations, it would be easier to transfer reputation and benefit from economies of scope resulting in better performance of PSFs.

Teece (1982) suggests that using common resource bases across a range of activities can lead to poorer performance of firms due to congestion. In other words, attempts by

firms to leverage the same resources (absence of organizational slack) for increased number of activities may lead to overstretching and thus could lead to poorer performance of PSFs. For example, if a firm is trying to cross sell multiple services to the same client using the same marketing / sales person, there is a constraint on his/her time for selling multiple services to different stakeholders of the same client leading to overstretching. In addition, very high relatedness could also lead to institutionalization of routines across specializations to exploit economies of scope. This means that as firms try to exploit the relatedness between the services to reap economies of scope, their routines get established and become rigid. As firms further try to extend the scope to other services they face significant difficulty in modifying these rigid routines leading to diminished performance (Leonard-Barton, 1992). Accordingly, we hypothesize:

H1. There is an inverted "U" shaped relationship between related diversification across specializations and performance of PSFs.

Performance implications of related diversification across industry domains

PSFs can also diversify by offering the same service to clients in different industry domains. There are economies of scope to be realized in the diversification across industry domains as well. In this case, firms can spread its investments on services across clients from multiple industries. Besides, firms can also transfer best practices of one industry domain to other industry domains. For example, a firm providing business process reengineering to a banking industry client, can also provide the same service to a client in industry say insurance. However, the reputation transfer is not as seamless as in the case of additional service offering. This is because PSFs need to build reputation with the clients in the new industry domain. PSFs can transfer reputation as well as acquire knowledge to reap economies of scope much more easily across highly related industry domains. One of the reasons for the above is that clients might perceive firms which are in highly related industry domains to be able to execute the services better than those firms which are not in highly related industry domains (Nayyar, 1990). For example, a consulting firm catering to the banking clients would find it difficult to convince clients in say Oil and Petroleum industry that their services will retain the same quality. However, they are likely to be more successful in selling their services to the clients in insurance industry, since insurance and banking may seem more related to the clients. Hence, PSFs are able to transfer reputation across highly related industry domains and thus they would be able to realize economies of scope. Thus, PSFs would perform significantly better at high degree of relatedness among industry domains.

PSFs face difficulty in transferring reputation across industry domains which are moderately related to each other. At moderate and low relatedness between industry domains the clients do not perceive any relatedness and hence reputation transfer becomes difficult.

As firms diversify into other industry domains, there is sharing of resources between existing industry domains and new industry domains. As the interdependencies increase with diversification into newer industry domains, co-ordination costs of managing the interdependencies also increase. These coordination costs manifest in the form of greater need for integration of knowledge to realize economies of scope. Zhou (2010) argues that the co-ordination costs increase at a greater rate for related diversification than less related diversification. Accordingly, the co-ordination costs that firms incur for moderately related diversification is higher than low related diversification across industry domains. Hence,

the performance of firms at low related diversification is higher than moderately related diversification across industry domains. Consequently, we hypothesize:

H2. There is a "U" shaped relationship between related diversification across industry domains and performance of PSFs.

Data, model and measures

We have used the setting of Indian IT industry to examine the link between related diversification and performance across industry domains and service specializations. Like other PSFs, Indian IT industry is also characterized by high human capital intensity (McManus, 2011) and low capital intensity. The Indian IT industry is estimated to contribute about 6 per cent of India's GDP and about 26 per cent of exports in the year 2010 (NASSCOM, 2010). The IT industry in India has evolved from providing on-shore services to offshore services and now to services distributed across various geographies. In terms of diversity offered, IT service firms have evolved from providing application, development & maintenance services to engineering & industrial services and infrastructure services to its clients worldwide across a variety of industries such as banking, retail, financial services, insurance and manufacturing. This makes the IT industry an ideal setting to examine the impact of related diversification across both industry domains and service specializations.

The sample was taken from National Association of Software and Service Companies (NASSCOM) directories containing information on its member companies. NASSCOM is the industry body for Indian IT firms. The combined revenues of NASSCOM member firms contribute to almost 95 per cent of the revenue of IT industry in India. Data from the NASSCOM directories have been used in various studies (Zaheer *et al.*, 2008; Gao *et al.*, 2010). These directories include data on number of employees, types of services rendered, industry domains served by the firms, certifications obtained, their revenues, export and ownership type of firms. We used the information given in the 2002 directory of NASSCOM containing 854 firms. Information was available on service specialization and industry domain for 675 companies out of which 94 per cent had mentioned both specializations and industry domains. The list of specializations and industry domains is given in Table I. Similar to previous studies, performance is taken as an outcome of diversification strategy of firms. All the variables that affect performance were lagged by one year to examine causality rather than association. Accordingly, the revenue or performance figures were obtained from the 2003 edition of the directory and this resulted in export information not being available for few companies. Further we excluded the business process outsourcing firms from the sample. Our resulting sample consisted of 227 firms.

Estimation model

The hypothesis developed above was tested using the following model:

$$\textit{Export performance}_t = \beta_0 + \beta_1(\textit{Relatedness in specializations}_{t-1}) + \beta_2(\textit{Relatedness in industry domains}_{t-1}) + \beta_3(\textit{Relatedness in specializations squared}_{t-1}) + \beta_4(\textit{Relatedness in industry domains squared}_{t-1}) + \beta_5(\textit{CMM Certification}_{t-1}) + \beta_6(\textit{Age}_{t-1}) + \beta_7(\textit{Size}_{t-1}) + \text{error}$$

Goddard *et al.*(2008) in a study of diversification of US credit unions suggested that small firms should eschew diversification and larger firms need to exploit opportunities for diversification. Similar to such studies, we also estimated diversification performance relationship across the two dimensions (i.e. industry domains and service specializations) for small, medium and large firms. We used the sub sample analysis using criteria from

Industry domains	Specializations	
Education and training	Web technologies	Microprocessor
Entertainment	Internet	ASIC
Engineering	Intranet	Localization of software
Defence	E-commerce	CD ROM publishing
Health & Medical	EDI	Multimedia
Telecommunications	CRM Solutions	GIS
Transport	Application Service Provider	Imaging
Ports	WAP	Web content development
Textiles	M-Commerce	Computer games
Printing & Publishing	ISPs	Computer graphics
Advertising	Payment Gateways	Animation
Travel, Hotel & Leisure	ERP	Data processing
Banking	MRP Solutions	Data conversion
Insurance	CAD	Antivirus
Stock Exchange/Financial Acc.	CAM	Security Solutions
Manufacturing	CAE	IT education and training
Retail	Telecom Solutions	
Trading & Distribution	Communication Software	
Electronic Government	Software Maintenance and Migration	
Public Services Admin.	RDBMS	
Web Applications	Data warehousing	
Online Information Services	Data mining	
Office Automation	System Integration	
Library Management Systems	Networking	
Airline	Business Process Consultancy	
Railways	Re-engineering	
Electronics	Software Product Development	
Design Automation	Product Distribution	
Robotics	Support	
Oil	Implementation	
Petroleum	Chip Design	

Table I.
List of industry domains and specializations

earlier studies to classify IT firms with < 50 software employees as small, between 50 and 250 employees as medium and more than 250 employees as large (Becchetti *et al.*, 2010).

Measures

Dependent variable. A very high number of firms in the Indian IT services industry are offshoring firms. Hence a better measure of performance for these firms is exports. A number of studies on related diversification have also chosen export intensity as a measure of performance (Aulakh *et al.*, 2000; Elango and Pattnaik, 2007; Sousa *et al.*, 2008; Gao *et al.*, 2010). In this study, we have taken exports instead of export intensity as a measure of performance. This is because the average export intensity was quite high leading to little variation. Hence, we have used absolute value of exports as a measure of performance in our model. Since past studies have used productivity as the dependent variable (Greenwood *et al.*, 2005),we have checked robustness of our results using export productivity (export revenue per employee) as a measure of performance.

Relatedness across service specializations and industry domains. Most of the studies at an inter-industry diversification level use industrial classification for measuring

relatedness. Two industries are taken to be related if their Standard Industrial Classification (SIC) codes have matching digits. However, for intra-industry diversification this measure cannot be used. Further, there is no a-priori consensus about relatedness of market niches within an industry (Davis and Thomas, 1993; Stimpert and Duhaime, 1997; Pehrsson, 2006). Recent studies on diversification have used survivor based measures of relatedness (Teece *et al.*, 1994; Bryce and Winter, 2009; Lee and Lieberman, 2009). This measure has several advantages. One of the advantages is that it does not depend on any a-priori defined hierarchical structure between market niches. Additionally, this measure of relatedness comes from observation of joint occurrence of business combinations. In this measure, the observed tendency of relatedness encompasses all the measurable and immeasurable synergies. Prevalence of combinations can be taken as proof of relatedness as poor decisions would be screened out in a competitive environment (Zuckerman, 2000). We compute survivor based measure of relatedness for both industry domains and service specializations.

The relatedness index between service specialization i and j was measured as follows.

Let us consider a population of diversified firms having total K firms and define the following:

$C_{ik} = 1$ if firm k offers service specialization i. Otherwise the value is 0;
$n_i = \sum_k C_{ik}$ and $n_j = \sum_k C_{jk}$ are the total count of firms offering specialization i and j, respectively;
$J_{ij} = \sum_k C_{ik} C_{jk}$ is the count of firms active in both i and j with $0 < J_{ij} \leqslant \min(n_i, n_j)$.

A measure of relatedness is computed by comparing the observed J_{ij} with the number of firms that would result from random diversification. The random diversification result can be calculated through the hyper-geometric random variable X_{ij}. This is done by extracting without replacement from a population of K firms two samples n_i and n_j. The probability to find x firms operating in both i and in j is the following:

$$\Pr(X_{ij} = x) = \frac{\binom{n_i}{x}\binom{K-n_i}{n_j-x}}{\binom{K}{n_j}}$$

The mean and variance of X_{ij} are, respectively:

$$\mu_{ij} = E(X_{ij}) = \frac{n_i n_j}{K}$$

$$\sigma_{ij}^2 = \mu_{ij}\left(1-\frac{n_i}{K}\right)\left(\frac{K-n_j}{K-1}\right)$$

The index of relatedness is computed by matching the observed value of J_{ij} with μ_{ij}, and scaling the difference with the standard deviation of X_{ij}:

$$SR_{ij} = \frac{J_{ij}-\mu_{ij}}{\sigma_{ij}}$$

The above relatedness index was computed for each pair of service specializations and each pair of industry domains.

To illustrate how the survivor based measure of relatedness faired in the IT context we report the highest and lowest value of relatedness index for pairs of service specializations and pairs of industry domains. The index of relatedness for service specializations is high for service line pairs such as *CAM* and *CAE*, *GIS* and imaging, Computer Graphics and Animation (data not reported) whereas it is lower for service line pairs such as microprocessors and business process consultancy, web content development and chip design. We also found that the index of relatedness for industry domain pairs is high for client industries such as printing/publishing and advertising, banking and insurance, retail and trading whereas it is lower for pairs such as public services and electronics, design automation and education. This shows that the relatedness measure has an intuitive appeal.

We arrived at a firm level measure of related diversification in service specialization using the following:

$$related\_diversification = \frac{\sum_{j \neq i} SR_{ij}}{m}$$

where m refers to the number of combination of service specializations in a firm and SR_{ij} refers to the relatedness index computed above. For example if an IT firm offers ERP, system integration, M-commerce and data mining, there will be six pairs of service specialization for the firm. The average of the relatedness index for these six pairs gives us the measure of related diversification in service specializations for this firm.

The same approach was followed for computing relatedness at firm level for the industry domains as well.

Control variables. IT firms can also use certification as a means to signal quality in addition to reputation. Similar to other studies (Gao *et al.*, 2010), we have used CMM certification to capture differences in quality processes of firms. CMM certification was measured as a binary variable and it equals 1 if a firm has a level 3 or above certification and 0 otherwise (Keeni, 2000; Gao *et al.*, 2010). Size of the firm is expected to have an influence on the performance of firm. We controlled for age and firm size (number of employees) as part of this study. To reduce skewness, all independent variables were converted to logarithms.

Past studies on diversification have highlighted the importance of size on diversification (Bood, 2001; Iacobucci and Rosa, 2005). Due to this differential effect of size, the coefficients are not likely to be remain the same across different firm sizes. Hence, sub sample analysis is considered more appropriate as there is a poor justification for pooling of such firms in a regression (Rogers, 2004).

Results

Table II displays the means, standard deviations for all the firms in the sample as well as for the subsample of small, medium and large firms. The means show that exports of medium sized firms are larger than the small sized firms. The correlation between exports and the number of employees was high for all firms at 0.8; however, the correlation dropped to < 0.5 for the medium sized firms and small firms. High correlation between exports and the number of employees is typical for PSFs. The value of related diversification in specializations is highest for large firms followed

Table II. Descriptive and correlation statistics

	Variable	Mean	SD	Min.	Max.	1	2	3	4	5	6	7
All firms (n = 235)												
1	Log of Exports	3.85	2.43	−2.41	10.57	1						
2	Log of Relatedness in specializations	1.09	0.46	−4.77	1.79	0.08	1					
3	Log of Relatedness in industry domains	1.06	0.48	−2.74	2.07	−0.04	0.00	1				
4	Log of Relatedness in specializations squared	1.40	1.48	0.07	22.78	−0.09	−0.62*	0.08	1			
5	Log of Relatedness in industry domains squared	1.34	0.87	0.00	7.50	0.10	−0.01	−0.01	0.08	1		
6	Certification	0.18	0.38	0.00	1.00	0.50*	−0.01	−0.02	−0.06	0.10	1	
7	Log of Age	1.76	0.86	0.00	7.60	0.39*	0.01	−0.04	0.04	0.06	0.28*	1
8	Log of No. of employees	4.46	1.55	0.69	9.73	0.80*	0.10	0.02	−0.11	0.06	0.58*	0.38*
Small firms (n = 90)												
1	Log of Exports	2.16	1.72	−2.41	5.09	1						
2	Log of Relatedness in specializations	1.04	0.67	−4.77	1.63	0.06	1					
3	Log of Relatedness in industry domains	1.08	0.36	−0.45	2.07	−0.07	−0.01	1				
4	Log of Relatedness in specializations squared	1.54	2.32	0.07	22.78	−0.11	−0.83*	0.15	1			
5	Log of Relatedness in industry domains squared	1.30	0.69	0.00	4.28	−0.02	0.00	0.91*	0.18*	1		
6	Certification	0.03	0.18	0.00	1.00	0.18*	0.00	−0.24*	−0.03	−0.08	1	
7	Log of Age	1.47	0.99	0.00	7.60	0.16	−0.03	−0.02	0.09	−0.03	−0.01	1
8	Log of No. of Employees	2.99	0.67	0.69	3.89	0.47*	0.15	0.08	−0.19*	−0.01	−0.06	0.00
Medium sized firms (n = 92)												
1	Log of Exports	3.80	1.67	−1.61	7.23	1						
2	Log of Relatedness in specializations	1.10	0.28	−0.46	1.79	0.00	1					
3	Log of Relatedness in industry domain	1.00	0.64	−2.74	2.03	−0.13	0.03	1				
4	Log of Relatedness in specializations squared	1.28	0.51	0.20	3.19	−0.06	0.91*	0.07	1			
5	Log of Relatedness in industry domains squared	1.41	1.11	0.03	7.50	0.28*	−0.04	−0.46*	−0.02	1		

(*continued*)

Table II.

	Variable	Mean	SD	Min.	Max.	1	2	3	4	5	6	7
6	Certification	0.09	0.28	0.00	1.00	−0.01	−0.01	−0.15	−0.03	0.22*	1	
7	Log of Age	1.77	0.69	0.00	3.37	0.20*	0.08	−0.10	0.06	0.17	0.05	1
8	Log of No. of employees	4.63	0.47	3.91	5.46	0.35*	0.08	−0.03	0.03	0.31*	0.22*	0.22*
Large firms (n = 53)												
1	Log of Exports	6.79	1.66	3.13	10.57	1						
2	Log of Relatedness in specializations	1.15	0.20	0.37	1.62	−0.06	1					
3	Log of Relatedness in industry domain	1.10	0.28	0.36	2.02	0.06	−0.07	1				
4	Log of Relatedness in specializations squared	1.36	0.43	0.14	2.63	−0.09	0.98*	−0.09	1			
5	Log of Relatedness in industry domains squared	1.29	0.62	0.13	4.07	0.06	−0.01	0.97*	−0.02	1		
6	Certification	0.58	0.50	0.00	1.00	0.44*	−0.40*	0.24*	−0.42*	0.22	1	
7	Log of Age	2.23	0.68	0.69	3.53	0.43*	−0.24*	−0.01	−0.24*	−0.02	0.39*	1
8	Log of No. of employees	6.65	1.03	5.53	9.73	0.75*	−0.25*	0.15	−0.28*	0.12	0.55*	0.51*

Note: *Significant at 10 per cent level

by medium and small firms while value of related diversification in industry domains is lowest for the medium firms.

The correlations of value of related diversification and its squared term were very high. Such a high level of correlation between a variable and its squared term is common in empirical studies. Though estimates are not likely to be biased due to such a high level of correlation, the standard errors may be high (Aiken and West, 1991). To ensure that this problem does not affect our estimation, we looked at the collinearity diagnostics using variance inflation factors and found that that maximum VIF was less than ten for our overall sample and subsample of medium and small firms which is accepted in empirical studies (Neter *et al.*, 1990). We have not shown the results for the large firms because the regression for large sized firms had high variance inflation factors (>10) and hence the model could not be interpreted meaningfully. The only reasonable alternative was to collect more data to test the effects for large firms (Gujarati, 2002) . In our research setting this would mean collecting longitudinal data which we advocate for future research. All other correlations were < 0.5.

Table III presents the results of our regression analysis. The regression estimates incorporate classic correction for heteroscedasticity, i.e. HC0 estimator proposed by Huber (1967) and White (1980). We show the model results for all the firms in our sample along with the results of subsample analysis on small sized firms and medium sized firms.

Overall, we find support for only age and size when we estimate the relationship by considering all firms in our sample. This shows that size plays an important role in related diversification performance relationship confirming the benefits of scale found in similar studies(Greenwood *et al.*, 2005; Gao *et al.*, 2010). The subsample results confirm that the coefficients do vary for differently sized firms. For small firms we see that certification affects export performance. We also find that diversification across

Variable	All firms	Small sized firms	Medium sized firms
Constant	−1.625***	−0.841	−2.033
	(0.623)	(1.051)	(1.763)
Log of Relatedness in specializations	−0.012	−0.344	1.370**
	(0.235)	(0.401)	(0.611)
Log of Relatedness in industry domains	−0.259	−1.980*	−0.060
	(0.177)	(1.090)	(0.219)
Log of Relatedness in specializations squared	−0.016	−0.105	−0.916*
	(0.067)	(0.118)	(0.467)
Log of Relatedness in industry domains squared	0.118	1.002**	0.293**
	(0.091)	(0.442)	(0.144)
Certification	0.255	1.394***	−0.788
	(0.362)	(0.506)	(0.724)
log of Age	0.253**	0.300**	0.249
	(0.122)	(0.130)	(0.273)
Log of No. of employees	1.151***	1.295***	1.033**
	(0.086)	(0.183)	(0.405)
Adj. R^2 (%)	63.9	25.7	13.2
n	235	90	92

Notes: Standard errors are in parenthesis. ***,**,*Significance at 1, 5, and 10 per cent, levels, respectively

Table III. Regression model results showing difference in determinants of export performance by size of the firms

service specializations do not impact performance of small firms. However, related diversification across industry domains does impact export performance of small firms. As hypothesized, we find support for a U shaped relationship between degree of related diversification across industry domains and export performance confirming non-linearity in related diversification performance relationship.

The result for medium sized firms contrasts interestingly with the findings for the small firms. While size influences exports, age of the firm does not. In contrast to the findings for small firms, we find support for an inverted U shaped relationship between related diversification across service specializations and export performance. Further we find weak support for our hypothesis on related diversification across industry domains. The relatedness across industry domains contributes to performance only at very high degree of relatedness as indicated by the significance of only the squared term. We also find that certification does not influence export performance of medium sized firms.

For large firms our results are tentative as regression could not be estimated due to multi collinearity. The correlation matrix does help us speculate on the relationship between related diversification and performance for large firms. The large firms show a negative correlation coefficient between performance and related diversification in service specializations unlike small and medium firms. This could mean that due to their size, large firms can attempt to become one stop shop for their clients to leverage the relationship with the clients. The correlation between related diversification in industry domains and performance is positive unlike negative sign in case of small and medium firms. This implies that large firms specialize in industry domains. This is consistent with the findings of Craswell *et al.* (1995) who show that the Big Eight accounting firms earned a higher premium over other audit firms because of their industry specialization.

Studies in the PSF context have also considered employee productivity as a performance measure and have found it be highly correlated with profitability of firms (Malos and Campion, 2000). To check the robustness of our findings, we used exports per employee as the dependent variable and found that the results are qualitatively similar (Table IV). This shows that our model is robust in capturing the implications for performance of Indian IT firms.

Discussion

Our findings extend the performance implications of related diversification in PSFs on three counts. First, previous studies on related diversification considered only the product or service dimension. We extend the same to highlight the importance of related diversification across industry domains as well. We show that the performance implications of related diversification vary across the two dimensions. Second, previous studies have studied the impact of reputation and economies of scope on diversification across PSFs. However, our study combines the relative effect of both reputation and economies of scope for diversifying PSFs and emphasizes limits to related diversification. Third, our study highlights the importance of different size categories in examining the impact of related diversification.

For small firms we find support for a U shaped relationship between related diversification across industry domains and performance. Credence is given by clients only if they perceive the industry domains as highly related. Small firms through their actions probably are not able to convince their clients of the relatedness between industry domains. Hence, export performance of small firms' increases when there is

Variable	All firms	Small sized firms	Medium sized firms
Constant	−1.625***	−0.841	−2.033
	(0.000)	(0.000)	(0.000)
Log of Relatedness in specializations	−0.012	−0.344	1.370**
	(1.672)	(3.482)	(5.844)
Log of Relatedness in industry domains	−0.259	−1.980*	−0.060
	(1.018)	(7.364)	(1.339)
Log of Relatedness in specializations squared	−0.016	−0.105	−0.916*
	(1.697)	(3.683)	(5.815)
Log of Relatedness in industry domains squared	0.118	1.002**	0.293**
	(1.020)	(7.185)	(1.485)
Certification	0.255	1.394***	−0.788
	(1.553)	(1.193)	(1.089)
log of Age	0.253**	0.300**	0.249
	(1.191)	(1.021)	(1.072)
Log of No. of employees	0.151*	0.295	0.033
	(1.682)	(1.089)	(1.226)
Adj. R^2 (%)	7.1	5.7	1.4
n	235	90	92

Notes: Standard errors are in parenthesis. ***,**,*Significance at 1, 5, and 10 per cent levels, respectively

Table IV. Robustness check: Regression model results showing difference in determinants of exports per employee by size of the firms

high relatedness across industry domains and reduces at a medium level of relatedness. We also find that diversifying across service specializations has no impact on performance of small firms. This implies that clients approach small PSFs for their niche services and do not respond to cross selling attempts. Our findings for small firms are consistent with previous studies that small firms need to first build a "strong foundation in their primary line of business" before diversifying to other services (Robson *et al.*, 1993). We further enhance this finding by showing that small firms need to concentrate on their primary line of services and consider diversifying only across related industry domains. Additionally, small firms can successfully use mechanisms such as certification to signal quality to their clients. This finding is consistent with previous studies which highlight the impact of quality certification on performance (Chan, 2002). While Nayyar (1990) downplayed certification as a mechanism to only show minimal quality standards, our results show that even such minimal signalling helps small firms overcome reputation barriers with their clients.

For medium sized firms our results show that related diversification across service specializations exhibit an inverted "U" shaped relationship. While expanding the scope of services, medium firms reap benefits even for moderately related service specializations. Our findings also show limits to exploitation of relatedness across service specializations. One of the probable reasons could be that firms may not have necessary organizational slack to achieve higher performance and resources may be over-stretched (Shayne, 2005). Our empirical finding corroborates the findings obtained using computer simulation that even related diversification can impact the performance negatively (Shayne, 2005). However, we augment this finding by showing that high related diversification across only one of the dimensions can affects performance negatively. In addition, we show that this negative relationship between very high related diversification in specializations and performance holds true only for medium sized firms. We also find that there is a weak U shaped relationship between degree of relatedness

across industry domains and performance of medium sized firms. The performance neither suffers nor improves when the medium sized firms are experimenting with relatedness across industry domains. However, there is a gain in performance at very high relatedness when reputation transfer is easier or very low relatedness when reputation transfer is not attempted. These findings underscore the importance of high relatedness between industry domains in a firm portfolio.

Overall, our findings indicate that size of the firms; in other words life cycle of firms moderates the relationship between related diversification and performance (see Table V). For small firms, the relationship between related diversification across service specializations and performance is not significant, while for medium sized firms it is significant. This implies that a minimum scale is necessary to exploit scope economies and transfer reputation across service specializations. For diversification along industry domains, we find that increased size tempers the degree to which firms can experiment with scope. While small firms face negative performance implications for diversification into moderately related industry domains, medium sized firms have more freedom to experiment within a limited range.

Conclusion

To the managers of PSFs, our research suggests that managers need to extend their thinking by paying attention to different types of knowledge bases they have. In addition to diversifying only across services knowledge, managers need to consider diversifying across their industry knowledge bases also. Additionally, our study also shows that it may not be appropriate for small firms to become a one stop shop. It is better if the small firms innovate or experiment across related industry domains. For medium sized firms it is better to attempt diversifying into moderately related specializations.

Our study contributes to the diversification literature by extending the uni-dimensional nature of diversification to a multi-dimensional one. Further, our study extends the theory of diversification of PSFs by arguing that reputation transfer and economies of scope work differently across the two dimensions namely, service specializations and industry domains. To the best of our knowledge only Nayyar (1992) and Tanriverdi and Lee (2008) have explored the implications of diversification across more than one dimension. While the existing literature has separately considered service diversification (Kor and Leblebici, 2005) or industry specialization (Lim and Tan, 2007), ours is the first study to consider both together. In addition, our study also shows that size plays a critical role in diversification performance relationship. By combining firms of different sizes, studies are not able to delineate the implications of diversification across life cycle of firms. Our study is also one of the few studies to use the survivor measure of relatedness which captures relatedness using managers' conception of business rather than any industrial classification. We did not have data on either employee headcount or revenue breakup

Table V.
Moderating effect of size on related diversification and performance relationship

Hypotheses	All firms	Small firms	Medium firms
H1: service specializations Inverted U shaped relationship	Not supported	Not supported	Supported
H2: industry domains U shaped relationship	Not supported	Supported	Supported only for extremes

for each service specialization and industry domain. Future studies can consider incorporating such data to arrive at a fine grained measure of related diversification. While we have used cross section data for studying relatedness, this does not capture inter-temporal economies of scope (Helfat and Eisenhardt, 2004). Future studies can explore this using longitudinal data. While, our study uses the IT industry setting to examine the related diversification relationship of PSFs, future studies can test these hypotheses across different PSF types such as accounting, management consulting, etc.

Note

1. In this study, we consider unrelated diversification as diversification with low level of relatedness. In this context, we fall in the category of studies which consider related diversification as a matter of degree (Montgomery and Wernerfelt, 1988; Chatterjee and Wernerfelt, 1991; Zhou, 2010).

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About the authors

Dr Karthik Dhandapani is an Assistant Professor at the Indian Institute of Management Ahmedabad (IIMA) in the Business Policy area. Prior to joining IIMA he worked in analytics field for four years. Has interest in the field of corporate and competitive strategies, applications of business intelligence and analytics in strategy. His current research includes geographic and

product/service diversification of IT and ITES firms and business groups in emerging economies. He teaches core courses in Strategic Management and an elective on Economics of Strategy. He is a Fellow of IIMA and an Associate Member of the Institute of Company Secretaries of India. Dr Karthik Dhandapani is the corresponding author and can be contacted at: dkarthik@iimahd.ernet.in

Rajesh S. Upadhyayula is an Assistant Professor at the Indian Institute of management Kozhikode (IIMK) in the Strategic Management area. Prior to joining IIMK, he worked as a Manager (Strategic Planning and Market Intelligence) at the Tata Consultancy Services for five years. He teaches courses on Strategic Management, Mergers Acquisitions and Strategic Alliances (MASA) and Economics of Strategy. His current research interests include the effect of location (especially industrial clusters) on competitive strategy of firms, role of location (industrial clusters) in capability formation of firms. He is a Fellow of IIMA, has a Post-Graduate Diploma in Management from the Indian Institute of Forest Management, Bhopal and a Bachelors of Engineering from the Andhra University.