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A new look at returns of information technology: firms' diversification to IT service market and firm value

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Abstract
Firms that are traditionally not in the scope of IT increasingly develop IT services as new business lines to create better customer offering portfolios. The current research takes the first step to theoretically explore and empirically examine how these firms' diversification to IT services may affect their performance as reflected in firm value. Furthermore, these relationships are modeled into three key interactions with firm size, firm age, and firm service intensity, to decode the differential roles of this diversification strategy on firm shareholder welfare in the varying scenarios along with the moderators. This research generates implications for theories such as IT and knowledge management, resource-based theories, and it provides practical implications for business managers.

Keywords Information services · Diversification · Firm value · Firm idiosyncratic risk · Moderating effects

1 Introduction

Information technology service (ITS) has captured remarkable attention from academic researchers as well as firm managers because ITS represents customer solutions that are realized through information exchange, system integration, and software support, and these solutions are largely innovation-oriented and application-embedded aiming for optimized corporate outcomes [57, 76, 84, 100]. Within this research domain, traditional ITS firms (e.g., Alphabet, IBM, Microsoft, Oracle, SAP, VMware, and so on) received the main research focus regarding their versatile IT offerings for a wide range of target markets. However, in the past decades, non-IT service firms have been witnessed to increasingly diversify into ITS market sectors. These non-ITS firms' core businesses may be in retailing, wholesaling, manufacturing, and professional services that are distant from ITS. Yet, this diversification strategy stands for one of the most important attempts for these non-ITS firms to seek new market opportunities and secure competitive advantages in the converging business world [69, 77, 85]. For example, Amazon diversified from online retail to various ITS lines such as enterprise cloud computing service (AWS); Samsung manufactured industrial and consumer products and then penetrated to information-related service lines such as smart home solutions. Also, Ricoh's Cyber Security Service, File Analysis Services, and eDiscovery Services, Best Buy's IT embedded Senior Care Solutions, and Fedex's Trade Networks and the associated e-commerce solutions for businesses are examples of this type of ITS diversification. Non-ITS firms, in the new era, are increasingly realizing the power of ITS development, and they are more willing than ever to embrace this strategic orientation due to the recognition of the critical power of an ecosystem that allows the firm to use mutually supportive product/service lines to create customer loyalty [40, 117]. ITS diversification, therefore, represents one of the key paths to the ecosystem because information-based service is the essential instrument to create necessary intra-links within a product family (e.g., Apple's iCloud services for businesses). More importantly, ITS diversification is radically different from the traditional view of using

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IT tools within a firm to facilitate operations because ITS diversification is largely externally-focused, represents the firm's full commitment to customer solutions, and creates a new frontline that directly faces the competition in the information product markets. This important research area, however, has been surprisingly neglected in the extant literature. The current research is motivated by this interesting asymmetry between the limited theoretical understanding and the popular real-world observation regarding the critical role of ITS diversification. We developed an empirical study to examine if firms' such endeavors truly produce positive business outcomes.

Shareholder value is a main performance indicator that is widely employed in strategic management studies in gauging the effectiveness of firm strategies, activities, and orientations [2, 23, 33, 53]. Nonetheless, in the IT management research streams, the explicit linkage between the IT metric to shareholder value is surprisingly understudied, and yet this linkage is of top importance to push the research frontier in information-related firm strategies for several notable reasons. First, information products deployment has been recognized as a powerful means for a firm to achieve financial returns such as profitability and cash flows [93, 98, 112], whereas its impact to the most fundamental firm welfare, firm value, is not well-established in the literature. This knowledge vacancy hinders further theoretical exploration of IT's function for firms. Second, for non-ITS firms, diversifying to ITS markets can be a seemingly risky strategy because firms have to develop a radically new set of operations and skills to capture the opportunity [45, 116]. In this sense, managers may have uncertainty without clear evidence regarding the outcome of this diversification strategy. Third, the stakeholder view of the firm supports that shareholder value is one of the most influential entities that affect firm future growth potentials [1]. Thus, clarifying the link between ITS diversification and firm value gives managers important support for seeking external favorability. Fourth, theorists in finance and strategic management have explicitly indicated that shareholders assess the firm as a comprehensive body and will scrutinize all functional areas of the firm [34]. Meanwhile, IT management literature holds the notion that IT development in a firm incurs comprehensive interdepartmental coordination [17]. Thus, bridging these two widely reaching constructs should yield valuable knowledge about the essential links between firm internal operations and external assessors. Fifth, in particular for non-ITS firms, investors will be especially cautious about, but also interested in, a firm's endeavors in the IT sector because the obvious co-existence of risks and returns of pursuing ITS market penetration, and therefore checking how ITS diversification impacts firm value gives firm managers as well as investors solid verification for improving their decision making [76].

Given these solid motivations, we theoretically built the relationship between ITS diversification and firm value in the current paper. Further, we modeled this relationship with three moderators: firm size, firm age, and firm service intensity, to give a richer understanding of the relationship (Fig. 1). These moderators are among the most crucial and popularly used factors that management researchers adopt to check the differential effects of firm strategies, and more importantly, these factors are essential because all the firms are necessarily different (or similar) along these dimensions (e.g. [81, 92, 119]). We collected a large set of firm data, 9179 observations, and we used multiple robustness methods

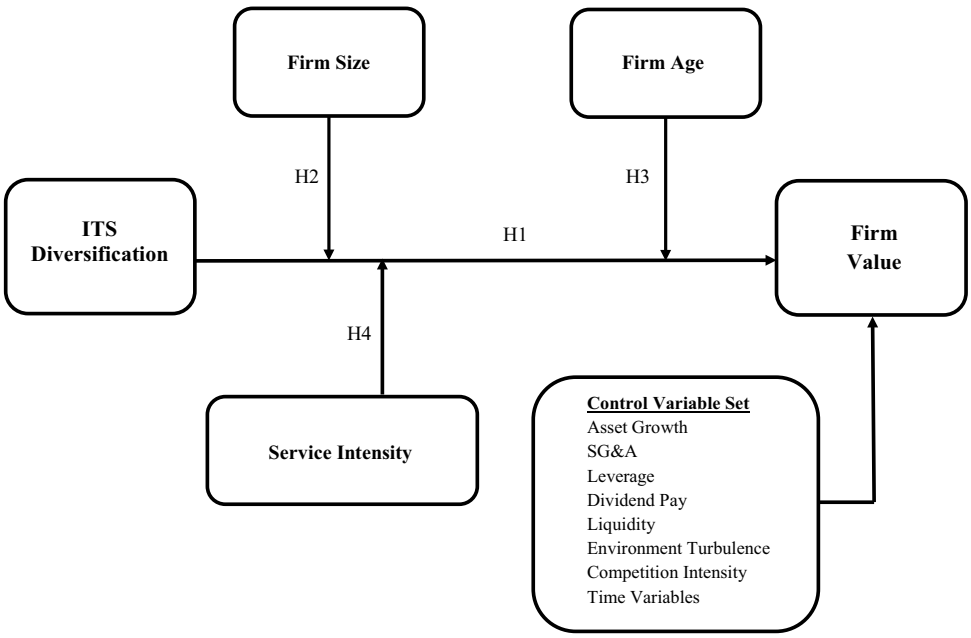

Fig. 1 A theoretical model of ITS diversification and firm value

to estimate the data. With the careful model building and extensive empirical studies, our research is projected to generate several key contributions to theories and practices. First, information has been suggested to be one pivotal firm resource under the framework of resource-based theories (RBT) [15, 93]. However, whether non-ITS firms seeking market opportunities in information service market hold the same trait is unknown because this type of research falls in a radically new domain. Thus, our research will further clarify how ITS diversification, as another key process that supports firm resource building, may help the firm reap benefits. Second, in the diversification theory, unrelated diversification is deemed largely unfavorable due to its significant deviation from firm's core business areas [24]. However, the RBT supports that ITS should be a significant tool to support firms' development [66]. Thus, our focus on ITS diversification of non-ITS firms provides a useful way of understanding this seeming contradiction by reconciling these two opposing theoretical rationales. Third, information technology has been characterized as the key firm knowledge generation process [28]. However, this process has been more focused on internal knowledge transfer or coordination. ITS diversification offers a fresh take that combines internal knowledge production and external intelligence absorption towards an effective knowledge accumulation, leading to better firm outcomes such as firm value [103]. From this angle, our research will also contribute to furthering the understanding of firm knowledge management. This research is also generating several other theoretical and practical contributions that will be discussed in the implication sections.

2 Theoretical foundations and hypotheses development

2.1 ITS diversification and firm value

Management theorists view a firm as a collection of endowments that are heterogeneous across firms [13, 108]. These endowments include versatile firm factors such as physical assets, intangible reputation, operational processes, managerial capabilities, and organizational experiences [49]. To be qualified as authentic firm resources, these endowments should meet a set of criteria: valuable, rare, inimitable, and free of substitution (VRIN). If and only if these criteria are met can these factors be the true resources for the firm. The underlying rationale is that these resource traits serve as the fundamental driver for the firm's sustained competitive advantages [14]. Within the RBT framework, a firm's information-based metric is examined from different angles. For example, a firm's ability and capacity for using information in the firm has been linked to a number of outcomes such as return on assets, return on sales, and profitability (e.g. [15, 94, 118]). This stream of research agrees that IT and its associated services are among the firm key resource types that enable a firm to achieve competitive strengths [108]. More importantly, information in the firms carries important characteristics that are not shared by other firm resource types. For example, the information-based firm assets are becoming the major driving force for innovative products and services [114]. Furthermore, information services facilitate intra-firm communication and operations and yield unparalleled efficiency gains [107]. Additionally, information services allow firms to be more responsive to external changes because information equips firms with a mechanism to receive and analyze external information more quickly [115]. These traits of information and its related services in the firm seamlessly satisfy the notion of RBT.

Firm value reflects investors' assessment of the firm's earning potential based on current asset levels. Based on the management view of the firm, firm value pertains to one of the most important stakeholders of the firm, i.e., the shareholders, and it is an authentic indicator of the willingness-to-support that firm managers are highly attentive to [96]. Therefore, finding drivers for increasing firm value is among the key tasks of management teams. We propose that ITS diversification should be such a driver for several important theoretical reasons. First, the RBT indicates that firm value increases when a firm may acquire valuable resources that meet the VRIN criteria [14]. ITS diversification of non-ITS firms is perfectly in line with this rationale. The penetration to customers' IT needs allows a firm to accumulate valuable knowledge stock that becomes integral to operations [58]. These knowledge stocks not only increase the financial benefits from the augmented market scope and thus increase firm value, but also improve firm internal efficiency that realizes more firm value via operations cost saving and faster responsiveness [90]. Second, ITS diversification in non-ITS firms enables the firms to build a more complete product portfolio in which individual product lines are internally supporting each other [27]. For instance, FedEx's data warehouse for small businesses creates a closer link between the clients' inventory management and shipping processes and FedEx warehouse management, physical logistics, and final delivery. This cross-product line coordination significantly increases firm value [3]. Third, ITS diversification has salient potentials to boost a firm's service quality, which is the essential factor leading to customer loyalty. Previous research has revealed that ITS helps firms more precisely focus on the components of customer needs and thus realize overall better solutions [79]. Further, these functions are highly valued by investors because customer loyalty translates to stable revenue flows that increase the overall attractiveness for investment [8]. Fourth, investors not only favor higher financial returns but also emphasize minimizing firm risks [97]. Diversification theories support that firm

business scope expansion is a strong factor in reducing firm risk due to the hedging effect. This effect is stronger if the diversification has further reach because by this strategy the firm can more significantly reduce systematic risk [109]. In this sense, ITS diversification will likely be favored by investors because this strategy will reduce firm risk by extending the firm's business coverage; additionally, ITS's support for firm coordination enables the firm to more effectively detect and handle uncertainties [87]. These risk reduction effects have been found to be robustly related to higher firm value [59]. Fifth, apart from the firm itself, ITS diversification builds networks that connect a number of key stakeholders such as customers, channel members, and third-party service providers. These networks will then build a more supportive environment for the firm to operate [74]. For example, a transportation firm's data service to clients in different industries will allow the firm to build an extended network that includes many different entities. In the management literature, this status of centrality in the network is highly valued by investors [74]. Sixth, from the signaling perspective, IT stands for a trendy direction that is increasingly embraced by investors. Therefore, non-ITS firms' creation of ITS solutions to customers will strengthen the confidence of investors and thus lead to better value assessment [30]. With these theoretical evidence and rationales, we hypothesize:

H1 All else equal, ITS diversification will be positively related to firm value.

2.2 Moderating effect of firm size

Firm size signifies the scale of a firm's various assets under the firm's controllable domain [95]. A vast body of business research incorporates firm size as a moderator when the research focus is to reveal the strategy effectiveness variation (e.g. [71, 119]). Large and small firms display different behavior patterns and face different sets of challenges and opportunities, resulting in varying relationship strengths of firm strategies [68]. In our research setting, the moderating effect of firm size is of particular importance because firms of all sizes have demonstrated interest in investing in ITS; however, how ITS diversification may function on firm performance may significantly differ. Several theoretical paths exist in this direction that leads to the proposition that larger firms may benefit more from ITS diversification. First, large firms normally cover a wider business scope regarding market types and volume [32]. Using new ITS lines may fully utilize the heterogeneity of the market and build a more complicated whole solution package that is less likely to be imitated by competitors and therefore more strongly secures the business advantages, which appeals to investors and further raises firm value [3]. Second, large firms have more internal strategic units and operations sections [37]. Launching IT service lines may create a particularly needed synergy that is otherwise difficult to realize. For example, a cloud service will not only benefit a firm's customers, but also connect different functional departments toward a joint force for best served market needs [56]. This functionality of ITS diversification serves as another push for firm value. Third, large firms tend to have extended external connections such as people links, partners, and third-party venders [86]. The firms' IT solutions may further engage these external connections into the firm's internal operations because of greater accessibility. This network advantage is favored by investors [101]. Additionally, large firms may have more hierarchies that often present hurdles to strategy implementation and operational smoothness [95]. However, the development process of IT product lines helps to build more flattened organizations [19]. In this sense, launching new information service lines tends to partially resolve the obstacles of hierarchy, which is especially important for large firms. Therefore, we hypothesize:

H2 ITS diversification's positive effect will be stronger for larger firms than for smaller firms.

2.3 Moderating effect of firm age

Firm age is another inherent firm factor that captures attention from business researchers regarding its moderating effects on firm strategies such as management structure and geographical expansion, and their relationships with performance outcomes such as market volume and growth (e.g. [20, 70, 71]). As firms age, they accumulate knowledge assets, have richer corporate memory, and gather operations experiences [10]. Thus, firm age should exert important interactions with ITS diversification and younger firms should gain more benefits from this diversification strategy. Young firms need corporate knowledge because they are in the early stages of learning curves [113]. This status makes younger firms particularly desire knowledge generation instruments such as information technology [72]. ITS diversification provides firms with precise and timely information as well as business patterns that are more likely to complement young firms' newly built management routines [21], and thus improve competitiveness that translates to increases in firm value. Moreover, when firms age they are more likely to build operations inertia that is hard to alter. However, young firms tend to absorb and apply new approaches more easily and quickly [105]. ITS diversification performs better for these young firms because new customer solutions can be quickly integrated into the firms' business functionality. Knight & Cavusgil's [63] research advocates that information solutions may help firms that are looking for new ways of doing business. Finally, young firms' network connection is more open to new entries while old firms usually

have stable patterns that resist changes [104]. ITS thus offers more assistance for young firms to build links between the firm and external entities, leading to increased attractiveness for investors. Firms such as Airbnb and Uber serve as good examples of young firms that absorb new information-based technologies, adapt to new environments, and increase shareholder value. Therefore, we postulate:

H3 ITS diversification's positive effect will be stronger for younger firms than for older firms.

2.4 Moderating effect of service intensity

Information based product lines are services in their nature. Thus, it is necessary to further examine how ITS diversification may differentially impact firms with varying levels of service versus manufacturing intensity. Firms range across the spectrum from primarily service-focused to primarily manufacturing-focused businesses. With these differences, penetrating to ITS markets should yield different effects. First, diversification theorists point out that expanding to markets that have a certain distance to the core business areas may allow the firm to generate more radical innovations because the new market insights often spur a complete reshuffle of the current management mindsets and routines [82]. Further, given ITS diversification's salient knowledge generation trait, this expansion should work better for manufacturing firms than service firms because ITS is a service-based solution that will likely be more complementary to manufacturing firms [61]. For example, Samsung's smart home endeavors that combine manufactured physical products and service-based IT solutions captured the attention of analysts as well as investors. Second, service firms have been found to be more potent in generating financial performance because service offers an important differentiation vehicle due to its adaptability, flexibility, and intangibility [4]. Conversely, manufacturing firms often lack such a capability because the physical products may be easier to decode and imitate than intangible services [16]. Thus, the addition of ITS may provide important support for a firm to build more idiosyncratic offerings that are harder to be copied and therefore protect the firm's market advantages, leading to an increase in firm value. For example, Seagate's customer data service associated with its hard drives generated stronger support for the device sales as well as the revenue from data usage. Investors are highly favorable to this strategic orientation [9]. Furthermore, while service firms' distribution is often direct, manufacturing firms' channels could be largely indirect. Thereby, providing IT-based services to customers may increase the power of manufacturing firms in the entire distribution system, which eventually translates to value addition for the firm. Thus, we postulate:

H4 ITS diversification's positive effect will be stronger for manufacturing-based firms than for service-based firms.

3 Empirical study methods

3.1 Data sources

We collected data from several databases including Standard & Poor Business Segment database, Compustat Annual and Quarterly database, and the Center for Research in Security Prices (CRSP). These data sources are characterized with several important strengths. First, each of the databases has a wide and extensive usage in management and related business research and the quality of data is ensured. Second, these databases comprehensively cover the entire spectrum of industries and allow researchers to collect a sufficiently large sample of firms. This trait satisfactorily guarantees the external validity. Third, collecting data items from different sources effectively reduces threats such as common method bias. Fourth, these data items are objective in nature and thus we can reduce the vulnerability induced by traditional perception-based survey measures [50]. This facet is particularly important for the current research setting because perception of diversification, firm value, and other firm and industry factors may be biased depending on the respondents' knowledge in their positions. Thus, the objective measure approach is highly desirable. Fifth, these databases allow researchers to have firm information over a time span, which will more authentically capture the firm strategies and performance that are largely long-term oriented. The final merged non-missing dataset contains 9179 observations from 1683 firms from the years 2000 to 2015. These firms are from all non-ITS sectors (excluding SIC 737, Information Technology Service) such as transportation, manufacturing, retail, wholesale, and professional services. The descriptive information and correlations are presented in Table 1.

3.2 Measuring ITS diversification

ITS diversification reflects the degree to which a firm penetrates to ITS sectors. To precisely capture this essence, we followed Doukas and Kan's [36] and Hann et al.'s [47] notion of diversification that not only considers the number of ITS segments that a firm diversifies into, but also includes the sales that a firm obtains from ITS market segments. These two dimensions are essentially inseparable and they together form the complete view of diversification. We obtained the dimension of number as the portion of the ITS segments in all the firm's product lines [75]. ITS sectors are selected from SIC 737 (Information Technology Services involving computer programming, software development, data processing, and system integration, excluding SIC 7377: computer rental and leasing)

Table 1 Variable means, standard deviations, and correlations

Variables		1	2	3	4	5	6	7	8	9	10	11	12
Firm value	1												
ITS diversification	2	0.14***											
Firm size	3	−0.26***	−0.34***										
Firm age	4	−0.12***	−0.22***	0.33***									
Service intensity	5	−0.01	0.24***	−0.10***	−0.18***								
Intangible assets	6	0.00	0.01	−0.03***	−0.06***	0.03***							
Asset growth	7	0.09***	0.04***	−0.02*	−0.16***	0.03***	0.07***						
SG&A	8	0.15***	0.13***	−0.34***	−0.16***	0.01	0.01	0.05***					
Leverage	9	−0.21***	−0.16***	0.25***	0.08***	0.02**	0.01	−0.02**	−0.09***				
Liquidity	10	0.17***	0.13***	−0.08***	−0.05***	−0.14***	0.01	0.12***	0.06***	−0.23***			
Env. turbulence	11	0.03**	0.05***	−0.12***	−0.13***	−0.02*	0.01	0.07***	0.05***	−0.07***	0.05***		
Competition intensity	12	0.00	0.01	0.07***	0.02	−0.06***	−0.01	−0.03***	−0.03**	0.04***	0.04***	−0.11***	
Mean		1.75	0.02	12.43	2.52	0.55	0.53	0.25	0.51	0.16	2.44	0.18	0.83
SD		1.96	0.85	2.91	0.82	0.34	3.62	1.13	1.01	0.21	2.20	0.15	0.14

*$p<0.1$; **$p<0.05$; ***$p<0.01$

[55, 102]. For sales dimension, we first calculated all the sales that a firm achieved from ITS lines and then we scaled it by the total sales of the firm (e.g. [51, 54, 67]). Then we generated the principal component of these two dimensions as the measure of ITS diversification. Both of the dimensions are highly loaded on the component (93.3%). This type of multi-dimensional construct can be found in a large body of diversification studies (e.g. [25, 38, 41]). Standard & Poor Business Segment database provides a good source of information and measures of product diversification using this database can be seen in all business research areas (e.g. [6, 18]).

3.3 Measuring firm value

Tobin's q is recommended by numerous previous researches to measure firm value. It examines the firm market value scaled by firm book value, and thus is an adequate gauge for investors' forward-looking value assessment on the firm (e.g. [39, 60, 64, 106]). Using Tobin's q as the firm value is also particularly preferable for the current research setting because ITS strategies are largely long-term oriented [88], and thus a forward-looking value measure would more authentically capture this nature. Another advantage of Tobin's q is that it is a unitless ratio that is not distorted by firm factors such as firm asset volume. Chung and Pruitt [29] provided the renowned operationalization using Compustat data:

$$Tobin's\ q = \frac{MV + PS + DEBT}{TA},$$

where MV denotes firm market value (share price × number of common stock shares outstanding); PS means the liquidating value of outstanding preferred stock; DEBT indicates the difference between the firm's short-term liabilities and assets; and TA is the book value of firm total assets.

3.4 Measuring moderators

Firm size is measured as the log-transformed firm asset size. This view is shared in a vast body of business researches (e.g. [78, 91]). To ensure the robustness, we also tested the measure using firms' number of employees and the results are consistent. Firm age is measured as the number of years that a firm is publicly listed in Compustat. A log-transformation is applied [99]. Service intensity is measured by the portion of service line sales (SIC 4–8) in the firm's entire sales volume from service and manufacturing sectors [65].

3.5 Control variables

In addition to the main effects, firm value may be explained by other firm and industry factors and therefore it is necessary to consider meaningful control variables. Intangible assets can be a factor influencing investors' valuation. Therefore, we included this factor by using the balance sheet intangibles (adjusted by firm asset size) [48]. We used asset growth, measured by (total $\text{assets}_{(t)}$ − total $\text{assets}_{(t-1)}$)/ (total $\text{assets}_{(t-1)}$), to control for the influence from asset volume change on investor's choice. Firm operations expenditures such as R&D and advertising may drive firm value by strengthening investors' confidence [29, 102]. We controlled for this effect by incorporating the selling, general, and administrative expenses (adjusted by firm asset size) [89]. A high level of debt is another important factor because it may increase investors' uncertainty. We controlled for this effect and used leverage, as measured by the long-term debt/total assets [5]. Also, we introduced dividend pay measured as a dummy variable indicating whether a firm pays a dividend in a certain year. We also included liquidity, measured as the ratio between current assets and liability [22], because shareholders emphasize the status of liquidity. To control for external environmental influences, we introduced two factors: turbulence and competition. Environmental turbulence is measured following Keats and Hitt's [62] method that reflects the business volume change in each industry over the five-year period, and competition intensity is based on the Herfindahl–Hirschman Index (1- HHI) [43]. Because the dataset ranges multiple years, we also included a set of time dummy variables to control for time related differences.

3.6 Estimation methods

The empirical model is specified as:

$$\begin{aligned} \textit{Firm Value}_{it+1} = {} & \beta_0 + \beta_1 \times \textit{ITS Diversification}_{it} \\ & + \beta_2 \times \textit{ITS Diversification}_{it} \times \textit{Firm Size}_{it} \\ & + \beta_3 \times \textit{ITS Diversification}_{it} \times \textit{Firm Age}_{it} \\ & + \beta_4 \times \textit{ITS Diversification}_{it} \times \textit{Service Intensity}_{it} \\ & + \beta_5 \times \textit{Firm Size}_{it} \\ & + \beta_6 \times \textit{Firm Age}_{it} \\ & + \beta_8 \times \textit{Service Intensity}_{it} \\ & + \beta_9 \times \textit{Intangible Assets}_{it} \\ & + \beta_{10} \times \textit{Asset Growth}_{it} \\ & + \beta_{11} \times \textit{SG\&A}_{it} \\ & + \beta_{12} \times \textit{Leverage}_{it} \\ & + \beta_{13} \times \textit{Dividend Pay}_{it} \\ & + \beta_{14} \times \textit{Liquidity}_{it} \\ & + \beta_{15} \times \textit{Envionmental Turbulence}_{jt} \\ & + \beta_{16} \times \textit{Competition Intensity}_{jt} \\ & + \textit{Time Dummy Variables} + \varepsilon_{it} \end{aligned}$$

in which i denotes firms, j denotes industries, and t is the time period (years). We used the lagged firm value for several crucial reasons. It has been well supported that a lagged dependent variable may minimize the problem of reverse causality. More importantly, this model formulation may effectively reduce the concern of endogeneity that may be induced by the simultaneity of the variables [11]. Further, the lagged firm value captures the real business scenario in which firm strategies may take time to generate effects and hence a lagged outcome variable better reflects this nature. Along with the dependent variable setting, the entire model construction also carries a number of key strengths. First, the three carefully selected moderators not only capture the interactions with ITS diversification, but also serve as useful control variables that may explain the variance of firm value. Second, the control variable list comprehensively covers multi-facets and multi-layers of the firm. For example, size and age control the inherent nature of the firm; service intensity captures the business orientation, intangible assets, asset growth, and liquidity reflect the firms' endowment strengths; SG&A, leverage, and dividend control the firms' strategic deployment of financial flows; the industry characteristics are controlled by environmental turbulence and competition intensity. Additionally, the time effects are captured by time dummy variables. This comprehensive set of variables in the main model also helps to reduce the concern of endogeneity that may be caused by omitted variables.

Due to the panel data structure of the dataset, special concerns arise because each firm may have multiple years' data points that cause autocorrelation. Further, the large set of firm data from different industries may raise concern of heterscedasticity because some sub-groups of firms may systematically and unproportionally explain the variance of firm value. To address these special traits of the dataset, we carefully selected two robust analysis methods. First, we used a robust regression that produces White standard errors [111] and meanwhile we clustered the errors by firm to address autocorrelation [26]. Second, we used Driscoll-Kraay robust regression to ensure the results were consistent across model estimation methods [35]. Both methods are widely found in business literature for their appropriateness in panel data analysis (e.g. [80, 83]).

4 Analysis results

For this moderator embedded formulation, we adopted a stepwise analysis approach (Table 2 shows the results). We first examined only the control variables, and then added main effects and last the moderating effects. During the incremental model building, no significant inconsistency was observed. We conducted partial F tests and found that the addition of explanatory power for each step

was significant (from control model to main effect model: $F = 26.57$, $p < 0.01$; from main effect model to full model: $F = 3.170$, $p < 0.01$). Also, we examined the variance inflation factors (VIFs) and found that no single VIF was greater than the threshold of 10, which signifies that multi-collinearity is not a concern for these models. To further ensure the model was free of endogeneity concerns, we performed a Durbin–Wu–Hausman test and found no such concerns. In the control variables, asset growth significantly and positively relates to firm value. This is in line with the previous work that confirmed the asset driven valuation [31]. SG&A is found to positively drive firm value. This echoes Banker et al.'s [12] research that illustrates how firm R&D, marketing, and related investments help firms gain competitive advantages that secure firm value. Leverage is negatively related to firm value, which matches a vast body of finance literature that firm borrowing may raise investors' insecurity and thus negatively affect firm value (e.g. [5]). Dividend pay and liquidity increase firm value, which is well documented

Table 2 Analytical results of ITS diversification and firm value

	Controls[a]	Controls and main effects[a]	Full model 1[a]	Full model 2[b]
	Coeff. (t value)	Coeff. (t value)	Coeff. (t value)	Coeff. (t value)
ITS diversification		0.036**	0.051***	0.051***
		(2.26)	(2.99)	(8.51)
ITS diversification × firm size			0.060***	0.060***
			(2.74)	(6.78)
ITS diversification × firm age			−0.033*	−0.033**
			(−1.94)	(−2.23)
ITS diversification × service intensity			−0.024	−0.024**
			(−1.21)	(−2.27)
Firm size		−0.211***	−0.215***	−0.215***
		(−8.05)	(−8.32)	(−13.15)
Firm age		−0.031*	−0.035*	−0.035***
		(−1.74)	(−1.88)	(−3.13)
Service intensity		−0.020	−0.030	−0.030***
		(−1.14)	(−1.56)	(−2.64)
Intangible assets	−0.003	−0.009	−0.009	−0.009
	(−0.20)	(−0.60)	(−0.60)	(−1.08)
Asset growth	0.061***	0.061***	0.059***	0.059**
	(3.48)	(3.49)	(3.44)	(2.05)
SG&A	0.123***	0.061***	0.061***	0.061***
	(5.82)	(2.78)	(2.76)	(3.63)
Leverage	−0.187***	−0.146***	−0.143***	−0.143***
	(−9.65)	(−7.96)	(−7.80)	(−16.15)
Dividend pay	−0.025	0.056***	0.060***	0.060***
	(−1.42)	(2.96)	(3.22)	(8.72)
Liquidity	0.125***	0.126***	0.118***	0.118***
	(6.30)	(6.44)	(5.94)	(6.34)
Environment turbulence	0.006	−0.008	−0.008	−0.008
	(0.38)	(−0.50)	(−0.55)	(−0.68)
Competition intensity	0.010	0.023	0.021	0.021***
	(0.54)	(1.29)	(1.18)	(3.30)
Time dummy variables	Included	Included	Included	Included
R-squared	0.101	0.161	0.182	0.182
Partial F	–	26.571***	3.170**	3.170**
# of observations	9179	9179	9179	9179

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$; all the variance inflation factors are lower than 10

[a]Model with robust regression with Huber–White and clustered (by firms) standard errors (heteroscedasticity- and autocorrelation-consistent)

[b]Model with robust regression with Driscoll–Kraay standard errors (heteroscedasticity- and autocorrelation-consistent)

in the literature, and these effects are evidently captured in our finding [42].

Our first hypothesis (H1) states that ITS diversification will positively drive firm value. This hypothesis is strongly supported ($\beta = 0.051$, $p < 0.01$). This finding is meaningful in several directions. First, recall that the measure of ITS diversification is a composite score of ITS diversification breadth as well as depth. Both are highly loaded on this measure. Therefore, the driving power for firm value is essentially from both dimensions. Traditional exploration in diversification often skews toward the scope of firm business, but our research shows that the market depth as reflected by the sales intensity of a new product line may be equally important. Second, firm value is the observable measure of investors' perspectives about a firm's future earning capability and thus is a forward-looking indicator. The significant power of ITS diversification on firm value thus reflects the confidence of investors embedded with a long-term willingness-to-support this firm strategy. Traditional performance measures in information related business studies primarily focus on factors that are largely backward-looking (e.g., profitability, revenues), and thus our incorporation of firm value completes the understanding of the performance implication along the time-embedded firm performance. Third, our dataset comprises non-ITS firms from different sectors and thus the significant relationship between ITS diversification and firm value is confirmed to be prevailing in all these firm types. Fourth, our large sample size also contributes to the external validity regarding this relationship. Fifth, the clustered standard error for the panel data generates a fixed effect that examines the firm data over 15 years in a comprehensive way. This way avoids using single time points that run the risk of yielding time-sensitive patterns. In this sense, this finding's validity along the timeline is enhanced.

The H2 postulates that firm size will positively moderate the relationship between ITS diversification and firm value. This hypothesis is strongly supported ($\beta = 0.060$, $p < 0.01$). To further illustrate the moderating, we graphed it into Fig. 2. The result shows that for larger firms, ITS diversification will increase firm value. In this scenario, an increase of ITS diversification by one standard deviation will have an increase of firm value by 0.112 standard deviation. But for smaller firms, this increase is marginal. This finding is logical in that large firms are more likely possess resources needed for expansion and thus penetrating to ITS product sectors is desirable for investors due to the resource support. Smaller firms, however, may not only lack resources but also have an experience shortage and thus cannot sufficiently obtain the benefits of diversification. This finding is also in

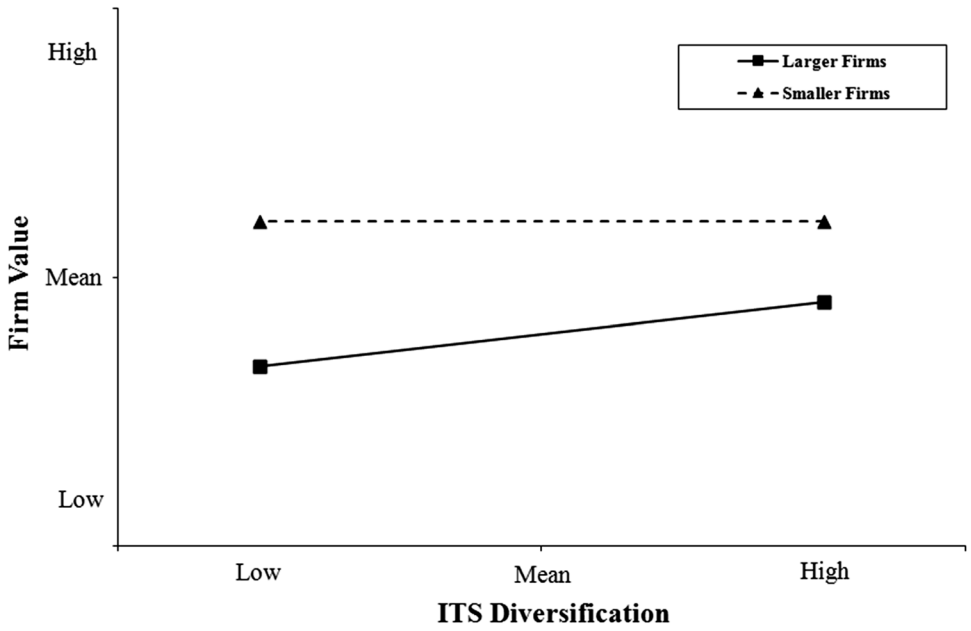

Fig. 2 Moderating role of firm size on ITS diversification and firm value

line with previous researches (e.g. [7]) that reveal large firms enjoy advantages in new product development.

Our H3 depicts the moderating effects of firm age. This relationship is also supported ($\beta = -0.033$, $p < 0.1$) and is graphically presented in Fig. 3. It is evident that ITS diversification is more beneficial for young firms than old firms. For young firms, an increase of ITS diversification by one standard deviation will result in an increase of firm value by 0.084 standard deviation. It is commonly observed that newly emerged firms quickly adopt IT product lines and these strategies are warmly embraced by investors. Our research is the first to theoretically develop and empirically test this relationship. Flatten et al. [44] illustrate how young firms quickly absorb external insights and translate them into corporate coping strategies. From the angle of IT market exploration, our research reveals similar rationales. Older firms' ITS diversification may encounter obstacles from the rigidity of the established routines and mentality and therefore cannot fully harvest the advantages of ITS expansion. This finding also demonstrates that investors are attentive to firm age when IT product development is considered. For one thing, they are willing to observe that newly emerged firms actively experiment with new product offerings and market reaction. For another thing, investors are aware of the contribution of ITS lines. When these two aspects are combined, investors' value assessment for young firms' ITS diversification becomes stronger. For older firms, although ITS penetration is desirable, investors may be concerned about the trade-off between the long-held core business lines and the new IT services. Therefore, uncertainty about the unrelated diversification may matter more for older firms than young firms, which are more willing to try out new options.

4.1 Additional studies

Viewing firms' performance from a shareholder value standpoint has primarily focused on returns. Scholars are increasing realizing that firm risk is another integral dimension that reflects shareholders' gains because high firm risk undermines investors' confidence about firm value [110]. To further enrich the understanding of ITS diversification on the complete version of firm value, we formulated a model examining its impact on firm idiosyncratic risk, which is deemed most sensitive to firm-specific strategic options and received special attention from management and finance researchers [46, 52]. The model is specified as:

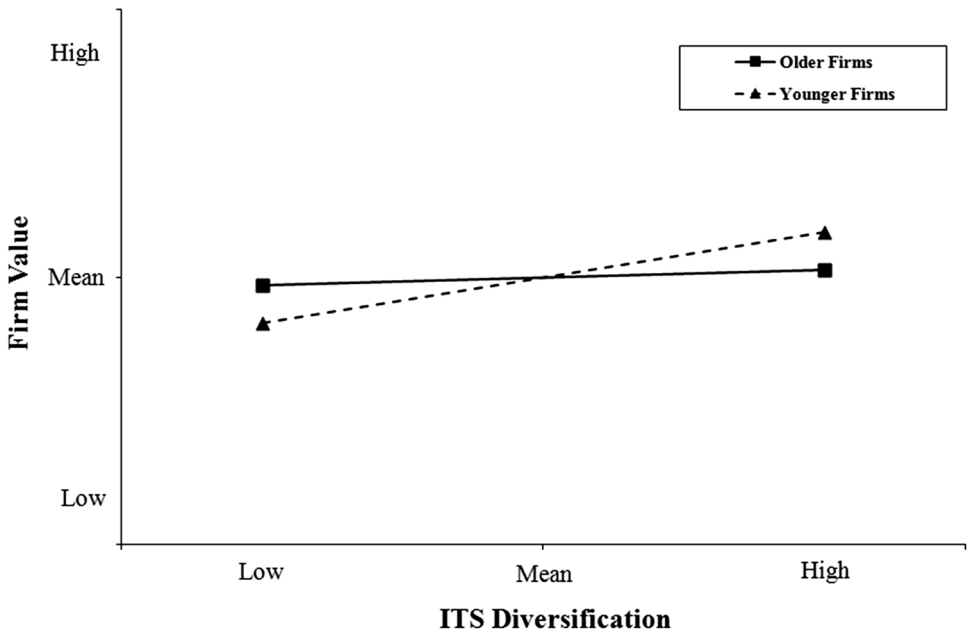

Fig. 3 Moderating role of firm age on ITS diversification and firm value

Table 3 Analytical results of ITS diversification and firm risk

	Controls[a] Coeff. (t value)	Controls and main effects[a] Coeff. (t value)	Full model 1[a] Coeff. (t value)	Full model 2[b] Coeff. (t value)
ITS diversification		−0.058***	−0.086***	−0.086***
		(−2.93)	(−3.85)	(−7.31)
ITS diversification × firm size			−0.050**	−0.050***
			(−2.09)	(−7.04)
ITS diversification × firm age			0.049**	0.049***
			(2.39)	(3.87)
ITS diversification × service intensity			0.054***	0.054***
			(2.68)	(5.54)
Firm size		−0.579***	−0.576***	−0.576***
		(−23.88)	(−23.29)	(−26.73)
Firm age		−0.016	−0.010	−0.010
		(−0.76)	(−0.47)	(−0.49)
Service intensity		−0.001	0.017	0.017***
		(−0.04)	(0.85)	(2.91)
Intangible assets	0.033***	0.017	0.017	0.017*
	(3.02)	(1.61)	(1.63)	(1.94)
Asset growth	−0.004	0.004	0.005	0.005
	(−0.35)	(0.39)	(0.51)	(0.62)
SG&A	0.164***	0.019*	0.021**	0.021***
	(12.97)	(1.82)	(2.03)	(3.79)
Leverage	−0.018	0.072***	0.068***	0.068***
	(−0.90)	(4.23)	(3.96)	(7.43)
Dividend pay	−0.110***	−0.048***	−0.045**	−0.045***
	(−4.90)	(−2.59)	(−2.35)	(−6.22)
Liquidity	−0.142***	−0.113***	−0.104***	−0.104***
	(−7.36)	(−7.27)	(−6.97)	(−16.10)
Environment turbulence	0.022	−0.002	−0.001	−0.001
	(1.28)	(−0.17)	(−0.05)	(−0.08)
Competition intensity	−0.042*	0.002	0.006	0.006
	(−1.95)	(0.09)	(0.32)	(0.39)
Time dummy variables	Included	Included	Included	Included
R-squared	0.126	0.340	0.357	0.357
Partial F	–	26.57***	4.14***	4.14***
# of observations	8783	8783	8783	8783

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$; all the variance inflation factors are lower than 10

[a]Model with robust regression with Huber–White and clustered (by firms) standard errors (heteroscedasticity- and autocorrelation-consistent)

[b]Model with robust regression with Driscoll–Kraay standard errors (heteroscedasticity- and autocorrelation-consistent)

$$
\begin{aligned}
\textit{Firm Idiosyncratic Risk}_{it+1} = {} & \beta_0 + \beta_1 \times \textit{ITS Diversification}_{it} \\
& + \beta_2 \times \textit{ITS Diversification}_{it} \times \textit{Firm Size}_{it} \\
& + \beta_3 \times \textit{ITS Diversification}_{it} \times \textit{Firm Age}_{it} \\
& + \beta_4 \times \textit{ITS Diversification}_{it} \times \textit{Service Intensity}_{it} \\
& + \beta_5 \times \textit{Firm Size}_{it} \\
& + \beta_6 \times \textit{Firm Age}_{it} \\
& + \beta_8 \times \textit{Service Intensity}_{it} \\
& + \beta_9 \times \textit{Intangible Assets}_{it} \\
& + \beta_{10} \times \textit{Asset Growth}_{it} \\
& + \beta_{11} \times \textit{SG\&A}_{it} \\
& + \beta_{12} \times \textit{Leverage}_{it} \\
& + \beta_{13} \times \textit{Dividend Pay}_{it} \\
& + \beta_{14} \times \textit{Liquidity}_{it} \\
& + \beta_{15} \times \textit{Envionmental Turbulence}_{jt} \\
& + \beta_{16} \times \textit{Competition Intensity}_{jt} \\
& + \textit{Time Dummy Variables} + \varepsilon_{it}
\end{aligned}
$$

We employed the popular four-factor model to measure firm risk [73], and we included the same set of moderators. The stepwise model building and partial F-tests and VIF tests show no concerns of inconsistent control variables as well as multi-collinearity. The main results are presented in Table 3. ITS diversification is found to have a significant negative relationship on firm risk ($\beta = -0.086$, $p < 0.01$), and this relationship varies in the presence of all the three moderators. These relationships are graphically shown in Figs. 4, 5, and 6. In particular, the risk reduction effect of ITS diversification is stronger for larger firms, younger firms, and manufacturing firms. These findings in the additional study further confirm our theory building from another important angle of shareholders.

Another interesting finding is that service intensity has a significant interaction with ITS diversification in the risk model ($\beta = 0.054$, $p < 0.01$), but it is insignificant in the firm value model. This means that ITS diversification plays equivalent roles for both service and manufacturing firms regarding contributing to firm value (return)

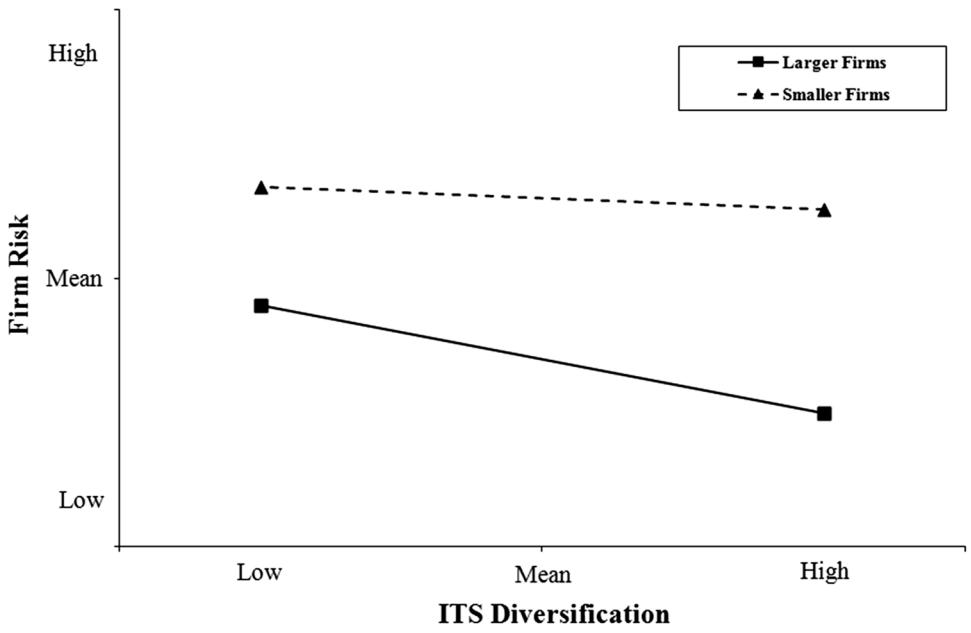

Fig. 4 Moderating role of firm size on ITS diversification and firm risk

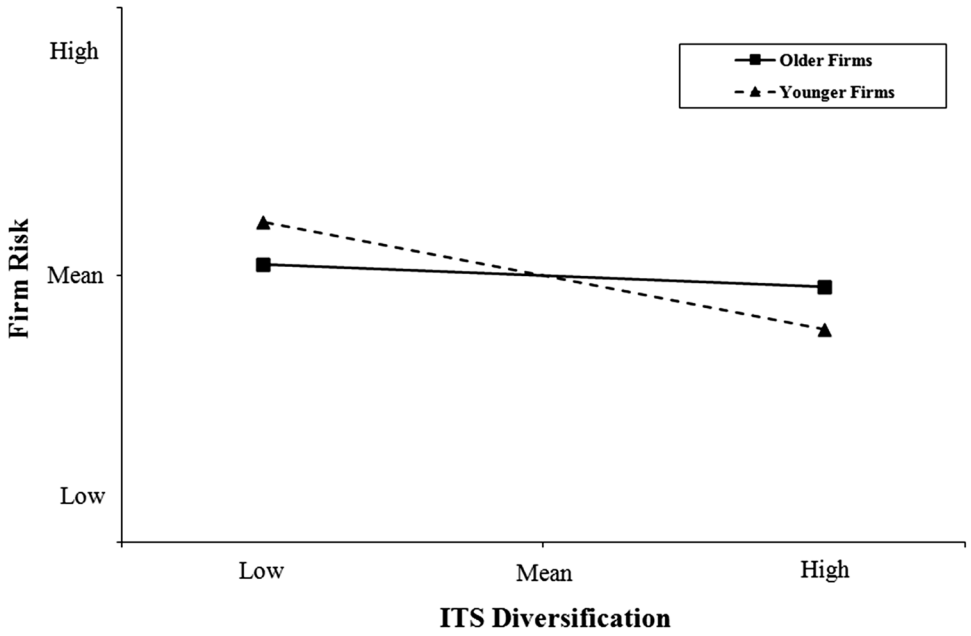

Fig. 5 Moderating role of firm age on ITS diversification and firm risk

increase. However, expanding to the IT service sector does help manufacturing firms more when firm-specific financial risk is considered. This reveals an important finding in line with the theoretical reasoning in our H4. ITS lines are service products and they complement physical product lines to constitute a better market offering composition that hedges the firm from risk. Idiosyncratic risk is defined as uncertainties that originate from firm-specific vulnerabilities. The significant moderating role of ITS diversification thus provides solid evidence showing its supporting roles in remedying firms', and especially manufacturing firms', weaknesses, leading to better risk reduction.

4.2 Sensitivity analysis

A series of sensitivity studies were taken to ensure the robustness of the findings. As mentioned above, we chose two robust regressions to make sure the results were robust against the method choice. Further, we chose different measure methods for the key variables. For example, we tried

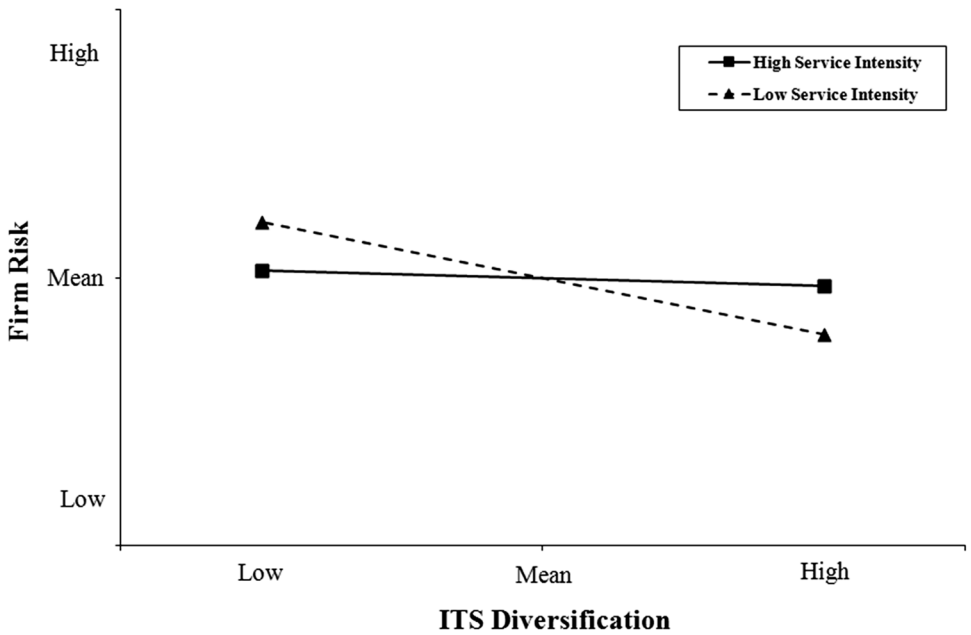

Fig. 6 Moderating role of firm service intensity on ITS diversification and firm risk

firm size as measured by number of employees and achieved consistent results. We also used working capital and retained earnings to replace SG&A to account for the resource abundance, the results stay consistent. For ITS diversification, we used a three-digit SIC market segment definition in addition to the four-digit SIC definition and we found the results were consistent. For the environmental factors, we also tried to measure industries by using a broader version (three-digit SICs) rather than a concentrated version (four-digit SICs), and further we included a set of industry dummy variables. The findings and inferences were largely unchanged.

5 Theoretical implications

This set of research findings shed light on several mainstream theory fields. First of all, ITS's role in a firm has been mainly defined within the boundary of technologies although its impact has a far reach in a firm's business domains. Our research echoes this need and provides evidence of ITS's effects on increasing firm shareholder value as reflected by higher firm value along with lower firm risk. This view of ITS generates insights for the IT management literature in two important aspects. On one side, the notion of IT in the literature is primarily conceptualized as functional assets such as information capacity. This conceptualization neglects that firms are also exploring market opportunities by providing the whole package of information-based solutions to customers. This broader view of ITS should receive more emphasis because it represents the full commitment of a firm's market orientation. On the other side, ITS diversification's impact on firm value and risk gives future researchers more options when they scan effective drivers for shareholder value. In all business fields, the link between technological departments and other functional areas has been recognized. However, the ITS diversification represents the integration of multiple functional areas including technology and management, and thus the established evidence between ITS diversification and shareholder value enables researchers to think in a more comprehensive way, by viewing firm in-house product development capability from a market-oriented perspective. This viewpoint allows researchers to establish better frameworks to understand the essential driving factors leading to increased shareholder value.

Our research results also yielded implications for the RBT. Traditional resource-oriented researches pertaining to information technology in the firm limit their scope in firms' capability of acquiring valuable IT resources such as a technological base and human capital. This view neglects the fact that information resources' superiority cannot be fully realized without considering their market functions. ITS diversification pinpoints this rationale in that it expands the firm's market exploration by organizing its information resources into concrete market solutions. This view constitutes a complete path of firm IT resource usage in a chain effect: IT resource acquisition→market definition→product creation→market solution→shareholder value realization. With this view, the RBT-related IT research should have a more complete picture of firms' utilization of this key resource type, which has a far broader reach than previously thought. More importantly, the entire process of ITS diversification is in line with the conceptualization of firm capability building, which denotes that the firm's competitive edge originates from its ability to deploy assets toward better customer solutions. ITS diversification is the result of the process in which the firm translates its information endowments into market solutions and thus embeds the firm's capability from both technology and marketing sides. This integration serves as the strongest push for firm performance. Our research in this regard provides evidence about the importance of firm capability from the angle of capability integration and synergy.

Our findings also contribute positively to the knowledge-based view of the firm. Previous thinking about the role of IT in firm knowledge acquisition is largely focused on how IT, as an information instrument, helps the firm gather intelligence. However, this view ignores another important way in which firms may actively seek penetrating into new territories via launching new ITS product lines. The information collected from this channel is fundamentally different from the traditional knowledge accumulation because ITS diversification comprehensively integrates the customer problems and corporate offerings, and thus creates a unique set of solutions that will add to the firm's knowledge basis. From another angle, knowledge management literature has put its primary focus on the firms' business activities in their core functional directions. However, a firm's radically new endeavors in seemingly unrelated market explorations may yield very positive results. Our empirical findings confirm this rationale using a large sample of non-ITS firms.

The findings of ITS diversification on both firm return and risk further enrich the current knowledge set on firm diversification from several important angles. Foremost, traditional thinking about unrelated diversification largely leans towards the negative or neutral effects because penetrating into unrelated business areas naturally incurs uncertainties in a competition-intensive era in which firms are focusing more on deepening their strengths rather than stepping into unfamiliar territory. This view, however, has a salient exception when ITS diversification is involved. Our results show that non-ITS firms may surely benefit from this type of diversification due to several special traits of information product lines and diversification's supporting functionality for a firm's overall strength. Second, in the current literature, studies of diversification often focus on either firm return or

risk, and rarely comprehensively and simultaneously investigate these two sides. Yet, this type of formulation is crucial because firms will inevitably consider both financial gains and uncertainties in order to truly gauge the effectiveness of strategic movements. Our research thus paves the road for future researchers who look for the broader version of the impact of firm diversifications. Furthermore, our research suggests to the diversification researchers in that this construct cannot be over-generalized regarding the performance implication. Our results show that ITS diversification yields differential strengths when several key moderators are introduced. In this sense, market diversification is expected to be a dynamic factor that displays a salient contingency-based nature that deserves future researchers' consideration.

Further, our research also yields implications for service management theories regarding traditional non-ITS firms, which primarily place their emphasis on enhancing metrics such as service quality by increasing, managing, and optimizing the resource inputs into the touchpoints between the firm and customers, and focusing much less on other firm strategies such as diversification. This viewpoint is understandable because diversification may incur heterogeneous ways of doing business and thus compromise the depth of service encounters, leading to undesirable business performance. However, our research results demonstrate that diversifying to ITS may be a special case that allows firms to enhance their market performance including return increase and risk reduction. The findings in this area generate at least two important points. First, firm diversification strategies may have a more complicated mechanism than previously found in the business field and researchers need to build more scenario-based studies. Second, researchers should decode the nature of ITS into a combination of information technology and services, in which there should be an interesting inter-link between these two important aspects that have been largely separated in the literature. A further examination of this combination should be highly rewarding given the trendy movement by firms of all types toward information-intensive business orientations.

6 Practical implications

In practice, our research generates a number of useful implications. In the information era, non-ITS firms often encounter puzzling decisions regarding whether to embrace ITS in their product portfolio. For one thing, the broadly shared impression about ITS's positive roles drives managers to consider diversification but the unrelated diversification that may be dissimilar from their current business lines may hinder their ambitions. For another, diversifying to ITS sectors demands significant resource deployment and commitment, which may likely distract from the firm's main business focus. However, from our research we observed the overall strengths of exploring ITS solutions. Many firms have successfully demonstrated the contributions of newly established ITS lines. Our research then uses a large dataset to confirm that these examples are prevailing in non-ITS firms seeking customer solutions.

Our empirical results also give firm managers a useful indication about how to further account for shareholders' expectations by actively exploring ITS lines and their embedded new and efficient ways to serve the firms' markets. Traditionally, non-ITS firms' managers' horizon about IT's role has been largely limited to the usage of IT in their firms' operations. However, managers neglect the fact that when all firms launch similar IT, the competitive edge disappears due to the technological parity. ITS diversification, however, moves beyond the traditional role of information technology in the firms and represents the firm's strengths in solving customers' problems/needs in a way that can integrate all the firm's product lines into an ecosystem that wins the market. Also, this type of strength is more sustainable because the firm can use information-based products to enable a distinctive solution set for customers and create significant differentiation effects, which translate to firm shareholder value.

The strong effect of ITS on firm idiosyncratic risk yields similar notions showing the nature of this firm strategy. Managers are increasingly aware of the importance of risk management in the information era, which enables stakeholders such as shareholders and customers to quickly assess the firm's overall potential in the financial and consumer markets. Uncertainties resting on the stakeholders' assessment may cause profoundly negative impacts on the firm's future financial stability. In this regard, ITS may be one of the satisfactory options that allows managers to cope with risks. By aggressively pursuing ITS diversification, a firm is likely to reinforce its original business lines with the support of the ITS lines and improve financial performance. This supporting function of ITS that assures investors has been reflected in the empirical results of the current research.

The simultaneous presence of the firm value improvement and firm risk reduction reveals another interesting aspect of ITS. Firm managers are familiar with the commonly accepted notion of the risk-reward equation in that higher return may be automatically concurrent with higher risk and therefore there is always a subtle balance and dilemma in swinging between high return-high risk and low return-low risk. However, our research results show that pursuing ITS diversification may be an effective means that allows managers to simultaneously gain high return and low risk. This desirable trait of ITS deserves more attention in the business area, especially for non-ITS firms that previously refrained from actively engaging in ITS.

In addition, the varying relationship strengths between ITS diversification and value/risk produce practical guidelines for managers to pursue ITS diversification. For example, younger and larger firms should be particularly attentive to ITS diversification because these new but fast-growing firms need the strength of IT services to create competitive barriers that will be otherwise easier to neutralize by the incumbent firms. These findings illustrate the special implications for specific firm types.

Our research also produces implications for a wide range of other firm internal and external stakeholders. For example, non-ITS firms are often opted to direct their R&D expenditures to their core business areas. However, our research shows that increasing the focus on developing ITS solutions may produce attractive results as reflected by firm value increase. For marketing department of non-ITS firm, our research is also helpful because the results essentially demonstrate how firms may create innovative customer solutions by actively deploying ITS and therefore obtain the favorability from shareholders. For external stakeholders, our research provides implications for firm stakeholders such as strategic partners. These partners should realize the power of ITS diversification of the firm and seek meaningful adaptation to achieve better realization of the cooperation. This type of cooperation is especially critical when ITS is involved because information sharing, operations optimizing, and competition sensing can be improved due to the integration of this type of diversification.

7 Concluding remarks

The fast-growing trend of incorporating IT spurs academic researchers to seek precise understanding of how this emerging technological competency may assist firms to realize business performance, but a significant gap exists in the theory regarding the non-ITS firms' expansion into IT service sectors. Yet in business practice these firms are very tentative when it comes to new opportunities and embracing and experimenting with IT customer solutions. The exploration of our research gives a scenario-based (moderation) relationship pattern illustrating ITS diversification's dynamic effects on firm value and risk. The empirical evidence in our study shows that investors highly value such a corporate move into IT sectors and they assign significant weight to this strategy. A deeper meaning in these findings is that there is an avenue for the firm that embraces IT to actively consider the combination of technology and customer needs because of their complementary functions.

References

1. Adams RB, Licht AN, Sagiv L (2011) Shareholders and stakeholders: how do directors decide? Strateg Manag J 32(12):1331–1355
2. Adam TR, Fernando CS (2006) Hedging, speculation, and shareholder value. J Financ Econ 81(2):283–309
3. Adner R, Kapoor R (2010) Value creation in innovation ecosystems: how the structure of technological interdependence affects firm performance in new technology generations. Strateg Manag J 31(3):306–333
4. Agarwal S, Krishna Erramilli M, Dev CS (2003) Market orientation and performance in service firms: role of innovation. J Serv Mark 17(1):68–82
5. Aivazian VA, Ge Y, Qiu J (2005) The impact of leverage on firm investment: Canadian evidence. J Corp Financ 11(1–2):277–291
6. Alessandri TM, Seth A (2014) The effects of managerial ownership on international and business diversification: Balancing incentives and risks. Strateg Manag J 35(13):2064–2075
7. Alvarez SA, Barney JB (2001) How entrepreneurial firms can benefit from alliances with large partners. Acad Manag Perspect 15(1):139–148
8. Anderson EW, Fornell C, Mazvancheryl SK (2004) Customer satisfaction and shareholder value. J Mark 68(4):172–185
9. Anderson MC, Banker RD, Ravindran S (2006) Value implications of investments in information technology. Manag Sci 52(9):1359–1376
10. Autio E, Sapienza HJ, Almeida JG (2000) Effects of age at entry, knowledge intensity, and imitability on international growth. Acad Manag J 43(5):909–924
11. Baltagi BH, Demetriades PO, Law SH (2009) Financial development and openness: evidence from panel data. J Dev Econ 89(2):285–296
12. Banker RD, Huang R, Natarajan R (2011) Equity incentives and long-term value created by SG&A expenditure. Contemp Account Res 28(3):794–830
13. Barney JB (2001) Resource-based theories of competitive advantage: a ten-year retrospective on the resource-based view. J Manag 27(6):643–650
14. Barney J, Wright M, Ketchen DJ Jr (2001) The resource-based view of the firm: ten years after 1991. J Manag 27(6):625–641
15. Bharadwaj AS (2000) A resource-based perspective on information technology capability and firm performance: an empirical investigation. Mis Quart 24(1):169–196
16. Bhatt G, Emdad A, Roberts N, Grover V (2010) Building and leveraging information in dynamic environments: The role of IT infrastructure flexibility as enabler of organizational responsiveness and competitive advantage. Inf Manag 47(7–8):341–349
17. Boh WF, Yellin D (2006) Using enterprise architecture standards in managing information technology. J Manag Inf Syst 23(3):163–207
18. Bowen HP, Wiersema MF (2005) Foreign-based competition and corporate diversification strategy. Strateg Manag J 26(12):1153–1171
19. Brynjolfsson E, Hitt LM (2000) Beyond computation: Information technology, organizational transformation and business performance. J Econ Perspect 14(4):23–48
20. Carr JC, Haggard KS, Hmieleski KM, Zahra SA (2010) A study of the moderating effects of firm age at internationalization on firm survival and short-term growth. Strateg Entrep J 4(2):183–192

21. Cavusgil ST, Knight G (2015) The born global firm: an entrepreneurial and capabilities perspective on early and rapid internationalization. J Int Bus Stud 46(1):3–16
22. Chalermchatvichien P, Jumreornvong S, Jiraporn P, Singh M (2014) The effect of bank ownership concentration on capital adequacy, liquidity, and capital stability. J Financ Serv Res 45(2):219–240
23. Chang KC, Jackson J, Grover V (2003) E-commerce and corporate strategy: an executive perspective. Inf Manag 40(7):663–675
24. Chang SC, Wang CF (2007) The effect of product diversification strategies on the relationship between international diversification and firm performance. J World Bus 42(1):61–79
25. Chari MD, Devaraj S, David P (2007) International diversification and firm performance: role of information technology investments. J World Bus 42(2):184–197
26. Chatain O (2011) Value creation, competition, and performance in buyer-supplier relationships. Strateg Manag J 32(1):76–102
27. Chen Y, Yang S, Wang Z (2016) Service cooperation and marketing strategies of infomediary and online retailer with eWOM effect. Inf Technol Manag 17(2):109–118
28. Choi SY, Lee H, Yoo Y (2010) The impact of information technology and transactive memory systems on knowledge sharing, application, and team performance: a field study. Mis Quart 34(4):855–870
29. Chung KH, Pruitt SW (1994) A simple approximation of Tobin's q. Financ Manag 23(3):70–74
30. Connelly BL, Certo ST, Ireland RD, Reutzel CR (2011) Signaling theory: a review and assessment. J Manag 37(1):39–67
31. Cooper MJ, Gulen H, Schill MJ (2008) Asset growth and the cross-section of stock returns. J Finance 63(4):1609–1651
32. Darnall N, Henriques I, Sadorsky P (2010) Adopting proactive environmental strategy: the influence of stakeholders and firm size. J Manag Stud 47(6):1072–1094
33. Deane JK, Goldberg DM, Rakes TR, Rees LP (2019) The effect of information security certification announcements on the market value of the firm. Inf Technol Manag 20(3):107–121
34. DeLong G, DeYoung R (2007) Learning by observing: Information spillovers in the execution and valuation of commercial bank M&As. J Finance 62(1):181–216
35. Deutsch Y, Keil T, Laamanen T (2011) A dual agency view of board compensation: The joint effects of outside director and CEO stock options on firm risk. Strateg Manag J 32(2):212–227
36. Doukas JA, Kan OB (2006) Does global diversification destroy firm value? J Int Bus Stud 37(3):352–371
37. Doyle J, Ge W, McVay S (2007) Determinants of weaknesses in internal control over financial reporting. J Account Econ 44(1–2):193–223
38. Duru A, Reeb DM (2002) International diversification and analysts' forecast accuracy and bias. Account Rev 77(2):415–433
39. Dushnitsky G, Lenox MJ (2006) When does corporate venture capital investment create firm value? J Bus Ventur 21(6):753–772
40. Giudici G, Paleari S (2000) The provision of finance to innovation: a survey conducted among Italian technology-based small firms. Small Bus Econ 14(1):37–53
41. Gomes L, Ramaswamy K (1999) An empirical examination of the form of the relationship between multinationality and performance. J Int Bus Stud 30(1):173–187
42. Fang VW, Noe TH, Tice S (2009) Stock market liquidity and firm value. J Financ Econ 94(1):150–169
43. Flammer C (2015) Does product market competition foster corporate social responsibility? Evidence from trade liberalization. Strateg Manag J 36(10):1469–1485
44. Flatten TC, Greve GI, Brettel M (2011) Absorptive capacity and firm performance in SMEs: the mediating influence of strategic alliances. Eur Manag Rev 8(3):137–152
45. Frishammar J, Åke Hörte S (2005) Managing external information in manufacturing firms: The impact on innovation performance. J Prod Innovat Manag 22(3):251–266
46. Glover B, Levine O (2017) Idiosyncratic risk and the manager. J Financ Econ 126(2):320–341
47. Hann RN, Ogneva M, Ozbas O (2013) Corporate diversification and the cost of capital. J Finance 68(5):1961–1999
48. Heiens RA, Leach RT, McGrath LC (2007) The contribution of intangible assets and expenditures to shareholder value. J Strateg Mark 15(2–3):149–159
49. Helfat CE, Peteraf MA (2003) The dynamic resource-based view: capability lifecycles. Strateg Manag J 24(10):997–1010
50. Henderson D, Miller AD, Hambrick DC (2006) How quickly do CEOs become obsolete? Industry dynamism, CEO tenure, and company performance. Strateg Manag J 27(5):447–460
51. Herrmann DR, Hope OK, Thomas WB (2008) International diversification and forecast optimism: the effects of Reg FD. Account Horiz 22(2):179–197
52. Heron RA, Lie E (2016) Do stock options overcome managerial risk aversion? Evidence from exercises of executive stock options. Manag Sci 63(9):3057–3071
53. Hillman AJ, Keim GD (2001) Shareholder value, stakeholder management, and social issues: what's the bottom line? Strateg Manag J 22(2):125–139
54. Hund J, Monk D, Tice S (2010) Uncertainty about average profitability and the diversification discount. J Financ Econ 96(3):463–484
55. Hoberg G, Phillips G (2016) Text-based network industries and endogenous product differentiation. J Polit Econ 124(5):1423–1465
56. Iyer B, Henderson JC (2010) Preparing for the future: understanding the seven capabilities cloud computing. Mis Q Exec 9(2):117–131
57. Jandhyala S (2013) Property rights and international investment in information technology services. Strateg Manag J 34(7):877–889
58. Jayachandran S, Sharma S, Kaufman P, Raman P (2005) The role of relational information processes and technology use in customer relationship management. J Mark 69(4):177–192
59. Jin Y, Jorion P (2006) Firm value and hedging: evidence from US oil and gas producers. J Finance 61(2):893–919
60. Kang HC, Anderson RM, Eom KS, Kang SK (2017) Controlling shareholders' value, long-run firm value and short-term performance. J Corp Financ 43(C):340–353
61. Kastalli V, Van Looy B (2013) Servitization: disentangling the impact of service business model innovation on manufacturing firm performance. J Oper Manag 31(4):169–180
62. Keats BW, Hitt MA (1988) A causal model of linkages among environmental dimensions, macro organizational characteristics, and performance. Acad Manag J 31(3):570–598
63. Knight GA, Cavusgil ST (2004) Innovation, organizational capabilities, and the born-global firm. J Int Bus Stud 35(2):124–141
64. Kohli R, Devaraj S, Ow TT (2012) Does information technology investment influence a firm's market value? A case of non-publicly traded healthcare firms. MIS Q 36(4):1145–1163
65. Krause DR, Scannell TV (2002) Supplier development practices: Product-and service-based industry comparisons. J Supply Chain Manag 38(1):13–21
66. Krishnan MS, Ramaswamy V, Meyer MC, Damien P (1999) Customer satisfaction for financial services: the role of products, services, and information technology. Manag Sci 45(9):1194–1209
67. Kumar MV (2009) The relationship between product and international diversification: the effects of short-run constraints and endogeneity. Strateg Manag J 30(1):99–116
68. Leal-Rodríguez L, Eldridge S, Roldán JL, Leal-Millán AG, Ortega-Gutiérrez J (2015) Organizational unlearning, innovation

outcomes, and performance: the moderating effect of firm size. J Bus Res 68(4):803–809
69. Lee C, Chen WJ (2007) Cross-functionality and charged behavior of the new product development teams in Taiwan's information technology industries. Technovation 27(10):605–615
70. Li X, Shen J, Ma W, Zhang W (2016) The effect of business ties and government ties on new IT venture growth: an empirical examination in China. Inf Technol Manag 17(3):245–261
71. Ling Y, Zhao H, Baron RA (2007) Influence of founder—CEOs' personal values on firm performance: moderating effects of firm age and size. J Manag 33(5):673–696
72. Löfsten H, Lindelöf P (2002) Science Parks and the growth of new technology-based firms—academic-industry links, innovation and markets. Res Policy 31(6):859–876
73. Luo X, Bhattacharya CB (2009) The debate over doing good: corporate social performance, strategic marketing levers, and firm-idiosyncratic risk. J Mark 73(6):198–213
74. Mani S, Luo X (2015) Product alliances, alliance networks, and shareholder value: evidence from the biopharmaceutical industry. Int J Res Mark 32(1):9–22
75. Mansi SA, Reeb DM (2002) Corporate diversification: what gets discounted? J Finance 57(5):2167–2183
76. Mayer J, Nickerson JA (2005) Antecedents and performance implications of contracting for knowledge workers: evidence from information technology services. Organ Sci 16(3):225–242
77. Melville N, Kraemer K, Gurbaxani V (2004) Information technology and organizational performance: an integrative model of IT business value. Mis Q 28(2):283–322
78. Meuleman M, De Maeseneire W (2012) Do R&D subsidies affect SMEs' access to external financing? Res Policy 41(3):580–591
79. Meuter ML, Ostrom AL, Roundtree RI, Bitner MJ (2000) Self-service technologies: understanding customer satisfaction with technology-based service encounters. J Mark 64(3):50–64
80. Mitsuhashi H, Min J (2016) Embedded networks and suboptimal resource matching in alliance formations. Br J Manag 27(2):287–303
81. Naldi L, Davidsson P (2014) Entrepreneurial growth: the role of international knowledge acquisition as moderated by firm age. J Bus Ventur 29(5):687–703
82. Ng W (2007) A modern resource based approach to unrelated diversification. J Manag Stud 44(8):1481–1502
83. Palich E, Cardinal LB, Miller CC (2000) Curvilinearity in the diversification-performance linkage: an examination of over three decades of research. Strateg Manag J 21(2):155–174
84. Paliwoda SJ, Slater S, Chadee D, Raman R (2009) International outsourcing of information technology services: review and future directions. Int Mark Rev 26(4/5):411–438
85. Park JG, Lee H, Lee J (2015) Applying social exchange theory in IT service relationships: exploring roles of exchange characteristics in knowledge sharing. Inf Technol Manag 16(3):193–206
86. Park SH, Luo Y (2001) Guanxi and organizational dynamics: organizational networking in Chinese firms. Strateg Manag J 22(5):455–477
87. Peffers K, Tuunanen T, Rothenberger MA, Chatterjee S (2007) A design science research methodology for information systems research. J Manag Inf Syst 24(3):45–77
88. Prajogo D, Olhager J (2012) Supply chain integration and performance: the effects of long-term relationships, information technology and sharing, and logistics integration. Int J Prod Econ 135(1):514–522
89. Ptok A, Jindal RP, Reinartz WJ (2018) Selling, general, and administrative expense (SGA)-based metrics in marketing: conceptual and measurement challenges. J Acad Mark Sci 46(6):987–1011
90. Ramaswami SN, Srivastava RK, Bhargava M (2009) Market-based capabilities and financial performance of firms: insights into marketing's contribution to firm value. J Acad Mark Sci 37(2):97–116
91. Richard OC, Barnett T, Dwyer S, Chadwick K (2004) Cultural diversity in management, firm performance, and the moderating role of entrepreneurial orientation dimensions. Acad Manag J 47(2):255–266
92. Rigtering JC, Kraus S, Eggers F, Jensen SH (2014) A comparative analysis of the entrepreneurial orientation/growth relationship in service firms and manufacturing firms. Serv Ind J 34(4):275–294
93. Rivard S, Raymond L, Verreault D (2006) Resource-based view and competitive strategy: an integrated model of the contribution of information technology to firm performance. J Strateg Inf Syst 15(1):29–50
94. Santhanam R, Hartono E (2003) Issues in linking information technology capability to firm performance. Mis Q 27(1):125–153
95. Santoro D, Chakrabarti AK (2002) Firm size and technology centrality in industry–university interactions. Res Policy 31(7):1163–1180
96. Servaes H, Tamayo A (2013) The impact of corporate social responsibility on firm value: the role of customer awareness. Manag Sci 59(5):1045–1061
97. Sharfman P, Fernando CS (2008) Environmental risk management and the cost of capital. Strateg Manag J 29(6):569–592
98. Shu W, Strassmann PA (2005) Does information technology provide banks with profit? Inf Manag 42(5):781–787
99. Stam W, Elfring T (2008) Entrepreneurial orientation and new venture performance: the moderating role of intra-and extraindustry social capital. Acad Manag J 51(1):97–111
100. Sun Y, Fang Y, Lim KH, Straub D (2012) User satisfaction with information technology service delivery: a social capital perspective. Inf Syst Res 23(4):1195–1211
101. Swaminathan V, Moorman C (2009) Marketing alliances, firm networks, and firm value creation. J Mark 73(5):52–69
102. Tang J, Crossan M (2017) Are dominant CEOs the saviors of troubled firms? Long Range Plann 50(6):782–793
103. Tanriverdi H (2005) Information technology relatedness, knowledge management capability, and performance of multibusiness firms. Mis Q 29(2):311–334
104. Thornhill S (2006) Knowledge, innovation and firm performance in high-and low-technology regimes. J Bus Ventur 21(5):687–703
105. Thornhill S, Amit R (2003) Learning about failure: Bankruptcy, firm age, and the resource-based view. Organ Sci 14(5):497–509
106. Vomberg A, Homburg C, Bornemann T (2015) Talented people and strong brands: the contribution of human capital and brand equity to firm value. Strateg Manag J 36(13):2122–2131
107. Von Zedtwitz M, Gassmann O (2002) Market versus technology drive in R&D internationalization: four different patterns of managing research and development. Res Policy 31(4):569–588
108. Wade M, Hulland J (2004) The resource-based view and information systems research: review, extension, and suggestions for future research. Mis Q 28(1):107–142
109. Wang H, Barney JB, Reuer JJ (2003) Stimulating firm-specific investment through risk management. Long Range Plann 36(1):49–59

110. Wang HC, Barney JB (2006) Employee incentives to make firm-specific investments: implications for resource-based theories of corporate diversification. Acad Manag Rev 31(2):466–476
111. White H (1980) A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrica 48(4):817–838
112. Wu F, Yeniyurt S, Kim D, Cavusgil ST (2006) The impact of information technology on supply chain capabilities and firm performance: a resource-based view. Ind Mark Manag 35(4):493–504
113. Yli-Renko H, Autio E, Sapienza HJ (2001) Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. Strateg Manag J 22(6–7):587–613
114. Yoo Y, Henfridsson O, Lyytinen K (2010) Research commentary—the new organizing logic of digital innovation: an agenda for information systems research. Inf Syst Res 21(4):724–735
115. Zaheer A, Bell GG (2005) Benefiting from network position: firm capabilities, structural holes, and performance. Strateg Manag J 26(9):809–825
116. Zain M, Rose RC, Abdullah I, Masrom M (2005) The relationship between information technology acceptance and organizational agility in Malaysia. Inf Manag 42(6):829–839
117. Zhu K (2004) The complementarity of information technology infrastructure and e-commerce capability: a resource-based assessment of their business value. J Manag Inf Syst 21(1):167–202
118. Zhu K, Kraemer KL, Dedrick J (2004) Information technology payoff in e-business environments: an international perspective on value creation of e-business in the financial services industry. J Manag Inf Syst 21(1):17–54
119. Zona F, Zattoni A, Minichilli A (2013) A contingency model of boards of directors and firm innovation: the moderating role of firm size. Br J Manag 24(3):299–315