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## The Effect of Organizational Learning and Knowledge Management Innovation on SMEs' Technological Capability

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### ABSTRACT

Organizational learning and knowledge management innovation are context-specific and they can influence SME's technological capability effectively. We defined knowledge management innovation as a two-stage process: adoption and implementation of a managerial practice, process, or tool that is new to the firms and is intended to enhance the firms' knowledge management efficiency. Then we constructed a conceptual model to discuss the relationship among organizational learning, knowledge management innovation and technological capability. We proposed that the effects of organizational learning were not only curvilinear but also differential across knowledge management innovation adoption and implementation process. The findings supported the hypotheses that (1) exploitative learning and exploratory learning had increasingly positive effects on knowledge management innovation; (2) knowledge management innovation had an inverted U relationship with technological capability; and (3) when exploitative learning was high, more knowledge management innovations were associated with better technological capability, but explorative innovation had insignificant moderating effects in knowledge management innovation implementation process.

**Keywords:** exploitative learning; exploratory learning; knowledge management innovation; technological capability

### INTRODUCTION

Small and medium-sized enterprises (SMEs) play an important role in the market economy and are also one of the primary driving forces for economic development. However, with the rapid technological evolution, turbulent complex market, increasingly sophisticated competitors, and economy globalization, SMEs face a challenging external business environment increasingly (De Clercq et al., 2015; Brettel et al., 2013). Innovation is the key for the enterprises to achieve sustainable competitive advantage and has become the common focus of academia and business career (Martinez-Conesa et al., 2017; Mukherjee et al., 2016; Tsai & Lei 2016; Zhou & Li, 2012). To develop innovation, firms in innovative industries invest heavily in the building of technological capabilities which offer the abilities and skills to utilize and deploy various resources and know-how (Sears & Hoetker, 2014; Zhou & Wu, 2010). Strengthening the firm's technological capability can create new market opportunities for the firm and reshape the firm's competitive landscape (Brunswick et al., 2015). It's hard to establish technological capability

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#### **State of the literature**

- With the confluence of knowledge inertia and knowledge management practices, the relationship between exploitation/exploration learning and technological capability may be more complicated than previously depicted.
- The analytical of this study may help in understanding how SMEs can benefit from organizational learning?
- This study contributed to the literature by exploring the relationship among organizational learning, knowledge management innovation and technological capability, and also had implications for SME managers to manage the existing knowledge, the absorbed knowledge from external and the new knowledge created after learning and thinking, and ensured the effectiveness of organizational learning.

#### **Contribution of this paper to the literature**

- SMEs should devote to creating a learning organization to thoroughly develop the employees' initiative, largely promoting teamwork, and establishing long-term learning mechanism so as to promote the management level with organizational learning.
- Knowledge management innovation implementation should be effect-oriented that the innovative solutions should be modified through exploitative learning when the implementation did not appear the expected deviation in order to avoid too much variant knowledge being created.
- Knowledge management innovation implementation generally depends on the comprehension and participation of several departments that variance would result in more uncertainties. The "butterfly effect" caused by the negligence of a detail could result in knowledge management innovation implementation not achieving the expectation.

in a short time. A firm's technological capability, which reflects the firm's abilities to explore and utilize various external technical resources or to develop new techniques, is accumulated through its past experience and built over time (Sears, 2017; Wilden & Gudergan, 2015; Zhou & Wu, 2010). Moreover, compared to the large-scale enterprises, SMEs often encounter more difficulties in developing technological capability because of the resource restraints on capitals and talents and the huge risk of R&D itself (Halme & Korpela, 2014). The burgeoning literatures on technological capability highlight the importance role of those driving factors which can promote the firm's technological capability (e.g., Parnell et al., 2015; Hansen & Ockwel, 2014), among which the organizational learning and knowledge management have gained prominence in the last few years (Helfat & Peteraf, 2015; Camisón & Villar-López, 2014; Zhou & Li, 2012).

We believe that these consistencies in present studies derive partially from the implicit assumption that organizational learning and knowledge management have a linear positive relationship with the technological capability, which means, a firm's engagement in organizational learning and knowledge management can promote the firm's technological capability. Organizational learning consists of two types of learning including exploitative and exploratory learning (March, 1991). A firm's technological capability accumulation rate can be accelerated (or slowed) depending on how the firm manipulates the organizational learning processes over time (Figueiredo, 2002). These processes may lead to "effective" or "ineffective" "knowledge management practices" within firms (Alavi & Leidner, 2001), and these knowledge management practices may deliberately influence the paths and effects of firm's technological capability accumulation (Tseng & Lee, 2014). However, a firm's enhancement in technological capability is often accompanied by the improvement of employees' creativity and the organization's more innovations, including strategic innovation, technology innovation, management innovation, process innovation and etc. (Birkinshaw et al., 2008; Crossan & Apaydin, 2010; Helfat & Campo-Rembado, 2016). These innovative activities may be bounded by the firm's existing routines, processes and experiences, which are called knowledge inertia (Li et al., 2016; Xie et al., 2016). Thus, understanding how organizations overcome knowledge inertia through organizational learning and knowledge management innovation is necessary to resolve the existing controversy. With the confluence of knowledge inertia and knowledge management practices, the relationship

between exploitation/exploration learning and technological capability may be more complicated than previously depicted.

This study used the concept of “knowledge management innovation” to represent the changes of firm in knowledge management practice including knowledge management processes, rules, systems and etc., and then aimed to examine the mechanism how organizational learning (exploitation and exploration) influences SME’s technological capability through knowledge management innovation. Knowledge management innovation is a type of management innovations and is regarded as a two-stage process: adoption and implementation (Volberda et al., 2014; Lin & Su, 2014). In particular, we proposed that the effects of organizational learning were not only curvilinear but also differential across knowledge management innovation adoption and implementation process. In the adoption process, organizational learning fostered knowledge management innovation at an accelerating rate, whereas it had moderating effect in the knowledge management innovation implementation process. The analytical of this study may help in understanding how SMEs can benefit from organizational learning. This study contributed to the literature by exploring the relationship among organizational learning, knowledge management innovation and technological capability, and also had implications for SME managers to manage the existing knowledge, the absorbed knowledge from external and the new knowledge created after learning and thinking, and ensured the effectiveness of organizational learning.

## LITERATURE REVIEW AND HYPOTHESIS

### **Knowledge management innovation adoption process**

Knowledge management includes the firm’s activities involving the capture, sharing, and use of knowledge (Wu et al., 2016; Cantor et al., 2014). Based on the concept of management innovation (Birkinshaw et al., 2008; Naveh et al, 2006), we defined knowledge management innovation as the adoption and implementation of a managerial practice, process, or tool that is new to the firms and is intended to enhance the firms’ knowledge management efficiency. Thus, the essence of knowledge management innovation is using a set of management techniques to create or add knowledge value. Some scholars regarded organizational learning as the basic condition of management innovation; particularly in knowledge intensive industries, individual and organizational learning could be the sole source of a firm continuing the competitive advantages (Mol & Birkinshaw, 2009; Stata, 1989). Hurley & Hult (1998) indicated that organizational learning could promote the firm’s actives in rebuilding the organizational structure and work process and further induce the innovation potential. Noruzy et al., (2013) found that organizational learning positively influenced knowledge management of manufacturing firms. Volberda et al. (2013) discovered that knowledge acquired from external knowledge sources and learned from partners was the key antecedents of management innovation, and a high level of organizational learning should facilitate greater management innovation. Accordingly, the following hypotheses were proposed in this study.

**H1:** Exploitative learning has an increasingly positive relationship with knowledge management innovation, such that it has (a) a positive linear effect and (b) a positive quadratic effect on knowledge management innovation.

**H2:** Exploratory Learning has an increasingly positive relationship with knowledge management innovation, such that it has (a) a positive linear effect and (b) a positive quadratic effect on knowledge management innovation.

### **Knowledge management innovation implementation process**

#### ***Knowledge management innovation and technological capability***

Current researches on management innovation implementation were mainly regarded as a linear process. Nevertheless, the relationship between knowledge management innovation and technological capability might be non-linear in this study. Obviously, even if the organization has made the management innovation adoption decisions, if there is no implementation successfully, means that the expected changes have not been fully internalized, then, the organization’s practices will not change, and it will be impossible to yield beneficial results

(Zbaracki, 1998). Marcus & Naveh (2005) discussed the effects of ISO 9000 implementation and proposed that exceeding implementation decentralized employee energy and hindered employees engaging in activities which benefited the increase of customer value; eventually, the capability could not be promoted and the performance could not be improved. Consequently, it is considered in this study that knowledge management innovation implementation could promote technological capability within a proper range. Khanagha et al. (2013) and Hollen et al. (2013) revealed the necessity of management innovation for an enterprise accumulating emerging knowledge in the dynamic environment. However, when management innovation implementation exceeded the point of effective change, such implementation could become a burden for an enterprise. Accordingly, the following hypothesis was proposed in this study.

**H3:** Knowledge management innovation has an inverted U-shaped relationship with technological capability, such that it has (a) a positive linear effect and (b) a negative quadratic effect on technological capability.

### *Moderating effect of organizational learning*

Any management innovation implementation was a systematic work; completely precise planning was about impossible in a complicated situation; and, there were plenty of fallacy in the comprehension of current emergencies (Feldman, 2004). Besides, situational changes resulted from innovation implementation might make the previously effective innovation become invalid in new situations, even though a comparatively more precise plan was made. As a result, Exploitative learning could enhance an enterprise recognizing and correcting the errors in innovation adoption, proposing better innovation, and coping with the deviation in the implementation as well as timely adjust the task and role of organizational members, job arrangement, communication model, and authority and responsibility relationship to promote the successful implementation. Nonetheless, exceeding exploitative learning in the implementation might have the execution become “daily routine” or “unconscious behaviors” (Sitkin et al., 1994). Exploratory learning, with the characteristics of exploration, testing, and attempt, could provide an organization with a mechanism avoiding inertial thinking and further induce the organization to exceed the frame and create a more comprehensive model (Barrett, 1998). The development of exploratory learning, based on implementation feedback, to respond to the previous custom could enhance the extra innovation of an organization and further facilitate the profound change. It is therefore considered that management innovation implementation with high-level exploitative learning and exploratory learning could achieve the better implementation. Accordingly, the following hypotheses were proposed in this study.

**H4:** Exploitative learning shows positive moderating effects on the relationship between knowledge management innovation and technological capability.

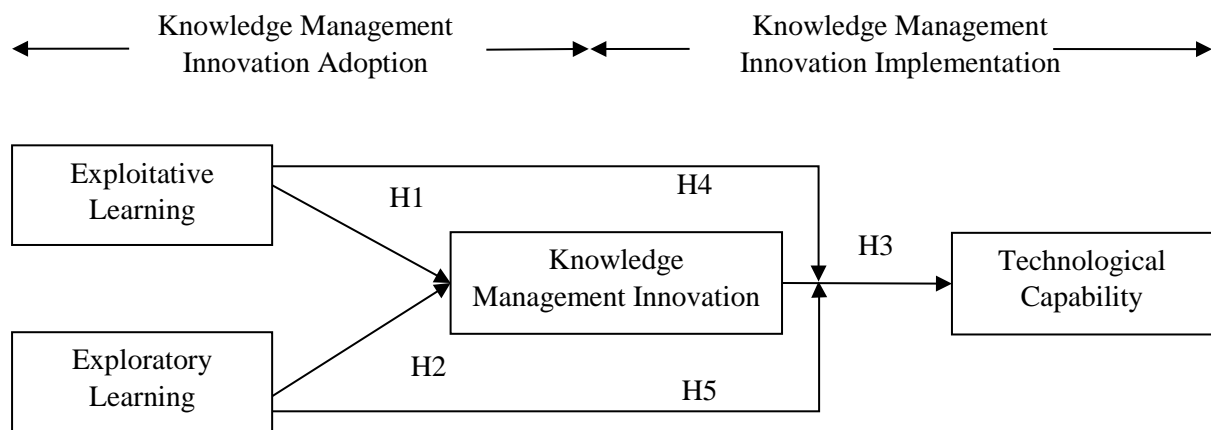
**H5:** Exploratory Learning shows positive moderating effects on the relationship between knowledge management innovation and technological capability.

In summary, **Figure 1** presents the research model of this study.

## METHOD

### Sample

In this study, we employed a questionnaire survey based on self-report measures as the main data collection method. The conversion of the questionnaire language (i.e. English to Chinese and then Chinese back to English) was done by a bilingual expert after the authors designed the questionnaire to ensure the translation quality (Brislin, 1970). Then some pre-tests by experts including two professors from university and three managers from SMEs were conducted to refine the item-wording and survey structure of the questionnaire. Using a list of SME managers' contact information from two executive training programs at a famous university in Pearl River delta in China, we sent a questionnaire by postal mail to 420 alumni requesting their supports for our study during the period from July to October 2016. All of these managers were the TMT members in their firms such as CEO, chief technology officer (CTO), chief operational officer (COO) and etc., who present more comprehensive understanding of organizational learning, knowledge management innovation, and technological capability. In our



**Figure 1.** Conceptual Framework

postal mail, the purpose of our study which aimed at understanding the influence of exploitative learning, exploratory learning and knowledge management innovation on SME's technological capability was described in detail to the SME managers, and we promised that their answers would be kept strictly confidential and only be used for the research. To encourage participation, we also promised that we would send the findings of the research to each participating firm after we finished the study. Finally, a total of 305 responses were received and the response rate was 72.62%. After screening for missing data and outliers, we obtained 260 usable questionnaires and the valid return rate was 61.90%. The valid respondents created a target research population of 260 SMEs from various industries (e.g. electronics, communication and information technology, metal material, clothing, software, furniture, mechanical, chemical, household electrical appliance).

### Measurements

Established scales for all the constructs were employed from existing studies where the scale was examined and validated carefully. In line with previous studies, all items were measured with seven-point Likert-type scale range from one (strongly disagree) to seven (strongly agree).

*Organizational learning.* The scale consists of ten items used by Zhou & Wu (2010) and Wei et al. (2014) was adapted to measure the organizational learning. It included two dimensions: exploitative learning (five items) and exploratory learning (five items). The items reflect the extent to which a firm used existing technologies and knowledges or explored new technologies and knowledges in its product development or business management process. Some sample items to measure exploitative learning were: "to what extent has your firm invested in exploiting mature technologies that improve the productivity of current innovation operations" and "to what extent has your firm strengthened the knowledge and skills to improve the efficiency of existing innovation activities", and the Cronbach'  $\alpha$  appears 0.887. Some sample items to measure exploratory learning were: "to what extent has your firm learned product development skills and processes entirely new to the industry" and "to what extent has your firm acquired entirely new managerial and organizational skills that are important for innovation", and the Cronbach'  $\alpha$  appears 0.838.

*Knowledge management innovation.* To measure the level of Knowledge management innovation in SMEs, a scale was developed through modifying the established scale of knowledge management used by Hsu & Sabherwal (2012) and of management innovation used by Vaccaro et al. (2012). It consist six items and reflected the manifestation of innovation in SME's knowledge management processes, practices, and systems. For example, item 1 (Our organization frequently introduces new approaches to transfer organizational knowledge to individuals) represented the new practices in knowledge management that could improve the organization's knowledge transfer efficiency. Item 2 (Our organization frequently introduces new information technology or system to

integrate different sources and types of knowledge) represented the new processes and rules in knowledge management that could improve the organization's knowledge acquisition and knowledge application effectively. Overall, our scale of knowledge management innovation reflect the main facets of innovation in knowledge management, including how the managers to establish or improve the processes and rules of knowledge acquisition, sharing, creation, application and etc., and the Cronbach'  $\alpha$  appears 0.818.

*Technological capability.* Following Zhou & Wu (2010) and Voudouris et al. (2012), a five-item measurement scale that assessed a firm's ability to use various technologies was used to measure technological capability. The items were designed to evaluate the SME's capabilities (Compared to your major competitors, how would you evaluate your firm's capability in ...) in the following areas such as "acquiring important technology information", "identifying new technology opportunities", "responding to technology changes" and etc., and the Cronbach'  $\alpha$  appears 0.859.

*Control variables.* Furthermore, the firm's characteristic variables such as property, scale, age, and annual revenue may affect a firm's technological capability regardless of its organizational learning and knowledge management (Wiklund & Shepherd, 2003). We therefore chose these characteristic variables as control variables. Property was captured by a dummy variable for the firm's ownership nature (state-owned or private); the natural logarithm of the number of employees was regarded as the proxy variable for the scale; the number of years from the establishment of an enterprise to 2016 was used for the age; and annual revenue was presented with Likert 7-point scale.

## ANALYSIS AND RESULTS

### Respondent profile

The research object of this study was SMEs, and we defined SME according to the standards which were set according to the number of employees or the annual revenues in different industries issued by China's ministry of industry and information technology. The respondents held chief executive positions such as CEO, chief technology officer (CTO), chief operational officer (COO) and etc. All of them had been in their position at least 1 year and 84.23% of them had been in their position for 3 years or more. Thus, the respondents had sufficient knowledge about their firms to complete the survey accurately. The respondent firms covered various industries, and the highest percentage of firms was reported in household electrical appliance industry, reached to 22.69%, followed by metal material and mechanical industries, reached to 21.54%. Regarding property, the respondent firms were dominated by private enterprises, accounted for 86.9% of all reporting firms. The median number of employees was approximately 230 and the median age of firms was approximately 8 years. 45.38% of the firms were small-sized companies, with less than 20 million annual revenues, and 54.62% of firms were medium-sized companies with 20-400 million annual revenues. Such a sample represents a wide range of SMEs in China. Furthermore, to test the non-response bias, we divided the sample into two subsamples according to the sample order and we compared property, number of employees, age, annual revenue and all variables used in this study (Mellahi & Harris, 2015; Cantor et al., 2014). No statistical differences were found between the two subsamples at the significance level of 0.05, suggesting that non-response bias was not a major problem in our study.

### Reliability and validity

We conducted the method adapted by Gerbing & Anderson (1988) to test the construct reliability. Firstly, we performed the exploratory factor analysis (EFA) to confirm the unidimensionality of the scale items. Principal component analysis using Varimax rotation with Kaiser normalization (Loehlin, 2004) was conducted to determine the main constructs and their related measurement items. The KMO (Kaiser-Meyer-Olkin) of 21 measured items was 0.919, and Bartlett's sphericity test result chi square was 2725.747 (degree of freedom was 210), and p reached significance at less than 0.001, suggesting that related matrices shared the same factors and the data was suitable for factor analysis. The results (Table 1) showed that four eigenvalues were larger than 1 and the total variance explained by these four factors were 62.19%. No item loaded on multiple factors and the difference among factor loadings across the factors were less than 0.10, suggesting that cross-loadings were not major concerns in this study



**Table 1.** EFA of the scales

Items	Factor loading			
	Exploitative learning	Exploratory learning	Knowledge management innovation	Technological capability
EIL1	<b>0.719</b>	0.193	0.254	0.135
EIL2	<b>0.723</b>	0.130	0.272	0.293
EIL3	<b>0.791</b>	0.151	0.123	0.180
EIL4	<b>0.773</b>	0.078	0.250	0.222
EIL5	<b>0.732</b>	0.088	0.268	0.288
KMI1	0.274	<b>0.657</b>	0.070	0.064
KMI2	0.110	<b>0.699</b>	0.064	0.204
KMI3	0.026	<b>0.654</b>	0.149	0.221
KMI4	0.206	<b>0.726</b>	0.211	0.016
KMI5	0.138	<b>0.676</b>	0.226	0.263
KMI6	-0.051	<b>0.668</b>	0.162	0.165
TC1	0.272	0.273	<b>0.642</b>	0.171
TC2	0.240	0.171	<b>0.720</b>	0.246
TC3	0.325	0.204	<b>0.710</b>	0.120
TC4	0.206	0.088	<b>0.780</b>	0.131
TC5	0.138	0.248	<b>0.678</b>	0.325
ERL1	0.229	0.214	0.123	<b>0.644</b>
ERL2	0.307	0.177	0.065	<b>0.727</b>
ERL3	0.212	0.223	0.203	<b>0.773</b>
ERL4	0.220	0.126	0.242	<b>0.701</b>
ERL5	0.095	0.206	0.324	<b>0.637</b>
Total variance explained			62.19%	

Notes:  $n=260$ ; EIL, exploitative learning; ERL, exploratory learning; KMI, knowledge management innovation; TC, technological capability.

(Henseler et al., 2015). Then we used confirmatory factor analysis (CFA) to validate the measurement structure and the model fit indices indicated that the measure model was acceptable, suggesting that unidimensionality was ensured.

Secondly, Cronbach's  $\alpha$  and composite reliability (CR) were calculated to assess the reliability of each construct. Cronbach's  $\alpha$  applying the recommended criterion of 0.7 (Hulland, 1999) was widely used to confirm the construct reliability. The results (Table 2) showed that all four constructs' Cronbach's  $\alpha$  value were above 0.80. In addition, all CR values were higher than the minimum acceptable value of 0.70. Thus, we could conclude that the measured constructs of this study were reliable.

Furthermore, we tested the content, convergent, and discriminant validity of scales (Henseler et al., 2015) to make sure whether a scale measured what it was supposed to measure. Content validity was guaranteed through using established scales, pre-test, and feedback received from academics and managers. We conducted CFA to test convergent and discriminant validity (Geldhof et al., 2014). The model fit indices were as follows:  $\chi^2 = 328.583$ , degree of freedom (df) = 183,  $p < 0.001$ ;  $\chi^2/df = 1.796$ ; comparative-fit index (CFI) = 0.944; goodness-of-fit index (GFI) = 0.893; incremental-fit index (IFI) = 0.945; Tucker-Lewis index (TLI) = 0.936; root mean-square residual (RMR) = 0.056; root mean-square error of approximation (RMSEA) = 0.055, indicated that the proposed measurement was acceptable (Hu and Bentler, 1999). All factor loadings were higher than 0.5 and all average variance extracted (AVE) values expect one (0.431) were greater than the threshold of 0.5 (Table 2), which confirmed the convergent validity of scales (Fornell & Larcker, 1981). For discriminant validity test, we calculated

**Table 2.** Correlation and reliability analysis

No.	Variables	Mean	SD	1	2	3	4	AVE	Cronbach' $\alpha$	CR
1 .	EIL	5.722	0.897	<b>0.782<sup>†</sup></b>				0.612	0.887	0.887
2 .	ERL	5.150	0.910	0.581**	<b>0.721<sup>†</sup></b>			0.520	0.838	0.843
3 .	KMI	5.046	0.789	0.404**	0.513**	<b>0.657<sup>†</sup></b>		0.431	0.818	0.819
4 .	TC	5.286	0.864	0.604**	0.578**	0.508**	<b>0.744<sup>†</sup></b>	0.553	0.859	0.861

Notes:  $n=260$ ; EIL, exploitative learning; ERL, exploratory learning; KMI, knowledge management innovation; TC, technological capability; AVE, average variance extracted; CR, composite reliability; \*\*  $P < 0.01$ ; <sup>†</sup>the square root of AVE.

the square root of AVE. When square roots of AVEs of all variables were bigger than correlations between variables, discriminant validity was researched (Hulland, 1999). The results were showed in [Table 2](#).

### Hierarchical Regression Analysis

Hierarchical regression analysis was utilized for testing the model and the hypotheses. [Table 2](#) presented the correlations, means, and standard deviations among the study's variables. Results indicated that exploitative learning, exploratory learning, knowledge management innovation and technological capability were moderately correlated with each other significantly. No correlations exceeded 0.75, and no problematically high correlations (generally 0.90 and above) were present, indicating that possible multicollinearity problems were not concerns (Hair et al. 1998). It was suitable for further regression analysis.

As shown in [Table 3](#), models 1 to 9 were used to test the 5 hypotheses proposed above. Across all models, the variance inflation factors (VIF) of the variables were between 1.009 and 3.229, and did not exceed 5 (Spector, 2006), which ruled out the possibility of any effect derived from multicollinearity.

In model 1 to 3, property, scale, age, and annual revenue were regarded as control variables, exploitative learning and its quadratic term as well as exploratory learning and its quadratic term were considered as independent variables, and knowledge management innovation was set to the dependent variable for regression analysis to test H1 and H2. Model 1 was the base model which tested the control variables only and explained a statistically significant share of the variance in knowledge management innovation ( $R^2 = 0.049$ ,  $P < 0.05$ ). Model 2 included the direct effect of exploitative learning and its quadratic term on knowledge management innovation, and made a significant contribution over and above the base model ( $\Delta R^2 = 0.156$ ,  $P < 0.001$ ). The monomial term ( $\beta = 0.46$ ,  $P < 0.001$ ) and quadratic term ( $\beta = 0.175$ ,  $P < 0.001$ ) of exploitative learning presented remarkably positive effects on knowledge management innovation, demonstrating the notably positive linear and quadratic effects of exploitative learning on knowledge management innovation, and H1 was supported by the empirical data. Model 3 included the direct effect of exploratory learning and its quadratic term on knowledge management innovation, and made a significant contribution over and above the base model ( $\Delta R^2 = 0.244$ ,  $P < 0.001$ ). The monomial term ( $\beta = 0.533$ ,  $P < 0.001$ ) and quadratic term ( $\beta = 0.133$ ,  $P < 0.001$ ) of exploratory learning appeared significantly positive effects on knowledge management innovation, revealing the remarkably positive linear and quadratic effects of exploratory learning on knowledge management innovation, and H2 was supported by the empirical data.

In model 4 to 9, property, scale, age, and annual revenue were regarded as control variables, exploitative learning and its quadratic term, exploratory learning and its quadratic term, knowledge management innovation and its quadratic term as well as interaction terms were considered as independent variables, and technological capability was set to the dependent variable for regression analysis to test H3, H4 and H5. Model 4 was the base model which tested the control variables only and explained a statistically significant share of the variance in technological capability ( $R^2 = 0.072$ ,  $P < 0.01$ ). Model 5 included the direct effect of knowledge management innovation and its quadratic term on technological capability, and made a significant contribution over and above the base model ( $\Delta R^2 = 0.190$ ,  $P < 0.001$ ). The monomial term ( $\beta = 0.413$ ,  $P < 0.001$ ) of knowledge management



**Table 3.** Results of hierarchical regression analysis

Variables	KMI					TC			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Property	0.093 (0.143)	0.071 (0.132)	0.026 (0.125)	0.128* (0.155)	0.084 (0.139)	0.087 (0.118)	0.088 (0.118)	0.043 (0.125)	0.042 (0.124)
Scale	0.049 (0.133)	-0.030 (0.124)	0.021 (0.115)	0.250* (0.144)	0.248 (0.130)	0.137 (0.112)	0.166* (0.114)	0.224** (0.116)	0.220** (0.116)
Age	0.047 (0.007)	0.038 (0.007)	-0.005 (0.006)	0.045 (0.008)	-0.005 (0.007)	0.021 (0.008)	0.018 (0.006)	-0.013 (0.006)	-0.012 (0.006)
Annual revenue	0.136 (0.040)	0.116 (0.037)	0.115 (0.035)	-0.044 (0.044)	-0.106 (0.039)	-0.115 (0.033)	-0.133 (0.034)	-0.100 (0.035)	-0.085 (0.035)
EIL		0.46*** (0.057)				0.483*** (0.050)	0.458*** (0.056)		
EIL <sup>2</sup>		0.175*** (0.030)							
ERL			0.533*** (0.050)					0.420*** (0.054)	0.463*** (0.060)
ERL <sup>2</sup>			0.113* (0.029)						
KMI					0.413*** (0.062)	0.284*** (0.057)	0.180*** (0.072)	0.270*** (0.063)	0.328*** (0.074)
KMI <sup>2</sup>					-0.111* (0.036)	-0.099* (0.031)	- 0.192*** (0.039)	-0.007 (0.032)	-0.094 (0.043)
EIL×KMI							0.116* (0.057)		
EIL×KMI <sup>2</sup>							0.141* (0.042)		
ERL×KMI									0.092 (0.056)
ERL×KMI <sup>2</sup>									-0.121 (0.033)
R <sup>2</sup>	0.049	0.205	0.293	0.072	0.254	0.470	0.484	0.418	0.430
F	3.269*	10.882***	17.479***	4.937**	14.342***	31.94***	26.051***	25.881***	20.94***
ΔR <sup>2</sup>		0.156	0.244		0.190	0.398	0.014	0.346	0.012
ΔF		24.883***	43.707***		32.294***	63.133***	3.353*	50.012***	2.538
VIF									1.009 ≤ VIF ≤ 3.299

Notes: n=260; EIL, exploitative learning; ERL, exploratory learning; KMI, knowledge management innovation; TC, technological capability. \* P < 0.05; \*\* P < 0.01; \*\*\* P < 0.001.

innovation presented notably positive effects on technological capability, while the quadratic term ( $\beta = -0.111, P < 0.05$ ) appeared remarkably negative effects, showing the inverted U relationship between knowledge management innovation and technological capability, and H3 was supported by the empirical data.

Two models, referring to Zhou & Wu (2010), were used for testing the moderating effects of exploitative learning (Model 6-7) and exploratory learning (Model 8-9) on the relationship between knowledge management innovation and technological capability. The results showed that the main effect models made a significant contribution over and above the base model (Model 6,  $\Delta R^2 = 0.398, P < 0.001$ ; Model 8,  $\Delta R^2 = 0.346, P < 0.001$ ). Model 7 included the interaction effect of exploitative learning and knowledge management innovation on technological capability, and made a significant contribution over and above the model 6 ( $\Delta R^2 = 0.014, P < 0.05$ ). The monomial term ( $\beta = 0.116, P < 0.05$ ) and quadratic term ( $\beta = 0.141, P < 0.05$ ) of the interaction between exploitative learning and knowledge management innovation revealed significantly positive effects on technological capability, indicating exploitative learning's positive moderating effects on the relationship between knowledge management innovation and technological capability, and H4 was supported by the empirical data. However, Model 9 included the interaction effect of exploratory learning and knowledge management innovation on technological capability, and did not make a significant contribution over and above the model 8 ( $\Delta R^2 = 0.012, P > 0.05$ ). The monomial term

and quadratic term of the interaction between exploratory learning and knowledge management innovation was not significant, and H5 was not supported by the empirical data.

## CONCLUSIONS

The effects of exploitative learning and exploratory learning on knowledge management innovation adoption and implementation are tested in this study. Firstly, the two learning approaches presented consistent and positive quadratic curve effects on knowledge management innovation adoption. Secondly, the effects of knowledge management innovation on technological capability showed inverted U relationship. Thirdly, the moderating effects of the two learning approaches on the relationship between knowledge management innovation and technological capability were inconsistent: exploitative learning revealed positive moderating effects on knowledge management innovation implementation, while exploratory learning did not appear remarkable moderating effects on knowledge management innovation implementation. The effects of organizational learning on knowledge management innovation adoption and implementation supplemented and completed current research on knowledge management innovation.

In terms of knowledge management innovation implementation, this study proposed that SMEs should devote to creating a learning organization to thoroughly develop the employees' initiative, largely promoting teamwork, and establishing long-term learning mechanism so as to promote the management level with organizational learning. Regarding the decision-making of knowledge management innovation, an organization could stress on both exploitative learning and exploratory learning to expand the innovation selection. However, knowledge management innovation implementation should be effect-oriented that the innovative solutions should be modified through exploitative learning when the implementation did not appear the expected deviation in order to avoid too much variant knowledge being created. Knowledge management innovation implementation generally depends on the comprehension and participation of several departments that variance would result in more uncertainties. The "butterfly effect" caused by the negligence of a detail could result in knowledge management innovation implementation not achieving the expectation.

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